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Calculated Values: The Politics and Epistemology of Economic Numbers in Britain, 1688-1738

Deringer, William Peter

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CALCULATED VALUES:
THE POLITICS AND EPISTEMOLOGY OF ECONOMIC NUMBERS IN BRITAIN, 1688-1738

William Peter Deringer

A DISSERTATION
PRESENTED TO THE FACULTY
OF PRINCETON UNIVERSITY
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OF DOCTOR OF PHILOSOPHY

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HISTORY OF SCIENCE

Advisers: Michael Gordin & Linda Colley

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ABSTRACT

This dissertation chronicles the emergence of economic calculation as an analytical, argumentative, and moral tool in British politics in the half-century after the 1688 Revolution. During Britain's "financial revolution," novel questions about the nation's "Trade & Revenue" were contested in the halls of Parliament and the pamphlet press. Accountants, journalists, and Parliamentary representatives built creative computations to make sense of imperfect data, interrogate political secrets, and critique opponents. Through seemingly endless numerical fights, fueled by intense partisanship, a novel practice of quantitative political economy coalesced. Practitioners skilled in complicated arithmetic found new opportunities for public advancement. Public calculators forged inventive techniques of estimation, modeling, and valuation, while pitching adventurous ideas about how better numbers could make a better nation. Epistemological questions about data sufficiency, probability, and prediction took on immediate political importance. While Britain's computational combatants produced few cohesive answers or comprehensive theories, their disagreements laid the foundation for a pervasive trust in the virtue of numbers as a medium of political knowledge.

The dissertation's first half traces economic calculation through three transformative moments that shaped modern Britain. Chapter 1 considers the challenges of public accounting—of "finding the money"—that arose in the aftermath of 1688. The second chapter looks at the "Equivalent," a complex financial payment that accompanied the Anglo-Scottish Union of 1707. Chapter 3 recounts the heated Tory-Whig controversy over Britain's "balance of trade" with France, which was triggered by the Peace of Utrecht in 1713. The second half begins with the 1720 South Sea Bubble, which more than any other event demonstrated why sound calculation was indispensable for a commercial polity. Chapter 4 recaptures the various plausible methods Britons developed for computing the value of South Sea stock before the Bubble burst. Chapter 5 explains how one valuation, crafted by MP Archibald Hutcheson, gained special authority in establishing both the stock's mathematical "intrinsick value" and the ethical wrongdoings behind the Bubble. The final chapter examines how, in the age of Walpole that followed 1720, calculation became not only vital for evaluating the past, but took on new powers for predicting and controlling the political future.

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The writing of acknowledgments is the most pleasing scholarly activity—an opportunity for a bit of serious reflection, a bit of playful prose, all without the demanding constraints of evidentiary rigor or word counts. It is also, more importantly, a chance to recall the many great people whom I have been lucky to encounter in the past five years and who have contributed in so many different ways to the pages that follow. I have been looking forward to this activity, so I am not about to let it pass without taking full advantage.

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Five and a half years ago, I was drawn to Princeton's Program in History of Science because it seemed to have a commitment to conversation, collaboration, and camaraderie among its members that was unmatched elsewhere in the field. My bet was an extremely good one, and with every year in the Program I have become especially aware what a special program Princeton's is. The greatest thanks I owe not to a single person, but to a ritual—our weekly "Program Seminar." It is quite simply the most vibrant, honest, engaging, thoughtful, and exciting intellectual forum in which I have ever had the fortune to participate. I suspect that will continue to be true for a very long time. While I am thankful for the interactions I have had with the many dozens who have participated in the Seminar in my time, a few people merit special mention. Angela Creager has been a wonderful teacher, mentor, and friend, and I have learned much from her insights on the challenges and rewards of an academic life. While my time at Princeton only overlapped with the late Michael Mahoney's for one year, at least one great lesson of his has stuck with me in all the work I have done: whatever kind of past knowledge you study, take it seriously, as your historical actors would have. In addition, I am thankful for all that I have learned from Charles Gillispie, Dan Garber, Tony Grafton, Katja Guenther, Erika Milam, Sue Naquin, Eileen Reeves, Emily Thompson, and Keith Wailoo.

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NOTE ON STYLE

All effort has been made to faithfully reproduce the original language, spelling, typography, and notational conventions used in primary manuscript and printed sources quoted herein. Spelling and punctuation have not been updated. Therefore, "*sic*" is generally not used to identify odd or irregular forms or spellings, except in cases where necessary to clarify an especially odd, ambiguous, or important usage. Similarly, I have tried to maintain original *italics*, CAPITALIZATION, and other emphatic typography from original sources (except in the titles of printed materials in the footnotes and bibliography). Therefore, all such emphases in quoted material should be assumed to come from the original text, *except* when I have noted "*Emphasis* mine."

All dates are Old Style dates, though I assume that the New Year begins on January 1 instead of March 25. I have therefore made an effort to clarify when historical dates given in one year by historical actors (e.g. 1714) were in fact from the first three months of the following year (January 1-March 24, 1715). For dates occurring within that ambiguous period, I note the transitional date with a "/", i.e. 1714/5.

Because many of the sources cited in this study, particularly printed pamphlets, are anonymous and many have very similar titles, I have made an effort to provide the dates of all printed primary materials in every footnote reference, including short-form references (e.g. Davenant, *Discourses on the Publick Revenues* (1698), vol. 1).

Information on abbreviations used in the references, particularly for archival sources, can be found in the Bibliography.

– INTRODUCTION –
CALCULATED VALUES

> Truth and Numbers are always the same; tho' the first may be obscured, yet it can never entirely lose its Lustre; and tho' the latter may be transpos'd, they can never lose their Denomination and true Value, when ranged in their proper place; and 45 in Figures, must always be read Forty five in Words.[1]

In a 1718 pamphlet about how to calculate the size of Britain's National Debt, a shadowy civil servant named John Crookshanks penned this poetic statement about numbers and their place in political life. Crookshanks's idea—that numbers are distinctively valuable as the foundation for making trustworthy knowledge—has become almost a commonplace of political deliberation in modern liberal democracies.[2] Yet, when Crookshanks made that claim, this was hardly so obvious, for at least two reasons. First, for Britons living only a few decades before Crookshanks wrote, the idea that numerical information or mathematical calculation carried any kind of inherent political good was far from standard. Numbers of course had long found their way into governmental activities, from the assessment of rents and taxes to military engineering, but that does not mean that numerical information had always been valued in and of itself by those who wielded political authority.[3] Before the Revolution of 1688, a select handful of politicians and thinkers, like the prophet of "political arithmetick" William Petty, had argued that better numerical data on the nation's natural resources, commerce, and demography might make for a more powerful state. Yet their isolated reflections had limited effect on the actual practices of governance in the seventeenth-

[1] [John Crookshanks], *Some Seasonable Remarks on a Book Publish'd in the Month of July, 1718* (London: *s.n.*, 1718), p. 7.
[2] Theodore M. Porter, *Trust in Numbers: The Pursuit of Objectivity in Science and Public Life* (Princeton, NJ: Princeton University Press, 1995).
[3] For a historical reference point, see: Olive Coleman, "What Figures? Some Thoughts on the Use of Information by Medieval Governments," in D. C. Coleman and A. H. John, eds. *Trade, Government and Economy in Pre-Industrial England: Essays Presented to F. J. Fisher* (London: Weidenfeld and Nicolson, 1976), pp. 96-112.

century.[4] The idea that numbers might serve not only as an administrative tool, but also as a communicative one for making a better polity, would have seemed even less familiar.

Crookshanks's paean to numbers was also odd in a second sense: he was in the midst of arguing about a collection of numbers, the accounts of Britain's National Debt, that were contentious and problematic, whose "Denomination and true Value" were hard to assess with certainty. His rhapsody on numbers was actually a kind of computational dirty-trick, intended to catch his polemical opponent, the Member of Parliament Archibald Hutcheson, in a moment of numerical hypocrisy.[5] Whatever his strategic motivations for invoking it, though, that special vision of political knowledge—that "Truth and Numbers are always the same"—would long outlast those specific disputes. This dissertation tells the story of Crookshanks's strange idea—of why the political environment of his day might prompt him to make such a statement, and then how such a strange assertion might have come to seem far less strange. It is the story of how the apparent objectivity of numbers became more than just a strange idea, but a kind of accepted political virtue, as a result of the repeated challenges of making decision in a republican polity strained by competing economic and political interests.[6]

In the aftermath the "Glorious" Revolution of 1688, a mess of unsettled questions left British politics in a state of sustained tension.[7] Britons struggled through fraught disputes about

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[4] This is argued persuasively in Paul Slack, "Government and Information in Seventeenth-Century England," *Past & Present* 184, no. 1 (Aug., 2004): 33-68. See also: Ted McCormick, *William Petty and the Ambitions of Political Arithmetick* (Oxford and New York: Oxford University Press, 2009); Mary Poovey, *A History of the Modern Fact: Problems of Knowledge in the Sciences of Wealth and Society* (Chicago and London: University of Chicago Press, 1998), esp. pp. 120-157.

[5] For Hutcheson's writings on the matter, see: Archibald Hutcheson, *Some Calculations and Remarks Relating to the Present State of the Publick Debts and Funds. And a Proposal for the Intire Discharge of the National Debt and Incumbrance in Thirty Years Time* (London: *s.n.*, 1718); Hutcheson, *Mr. Hutcheson's Answer to Mr. Crookshanks's* Seasonable Remarks (London: *s.n.*, 1719). For the one discussion of the argument, see J. D. Alsop, "The Politics of Whig Economics: the National Debt on the Eve of the South Sea Bubble," *Durham University Journal* 77, no. 2 (1985): 211-18.

[6] For alternative perspectives on the historical meanings of "objectivity," see: Lorraine Daston and Peter Galison, *Objectivity* (New York/Cambridge, MA: Zone Books/MIT Press, 2007); Porter, *Trust in Numbers*; Porter, "The Objective Self," review of *Objectivity* by Daston and Galison, *Victorian Studies* 50, no. 4 (Summer, 2008): 641-7.

[7] The choice of national labels can be complicated matter, given that the "Kingdom of Great Britain" (comprising England, Wales, and Scotland) did not come into being until the Union of 1707. Generally, I have chosen more specific labels—*England/English* and *Scotland/Scottish*—when discussing events before 1707 or when attempting to make a

religious conformity, about the future of the monarchy, and about military and diplomatic policy, particularly with regards to the ominous French power across the English Channel. Deeply entangled with these were the conflicts contemporaries fought over how to understand and regulate their economic lives, problems as much about moral order, political stability, and international diplomacy as about profits and prosperity. Britons confronted the emergence of many seemingly modern forces of economic change—a powerful military-fiscal state, increasingly global trade, vibrant financial markets. These forces bore with them analytical problems that demanded swift and credible answers, whether it was assessing the efficacy of a tax, reconciling the costs and benefits of a change in trade policy, or assessing the value of the stock of a state-sanctioned company. At the beginning of the "long" eighteenth century, though, Britain did not have modern structures of economic expertise to provide authoritative answers to these questions. Conceptual and computational problems about fiscal policy, trade, and finance were therefore fought out in the halls of Parliament and in the public press. Out of such heated, partisan, and self-serving political conflicts came enduring products, from new computational techniques for analyzing trade and finance, to new solutions to the moral problems of a profit-seeking society, to new political ideas about numbers themselves.

The elevation of numerical reasoning in British political culture in the half-century after 1688 was messy, even accidental. It is a story of party propagandists and frustrated careerists, like John Crookshanks, calling upon numerical arguments in opportunistic ways in order to win friends and influence people. The anxious realignment of political power that followed the Revolution of 1688 set the stage. As Parliament took more frequent and active control over political decision-making, political representatives confronted how little they knew about the public's revenue and the nation's commerce, and how little they trusted many of their fellow countrymen. Numerical calculation

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specific geographic distinction, and use *Britain/British* thereafter. On the emergence of "British" identity in the eighteenth century, see Linda Colley, *Britons: Forging the Nation, 1707-1837* (New Haven: Yale University Press, 1992).

entered the day-to-day discourse of British politics largely because those operating outside the seats of immediate political power, like Crookshanks's adversary Archibald Hutcheson, found it a useful instrument for interrogating political and corporate insiders. (Hutcheson had initiated the 1718 conflict with Crookshanks by publishing an elaborate and somewhat speculative model of the recent history of the National Debt, in order to criticize the management of Whig party ministers.) In a political culture racked by fear of secrecy and deception, these critics used creative computations to overcome asymmetries in available information and conjecture about what might be happening on the inside, taking advantage of newly-lax publishing regulations to make their messages public.

The pressure of critical calculations like Hutcheson's had many effects. It made new demands on those wielding executive power, encouraging them to refine their own administrative procedures, publish more official data, and to think about the value of information in new ways. The pressures of this computational combat also help created a new, distinctly quantitative, body of political economy in early-eighteenth-century Britain. It did not so much produce a coherent body of new theory, as a novel *practice* of political economy, marked by computational practitioners, techniques, and standards. Important political roles developed for those who could carry out difficult economic and financial calculations. On the one hand, administrators like William Lowndes (Secretary to the Treasury, 1695-1724), who managed to gain a reputation for their computational skills and disinterestedness, became foundational components of the emergent state, in part because they were unusually immune from partisan purges. On the other, powerful politicians sought out crafty calculators willing to lend their numerical minds to an interested cause and produce public calculations on their behalf.[8] Exemplary was Crookshanks, who was commissioned by Whig

[8] This dissertation is more concerned with the latter group, the public and partisan calculators, than the former, though the character of Lowndes in particular does meander throughout nearly the entire story. On the emergence of the honest civil servant, see: Geoffrey Holmes, *Augustan England: Professions, State and Society, 1680-1730* (London et al.: George Allen & Unwin, 1982), ch. 8.

Secretary of State Lord Sunderland to fashion a public take-down of Hutcheson.[9] Partisan conflict created a niche for a new kind of economic expert, one whose skill was measured not by its commercial utility or scholarly interest, but by its ability to render complex economic questions into convincing public arguments.

As readers and representatives became inundated with unseen volumes of political numbers, public calculators sought new strategies for justifying the validity of their own numbers, for pointing out the inadequacies of competing figures, and for educating readers in how to assess the credibility of calculations. The computational work of these pundits, while almost invariably driven by immediate political motivations, was not simply shallow and cynical. Rather, it often represented the cutting-edge of British political economy in the century before Adam Smith's *Wealth of Nations*. In fact, as public calculators wrestled with how to make coherent arguments from incomplete and imperfect information, they made questions of epistemology into problems of immediate political concern.[10] The political and financial "revolutions" of the late seventeenth century generated challenging "problems of knowledge"—about evaluating the reliability of data and personal experience, about certainty versus probability, about reasoning about the future on the basis of the past—many of which also troubled the philosophers and naturalists who contributed to Britain's "scientific" revolution.[11]

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[9] See John Crookshanks to the Earl of Sunderland, 13 August 1718, Sunderland Papers, Financial Tracts, BL Add. MS 61,605, ff. 32-34, quotation on f. 32r.

[10] Larry Stewart, among others, has explored the vital interrelationships between scientific and financial developments in Restoration and Augustan Britain. I hope to explore a somewhat different kind of convergence. See: Larry R. Stewart, *The Rise of Public Science: Rhetoric, Technology, and Natural Philosophy in Newtonian Britain, 1660-1750* (Cambridge, UK and New York: Cambridge University Press, 1992), esp. parts II and III; Stewart, "Other Centres of Calculation, or, Where the Royal Society Didn't Count: Commerce, Coffee-Houses and Natural Philosophy in Early Modern London," *The British Journal for the History of Science* 32, no. 3 (Jun., 1999): 133-153.

[11] On "problems of knowledge" and the scientific revolution, see: Poovey, *History of the Modern Fact*; Ian Hacking, *The Emergence of Probability: A Philosophical Study of Early Ideas about Probability, Induction, and Statistical Inference*, 2nd ed. (Cambridge, UK and New York: Cambridge University Press, 2006 [1975]); Barbara J. Shapiro, *Probability and Certainty in Seventeenth-Century England: A Study of the Relationships between Natural Science, Religion, History, Law, and Literature* (Princeton: Princeton University Press, 1983); Shapiro, *A Culture of Fact: England, 1550-1720* (Ithaca and London: Cornell University Press, 2000); Steven Shapin and Simon Schaffer, *Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life*, 1st Paperback Ed. (Princeton: Princeton University Press, 1989 [1985]); Simon Schaffer, "A Social History of Plausibility:

Over the first three decades after 1688, up to an including Crookshanks's fight with Hutcheson, Britons of various political loyalties began to look to numbers as solutions for how to communicate, deliberate, and govern within a pluralistic polity. Some competitors consciously celebrated the political virtues of numerical calculation as part of longer-standing intellectual projects, like the Scottish mathematician David Gregory, a leading figure among a group of Newtonian thinkers who believed that mathematical learning held the secrets not only of better science, but of better medicine, better theology, and a better society. Yet many others held far less clear or consistent visions of what made numbers politically valuable. For them, it was not so important what they believed about economic calculation abstractly, but what they thought calculations could do for the moment—to embarrass a partisan opponent, to forestall an unappealing policy, to earn the favor of a powerful patron. The most important factor in making calculation such a part of British political culture was the fighting itself. No matter who won or what was settled, the numbers remained. When Crookshanks declared that "Truth and Numbers are always the Same," he may have done so for some very immediate, very pointed reasons. But to say so was, in a way, to agree to play by those very same rules.

Shortly after Crookshanks and Hutcheson battled over the true size of the National Debt, a financial-political crisis triggered by the mounting Debt provided a devastating demonstration of the political need for the virtues of numbers. The South Sea Crisis of 1720, the first major crash of London's growing stock market, dramatically revealed the dangers of leaving control of the nation's economic future in the hands of a few secretive individuals. In the months before the crash of South Sea Company Stock, critical calculators—none more so than Crookshanks's adversary Archibald

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Country, City and Calculation in Augustan Britain," in *Rethinking Social History: English Society 1570-1920 and Its Interpretation*, ed. Adrian Wilson (Manchester and New York: Manchester University Press, 1993), p. 128-157; Steven Shapin, *A Social History of Truth: Civility and Science in Seventeenth-Century England* (Chicago and London: University of Chicago Press, 1994); Peter Dear, *Discipline and Experience: The Mathematical Way in the Scientific Revolution* (Chicago and London: University of Chicago Press, 1995).

Hutcheson—developed creative numerical analyses to compute the real value of that stock, and to interrogate the secret motivations of the Company and its political allies. In the months after the crash, those same calculations became invoked as objective evidence of the Company's wrongdoing. The nation's greatest economic disaster made it painfully clear why it was more prudent to trust in numbers than in people. In turn, as financial calculations became so valuable for proving the ethical failures of the past, they began to assume new powers for predicting and controlling the future, whether in the halls of Parliament or the dark corners of Exchange Alley.

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Let us return to the quarrel between Mr. Crookshanks and Mr. Hutcheson, which falls chronologically in the mid-point of the dissertation, and serves as a valuable window into the nexus of political, economic, and epistemological concerns that occupy the following chapters. So, three questions to begin: What were Crookshanks and Hutcheson fighting about? Who was fighting? And, why was it important?

I. What Were Crookshanks and Hutcheson Fighting About?

They were arguing about "the Present State of the Publick Debts." The total size of this "National Debt" was a large and frightening figure: around £45 million by 1714, or larger than the best current estimates for the nation's annual income.[12] The National Debt was also disturbingly new, dating back only to the 1690s.[13] Governments borrowing money was hardly novel, but never before had

[12] Note, for example, that the best estimates of national wealth at the time were the 1696 figures of demographer Gregory King, who held that the combined national income of all of England and Wales was roughly £42-44 million. See: King, "Natural and Political Observations and Conclusions upon the State and Condition of England," in King, *Two Tracts*, ed. George E. Barnett (Baltimore, 1936 [1696]); Paul Slack, "Measuring the National Wealth in Seventeenth-Century England," *Economic History Review* 57, no. 4 (Nov., 2004): 607-635.

[13] The earliest invocations of a "National Debt" in the modern sense of a large, potentially permanent public debt guaranteed by the government date from the 1690s. See: Charles Davenant, *Discourses on the Publick Revenues, and On the Trade of England*…, Vol. 1 (London: Printed for J. Knapton, 1698), p. 42. There are references to a "national debt" at least as early as the 1650s, though referring more generally to certain obligations that could only be incurred by a national government, such as soldiers' wages.

one borrowed as extensively as England's did, from such a broad and impersonal base of lenders. These "Publick Debts" were emblematic of England's ongoing "Financial Revolution," a massive transformation in the nation's public and private financial capacities which began in the mid-seventeenth century and accelerated after 1688.[14] These developments promoted the growth of Britain's modern "military-fiscal state," made possible a quarter-century of nearly-constant war with France from 1688 to 1713, and laid the foundations for much of modern financial capitalism.[15]

Britain's financial revolution was initiated by a variety of minor, often uncoordinated developments in public administration and private enterprise. The English government had made vital strides in tax collection in the Restoration period, marked by the transition from the "farming" to the central administration of Excise taxes in 1671 (the end of Customs farming followed in 1683).[16] Prior to 1688, increasing professionalism combined with booming foreign trade to greatly increase proceeds from those traditional taxes, while after the Revolution new institutions like the Land Tax tapped previously inaccessible sources of wealth.[17] Robust and reliable tax revenues helped make possible new forms of government borrowing—as did, perhaps, greater popular acceptance of

[14] The benchmark study is P. G. M. Dickson, *The Financial Revolution in England: A Study in the Development of Public Credit* (London et al. & New York: Macmillan/St. Martin's Press, 1967). See also: Larry Neal, *The Rise of Financial Capitalism: International Capital Markets in the Age of Reason* (Cambridge, UK and New York: Cambridge University Press, 1990); Henry Roseveare, *The Financial Revolution 1660-1760* (London & New York: Longman, 1991); Anne L. Murphy, *The Origins of English Financial Markets: Investment and Speculation before the South Sea Bubble* (Cambridge, UK: Cambridge University Press, 2009); Jeremy Atack and Larry Neal, eds. *The Origins and Development of Financial Markets and Institutions: From the Seventeenth Century to the Present* (Cambridge, UK and New York: Cambridge University Press, 2009); Carl Wennerlind, *Casualties of Credit: The English Financial Revolution, 1620-1720* (Cambridge, MA: Harvard University Press, 2011).

[15] The standard is John Brewer's superlative *The Sinews of Power: War, Money, and the English State, 1688-1783* (London & Boston: Unwin Hyman, 1989). See also: D. W. Jones, *War and Economy in the Age of William III and Marlborough* (Oxford and New York: Basil Blackwell, 1988).

[16] On the particular importance of pre-1688 developments in English public finance, see: Patrick K. O'Brien, "Fiscal Exceptionalism: Great Britain and Its European Rivals from Civil War to Triumph at Trafalgar and Waterloo," Working Paper no. 65/01, Department of Economic History, London School of Economics and Political Science (Oct., 2001); Roseveare, *Financial Revolution*. On taxation, and especially the Excise, see: C. D. Chandaman, *The English Public Revenue 1660-1688* (Oxford, 1975); Michael J. Braddick, *The Nerves of State: Taxation and the Financing of the English State, 1558-1714 (*Manchester, 1995); Miles Ogborn, "The Capacities of the State: Charles Davenant and the Management of the Excise, 1683-1698," *Journal of Historical Geography* 24, no. 3 (July, 1998): 289-312; Colin Brooks, "Taxation, Finance and Public Opinion, 1688-1714," (Ph.D. Diss., University of Cambridge, 1970); Brewer, *Sinews of Power,* pp. 101-114.

[17] On the land tax, and particularly its role in producing greater popular acceptance of state authority, see: Colin Brooks, "Public Finance and Political Stability: The Administration of the Land Tax," *The Historical Journal* 17, no. 2 (Jun., 1974): 281-300.

taxation and faith in the security of property rights triggered by the constitutional transformations of 1688.[18] The government's credit needs prior to 1688 had been serviced primarily through relationships with a few dozen individual bankers, merchants, and "undertakers."[19] After 1688, though, Parliament began raising large public loans by selling financial instruments to a broader base of diverse and anonymous investors, guaranteeing the interest on such instruments on the proceeds of specific taxes. This new borrowing was necessary to fund the expensive war with France that began in 1689, shortly after William and Mary took over the monarchy. Government efforts to raise debt financing in the markets of the "City of London" capitalized on the financial skills and speculative appetites of an adolescent network of financial lenders, brokers, and traders within the City. Those efforts also produced large and exciting new objects for private investment, which in turn fueled rapid expansion of London's informal financial markets, "Exchange Alley."[20]

With new powers and institutions came new political and moral anxieties.[21] As vividly recaptured by J. G. A. Pocock, Carl Wennerlind, and others, the growth of the National Debt and

[18] The importance of Britain's post-1688 political constitution to the development of the nation's public and private financial system has been a topic of major scholarly interest, kicked off by the arguments of "New Institutional" economists Douglass C. North and Barry R. Weingast. For their argument, and challenges to it, see: North and Weingast, "Constitutions and Commitment: The Evolution of Institutional Governing Public Choice in Seventeenth-Century England," *The Journal of Economic History* 49, no. 4 (Dec., 1989): 803-832; Bruce G. Carruthers, "Politics, Popery, and Property: A Comment on North and Weingast," *The Journal of Economic History* 50, no. 3 (Sept., 1990): 693-698; David Stasavage, "Partisan Politics and Public Debt: The Importance of the Whig Supremacy for Britain's Financial Revolution," *European Review of Economic History* 11, no. 1 (2007): 123-153; O'Brien, "Fiscal Exceptionalism."

[19] On the nature of government borrowing before 1688, see: Christopher Clay, *Public Finance and Private Wealth: The Career of Sir Stephen Fox, 1627-1716* (Oxford: Clarendon Press, 1978), pp. 40-111; Roseveare, *The Financial Revolution*, pp. 9-10, 17-21.

[20] Murphy, *The Origins of English Financial Markets*; Ann M. Carlos, Jennifer Key, and Jill L. Dupree, "Learning and the Creation of Stock-Market Institutions: Evidence from the Royal African and Hudson's Bay Companies, 1670-1700," *The Journal of Economic History* 58, no. 2 (June 1998): 318-344.

[21] Writing about late medieval Florence, Anthony Molho encourages historians to look more richly at the dense interactions between state building, public finance, and political ideas and interests: "Missing from many discussions of the history of the relations between fiscal policy and state making is a credible internal dimensions—the state's politics, its power balances and social tensions, and the ideological orientation of politically active classes." (Molho, "The State and Public Finance: A Hypothesis Based on the History of Late Medieval Florence," *The Journal of Modern History* 67, Supplement: *The Origins of the State in Italy, 1300-1600* (Dec., 1995): S97-S135, on p. S103. A useful sociological take on such interactions in Britain's "financial revolution," with an emphasis on the non-market dimensions of that "revolution," see: Bruce G. Carruthers, *City of Capital: Politics and Markets in the English Financial Revolution* (Princeton: Princeton University Press, 1996).

concerns about national "credit" became a major fixation in post-1688 politics.[22] In early modern Britain, business had always been done primarily on credit, whether the face-to-face transactions of the rural village or the long-distance dealings of colonial trade.[23] But the kind of massive, abstract, potentially permanent "credit" transactions that had produced Britain's new National Debt were a different beast.[24] Many Britons, whether country landowners, religious conservatives, or "classical republicans," worried that rampant government borrowing would impoverish future generations. They also feared that such easy credit-money would feed an overgrown government and standing military that would breed corruption and endanger personal liberties. Many lamented the development of new "paper" wealth and an artificially wealthy class or "monied interest," whose growing commercial and political power threatened to upend an established social order long based on the equation of political influence with landed riches.[25]

The polemics exchanged by Hutcheson and Crookshanks in 1718 reflected on the startling public financial powers brought by this financial revolution. But, even more, those writings captured just how confusing and troubling that empowerment could be for contemporaries. Britain's "National Debt" in 1718 was actually a motley hybrid of *ad hoc* obligations: large loans advanced by quasi-public companies like the Bank of England, annuities sold to public investors, prizes issued in

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[22] J. G. A. Pocock, *The Machiavellian Moment: Florentine Political Thought and the Atlantic Republican Tradition* (Princeton, NJ: Princeton University Press, 1975), esp. Part III.

[23] Craig Muldrew, *The Economy of Obligation: The Culture of Credit and Social Relations in Early Modern England* (Houndmills, UK and New York: Palgrave, 1998); Muldrew, "'Hard Food for Midas': Cash and its Social Value in Early Modern England," *Past & Present* 170 (Feb., 2001): 78-120; Nuala Zahedieh, "Credit, Risk and Reputation in late Seventeenth-Century Colonial Trade," in *Research in Maritime History* 15: *Merchant Organization and Maritime Trade in the North Atlantic, 1660-1815*, ed. Olaf Uwe Janzen (St. John's, Newfoundland: International Maritime Economic History Association, 1998): 53-74; Peter Mathias, "Risk, Credit and Kinship in Early Modern Enterprise," in *The Early Modern Atlantic Economy*, ed. John J. McCusker and Kenneth Morgan (Cambridge, UK: Cambridge University Press, 2000), pp. 15-35; Margot C. Finn, *The Character of Credit: Personal Debt in English Culture, 1740-1914* (Cambridge, UK and New York: Cambridge University Press, 2003); John Smail, "The Culture of Credit in Eighteenth-Century Commerce: The English Textile Industry," *Enterprise & Society* 4, no. 2 (Jun., 2003): 299-325.

[24] The distinction between the interpersonal "credit" of everyday economic life, as described by Muldrew and others, and the new notions of public "credit" that emerged in the financial revolution is explored in Wennerlind's *Casualties of Credit*.

[25] J. G. A. Pocock, "The Mobility of Property and the Rise of Eighteenth-Century Sociology," in *Virtue, Commerce and History: Essays on Political Thought and History* (Cambridge, UK: Cambridge University Press, 1985): 103-123.

public lotteries, and a dizzying collection of smaller, shorter-term debt instruments like Exchequer "tallies" and debentures issued to cover military expenses. The challenge with the public Debts was not just how to pay them off, but how to identify them all, determine what they were worth, and assess how they were changing over time. Crookshanks and Hutcheson in fact argued about a broad array of informational and interpretive problems about the quantitative analysis of public finance. Did an increase in the market price (but not annual cost) of government annuities mean that the total debt owed by government actually *increased*, as Hutcheson argued? Did the £120,000 per year in public revenue that Parliament had agreed to divert away from debt repayment to monarchical expenses (the so-called "Civil List") qualify as a public *debt* in its own right?[26] Buried in a debate about one number was a diversity of difficult problems—technical questions about accounting method and data quality, theoretical questions about financial valuation and economic prognostication, even constitutional questions about the fiscal responsibilities of Crown and Parliament.

This dynamic—the way Britain's financial revolution elicited unprecedented problems of political-economic knowledge—is a central theme in this dissertation.[27] But why was the pointed question of the size of the National Debt so intractable?[28] Three general sets of limitations

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[26] Hutcheson argued that, because part of the total Parliament promised to pay for new King George I's "Civil List" (a total of £700,000) was taken from sums previously devoted to paying back debts owed to the Bank of England, a total sum of £2.4 million (equal to 20x the yearly payment of £120,000) ought to be added to the effective size of the National Debt. See: Hutcheson, *Calculations and Remarks* (1718), pp. 10-1; Crookshanks, *Seasonable Remarks* (1718), p. 4. On the civil list, see: E. A. Reitan, "The Civil List in Eighteenth-Century British Politics: Parliamentary Supremacy versus the Independence of the Crown," *The Historical Journal* 9, no. 3 (1966): 318-337; Reitan, "From Revenue to Civil List, 1689-1702: The Revolution Settlement and the 'Mixed and Balanced' Constitution," *The Historical Journal* 13, no. 4 (Dec., 1970): 571-88.

[27] A few scholars, representing a variety of disciplinary perspectives, have begun to explore the epistemic dimensions of the early history of financial capitalism, including Mary Poovey (literary studies), Alex Preda (sociology), and Carl Wennerlind (intellectual history). See: Poovey, *A History of the Modern Fact*, esp. chs. 2,4; Poovey, *Genres of the Credit Economy: Mediating Value in Eighteenth- and Nineteenth-Century Britain* (Chicago and London: University of Chicago Press, 2008); Alex Preda, "The Rise of the Popular Investor: Financial Knowledge and Investing in England and France, 1840-1880," *The Sociological Quarterly* 42, no. 2 (Spring, 2001): 205-232; Preda, *Framing Finance: The Boundaries of Markets and Modern Capitalism* (Chicago and London: University of Chicago Press, 2009); Carl Wennerlind, *Casualties of Credit*, esp. ch. 3, "The Epistemology of Credit."

[28] Compare <http://www.usdebtclock.org>.

contributed to this quantitative instability: informational, interpretive, and social. The first limitation derived from the availability of reliable fiscal data. Hutcheson and Crookshanks had to do substantial work simply to pull together the scattered information available on the different public obligations into some kind of coherent picture of the total Debt, creatively correcting available data and filling in holes through estimation. Official reports offered by the Treasury provided only partial figures, in large part because the British government simply did not have the available infrastructure or civil-service personnel to produce ideal data. The expanded fiscal powers that the British government had developed, especially the myriad improvisations in public debt financing, meant new accounting challenges. Even those with the best data could disagree about seemingly basic points. For example, in late 1712, the Directors of the year-old South Sea Company went back and forth with the government's effective finance czar, William Lowndes, trying to reconcile a £13,112 dispute about the "Publick Stock" in the Company held by the government.[29] The state's informational powers persistently lagged behind its monetary ones, and there were few clear expectations governing what kinds of data the state or private corporations ought to collect. "Information" did not yet have its modern cachet; indeed, the word very often carried a distinctive and unfamiliar meaning at the time, referring to the "imparting of incriminating knowledge."[30] New ideas about the abstract value of information were in the process of being formed.[31]

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[29] Minutes of the Court of Directors of the South Sea Company, Vol. 2, BL Add. MS 25,495, ff. 22^{v}, 24^{v}, 26^{r}.
[30] This is indeed the first meaning listed in the *Oxford English Dictionary* entry for "Information, n." See: *OED* Online. Sept. 2011. Oxford University Press. <http://www.oed.com/view/Entry/95568> (accessed 12 December 2011).
[31] The history of "information" has recently become a major topic of scholarly interest. For a useful selection of such literature, see: C. A. Bayly, *Empire and Information: Intelligence Gathering and Social Communication in India, 1780-1870* (Cambridge, UK and New York: Cambridge University Press, 1996); Daniel R. Headrick, *When Information Came of Age: Technologies of Knowledge in the Age of Reason and Revolution* (Oxford and New York: Oxford University Press, 2000); Edward Higgs, "The Rise of the Information State: the Development of Central State Surveillance of the Citizen in England," *Journal of Historical Sociology* 14, no. 2 (Jun., 2001): 175-197; Slack, "Government and Information"; Filippo de Vivo, *Information and Communication in Venice: Rethinking Early Modern Politics* (Oxford and New York: Oxford University Press, 2007); Markus Friedrich, "Government and Information-Management in Early Modern Europe: The Case of the Society of Jesus, 1540-1773," *Journal of Early Modern History* 12, no. 6 (2008): 539-63; Jacob Soll, *The Information Master: Jean-Baptiste Colbert's Secret State Intelligence System* (Ann Arbor, MI: University of Michigan Press, 2009); Ann Blair, *Too Much to Know: Managing Scholarly Information before the Modern Age* (New Haven and London: Yale University Press, 2010); Michael John Jones, "Sources of Power and Infrastructural Conditions in Medieval Government Accounting," *Accounting,*

Acquiring data was not the only problem. Public calculators were unsettled on central principles regarding how to interpret such data. When Hutcheson and Crookshanks argued over whether or not to include the appreciated market price of long-term annuities as a new debt incurred, or the potential impact of an interest-rate reduction on such prices, they were confronting subtle matters of financial interpretation.[32] Unfamiliar strategies and financial inventions, like lottery annuities or "sinking funds," made for especially thorny interpretive problems.[33] Economic analysts did have access to instructional texts and courses on mercantile accounting and arithmetic, on commercial best-practices and merchant law, perhaps on the basics of investment or "stock-jobbing."[34] But familiarity with commercial rudiments did not add up to a full command of the difficult problems with which Hutcheson and Crookshanks wrestled. Neither man could point to any well-established set of principles or texts as comprising a theory of finance.[35] While the mathematics of their calculations might seem simple in retrospect, the underlying conceptual questions were anything but.

Organizations & Society 35, no. 1 (Jan., 2010): 81-94; Alexander Bick, "Governing the Free Sea: The Dutch West India Company and Commercial Politics, 1618-45," (Ph. D. Diss., Princeton University, 2012), esp. ch. 2.

[32] This is not, of course, to suggest that a clear line could be drawn between "data" and "theory," as attitudes toward what qualified as useful or legitimate data, and ideas about how to get such data, were themselves interpretive.

[33] For a picture of the confusions that could be wrought by lotteries, both for investors and for finance ministers, see, for example: [William Paterson?], "A Comparison of the two Lottery Annuitys with a Fund of Redeemable Interest at 4, 5, & 8. Per Cent per Annum for 16, 32, 42, & 99 Years – In way of Rebate," 16 January 1709, Marlborough Papers, BL Add. MSS 61,358, ff. 136-7; John Carswell, *The South Sea Bubble*, 2nd ed. (Dover, NH: Sutton, 1993 [1960]), p. 43; Lee Krim Davison, "Public Policy in an Age of Economic Expansion: The Search for Commercial Accountability in England, 1690-1750" (Ph. D. Diss., Harvard University, 1990), pp. 98-99, 107-108. On sinking funds, see Chapter 6, below.

[34] On the state of commercial and financial literature in the period, see: Preda, "Rise of the Popular Investor"; Phyllis Whitman Hunter, "Containing the Marvelous: Instructions to Buyers and Sellers," in *Didactic Literature in England, 1500-1800*, edited by Natasha Glaisyer and Sarah Pennell (Aldershot, UK and Burlington, VT: Ashgate, 2003), pp. 169-185; Natasha Glaisyer, *The Culture of Commerce in England, 1660-1720* (Woodbridge, UK and Rochester, NY: The Royal Historical Society/Boydell Press, 2006), esp. ch. 3; Glaisyer, "Calculating Credibility: Print Culture, Trust and Economic Figures in Early Eighteenth-Century England," *Economic History Review*, New Series, 60, no. 4 (Nov., 2007): 685-711; John Richard Edwards, Graeme Dean, and Frank Clarke, "Merchants' Accounts, Performance Assessment and Decision Making in Mercantilist Britain," *Accounting, Organizations & Society* 34, no. 5 (Jul., 2009): 551-570.

[35] Helen J. Paul, *The South Sea Bubble: An Economic History of its Origins and Consequences* (London and New York: Routledge, 2011), p. 7; Antoin E. Murphy, *The Genesis of Macroeconomics: New Ideas from Sir William Petty to Henry Thornton* (Oxford et al.: Oxford University Press, 2009), p. 6.

As a result, partisan controversy like the Hutcheson-Crookshanks debate forced unsettled interpretive questions into the open, and became a major driver of new political-economic ideas.[36] The brand of political economy they practiced differed from the statist approaches pioneered in the seventeenth century and honed in the eighteenth century by Britain's European counterparts, from the "reason of state" theories of Giovanni Botero to French Colbertism to Continental Cameralism.[37] It sought less to mine the secrets of nature and empire for the sole benefit of the state, as to mine, interrogate, or justify the secrets of state power itself.[38] Further, understanding how the distinctive culture of political combat that emerged in Britain produced new computational methods and analytical techniques, often for the purposes of internal political disagreement, is essential to understanding the disorderly collection of practices and principles traditionally arrayed under the banner of British "mercantilism."[39]

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[36] On political debate and the shaping of economic thought in the period, see Julian Hoppit, "The Contours and Contexts of British Economic Literature, 1660-1760," *The Historical Journal* 49, no. 1 (Mar., 2006): 79-110. On the history of British economic thought in the period, see: William Letwin, *The Origins of Scientific Economics: English Economic Thought 1660-1776* (London: Methuen, 1963); T. W. Hutchison, *Before Adam Smith: The Emergence of Political Economy, 1662-1776* (Oxford, UK and New York: B. Blackwell, 1988); Tony Aspromourgos, *On the Origins of Classical Economics: Distribution and Value from William Petty to Adam Smith* (London and New York: Routledge, 1996); Andrea Finkelstein, *Harmony and the Balance: An Intellectual History of Seventeenth-Century English Economic Thought* (Ann Arbor, MI: University of Michigan Press, 2000); Murphy, *Genesis of Macroeconomics.*

[37] "Cameralism," as a science of state resource and financial management, became an officially-recognized discipline at the universities of Halle and Frankfurt in 1727. For an introduction to practices of economic management in Germany, France, Holland, and Scandinavia, and their intersections with developments in quantitative and scientific thought, see: Henry E. Lowood, "The Calculating Forester: Quantification, Cameral Science, and the Emergence of Scientific Forestry Management in Germany," in *The Quantifying Spirit in the Eighteenth Century*, ed. Tore Frängsmyr, J. L. Heilbron, and Robin E. Rider (Berkeley et al.: University of California Press, 1990), pp. 315-42; Pamela Smith, *The Business of Alchemy: Science and Culture in the Holy Roman Empire* (Princeton, NJ: Princeton University Press, 1994); Andre Wakefield, *The Disordered Police State: German Cameralism as Science and Practice* (Chicago: University of Chicago Press, 2009); Jacob Soll, "Accounting for Government: Holland and the Rise of Political Economy in Seventeenth-Century Europe," *The Journal of Interdisciplinary History* 40, no. 2 (Autumn, 2009): 215-238; Soll, *Information Master,* esp. chs. 3-6; Lisbet Koerner, *Linnaeus: Nature and Nation* (Cambridge, MA: Harvard University Press, 1999), chs. 5-6.

[38] Compare Vera Keller, "Mining Tacitus: Secrets of Empire, Nature and Art in the Reason of State," *The British Journal for the History of Science* 45, Special Issue no. 2, *States of Secrecy* (Jun., 2012): 189-212.

[39] Steve Pincus has persuasively argued that there was never a coherent "mercantilist concensus," particularly in eighteenth-century Britain. Instead, that era featured different economic philosophies that vigorously competed with one another. For this argument, and other perspectives on mercantilism, see: Pincus, "Rethinking Mercantilism: Political Economy, the British Empire, and the Atlantic World in the Seventeenth and Eighteenth Centuries," *The William and Mary Quarterly* 69, no. 1 (Jan., 2012): 3-34, as well as the responses in that same volume (pp. 35-70); Eli Heckscher, *Mercantilism*, trans. Mendel Shapiro, Revised 2nd Edition, 2 Vols. (London: George Allen & Unwin, 1955 [1931]); D. C. Coleman, "Mercantilism Revisited," *The Historical Journal* 24, no. 4 (Dec., 1980): 773-791. For a provocative study of how certain British mercantilist approaches to political economy became transmitted to other nations, see: Sophus A. Reinert, *Translating Empire: Emulation and the Origins of Political Economy* (Cambridge, MA: Harvard University Press, 2011).

Yet a third source of uncertainty derived from the social context of contemporary economic knowledge. Just as there were many as-yet unanswered questions about what made for good economic data, or a good economic calculation, so were there many open questions about who might qualify as a good economic calculator.

II. Who Were John Crookshanks and Archibald Hutcheson?

In the disorder of Britain's financial revolution, it was quite unclear who, if anyone, could really claim to understand what was going on. At a time before Economics Ph.D.s or chartered accountants, modest civil servants argued with Parliamentarians, and Grub Street hacks wrestled with the wealthiest foreign traders. There was no single path by which a man could become a participant in this computational game.[40] The strange careers of John Crookshanks and Archibald Hutcheson offer two illustrative examples of the circuitous routes taken toward a fledgling economic expertise.[41]

The entire story of this dissertation might be told through the eyes of Mr. Crookshanks, who managed to play some minor part in the events of almost every chapter across his frustrated, five-decade career (save perhaps Chapter 1). He was probably born in the 1670s and "had the happiness

[40] The characters in this story are, indeed, almost exclusively men. Understanding women's role in the history of economic understanding during the Financial Revolution is deserving of far greater attention. The evidence gathered so far points in various directions. On the one hand, scholars like Ann Carlos, Karen Maguire, and Larry Neal have shown based on empirical data that women were not only active investors during the period, but in fact had notable rates of success, indicative of a level of "financial acumen" that may have surpassed their male counterparts. (See Carlos, Maguire, and Neal, "Financial Acumen, Women Speculators, and the Royal African Company during the South Sea Bubble," *Accounting, Business, and Financial History* 16, no. 2 (Aug., 2006): 219-243.) On the other hand, studies have shown that women lagged behind men considerably when it came to numeracy, as through the early modern period "mathematics was thought of as an essentially masculine affair." (Keith Thomas, "Numeracy in Early Modern England: The Prothero Lecture," *Transactions of the Royal Historical Society*, Fifth Series, 37 (1987): 103-132, quotation on p. 113.)

[41] Compare the eventful, global lives of other eighteenth-century world travelers, whose emblematic stories have provided vivid pictures of broader developments in economy, empire, and enlightenment in that century. See: Linda Colley, *The Ordeal of Elizabeth Marsh: A Woman in World History*, (New York: Pantheon Books, 2007); Emma Rothschild, *The Inner Life of Empires: An Eighteenth-Century History* (Princeton, NJ: Princeton University Press, 2011).

to be born in *Scotland*, to be Educated in *Ireland*, brought up in *France*, and Finished in *Italy*."[42] By the mid-1690s, he had become a trusted accountant for the traders Alexander Rigby & Co. in Livorno, Italy, where he earned a reputation as one "who disputes the Preheminence with all *Book-keepers* in *Christendom*."[43] There, he became embroiled in a geopolitical scuffle, when a former company partner was arrested in 1697 by the Grand Duke of Tuscany on charges of piracy.[44] The bookkeeper found himself negotiating with Tuscan and French diplomatic officials for the release of one of his bosses.

By 1706, Crookshanks had migrated from the world of trade to the quasi-public (and no-less profitable) world of military administration, assisting with payments and recruitment under a prominent English general.[45] In the following year, he was promoted to Controller-General of the Customs in Scotland, just recently unified with England, where he was tasked with drafting a "Book of Instructions" on accounting for all Scottish Customs officers.[46] By late 1708, he moved to a similar post in London, where he continued to working out the fiscal complications of the Union.[47] His work included proposing methods for cutting down on tax evasion in the Scottish tobacco trade and managing the ongoing problem of the "Equivalent," a large payment to be given to various Scottish stakeholders as a condition of the Union (the topic of Chapter 2).[48] Crookshanks's facility

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[42] *The Answer of the Merchants-Petitioners, and Trustees for the Factory at Legorn, To The Account of Damages, Laid to the Charge of the Great Duke of Toscany, by Sir Alexander Rigby…* (London: *s.n.*, 1704), p. 48.
[43] *Answer of the Merchants-Petitioners* (1704), p. 48.
[44] See: Alexander Rigby, *The Case of Sir Alexander Rigby, and William Shephard, Complainants, as to Their Particular Damages by the Grand Duke of Tuscany's Proceedings, in the Seizure of William Plowman, and of their Effects* (London: *s.n.*, 1704), esp. pp. 17-22; *Answer of the Merchant-Petitioners* (1704); Eveline Cruickshanks et al., "Sir Alexander Rigby," in Eveline Cruickshanks, Stuart Handley, and D.W. Hayton, eds. *The History of Parliament: The House of Commons 1690-1715,* Vol. V (Cambridge: Cambridge University Press, for the History of Parliament Trust, 2002), pp. 278-80.
[45]Crookshanks found a position under Lieutenant General Richard Ingoldsby, who played a central role at the English victory at Blenheim in 1704 and became the Master-General of the Ordnance in Ireland in 1705. See: John Crookshanks to the Duke of Marlborough, 27 March 1706, Bleinheim Papers, BL Add. MS 61,285, ff. 159-60. On military profiteering, see: Godfrey Davies, "The Seamy Side of Marlborough's War," *Huntington Library Quarterly* 15, no. 1 (Nov., 1951): 21-44; Clay, *Public Finance and Private Wealth*, chs. 2-4.
[46] Crookshanks gave a brief summary of his career from this point up to 1727 in a letter to Robert Walpole. See "The Case and Petition of John Crookshanks," in John Crookshanks to Robert Walpole, 28 March 1727, CamUL, Ch(H) Letter 1415.
[47] "Presentment of the Commissioners of the Customs," 27 November 1708, NA T 1/110, f. 126. See also: Commissioners of the Customs of North Britain to John Crookshanks, 30 December 1708, NA T 1/110, ff. 226-7.
[48] See: "Case and Petition of John Crookshanks," in CamUL Ch(H) Letters 1415; "North Britain: An Account of the Tobacco Imported and Exported since the 1st May 1707 to the 29 Septemr. 1711," 15 November 1711, NA T 1/139, f.

with the "intricate Affair" of the Equivalent attracted the attention of the aging Earl of Halifax, a major Whig powerbroker, around 1714.[49] That relationship ushered in a new phase of Crookshanks's career. He became a valued behind-the-scenes advisor to Whig politicians, including future Prime Minister Robert Walpole, on technical matters related to "Trade & Revenue." [50] It was in this capacity that he became embroiled in the dispute with Hutcheson in the summer of 1718. Crookshanks was enlisted by Sir David Dalrymple, a top Scottish Whig, who presented him with Hutcheson's pamphlet and desired that he "examin some accounts therein."[51] He responded with a detailed letter to the top Whig minister of the moment, the Earl of Sunderland, which Crookshanks soon expanded and published.[52]

Hutcheson's biography is no less intriguing than Crookshanks's.[53] He was born around 1660 to Ulster-Scottish parents. Trained as a lawyer at the Middle Temple by the early 1680s, he became attorney-general and agent to the Colonial Governor of the Leeward Islands in 1688, where he became helped manage the complicated logistics of paying overseas military forces. [54] From the West Indies, he also offered his advice to English politicians on the merits of expanding England's

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102; Jacob M. Price, "Glasgow, the Tobacco Trade, and the Scottish Customs, 1707-1730: Some Commercial, Administrative and Political Implications of the Union," *The Scottish Historical Review* 63, no. 175, Part 1 (Apr., 1984): 1-36, esp. pp. 2, 8-12; "Observations Made by J. C. on the Arguments about Unrated East India Goods," 7 July 1715, NA T 1/191, ff. 49-50.

[49] "Case and Petition of John Crookshanks," in CamUL Ch(H) Letters 1415, no foliation.

[50] For correspondence between Walpole and Crookshanks from 1721-1733, see: CamUL Ch(H) Letters 923, 1150-1, 1161-2, 1397, 1400, 1405, 1415, 1417-8, 1742-3, 1759-60, 1770, 1809, 1833, 1944.

[51] John Crookshanks to the Earl of Sunderland, 13 August 1718, Bleinheim-Sunderland Papers, BL Add. MS 61,605, ff. 32-34, quotation on f. 32^{r}.

[52] Crookshanks continued to operate on the fringes of the big stories that are traced in this dissertation. In 1720, for example, he apparently profited from dubious deals relating to the Stock of the South Sea Company. In the mid-1720s, he advised Walpole on methods for paying down the National Debt. See: "Memorial for the Lord President concerning a Debt due by John Cruikshanks Esqr," c. 1726, Hamilton-Dalrymple Papers, NAS GD 110/57; Crookshanks to Walpole, 20 February 1726/7 and 3 April 1727, CamUL Ch(H) Letters 1405 and 1417.

[53] For a more extended biography of Hutcheson, see: A. A. Hanham, "Hutcheson, Archibald," in Cruickshanks et al, eds. *History of Parliament: The House of Commons 1690-1715,* Vol. IV, pp. 449-450.

[54] "Report of Lord Ranelagh… laying before them the state of the debt owing to the regiment of foot, under the command of Col. Holt, in the West Indies… Accompanied by the memorial of Archibald Hutcheson, Esq.," 5 February 1695/6, Treasury Papers, NA T 1/36, ff. 106-108.

imperial influence, for example into French-controlled parts of St. Christopher.[55] When he returned to England in 1704, he resumed his legal practice and, four years later, earned election to the Royal Society of London. From at least 1710, Hutcheson became a trusted confidant of the Duke of Ormond, and it was presumably through the favoritism of that influential Tory that Hutcheson was elected MP for the seaside town of Hastings in 1713. Despite his Tory affiliations, Hutcheson built up sufficient goodwill with the Hanoverian Court and key Whigs to earn himself a prized position on the Board of Trade. Hutcheson's relationship with the Whigs quickly soured, though, as he began vociferously to question Whig policies, especially on matters of public finance; he quit the Board of Trade in 1716, a mere two years after he joined it. It is in his role as a Parliamentary gadfly, outside government administration, that Hutcheson enters our story.[56]

The stories of Hutcheson and Crookshanks shared essential similarities. Both hailed from Britain's geographic periphery, and in their early careers both had to travel to distant outposts of Britain's economic and imperial reach. They both learned to manage challenging accounting and logistical enterprises, in particular those related to international military administration. Their competence in handling such difficult tasks helped them earn more prominent and lucrative positions within the growing military-fiscal state, and attracted the patronage of influential politicians. The differences between their careers, though, speak to the inchoate nature of the economic knowledge on which they tried to build their lives. They were trained in very different occupations, Hutcheson going through the Inns of Court and Crookshanks through mercantile clerkship in Mediterranean trade. Hutcheson was more closely connected to the vibrant scientific and literary culture of his age.[57] Crookshanks attempted to convert his computational skills into a

[55] Archibald Hutcheson to John Ellis, 24 December 1697, Ellis Correspondence, BL Add. MS 28,881, f. 602.
[56] On Hutcheson's early Parliamentary career, see Ch. 5, Section I.
[57] Hutcheson, for example, was friends with physician and polymath John Arbuthnot, and was later a patron of novelist Samuel Richardson. See: Lester M. Beattie, *John Arbuthnot, Mathematician and Satirist* (Cambridge, MA: Harvard University Press, 1935), p. 29; John A. Dussinger, "Samuel Richardson's 'Elegant Disquisitions': Anonymous Writing in the 'True Briton' and Other Journals," *Studies in Bibliography* 53 (2000): 195-226, esp. pp. 201-2.

coveted "place" in the machine of executive government, whereas Hutcheson spent most of his later career criticizing it. Crookshanks, it would seem, engaged in public calculation because he had to, because it provided a service to powerful patrons; Hutcheson, rather, engaged in public calculation because he wanted to, because it served certain political and ideological ends.

Yet they both, ultimately, attempted to forge a career on the strength of their ability to carry out complex calculations on matters of "Trade & Revenue." More than just competence, skill, or knowledge, Hutcheson and Crookshanks both cultivated a new, if immature, kind of *expertise*.[58] This dissertation seeks to deepen our understanding of the dynamics of expertise in the early modern world, by looking at the emergence of a peculiar kind that emerged in the period, namely expertise in the analysis of fiscal policy, trade, and finance.[59] "Expertise" was hardly a well-developed category for historical actors in the post-1688 period. To describe Hutcheson and Crookshanks as representing an emerging kind of economic expert in eighteenth-century political culture is to cast them in a role that they themselves would not have fully understood, and to describe them in language they would not have used. Yet I argue that thinking of these two, as well as the many other economic calculators who populate the following pages, as "experts" *in-the-making* provides a useful interpretive frame for understanding the problematic social dynamics that surrounded economic knowledge at the time.[60] Further, by looking closely at the activities of such embryonic economic

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[58] Recently, a keen scholarly interest has developed around the nature and development of expertise in the modern world, motivated by diverse topical concerns ranging from science and technology studies to post-colonial studies. STS scholars Harry Collins and Robert Evans have made a project of critically rehabilitating expertise the basis of what they call a "Third Wave of Science Studies." For an introduction, see: Collins and Evans, *Rethinking Expertise* (Chicago and London: University of Chicago Press, 2007). Historians like Timothy Mitchell have become interested in the interactions of expertise (especially economic and social-scientific expertise), imperial power, and "modernity" in regions under colonial hegemony. The latter literature tends to emphasize that, as Omnia El Shakry writes, "social science itself emerged as an authoritative field of expertise in an imperial age." See: Mitchell, *The Rule of Experts: Egypt, Techno-Politics, Modernity* (Berkeley et al.: University of California Press, 2002); El Shakry, *The Great Social Laboratory: Subjects of Knowledge in Colonial and Postcolonial Egypt* (Stanford, CA: Stanford University Press, 2007), quotation on p. 2.

[59] See: Eric H. Ash, ed. *Expertise: Practical Knowledge and the Early Modern State, Osiris* 25 (Chicago: University of Chicago Press, 2010). My thanks also to Prof. Thomas Broman for several useful conversations on this topic.

[60] Looking at the activities of both Crookshanks and Hutcheson, it is indeed evident that they substantially, if not entirely, fulfilled the five requirements for being considered "expert" in the early modern world, as recently defined by Eric Ash. (1) In knowing how to carry out difficult financial computations, they could be said to "possess and control a

experts, this dissertation seeks to provide color on two bigger questions. First, what was the relationship between practical skill and abstract knowledge—between "practice" and "theory"—in the constitution of early-modern expertise? Second, how central was the role of the state in creating the early-modern expert?

To begin, the chapters below explore one evocative instance of how the practical and theoretical wrestled with one another in the shaping of a new body of knowledge, and a new collection of would-be experts, in the early modern world. One of the most provocative trends in the recent historiography of early modern science has been reconstructing the close relationship between the formal activities of natural philosophers and the practical, tacit knowledge of skilled artisans.[61] Scholars of early modern expertise have in turn examined the degree to which early modern practitioners became experts precisely by governing the relationship between the theoretical and the practical. Eric Ash has argued, for example, that for those who aspired to be "expert mediators" in fields like navigation and mining in Elizabethan England, expert status depended on the ability to command "theory," as something separate from, and superior to, "practice."[62] The story of economic expertise in Augustan Britain, by contrast, provides one example of a nascent kind of expertise in which the relationship between theory and practice was not only unsettled, but

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body of specialized practical and productive knowledge, not readily available to everyone." (2) That knowledge was based in part on *experience* carrying out difficult computational tasks, be it in the counting-houses of Mediterranean traders or the administrative offices of distant colonies. (3) They were arguably engaged, though in different degrees, in the "abstraction or distillation of theory from practice," especially Hutcheson. (4) They were both clearly "distinguishable from common practitioners" within the relevant fields, like mercantile accounting or fiscal administration, both at various times singled out for their exceptional competence. (5) Finally, they both sought, and to a great degree obtained, "some form of public acknowledgement, affirmation, or legitimation" of their expert status—even if there were not yet clear or consistent vocabularies of expertise to describe that status. See: Ash, "Introduction: Expertise and the Early Modern State," in *Expertise*, *Osiris* 25 (2010), pp. 1-24, esp. p. 4-11.

[61] Pamela O. Long, *Openness, Secrecy, Authorship : Technical Arts and the Culture of Knowledge from Antiquity to the Renaissance* (Baltimore: Johns Hopkins University Press, 2001); Deborah E. Harkness, *The Jewel House: Elizabethan London and the Scientific Revolution* (New Haven, CT: Yale University Press, 2007); Lissa Roberts, Simon Schaffer, and Peter Dear, eds., *The Mindful Hand: Inquiry and Invention from the Late Renaissance to Early Industrialization* (Amsterdam : Koninkliijke Nederlandse Akademie van Wetenschappen, 2007).

[62] Eric Ash, *Power, Knowledge, and Expertise in Elizabethan England* (Baltimore, MD and London: Johns Hopkins University Press, 2004), esp. pp. 8-17. Compare the story offered by Larry Stewart. He argues that, in the case of one especially abstract body of knowledge, Newtonian natural philosophy, a broader cultural esteem for Newtonian "theory" came only after popularizers and practitioners were able to demonstrate that the theory was of tremendous *practical* use. See: Stewart, *The Rise of Public Science*, esp. Part II.

actively contested.[63] When it came to matters like foreign trade or public finance, contemporaries regularly fought about whether such questions ought to be settled according to the practical know-how of experienced merchants, or according to some more abstract set of principles or theories about what Daniel Defoe once called "Universal Commerce."[64]

Second, historians have explored how, across many different national contexts and specific technical problems, the construction of the early-modern expert was deeply entwined with the building of the early modern state.[65] Experts helped put the economic and military ambitions of princes into practical effect, whether by improving maritime navigation procedures or charting geological resources or building gardens and canals. They helped to mediate between the exalted world of the court and the gritty, mundane labors of those subjects on whom the state depended. For both Hutcheson and Crookshanks, their careers were deeply involved with the growth of new state (indeed, imperial) capacities. At the same time, the demand for their particular skills could not be explained entirely in terms of the needs of the military-fiscal state. At various points in their careers, Hutcheson and Crookshanks both attempted to use their skills not only in carrying out difficult administrative tasks, but in presenting penetrating, lucid calculations that could be mobilized toward *public*, political ends. I show that in the newly participatory, representative political context of eighteenth-century Britain (if not necessarily in other times and places), some kinds of expertise were necessarily built both inside and *outside* the state.[66]

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[63] In that way, this study follows the lead of Thomas Broman, who has argued that scholars ought to attend not only to the critical theory-practice linkage in the making of modern expert and professional identities, but to how "the link between theory and practice has to be forged *in discourse*." See: Thomas Broman, "Rethinking Professionalization: Theory, Practice, and Professional Identity in Eighteenth-Century German Medicine," *The Journal of Modern History* 67, no. 4 (Dec., 1995): 835-72, quotation on p. 837.

[64] [Daniel Defoe], *A General History of Trade, and Especially Consider'd As It Respects The British Commerce*…, no. 1, (London: Printed for J. Baker, June, 1713), p. 13.

[65] See, for example: Chandra Mukerji, "The Political Mobilization of Nature in 17th-Century French Formal Gardens," *Theory and Society* 23, no. 5 (1994): 651-677; Ash, *Power, Knowledge, and Expertise*.

[66] One might simply point out, of course, that the kind of expertise that Secretary of State Sunderland sought from John Crookshanks was in fact about a kind of state control—about the state's desire to control public opinion. For an interesting case study of the ambivalent character of political-economic expertise in a polity with an emergent "public,"

III. Why Did the Hutcheson-Crookshanks Debate Matter?

Why was it, though, that the specific value of one number, the £45 million size of the National Debt as of 1713, merited so much attention, and labor, not only from Hutcheson and Crookshanks, but from eminent politicians like Sunderland? The size of the National Debt, like many similar computational questions, was a node in a tight network of political controversies that spread well beyond the specifics of fiscal policy. By calculating where the National Debt stood as of 1713, Hutcheson had attempted to show that the Debt had substantially increased under the Whig ministry of the intervening half-decade, a remarkable indication of the Whigs' mismanagement—and possibly corruption. For Crookshanks and his Whig patrons, though, to impugn the probity of the Whig ministry, which had taken over at the 1714 Succession of the new King George I, was to impugn the "Hanoverian" Succession itself. To the Whigs, installing the Protestant George I on the throne following the death of Queen Anne was the final victory in a triumphant defense of the nation's ancient constitution from Popish tyranny, a struggle dating back to before the Revolution of 1688. Whatever the debts incurred in that defense, it was more than justified, because as Crookshanks himself put it, "the Protestants have advanced the Money, and leave it as a Wager, that the Protestant Succession shall remain firmly fix'd."[67] To question, as Hutcheson did, whether the nation was worse off since 1714 than before was almost to doubt the value of that Revolution itself, and to suggest that the nation might have been better off had it remained under the Catholic Stuarts. The specter of "Jacobitism" colored political debates for decades after 1688.[68] Whigs like Crookshanks worried incessantly about a Jacobite insurgence overturning the achievements of the Revolution, or at least played upon such fears to gain political leverage; opposition politicians like

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see: Anna Maerker, "Political Order and the Ambivalence of Expertise: Count Rumford and Welfare Reform in Late Eighteenth-Century Munich," in *Expertise*, *Osiris* 25 (2010), pp. 213-30.

[67] Crookshanks, *Seasonable Remarks*, p. 12.

[68] On Jacobitism, see Paul Kleber Monod, *Jacobitism and the English People 1688-1788* (Cambridge, UK et al.: Cambridge University Press, 1989).

Hutcheson, by contrast, had to fight the accusation that any kind of scrutiny or criticism of the monarchy or its ministers was tantamount to Jacobitical treason.

Recently, historians Tim Harris and Steve Pincus have brought fresh attention to the diverse ways in which the events of 1688-9 revolutionized political life in England, Scotland, and Ireland.[69] The Revolution not only reshaped the nation's political constitution, but impacted on religious life, economic activity, legal institutions, and even cultural production and scientific thinking.[70] It also triggered a quarter-century of war between the three British kingdoms and France, a conflict which left few areas of life in Britain and its emergent empire untouched. This dissertation seeks to explore yet another consequence of the Revolution—its impact on collective political cognition, on the methods and materials employed in political reasoning. Those transformations were made possible by the rise of three powerful new political forces that Britons experienced in the aftermath of 1688—which might be described simply as Parliament, parties, and the press—which created an especially nourishing environment for new computational tools of political argument to develop.

To begin, the Revolution of 1688 and its aftermath dramatically changed the structures of political power and deliberation in England. The "Revolutionary Settlement" of 1689 reshaped the power balance between Crown and Parliament. Explicit constitutional acts, like the 1689 Bill of Rights, the 1694 Triennial Act, and the 1701 Act of Settlement began to delimit the extent of monarchical authority. Though much about the powers of Crown and Parliament remained murky and unspecified, these constitutional acts restricted the Crown's ability to interfere with the courts or with elections and also asserted vital Parliamentary rights and privileges, including the right of free

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[69] Tim Harris, *Revolution: The Great Crisis of the British Monarchy, 1685-1720* (London et al.: Allen Lane, 2006); Steve Pincus, *1688: The First Modern Revolution* (New Haven, CT: Yale University Press, 2009).

[70] Historical studies have explored the impacts of 1688 on, for example, attitudes toward economic monopolies, the development of a centralized legal authority (the Court of King's Bench) and its impact on social stability, and the popular reception of Newtonian natural philosophy. W. Darrell Stump, "An Economic Consequence of 1688," *Albion* 6, no. 1 (Spring, 1974): 26-35; Paul D. Halliday, *Dismembering the Body Politic: Partisan Politics in England's Towns, 1650-1730* (Cambridge, UK et al.: Cambridge University Press, 2003); Margaret C. Jacob, *Newtonians and the English Revolution 1689-1720* (Ithaca, NY: Cornell University Press, 1976); Steven Shapin, "Of Gods and Kings: Natural Philosophy and Politics in the Leibniz-Clarke Disputes," *Isis* 72, no. 2 (Jun., 1981): 187-215.

speech within Parliament and the requirement that new Parliamentary elections be held every three years (at least until 1716, when the Act was repealed). A key component of Parliament's expanded constitutional authority was the "financial settlement" that followed the Revolution, which bounded the size and permanence of the revenue granted to the Crown by Parliament, making subsequent monarchs newly reliant on the monetary generosity of the legislators.[71] These new powers reshaped the very nature of Parliament itself, from an occasional event carried out at the pleasure of the monarch (which, indeed, had met only once between 1681 and 1689), into a permanent institution upon which the Crown depended. New powers also brought new responsibilities, and Parliament's increasing fiscal command meant that MPs found themselves deliberating over technical questions of trade and finance of unaccustomed complexity.

The political transformation of post-Revolutionary England was not confined to the walls of Westminster. Two other major forces—political parties and the public press—meant the quarrels of MPs resonated far more widely. First, political conflict in the late seventeenth century came to be increasingly organized and perceived in partisan terms, as an antagonistic showdown between competing parties that feared victory by the opponent meant political and constitutional catastrophe. Much of the time, such conflict was aligned along an axis of "Whig" versus "Tory." The two great parties first coalesced in the late 1670s around the so-called "Exclusion Crisis," when a group of politicians attempted to legally prohibit King Charles II's Catholic brother James (future King James II), from ascending to the throne upon Charles's death. Those who supported this Exclusion Bill were derisively termed "Whigs" by their opponents, who in turn earned their own abusive epithet of "Tory." Although, by 1688, Whigs and Tories agreed on the need for Revolution, they nonetheless

[71] On the financial settlement, see, for example: Jennifer Carter, "The Revolution and the Constitution," in *Britain after the Glorious Revolution 1689-1714,* ed. Geoffrey Holmes (London, 1969), 39-58; E. A. Reitan, "From Revenue to Civil List"; Clayton Roberts, "The Constitutional Significance of the Financial Settlement of 1690," *The Historical Journal* 20, no. 1 (Mar., 1977): 59-76.

saw England (soon, Britain) taking fundamentally divergent courses toward "modernity."[72] These competing visions became a major driver of political controversy for decades. Whigs envisioned expanded Parliamentary power, the aggressive promotion of domestic manufacturing, proactive defense against the threat of France through military conflict in Europe, and moderate religious policies toward dissenting Protestants. For Tories, Britain's modernity meant a strong and largely independent monarchy, commercial and tax policies that favored the nation's natural and agricultural products, avoidance of entanglements with the Continent and emphasis on naval defense, and strong support for the moral and religious leadership of the Church of England.

In the fifty years after 1688, both the individual makeup and the political importance of the Whig and Tory parties shifted, which only added to contemporary anxieties about the detrimental effects of partisanship. At some moments, few would have doubted that the battle of Whig and Tory was the defining feature of political life. In the fraught reign of Queen Anne (1702-1714) and particularly in the years 1710-1714, the divergence between the two major political parties became "the most dominating, inescapable fact of political life at all levels," as the work of Geoffrey Holmes has demonstrated.[73] The labels of Whig and Tory came to define not only the choice of MPs at the polls and voting patterns in Westminster, but also governed Britons' choices of newspapers, dinner clubs, coffeehouses, playhouses, and even physicians.[74] At moments, the energy of partisan controversy could generate popular unrest and even violence.[75] At other times, though, political alignments were not so obvious, and alternative systems of political identification overlapped with

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[72] This is a central argument of Pincus, *1688*, esp. ch. 10.

[73] Geoffrey Holmes, *British Politics in the Age of Anne* (London et al./New York: Macmillan/St. Martin's, 1967), quotation on p. 8; Holmes and W. A. Speck, eds. *The Divided Society: Parties and Politics in England 1694-1716* (London: Edward Arnold, 1967); Speck, *Tory & Whig: The Struggle in the Constituencies* (London/New York: Macmillan/St. Martin's, 1970); Gary Stuart De Krey, *A Fractured Society: The Politics of London in the First Age of Party 1688-1715* (Oxford: Clarendon Press, 1985); Halliday, *Dismembering the Body Politic*, chs. 8-9; John Miller, *Cities Divided: Politics and Religion in English Provincial Towns, 1660-1722* (Oxford et al.: Oxford University Press, 2007), chs. 12-13.

[74] Holmes, *British Politics in the Age of Anne*, ch. 1.

[75] Geoffrey Holmes, "The Sacheverell Riots: The Crowd and Church in Early Eighteenth-Century London," *Past & Present* 72 (Aug., 1976): 55-85.

and confused those of Whig and Tory. Some historians have argued that the political controversies of the 1690s, for example, were sometimes arranged along an alternative axis of "Court" vs. "Country," which tended to pit "Court" ministers, entrusted with administrative responsibilities by the Crown, against a collection of independent "Country" MPs skeptical of such insiders.[76] The animosity between ministerial and place-holding MPs and their independent counterparts persisted into the eighteenth-century, and the anti-corruption language of 1690s "Country" politics infused later conflicts. At other times, the predominant political fissures were intra- rather than inter-party, as for example during the schism that split the ruling Whigs from 1717 to Robert Walpole's ascendance in 1721, or after 1725, when Walpole's former ally William Pulteney led a group of disenchanted Whigs into a "Patriot" opposition, with the aid of traditional Tories like Lord Bolingbroke.[77]

Another complication was that the composition of the two great parties was often in flux. Politicians and political writers straddled multiple partisan identities and moved between parties over time. Robert Harley, for example, entered Parliament in 1689 as a nominal Whig, espoused Country views through much of the 1690s, held prominent positions in Whig-dominated governments in the first decade of the 1700s, before defecting to lead a Tory government that won a massive electoral victory in 1710. Political writers like Daniel Defoe, among Harley's favorite polemicists, were even harder to pin down. Hutcheson, as we will see, entered Parliament with the help of a Tory patron, and was a ceaseless critic of Whig ministries, but also deviated sharply from the Tory party-line on

[76] On the politics of Court and Country, see: Dennis Rubini, *Court and Country 1688-1702* (London: Hart-Davis, 1968); J. A. Downie, "The Commission of Public Accounts and the Formation of the Country Party," *The English Historical Review* 91, no. 358 (Jan., 1976): 33-51; David Hayton, "Moral Reform and Country Politics in the Late Seventeenth-Century House of Commons," *Past & Present* 128 (Aug., 1990): 48-91.

[77] On the Patriot opposition, see: Christine Gerrard, *The Patriot Opposition to Walpole: Politics, Poetry, and National Myth, 1725-1742* (Oxford: Clarendon Press, 1994). Lewis B. Namier famously argued that political life in Britain from the age of Walpole through mid-century was driven not by ideological principle or party allegiance, but rather by smaller factional allegiances, patronage, and the quest for the spoils of government. See: L. B. Namier, *The Structure of Politics at the Accession of George III*, 2nd edition (London/New York: Macmillan/St. Martin's Press, 1957 [1929]).

major issues like religious conformity.[78]Ambivalent political identities fueled political angst, as contemporaries not only feared that their own cherished political values were under assault from inimical factions, but also that they might not even know who constituted such factions, or that partisan schemers might be hiding their true motivations.[79] A perceived political need for more transparency about party affiliations was evident in the contemporary proliferation of "division lists," particularly in print, which informed a wider public audience about how MPs actually voted on critical questions.[80] Scholars continue to dispute the nature and political significance of Whig-Tory party identities across this period. One thing that cannot be denied is that politically-active Britons across the period thought of themselves as living in an age in which political decisions were controlled—or at risk of being controlled—by large-scale factional interests. Partisan anxieties and anxieties about partisanship instilled even the most technical policy disputes with incredibly high political stakes, and are therefore essential to explaining the acrimony and attention to detail evident in the Hutcheson-Crookshanks debate. This dissertation seeks to deepen our understanding of the nature of partisanship in the period by exploring both how party conflict (or the perception thereof) created distinctive conditions for making and evaluating political knowledge, and how critical, contrasting ideas about credibility, self-interest, and expertise undergirded party fractures.

The form taken by the Hutcheson-Crookshanks controversy was as important as its partisan character. Theirs was a paper war, a battle played out through pamphlets of moderate length and modest price. To the political culture of the post-1688 era, the rise of the press was as definitive as

[78] For a more precise discussion of Hutcheson's political identity, see Chapter 5, Section I.
[79] For a discussion of contemporary attitudes about parties themselves, with a useful collection of contemporary documents, see: J. A. W. Gunn, *Factions No More: Attitudes to Party in Government and Opposition in Eighteenth-Century England* (London: Frank Cass, 1971). For broader background on political dissimulation in early modern Europe, and the anxieties it caused, see: Jon R. Snyder, *Dissimulation and the Culture of Secrecy in Early Modern Europe* (Berkeley et al.: University of California Press, 2009).
[80] On division lists, see: Aubrey Newman, ed. *The Parliamentary Lists of the Early Eighteenth Century: Their Compilation and Use* (Leicester: Leicester University Press, 1973).

that of Parliament or parties.[81] In 1695, Parliament refused to renew the Licensing Act, a collection of press restrictions initiated in the 1630s that necessitated that printed texts be approved and potentially censored prior to their printing. The elimination of pre-publication censorship energized a publishing industry that had already experienced considerable growth in the previous century. New publishers cropped up in the late seventeenth century, producing cheap polemical tracts and helping to protect authors' anonymity and screen them from legal penalties. This developing commercial infrastructure proved of great value in the contentious partisan politics of the post-1688 period. Party leaders, most especially Robert Harley, began to make great efforts to use newspapers and pamphlets to generate political support among representatives and voters and to discredit political enemies. Harley kept a stable of writers in his employ to help craft pointed technical arguments and biting satires for a public readership, including political economist Charles Davenant and the tireless Daniel Defoe. Often, party leaders turned to more obscure figures to carry out such argumentative tasks, figures like John Crookshanks.

In large part because of these interrelated forces—Parliament, parties, and the press—post-1688 Britain witnessed the rise of a distinctive epistemic culture.[82] That culture was as paranoid as it was unforgiving. Politically-engaged Britons of this era lived in a kind of collective fear that they were being deceived.[83] Across many areas of their political and economic lives, Britons frequently expressed anxiety that they were not being told the whole truth by the people and institutions that governed their lives—political ministers, government administrators, economic agents, corporate

[81] On the political uses of the press after 1688, as well as discussion of earlier precedents, see: Holmes, *British Politics in the Age of Anne*, pp. 30-33; W. A. Speck, "Political Propaganda in Augustan England," *Transactions of the Royal Historical Society,* Fifth Series, 22 (1972): 17-32; J. A. Downie, *Robert Harley and the Press: Propaganda and Public Opinion in the Age of Swift and Defoe* (Cambridge, UK et al.: Cambridge University Press, 1979); P. B. J. Hyland, "Liberty and Libel: Government and the Press during the Succession Crisis in Britain, 1712-1716," *English Historical Review* 101, no. 401 (Oct., 1986): 863-888; Joad Raymond, *Pamphlets and Pamphleteering in Early Modern Britain* (Cambridge, UK et al.: Cambridge University Press, 2003).

[82] Karin Knorr-Cetina, *Epistemic Cultures: How the Sciences Make Knowledge* (Cambridge, MA: Harvard University Press, 1999).

[83] Compare the different sense in which Daston and Galison claim that "all epistemology begins in fear." (*Objectivity*, pp. 372-4)

managers, journalists, lawyers.[84] Mark Knights and Kate Loveman have captured in vibrant detail how an endemic fear of dissimulation and misrepresentation played out in the daily lives and artistic imaginations of Britons, be it in the legal turmoil of rural Hertford or the emergence of new skeptical reading practices and the fictional writings that played upon them.[85] Politically, Britons lived in fear of covert Jacobites and mercenary politicians co-opting the cause of the Revolution for personal gain.[86] In economic life, they feared forged credit instruments, the lies of the "stock-jobber," and the false promises of the "projector."[87] New spaces for commerce and conversation—the places of Britain's emergent "public sphere"—seemed to many to be riddled with any number of different tricksters hawking alluring lies.[88] The wittiest pens of the age indeed drew biting analogies

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[84] For introduction, see Gordon S. Wood, "Conspiracy and the Paranoid Style: Causality and Deceit in the Eighteenth Century," *The William & Mary Quarterly,* Third Series, 39, no. 3 (Jul., 1982): 401-441. Compare: Eveline Cruickshanks and Howard Erskine-Hill, *The Atterbury Plot* (Houndmills, UK and New York: Palgrave Macmillan, 2004).

[85] Mark Knights, *Representation and Misrepresentation in Later Stuart England: Partisanship and Political Culture* (Oxford et al.: Oxford University Press, 2005); Knights, *The Devil in Disguise: Deception, Delusion, and Fanaticism in the Early English Enlightenment* (Oxford et al.: Oxford University Press, 2011); Kate Loveman, *Reading Fictions, 1600-1740: Deception in English Literary and Political Culture* (Aldershot, UK and Burlington, VT: Ashgate, 2008).

[86] On contemporary fears of corruption and immorality after 1688, see: J. A. W. Gunn, *Beyond Liberty and Property: The Process of Self-Recognition in Eighteenth-Century Political Thought* (Kingston, CA: McGill-Queen's University Press, 1983), pp. 10-15; Hayton, "Moral Reform and Country Politics."

[87] On forgers, see: Randall McGowen, "Knowing the Hand: Forgery and the Proof of Writing in Eighteenth-Century England," *Historical Reflections/Reflexions Historiques* 24, no. 3 (Fall, 1998): 385-414; McGowen, "From Pillory to Gallows: The Punishment of Forgery in the Age of Financial Revolution," *Past & Present* 165 (Nov., 1999): 107-140; Wennerlind, *Casualties of Credit,* chs. 3-4. On jobbers, see: "A Jobber" [Daniel Defoe], *Anatomy of Exchange Alley or a System of Stock-Jobbing* (London: Printed for E. Smith, 1719), esp. p. 13; [Defoe], *The Villainy of Stock-Jobbers Detected, and the Causes of the Late Run upon the Bank and Bankers Discovered and Considered* (London: *s.n.*, 1701); Alex Preda, "In the Enchanted Grove: Financial Conversations and the Marketplace in England and France in the 18th Century," *The Journal of Historical Sociology* 14:3 (Sept., 2001): 276-307; Richard Dale, *The First Crash: Lessons from the South Sea Bubble* (Princeton, NJ: Princeton University Press, 2004), ch. 1. On projectors, see: [Daniel Defoe], *An Essay upon Projects* (London: Printed by R. R. for Tho. Cockerill, 1697); Pat Rogers, "Gulliver and the Engineers," *Modern Language Review* 70, no. 2 (Apr., 1975): 260-270; Christine Macleod, "The 1690s Patent Boom: Invention or Stock-Jobbing?" *The Economic History Review* 39, no. 4 (Nov., 1986): 549-571; Macleod, *Inventing the Industrial Revolution: The English Patent System, 1660-1800* (Cambridge, UK et al.: Cambridge University Press, 1988), esp. chs. 2-3; Larry Stewart, *The Rise of Public Science*, ch. 5; A. J. G. Cummings and Larry Stewart, "The Case of the Eighteenth-Century Projector: Entrepreneurs, Engineers, and Legitimacy at the Hanoverian Court in Britain," in Bruce T. Moran, ed. *Patronage and Institutions: Science, Technology, and Medicine at the European Court, 1500-1750* (Woodbridge, UK and Rochester, NY: Boydell Press, 1991), pp. 235-261; Simon Schaffer, "The Show That Never Ends: Perpetual Motion in the Early Eighteenth Century," *The British Journal for the History of Science* 28, no. 2 (Jun., 1995): 157-189.

[88] For a selection of literature on the "public sphere," and especially how contemporaries sought to regulate and control the risks that were brought by the potential for deceptive practices within public spaces, see: Jürgen Habermas, *The Structural Transformation of the Public Sphere: An Inquiry into a Category of Bourgeois Society,* trans. Thomas Burger (Cambridge, MA: MIT Press, 1989); Lake and Pincus, "Rethinking the Public Sphere"; Peter Lake and Steven Pincus, eds. *The Politics of the Public Sphere in Early Modern England* (Manchester, UK and New York: Manchester University Press, 2007); Lawrence Klein, *Shaftesbury and the Culture of Politeness: Moral Discourse and Cultural Politics in Early Eighteenth-Century England*

between the deceptions of politics and those of commerce.[89] They also reflected on the potential dishonesty of writing itself, and particularly the anonymous or pseudonymous words of the cheap press.[90]

I argue that this nervous condition, of necessary yet begrudging trust under uncertainty, was a vital condition for the emergence of a new culture of political numeracy. More than anything else, calculation developed as tool of interrogation and critique, a way to peer inside the closed sites of political and commercial power, to overcome informational asymmetries, and to critique those powerful insiders who many Britons feared might just be deceiving them. Yet the development of new ideas about the special political virtues of numbers owed just as much to the second—and very much related—feature of Britain's political-epistemic culture in the aftermath of 1688, its profound lack of forgiveness. In matters of political dispute, Britons in the generation after 1688 could be unforgiving about one another's personal qualities, about the outcomes of policy decisions, and especially about statements of political knowledge. This was especially true in matters of political economy—the past or future efficacy of a certain tax, the profitability of foreign trade in a certain good or with a certain country, the size of the National Debt. The most important cause of the unforgiving nature of political-economic disputation was, of course, the simple fact of party politics. The questions of economic analysis were fought out during this period in the no-holds-barred arena

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(Cambridge, UK et al.: Cambridge University Press, 1994), esp. pp. 1-14; Klein, "Gender and the Public/Private Distinction in the Eighteenth Century: Some Questions about Evidence and Analytic Procedure," *Eighteenth-Century Studies* 29, no. 1 (Fall, 1995): 97-109; Brian Cowan, "Mr. Spectator and the Coffeehouse Public Sphere," *Eighteenth-Century Studies* 37, no. 3 (Spring, 2004): 345-366; Miles Ogborn, *Spaces of Modernity: London's Geographies, 1680-1780* (New York: Guilford Press, 1998), ch. 3 ("The Street").

[89] See, for example: [Daniel Defoe], *The Free-Holders Plea against Stock-Jobbing Elections of Parliament Men* (London: *s.n.*, 1701); "A Small Courtier," [Jonathan Swift], *The New Way of Selling Places at Court. In a Letter from a Small Courtier to a Great Stock-Jobber* (London: Printed for J. Morphew, 1712); [John Arbuthnot], *Proposals for Printing a Very Curious Discourse, in Two Volumes in Quarto, Intitled…A Treatise of the Art of Political Lying* (London: Printed for John Morphew, 1712).

[90] A collection of literary studies in the 1990s reconstructed the parallels Augustan Britons saw between the deceptive nature of new paper financial instruments, and the fictions perpetrated by literary styles emergent in the early eighteenth century. See: Colin Nicholson, *Writing and the Rise of Finance: Capital Satires of the Early Eighteenth Century* (Cambridge, UK et al.: Cambridge University Press, 1994); Patrick Brantlinger, *Fictions of State: Culture and Credit in Britain, 1694-1994* (Ithaca, NY: Cornell University Press, 1996); Sandra Sherman, *Finance and Fictionality: Accounting for Defoe* (Cambridge, UK et al.: Cambridge University Press, 1996); Catherine Ingrassia, *Authorship, Commerce, and Gender in Early Eighteenth-Century England: A Culture of Paper Credit* (Cambridge, UK et al.: Cambridge University Press, 1998).

of the public press, often between Whig and Tory parties that were convinced (or at least spoke as if they were) that any kind of victory by the other side threatened the very security of the nation.[91]

This might not seem an environment especially favorable for the development of a new kind of computational culture within politics. But, the unforgiving culture of political knowledge in the era forced those who ventured computations to think with unprecedented seriousness about what it took to make a valid numerical argument that might hold up under such rabid partisan scrutiny. The fact of party politics made deep questions of economic understanding into public conversations. Even more, the combative epistemic culture of the period made politicians and administrators and hack journalists contemplate what made good economic knowledge at all.

IV. Truth and Numbers

Let us return, now, to Crookshanks's ode to the relentless honesty of numbers:

> Truth and Numbers are always the same; tho' the first may be obscured, yet it can never entirely lose its Lustre; and tho' the latter may be transpos'd, they can never lose their Denomination and true Value, when ranged in their proper place; and 45 in Figures, must always be read Forty five in Words.

What precisely was Crookshanks talking about? What was the mysterious "45" he invoked? In 1718, Hutcheson had claimed that the size of the Debt as of 1713 was £46.7 million. In an earlier pamphlet in 1714, though, Hutcheson had cited that number as about £45 million.[92] Crookshanks was not about to let his opponent get away with such a blatant, if seemingly minor, self-contradiction. This was what he meant when he spoke of the "45 in Figures." Crookshanks's grand statement about "Truth and Numbers" was, to some degree, a kind of nit-picking rhetorical trick.

[91] For example, students of science in modern society have pointed out that many legal courts hold claims of scientific and other expert knowledge to standards that far exceed the most stringent procedures of peer-review. See: Porter, *Trust in Numbers*, pp. 195-6.
[92] See: Hutcheson, *A Proposal for the Payments of the Publick Debts*… (*s.l.*: *s.n.*, 1714/5), p. 17.

He wanted to catch Hutcheson in a moment of inconsistency in order to undermine his credibility as a calculator, even if doing so brought up evidence that seemed to bolster Hutcheson's argument.[93]

Whatever his momentary agenda, though, Crookshanks's criticisms were part of a much broader conversation, both implicit and explicit, about what made for a credible calculation in the field of "Trade & Revenue." To his credit, Crookshanks was quite forthcoming about what he said made for a good calculation. A good calculation was built from clear and complete information and did not venture into speculation. Or, as he put it in a letter to Sunderland: "In just Accounts we should begin with Particulars, every Article should be supported with a proper & Authentick Voucher, & then the Genl account should carry a Mathematical Certainty & Demonstration to the meanest capacity."[94] Crookshanks and Hutcheson, and the many other computational combatants of the day, were not simply arguing with numbers, they were arguing *about* numbers: about what role numbers played in political argument, their value in guiding political decisions, and who could say what about them. Just because they attempted to rig the rules of the computational game in ways that favored their own immediate political arguments, does not mean that those rules had no impact on the way the game of "just Accounts" played out, then or in the future.

The history of Britons' evolving *political epistemology* is the broadest concern of this dissertation. Over the past quarter-century, an exciting scholarly conversation has emerged around the questions of *historical epistemology*, the close, contextualized study of what it meant "to know" something, especially about the natural world, at a specific historical moment.[95] Two pioneers in the

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[93] If the National Debt had in fact been lower in 1713—£45 million rather than £46.7 million—that only made stronger Hutcheson's claim that the National Debt had increased under the guidance of the Whig ministers. This was not the only time in their argument Crookshanks introduced numerical claims that in fact seemed to help Hutcheson.

[94] Jo[h]n Crookshanks to the [Earl of Sunderland], 13 August 1718, Bleinheim-Sunderland Papers, BL Add. MS 61,605, ff. 32-34, quotation on f. 33^{v}.

[95] Of the growing literature in this tradition, I have found the following especially inspiring: Hacking, *The Emergence of Probability;* Shapiro, *Probability and Certainty*; Shapiro, *A Culture of Fact*; Lorraine Daston, *Classical Probability in the Enlightenment* (Princeton, NJ: Princeton University Press, 1988); Daston, "The Moral Economy of Science," in Arnold Thackray, ed. *Constructing Knowledge in the History of Science, Osiris,* 2nd Series, 10 (Chicago: University of Chicago Press, 1995), pp. 2-24; Peter Galison, *Image and Logic: A Material Culture of Microphysics* (Chicago and London: University of

study of historical epistemology, Ian Hacking and Lorraine Daston, for example, have recaptured how new mathematical ideas about probability in the late seventeenth and early eighteenth century embodied the distinctive contextual concerns of the period.[96] The concerns extended far beyond the specifics of mathematical practice, encompassing broader uncertainties about justice, rationality, and human nature. Hacking and Daston have demonstrated that, in the early modern world, the relationship between "truth" and "numbers" was anything but obvious. My study takes their efforts even further, grounding contemporary thoughts about numbers, mathematics, and epistemology in the practical, political problems of the day. I explore how contemporary concerns about a kind of "problem of induction," a major concern of Hacking's work, were not limited to philosophers, but were in fact a frequent, implicit challenge faced by economic calculators and administrators wrestling with how to make credible claims on the basis of large volumes of irregular, numerical data. Neither was the problem of developing a "reasonable calculus," an applied mathematics that encoded the practices of rational decision-making, a concern limited to academic mathematicians. Rather, the broader problem of how to use numerical calculations to make sound, ethical economic decisions was a problem shared quite broadly, among the economic pamphleteers and social commentators and politicians of post-1688 Britain.

This dissertation is in keeping with those works in historical epistemology that have focused on a specific activity of knowledge-making—in this case *calculation*. Recently, historians of the mathematical sciences have demonstrated that calculation is far from an individualistic, immaterial,

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Chicago Press, 1997); Daston and Galison, *Objectivity*; Peter Dear, *Discipline and Experience*; Poovey, *History of the Modern Fact*; Daston and Elizabeth Lunbeck, eds. *Histories of Scientific Observation* (Chicago and London: University of Chicago Press, 2011).

[96] Hacking's *Emergence of Probability* explores how the critical epistemological problems of statistical inference coalesced in the period 1650-1700 out of a variety of different sources, including the vital statistics of early political arithmetic, investigations into games of chance, and attempts to develop formal treatises of logic. In particular, Hacking argues that this period witnessed the delineation of an uncomfortable, "Janus-faced" understanding of what "probability" meant—one side that assessed "reasonable degrees of belief in propositions" and another, stochastic or "frequentist" side that examined the stable regularity of events—a duality that persists today (quotation on p. 12). Daston's *Classical Probability in the Enlightenment* explores how, later in the eighteenth century, mathematicians attempted to formalize a probabilistic calculus in order to codify the decision-making processes of the "reasonable man." Daston explores how Enlightenment thinkers struggled to create a set of mathematical rules that accurately captured what it meant to be rational.

or placeless activity, vividly recapturing the localized significance and historical specificity of calculation, from seventeenth-century mathematics to modern quantum physics.[97] I take inspiration from two aspects of the histories offered by Matthew Jones, Andrew Warwick, and David Kaiser. First, methodologically, I seek to show how the seemingly dense, arid economic numbers of the past—like the devotional geometric exercises of René Descartes, or the world-traveling Feynman diagrams of twentieth-century theoretical physicists—are themselves vivid and surprising sources for historical investigation. Many of the arguments in this dissertation start from the numbers and work outward. Even though the economic and financial figures of the past may appear very similar in form to those produced by modern computational practices, the thought processes that produced such historical numbers were often very different from later patterns of economic reasoning. By trying to reconstruct the logics and agendas that produced these calculations in their own, contextualized terms can we recover the distinctive, uncertain, and unfamiliar nature of economic thinking amidst Britain's "financial revolution."

Reconstructing the practical-epistemological concerns of political life in early-eighteenth-century Britain is necessary to understand a pivotal, overlooked moment in the history of quantification in the modern world. A chronological and topical gap has existed in broader narratives of what might be loosely termed "statistical thinking." Previous historians of the topic have paid little attention to either the early eighteenth-century or to matters of trade and finance. Major histories of modern statistical thought have emphasized the late-eighteenth and especially early-nineteenth centuries as the critical flashpoint in the development of modern statistical methods and the social authority accorded to them.[98] Historians interested in numerical reasoning and

[97] Matthew Jones, *The Good Life in the Scientific Revolution: Descartes, Pascal, Leibniz, and the Cultivation of Virtue* (Chicago and London: University of Chicago Press, 2006); Andrew Warwick, *Masters of Theory: Cambridge and the Rise of Mathematical Physics* (Chicago and London: University of Chicago Press, 2003); David Kaiser, *Drawing Theories Apart: The Dispersion of Feynman Diagrams in Postwar Physics* (Chicago and London: University of Chicago Press, 2005).

[98] Both Ian Hacking's *Taming of Chance* and Theodore Porter's *Rise of Statistical Thinking* take the early nineteenth century as the critical moment at which an "avalanche of printed numbers" made available for public consideration led to a vast

political power in the early-modern world, by contrast, have tended to focus on the novel departures of English "political arithmetic," pioneered in the period 1650s-80s by John Graunt and William Petty.[99] Scholars have been less clear on how Pettian political arithmetic contributed to more enduring traditions of political calculation in the dramatically-changed political environment after 1688. Some scholars have even suggested that early eighteenth-century Britain was a particularly inhospitable environment for numerical thinking. Patricia Cline Cohen, for instance, argues that by 1700 in England "probably fewer than four hundred men could be said to be mathematically minded"; in her perspective, it took the peculiar circumstances of America for political numeracy to take hold.[100] Those historians who have addressed the history of applied mathematical thought in eighteenth-century Britain have largely neglected questions of fiscal and commercial policy, one of the most voluminous and vigorous areas of numerical debate in the period.[101]

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proliferation of new uses for numbers in reasoning on political and social questions; neither give significant consideration to how changes in the eighteenth century created preconditions for this avalanche. Stephen Stigler's *History of Statistics* gives greater attention to the eighteenth century, though his focus is more squarely on the physical sciences, especially astronomy. See Ian Hacking, *The Taming of Chance* (Cambridge, UK and New York: Cambridge University Press, 1990); Theodore M. Porter, *The Rise of Statistical Thinking, 1820-1900* (Princeton, NJ: Princeton University Press, 1986); Stephen M. Stigler, *The History of Statistics: the Measurement of Uncertainty before 1900* (Cambridge, MA: Belknap/Harvard University Press, 1986).

[99] Scholars like Ted McCormick, the author of a fine new biography of Petty, have done much to recreate the political and intellectual context that prompted innovations in political calculation in Petty's period, including Baconian natural philosophy, the Restoration of the Stuart Monarchy after 1660, and especially English administrative intervention and 'colonization' of Ireland. See: McCormick, *William Petty*; Peter Buck, "Seventeenth-Century Political Arithmetic: Civil Strife and Vital Statistics," *Isis* 68, no. 1 (Mar., 1977): 67-84; Patrick Carroll, *Science, Culture, and Modern State Formation* (Berkeley, CA et al.: University of California Press, 2006), esp. ch. 3; Adam Fox, "Sir William Petty, Ireland, and the Making of a Political Economist, 1653-87," *Economic History Review* 62, no. 2 (May, 2009): 388-404.

[100] Patricia Cline Cohen, *A Calculating People: the Spread of Numeracy in Early America* (Chicago: University of Chicago Press, 1981), ch. 1, esp. p. 39. Cohen's interest is in demonstrating a particular rise of popular numeracy associated with American republican ideology after 1776; England therefore provides a foil for America's "republican arithmetic" in her account.

[101] Among historians more focused on the eighteenth-century, Andrea Rusnock, Joanna Innes, and Jessica Warner have reconstructed the central place of numerical argumentation in eighteenth-century political controversies over public health and social reform, in Britain and beyond, from the use of comparative statistics to the efficacy of smallpox inoculation, to the use of empirical data in Parliamentary lobbying on alcohol taxes. Julian Hoppit, Colin Brooks, and Peter Buck have offered insightful reflections on the place of "political arithmetic" in the long eighteenth century, including on matters of public finance and trade policy, though their work has been largely preliminary. Andrea Rusnock, *Vital Accounts: Quantifying Health and Population in Eighteenth-Century England and France* (Cambridge, UK and New York: Cambridge University Press, 2002); Joanna Innes, *Inferior Politics: Social Problems and Social Policies in Eighteenth-Century Britain* (Oxford, UK and New York: Oxford University Press, 2009), ch. 4; Jessica Warner, "Faith in Numbers: Quantifying Gin and Sin in Eighteenth-Century England," *The Journal of British Studies* 50, no. 1 (Jan., 2011): 76-99; Julian Hoppit, "Political Arithmetic in Eighteenth-Century England," *Economic History Review* 49, no. 3 (1996): 516-40; Colin

Synthetic histories of statistical thinking or political calculation that have attempted to bridge the gap between seventeenth-century political arithmetic and the boom in statistical thought in the 1820s-30s have largely bypassed the mini-avalanche of printed economic numbers that occurred in early-eighteenth-century Britain. Two evocative, and very different, examples of this are Alain Desrosières's *Politics of Large Numbers* and Mary Poovey's *History of the Modern Fact.* Desrosières elegantly attempts to explain nineteenth-century statistical thinking, and ultimately twentieth-century econometrics, as an interweaving of three historical threads: state-driven information gathering or *statistics*, the calculus of *probabilities*, and attempts to *estimate* physical or astronomical constants.[102] Though he is keenly interested in both the political uses of statistical thought and the development of modern quantitative economics, none of his three main arcs passes through Britain's financial revolution.[103] The most adventurous treatment of the history of numbers, commerce, and politics across the period, literary scholar Mary Poovey's *A History of the Modern Fact*, offers a distinctly negative take. Poovey does not simply neglect the importance of early-eighteenth-century politics to the history of numbers; she in fact *rejects* the importance of numbers to the political and social discourse of the post-1688 age. Poovey contends that in the *seventeenth* century, numerical "facts" modeled on mercantile accounts came to attain an authoritative status as the building-blocks of knowledge, in large part thanks to economic arguments like Petty's.[104] She argues, however, that in the period between 1688 and the 1710s, an emergent anti-authoritarian political culture—a "liberal governmentality"—strongly rejected "large-scale, government-sponsored projects intended to

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Brooks, "Projecting, Political Arithmetic and the Act of 1695," *English Historical Review* 97, no. 382, (Jan., 1982): 31-53; Peter Buck, "People Who Counted: Political Arithmetic in the Eighteenth Century," *Isis* 73, no. 1 (Mar., 1982): 28-45.

[102] Alain Desrosières, *The Politics of Large Numbers: A History of Statistical Reasoning,* English ed., translated by Camille Naish (Cambridge, MA: Harvard University Press, 1998 [1993]), esp. pp. 16-18.

[103] His narrative, like many others, emphasizes the primary importance of centralized state objectives in the building of a political role for numerical thinking, downplaying the potential importance of critical or public calculations.

[104] Poovey, *A History of the Modern Fact,* pp. 120-143. For an alternative take on the history of the "fact" in the period, compare Shapiro, *Culture of Fact*.

generate knowledge that could be conveyed in numerical form."[105] Subsequently, she argues, social commentators and philosophers migrated away from numbers as the basis of good social and political knowledge.

Poovey's narrative does little to explain a statement like Crookshanks's equation of "Truth and Numbers." I argue that only by reconsidering the very period in which Poovey suggests that numbers declined in political importance can we understand how numbers took on the special kind of authority they have attained in modern political culture. The defining study of that modern phenomenon is Theodore Porter's *Trust in Numbers*. Among Porter's greatest achievements is to show that the modern political idealization of numbers is *not* an automatic consequence of the practical success of counting or calculating as a tool for knowing about and governing the world. Instead, Porter explains the special political prestige of "numbers, graphs, and formulas" in terms of their communicative functions, especially their success as a "technology of distance."[106] He argues that rigorous "regimes of calculation" have served to create "a basis for *mutual accommodation*" among consumers and producers of expert knowledge.[107] For polities at large, numerical discipline limits the necessary reliance on the discretion of individuals for technical judgment. For those offering such technical guidance, the language of quantity offers defense against the interference of meddlesome outsiders. I wish to provide the missing prehistory to Porter's story, and in doing so to make two major elaborations on his work. First, I wish to complicate his picture of the seemingly inverse relationship between numerical objectivity and professional identity by exploring a moment and topic in which the very nature of expertise was only beginning to be defined.[108] Second, I seek to

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[105] Poovey, *History of the Modern Fact,* pp. 143-214, quotation on p. 146. Poovey explains: "Operating in civil society and through the market, liberal governmentality depended (depends) on self-rule rather than rule by coercion; eliciting voluntary compliance through mechanisms of discrimination and emulation essential to rule by fashion, it did not rely on numbers in the same way that sovereignty did." (p. 147)

[106] Porter, *Trust in Numbers*, p. viii-ix.

[107] Porter, *Trust in Numbers*, p. 149. *Emphasis mine.*

[108] For Porter, an essential inverse formula has come to relate level of quantitative discipline to the structure of expert knowledge over a particular technical question: the stronger and more autonomous the group of experts, the less their

show that, if modern practices of numerical discipline are primarily defensive weapons used by those in positions of trust, numerical calculation in the eighteenth century was foremost an *offensive* weapon. Calculations were employed by political outsiders to critique those who held positions of political and corporate power, to figure out what was really going on behind the barriers of secrecy and privilege. Only by understanding how numbers first became employed as a *technology of proximity* in the early-modern world can we then understand their characteristic function as a *technology of distance* in the modern age.

V. The Course of the Argument

The first half of the dissertation—which effectively covers the period before the Crookshanks-Hutcheson debate of 1718—traces the emergence of a new place for numerical calculation as a valued tool of political deliberation in Augustan Britain. These chapters trace the career of calculation through the major constitutional and geopolitical transformations that shaped the modern British nation at the beginning of the long eighteenth century: the Revolution of 1688, the Anglo-Scottish Union of 1707, and the 1713 Treaty of Utrecht. Three themes unite the first half of the study. First, these chapters demonstrate that much of the enthusiasm for calculation came from its political efficacy as a tool of interrogation, critique, and reform, particularly for relative political outsiders. Second, numerical arguments in Augustan Britain were simultaneously arguments through computation and arguments about computation; political controversy was epistemological, and *vice versa*. Different political interests and different computational practitioners harbored distinctive ideas about what and who made for good and reliable numbers. Technical sophistication or mathematical

need for numerical rigor in communicating their knowledge to the public. Porter's central comparison is between French engineers, who held prestigious and exclusive expert status thanks in large part to the educational traditions of the École Polytechnique, and American military engineers, whose professional status was more tenuous and who were therefore more susceptible to external oversight. While French Polytechnicians underwent unparalleled levels of mathematical training, they were not required to account for their activities in the rigid cost-benefit terms of their weaker American counterparts. This formula, while perhaps a stable description of modern public life, breaks down in the context of the eighteenth century. See Porter, *Trust in Numbers*, chs. 6-7.

rigor did not necessarily equate to political acceptance, and those who presented especially creative estimations or complex calculations met with resistance from those who felt such figures were elitist, deceptive, or insufficiently certain. Third, the pressure of public contestation nonetheless forged new, pervasive roles for numbers as a medium of political knowledge, even though not everyone agreed on exactly which calculations or which calculators to trust.

The narrative opens in the aftermath of the Revolution of 1688, with a problematic numerical secret. This was the mystery of the covert "Secret Service" payments made by William Jephson, who in his capacity as Secretary to the Treasury paid some £100,000 out of public revenues to various individuals (foreign and domestic) with no public record. The enigma of Jephson's accounts was a microcosm of a broader crisis of knowledge that beset English MPs. In the wake of 1688, many MPs realized that few among them, save select individuals like Jephson, had any information or any insight into the nation's fiscal well-being. Parliament's own collective ignorance became glaringly obvious in 1689, when legislators had to decide how much they wanted to pay their new monarchs for the ordinary costs of government. Parliament's numerical education proved anything but easy. A new Parliamentary Commission of Public Accounts, formed in 1690, discovered that even the most basic assessment of the nation's fiscal condition was incredibly difficult. Yet the travails of the Accounts Commission also revealed how numerical calculations could become a potent analytical and political tool, allowing politicians on the outside of executive power to make incisive criticisms even when they could not obtain all the information they desired. Aggressive computation became a key part of the arsenal of political debate in the 1690s, especially in the hands of Accounts Commissioner Robert Harley. It also became systematized in the political economy of Charles Davenant, who combined strategies of numerical interrogation with the adventurous techniques of Petty's "political arithmetick" in order to create a combative style of political calculation designed for the 1690s. In attempting to create computational analyses that were

politically credible even while based on imperfect data, Davenant took on serious epistemological questions about numerical reasoning that simultaneously troubled mathematicians and philosophers interested in the nature of "probable" knowledge.

Chapter 2 moves forward to consider the central role played by economic calculations in the Union of England and Scotland, forged in 1706 and made official in 1707. A key condition of the Union was that the English government pay a monetary sum, called the "Equivalent," to compensate certain Scottish stakeholders for accepting higher levels of taxation and for assuming partial responsibility for England's National Debt. The figure settled upon, £398,085.10*s.*, was the result of an extremely intricate calculation, involving a Committee of Six people, two months, and some of the most intricate public accounting data and financial mathematics available at the time. The task fell not only to some of England's top accounting experts, but also to Bank of England founder William Paterson and one of Scotland's foremost university mathematicians, David Gregory. The Equivalent—as a diplomatic concession, as a political-economic expedient, and as a calculation—was a testament to the distinct belief, fostered by both Paterson and Gregory, that greater reliance on mathematical calculation promised to make a better nation. The financier Paterson, who was largely responsible for designing the general architecture of the Equivalent, believed that both English and Scottish commerce was being held back by their governmental ignorance, and believed that greater prosperity awaited both nations if only they allowed policy to be directed by the shrewd computational logic of the elite merchant. The academic Gregory, on the other hand, hailed from a group of "Tory Newtonians" who believed that not only natural science, but medicine, philosophy, and governance ought to be redesigned according to the dictates of mathematics. Not everyone, particularly in Scotland, shared this political faith in the authority of calculation and the rule of mathematical experts. Marshaling public support for the "Great Project" of the Equivalent involved asking a broad, lay audience to believe in the fairness of opaque

computational practices. Even though the Equivalent calculation was eventually approved by both nations' Parliaments, the confused ways in which the Equivalent calculation was communicated, interpreted, and criticized revealed the unstable authority of mathematics in public politics at the dawn of the eighteenth century. Nowhere was this more evident than in a recurring debate over how to calculate the *present* value of money to be paid or earned in the distant *future*, a debate in which the rigorous mathematical answer espoused by Paterson and Gregory—and embedded in the calculation of the Equivalent—differed substantially from common wisdom.

An even more vicious computational conflict came to occupy British politics little more than a half decade later, and once again the tension between elite computational knowledge and common wisdom was at the heart of the story. In 1712-13, peace negotiations between Britain and France promised to bring an end to nearly a quarter-century of war. The proposed peace also prompted an intense partisan controversy over efforts by the ruling Tory government to open up freer trade between the two nations. Chapter 3 examines the ensuing fight over the 1713 Treaty of Commerce, a watershed moment in the use of statistics in public policy debate. The conversation became fixated upon dueling, highly technical calculations, offered in partisan pamphlets and newspapers, of the supposed *balance of trade* between the two nations. For the Tory ministry, the Anglo-French balance was positive, meaning that Britain exported more to France than it imported and therefore, according to a zero-sum picture of international commerce, Britain profited from the trade. For their Whig critics, the balance was negative, as many in Britain's mercantile community had long assumed it to be. Though the balance-of-trade concept has long been considered a pillar of "mercantilist" political economy, many economic thinkers and administrators by 1713 had voiced concerns about calculating such balances. Britons did not in fact hold to a common "mercantilist consensus," and so it was hardly a foregone conclusion that the balance of trade would come to

dominate the debate.[109] Historians have therefore failed to explain why British politicians, journalists, and political economists became so obsessed with precisely calculating the balance in 1713. I argue that the controversy became so numerical because key Tory and Whig voices wanted to make the argument about the numbers, but for different political-epistemic reasons. Tory polemicists believed that an expert calculation was necessary to protect Britons from popular misrepresentations advanced by self-serving interests. Their Whig opponents felt that plain-spoken numbers articulated the common wisdom of merchants. The parties' respective positions on the nature of economic knowledge reflected deeper fissures, especially their attitudes toward political and commercial *interest*. Although they seized upon calculating the balance of trade for different ideological reasons, the two parties converged on numerical calculation as a shared medium of political disputation.

The first half of the dissertation explores how the political and economic contexts of Augustan Britain created a new place for numerical reasoning in British political culture. The second half in turn explores how those emergent computational tools and ethics—those "calculated values"—came to shape the nation's political and economic landscape in the subsequent quarter-century, with special attention to matters of public finance. These three chapters examine how public calculations were used to express new standards for what qualified as ethical behavior for corporate leaders (Chapters 4-5) and political ministers (Chapter 6). Numbers became ever more entrenched in the political discourse of the time because calculations proved especially useful as a way to place limitations on those in positions of power. These new numerical boundaries, in turn, gave Britons increased confidence those novel political-economic phenomena that generated such fear—the chaotic financial markets of "Exchange Alley," the burgeoning military-fiscal state—might in fact be intelligible after all.

[109] Pincus, "Rethinking Mercantilism."

The period's most notorious financial crisis, the so-called "South Sea Bubble" of 1720, is the focus of Chapters 4 and 5. In that year, the young London stock market experienced its first dramatic example of an asset bubble. The asset concerned was the stock of the South Sea Company, a novel corporate hybrid simultaneously in the business of trading slaves to Spanish America and refinancing government debt. In 1719 the Company had proposed to buy up roughly three-quarters of all government bonds outstanding and to exchange those debts for Company Stock. As part of this refinancing Scheme, the Company became legally permitted to sell new stock, a carefully limited and highly coveted privilege. Investors rushed for the stock, driving it up some 600-700% in three months. By fall 1720, though, it took even less time for that price to collapse. I tell the story of the Bubble through the calculations that contemporaries actually made during 1720 as they tried to assess what the Company's Stock was really worth. This story has two main parts. First, in Chapter 4, I argue that, for analysts in 1720, calculating the value of South Sea Stock was a challenging technical problem that pushed the boundaries of contemporary knowledge and elicited meaningful analytical disagreement. Without an authoritative body of financial theory or credentialed financial experts to call upon, different analysts looked at the same Stock, with the same basic public information, and came to a wide range of *plausible* models of its value. This study of financial plausibility suggests an important way in which we ought to rethink historical financial bubbles. Instead of deploying them as test-cases in the rationality or irrationality of past investors, as they have been for many economic historians, financial crises ought to be understood simultaneously as moments of crisis in financial knowledge, points where the pace of economic change far outstripped the epistemic resources available for understanding it.

This is not how the South Sea Bubble has most often been understood. Since very shortly after the Stock crashed, the story of the Crisis has been told as though the fundamental value of the South Sea Stock was always obviously calculable. Chapter 5 examines why Britons came to believe

that was the case. I claim that the Crash and its resulting political autopsy served to filter out the many different ways to calculate value that had existed earlier in 1720, and ratify one method of valuation as correct. That approach to valuation belonged to none other than Archibald Hutcheson. His computational method took a very conservative and static approach to valuation, based solely on the value of the Company's most tangible, immediate financial resources. I argue that one specific valuation model emerged as authoritative not only because the Bubble's collapse seemed to confirm its predictions empirically, but especially because that model proved particularly useful for retrospective ethical analysis. In order to understand how his methods of financial valuation embedded his own assumptions about ethics and social order, Chapter 5 first reconstructs Hutcheson's political sentiments prior to 1720, with an emphasis on two themes. First, it explores Hutcheson's deep fear of political secrecy, and how he used calculations, and particularly computational *models*, to shed light on situations of dangerous political uncertainty. Second, it looks at his conception of the "intrinsick value" of financial objects, surveying the historical roots of the concept in earlier ethical and economic thinking before examining how Hutcheson's distinctive vision of it was conditioned by his 1718 observations on the value of currencies—and their manipulation—in John Law's France. The chapter then examines his tireless computations over the course of 1720 and then how Hutcheson literally wrote his own computational perspectives into official Parliamentary reports about the Bubble in its aftermath. Yet Hutcheson's calculations effaced many of the serious open questions that had made financial valuation so difficult only months before, uncertainties that may have even troubled the South Sea Company's own representatives, as can be seen in a previously overlooked manuscript calculation. The crash of the South Sea Bubble, and Hutcheson's purported prediction of it, offered devastating evidence for the political value of calculation in controlling the excesses and uncertainties of the new financial

economy. In doing so, it provided a comforting story, perhaps paradoxically, that the chaos of Exchange Alley might in fact be controllable after all.[110]

The South Sea Bubble helped created new expectations about the power of calculation and the necessity of clear numbers in building financial and political trust. The final chapter examines the role of numerical calculation in the government of Britain's first "Prime Minister," Robert Walpole (1721-1742), who rose to prominence in the immediate aftermath of the Bubble. In many ways, Walpole embodied the kind of computing statesman that Charles Davenant had once envisioned in his 1690s writings on political arithmetic (though otherwise the Tory Davenant would certainly not have approved of much about the arch-Whig). Walpole was not only a diligent and competent calculator himself, but also drew upon an extensive network of calculating advisors, including John Crookshanks. The Prime Minister and his team of calculators produced vast quantities of creative analyses aimed at both modeling the potential outcomes of policy decisions and, at the same time, shaping the public discourse surrounding proposed policies. In the age of Walpole, economic calculations made it possible to reason about—and potentially to control—the political future in new ways. This forward-looking political discourse was emblematic of a broader epistemic shift toward predictive reasoning evident in many aspects of eighteenth-century British life, from news-reporting to meteorology. Chapter 6 explores such calculated futures through two major problems of fiscal policy: the restructuring of the South Sea Company after the Bubble and the fate of Walpole's "Sinking Fund," an inventive fiscal mechanism that aimed to repay the National Debt by harnessing the exponential power of compound interest. In his 1720s, Walpole and his supporters pointed to the Sinking Fund as evidence of Walpole's command over the nation's financial future, and the almost mythic identity they fashioned for the Sinking Fund testified to the substantial political authority that arithmetical calculation had earned. Yet, as Walpole's opponents mobilized

[110] Compare the argument of Preda, *Framing Finance*, esp. p. 86.

their own computations to hold Walpole to account for his fiscal promises, the Prime Minister learned that calculating the political future placed constraints on the political present.

– CHAPTER 1 –
FINDING THE MONEY
Public Accounting, Political Arithmetic, and Probable Knowledge in the 1690s

I. Introduction: Jephson's Big Secret

We begin with a story of a man who knew too much, and a nation that didn't. At the beginning of the 1690s, no one knew more secrets about the government's money than William Jephson.[1] Others had more visible power, like the Lords of the Treasury, or extracted greater personal profits from their positions of financial trust, like the Auditor of the Exchequer Sir Robert Howard. But Jephson knew something it seemed no one else could. In his capacity as Secretary to the Treasury since April 1689, Jephson was responsible for paying over £100,000 per year out of public revenues for "Secret Service," money paid directly on order of the monarchs without public record.[2] Many Englishmen suspected that Jephson's account-books mapped a covert network of payoffs to the public's political representatives. In the wake of the "Glorious" Revolution of 1688-9, Jephson's secret accounts reminded some that the threat of autocracy was not dead. And Jephson was willing to take these secrets to his grave.

To Jephson's ultimate employers, the new monarchs William and Mary, maintaining absolute secrecy over these payments was essential for exercising their royal prerogative. Secret Service legitimately included many minor expenses related to the everyday business of government, such as rewards to royal employees under £100. Yet it also encompassed considerably larger payments (up to thousands of pounds) to royal household officials, diplomats, and the king's personal creditors. Many Englishmen feared that these sums were being used as kickbacks to royal favorites or, even worse, royal bribes to members of Parliament. The exploitation of Secret Service money had

[1] On Jephson, see Stephen B. Baxter, *The Development of the Treasury 1660-1720* (Cambridge, MA: Harvard University Press, 1957), pp. 195-7.
[2] Information on Jephson's accounts is reprinted in Shaw, ed., *CTB: Vol. 17: 1702*, pp. 515-626.

exploded under the late Stuarts, largely through the efforts of Charles II's suspicious minister the Earl of Danby to "manage" Parliament in the late 1670s.[3] The fact that large uses of public money were still kept secret from Parliament after 1688 indicated to many MPs that the Crown maintained too much autonomy even after the removal of James II. So when the Commons' new Commission of Public Accounts began to investigate the movements of public money in March 1691, Jephson was one of their prime targets.[4]

But that Commission quickly hit the ultimate obstacle in their Secret Service investigations. On June 7, Jephson died. Over the next six months, the Commission tried desperately to recover Jephson's secret accounts by harassing his employees and pleading with his employers at the Treasury. In return they received partial answers and appeals to executive privilege, none of which explained where Jephson's secret money had gone, or even who might know where it went. In the end, the Commission could only account for payments to eighteen members of Parliament since November 1688, totaling just under £27,000. This was a fraction of the £243,000 in secret money which the Commissioners figured Jephson to have distributed during that time.[5] Rumors abounded about £20,000 supposedly paid to the Earl of Nottingham for the purchase of his house in Kensington.[6] The Commission's audience remained incredulous that such critical information really could not be recovered.[7] MP Sir John Thompson captured the mood best when he said: "I stand amazed that, in the best times and Governments, things should be in such darkness… 'Tis our misfortune, the person is dead that should give you Account."[8]

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[3] On Secret Service, see: Shaw, *CTB, Vol. 4: 1672-1675*, pp. xlvi-xlvii; C. D. Chandaman, *The English Public Revenue 1660-1688* (Oxford: Clarendon Press, 1975), pp. 244-8, 271-2; Christopher Clay, *Public Finance and Private Wealth: The Career of Sir Stephen Fox, 1627-1716* (Oxford: Clarendon Press, 1978), pp. 25-6.
[4] Minutes of the Commissioners of Public Accounts, Vol. I, 5 Mar. 1690/1 to 4 Sept. 1691, BL Harley MS 1,488, ff. 20^{r-v}, 34^{r}, 38^{r}, 52^{v}-53^{r}, 64^{r}.
[5] HMC *Lords, 1690-91*, pp. 363, 399.
[6] Anchitell Grey, ed. *The Debates in the House of Commons, From the Year 1667 to the Year 1694*, Vol. 10 (London: Printed for D. Henry and R. Cave, and J. Emonson, 1763), p. 200.
[7] HMC *Lords, 1690-91*, p. 420.
[8] Grey, *Debates*, Vol. 10, p. 191.

The enigma of Jephson's accounts was a microcosm of a broader crisis of knowledge that beset English Parliamentary representatives. In the wake of 1688, many MPs realized they had long left the management of the nation's financial information to a handful of individuals, like Jephson. As a collective body, Parliament, especially the Commons, knew almost nothing. Even more vexing, the Commoners had a hard time figuring out what they did not know, or what it was possible *to* know. In 1689, the problem of deciding how much the legislators were willing to pay their new monarchs for the ordinary costs of government put this ignorance in stark relief. Parliament's subsequent investigations into the dark recesses of the public's finances offered valuable lessons about the frailty of the government's informational infrastructure and the political value of informational control.

The primary institutional locus for these explorations was a new Parliamentary Commission of Public Accounts, formed in 1690. Designed largely to curb executive autonomy and root out administrative corruption, the Commission became an unexpected project in quantitative political analysis. Steve Pincus has recently noted that "for most people in later seventeenth-century England, determining the nation's economic interest was a complex calculation."[9] For no one was this more literally true than the inexperienced Accounts Commissioners, who found that even the most seemingly straightforward calculation—determining the government's fiscal condition—was profoundly perplexing. The process of overcoming such challenges drove a broader transformation in the place of numerical information in English government. Mary Poovey and Jacob Soll have shown how important the idioms of accounting were to the development of theories of state in the early modern period.[10] In the 1690s, those connections between numerical accounts and ideas about

[9] David R. Como, Rachel Weil, and Steve Pincus, "Modernity and the Glorious Revolution," *Huntington Library Quarterly* 73, no. 1 (Mar., 2010): 135-162, on p. 155.
[10] Mary Poovey, *A History of the Modern Fact: Problems of Knowledge in the Sciences of Wealth and Society* (Chicago and London: University of Chicago Press, 1998), chs. 2-3; Jacob Soll, "Accounting for Government: Holland and the Rise of Political Economy in Seventeenth-Century Europe," *The Journal of Interdisciplinary History* 40, no. 2 (Autumn, 2009): 215-238.

good governance became startlingly tangible. Parliamentarians began to demand more information from the Crown's agents and to use arithmetic as a tool of critique. Numerical assaults became a potent weapon of partisan politicking, exemplified by the efforts of Accounts Commissioner Robert Harley and like-minded "Country" MPs fearful of the abuses of ministerial power. Such critics found calculation especially useful for piecing together the spotty governmental information they were able to extract about the public's money.

The kinds of informational challenges that frustrated the Accounts Commissioners reverberated beyond Westminster, prompting new concerns and inspiring new methods for theorists of political economy. In particular, the characteristic uncertainty that plagued the Parliamentary public accountants also frustrated practitioners of "political arithmetick," triggering a transformation of that nascent science after the death of its pioneer, the Restoration virtuoso William Petty (d. 1687).[11] This was most evident in the mid-1690s writings of Charles Davenant, a former Excise Commissioner. Davenant espoused many common commitments and shared many experiences with the Public Accounts Commissioners, especially Harley: deep fear of ministerial corruption; intolerance for the ignorance that pervaded the nation's fiscal administration; and, most critically, the frustration of trying to craft computational arguments on the basis of limited fiscal data. Davenant fashioned a new theory and practice of political arithmetic around these shared anxieties. He articulated an embryonic Country ideology of the administrative and ethical value of information, and combined the strategies of numerical interrogation pursued by the Accounts Commissioners with the creative estimation techniques of Pettian political arithmetic. Davenant's most important departure, though, came in the searching attention he gave to the question of what kind of knowledge political arithmetic really could produce. Faced with the quandary of trying to make numerical arguments based on imperfect data, in the face of opponents who claimed his evidence

[11] Section V will explore the historiography of political arithmetic in greater detail. To begin, see Ted McCormick's excellent *William Petty and the Ambitions of Political Arithmetic* (Oxford and New York: Oxford University Press, 2009).

was never sufficient, he began to think in new ways about what made a numerical claim of knowledge *good enough* to believe. As Davenant contemplated the epistemological dimensions of political arithmetic, he stumbled upon a broader set of concerns about probabilistic knowledge that were simultaneously troubling some of Europe's cleverest philosophers and mathematicians.[12]

This chapter seeks therefore to make two central arguments. The first is that, in the 1690s, numerical calculation found a new and vital place in political life as a tool of criticism. This instrument was forged rather suddenly after 1688, as political representatives and commentators confronted how little they, or even those within the government's administrative apparatus, knew about the nation's tenuous fiscal condition. New techniques of political calculation developed largely as a way to make the most of the limited information, particularly about the government itself. If, as Paul Slack has recently argued, the English state had developed little interest in gathering information about the nation by the 1690s, at that very moment parts of the nation became extremely interested in gathering information on the *state*.[13] Moreover, the central problem of how to make useful fiscal knowledge despite the informational jealousy and disorder that reigned within the government was common to the day-to-day investigations of Parliamentary auditors—to "public accounting"—and to the systematic reflections of Charles Davenant, a self-conscious theorist of "political arithmetic."[14] My second key argument is that these agonistic numerical struggles also forced politicians and political economists to confront new questions about the nature of economic knowledge itself. The political chaos surrounding fiscal information was a critical site in which

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[12] On probabilistic reasoning, see: Ian Hacking, *The Emergence of Probability: A Philosophical Study of Early Ideas about Probability, Induction, and Statistical Inference*, 2nd ed. (Cambridge, UK and New York: Cambridge University Press, 2006 [1975]); Barbara J. Shapiro, *Probability and Certainty in Seventeenth-Century England: A Study of the Relationships between Natural Science, Religion, History, Law, and Literature* (Princeton: Princeton University Press, 1983); Lorraine Daston, *Classical Probability in the Enlightenment* (Princeton: Princeton University Press, 1988).

[13] Slack, "Government and Information."

[14] In distinguishing between "public accounting" and "political arithmetic," I wish to emphasize differences in place and practice. By "public accounting," I refer specifically to the efforts of political representatives, especially members of the Commission of Public Accounts, carrying out on-the-ground investigations of government finances for use primarily within Westminster. By "political arithmetic," I refer to sustained, self-conscious contributions to a field of study by that name, written for broader circulation.

people at the dawn of the eighteenth century confronted the problem of making knowledge amidst uncertainty. The new kinds of calculations developed to combat that uncertainty, though, generated heated opposition. The more some politicians and writers called upon creative arithmetic to diagnose problems in government policy and practice, the more intensely their opponents scrutinized the validity of those numbers. As Mark Knights has put it, "knowledge and truth were thus political issues."[15] The problems of informational access, combined with the adversarial style of deliberation that characterized 1690s politics, generated new thinking about probable knowledge.

More broadly, this chapter seeks to demonstrate that developments in administration, politics, and economic (and even mathematical) theory were closely linked by problems that were common to them all—problems not only about the nation's finances, but about the nature of knowledge itself.[16] In doing so, it seeks to build on the work of scholars who have explored how Britain's "Glorious" and "financial" revolutions were entangled with new thoughts, and new anxieties, about information, knowledge, and credibility. John Brewer's formative *Sinews of Power* was among the first to explore how the administrative challenges that confronted an emergent fiscal-military state prompted people to fight over, and about, information itself.[17] Mark Knights has argued that the bitter politics of the later Stuart period, nationally and locally, forced Britons to ponder what made public claims of political knowledge valid.[18] Such implicit epistemological anxieties were especially pressing when it came to fraught questions of political economy.[19] In his recent *Casualties of Credit*, Carl Wennerlind has indeed demonstrated that the English "financial

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[15] Mark Knights, *Representation and Misrepresentation in Later Stuart Britain: Partisanship and Political Culture* (Oxford et al.: Oxford University Press, 2005), p. 6.

[16] Historians of science have demonstrated vividly how the converse is true, namely that conflicts about the nature of knowledge were inherently conflicts about political order, particularly in early modern England. See Steven Shapin and Simon Schaffer, *Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life* (Princeton: Princeton University Press, 1985).

[17] John Brewer, *The Sinews of Power: War, Money and the English State, 1688-1783* (London and Boston: Unwin Hyman, 1989), especially ch. 8.

[18] Knights, *Representation and Misrepresentation*, on p. 3; see also pp. 1-66, 209-334. See also: Kate Loveman, *Reading Fictions, 1600-1740: Deception in English Literary and Political Culture* (Aldershot, UK and Burlington, VT: Ashgate, 2008).

[19] Knights, *Representation and Misrepresentation*, pp. 13-15.

revolution" was empowered by a century of new thinking, not only about how money and credit worked, but also about public opinion, interpersonal trust, and knowledge itself.[20] Building upon pioneering work by Ian Hacking, Barbara Shapiro, and Lorraine Daston, Wennerlind argues that the innovative schemes for a national credit system that proliferated in the late 1600s were based in a new style of "qualitative probabilistic reasoning" that emerged in that century.[21] In a political world racked by partisanship and distrust, making useful knowledge about politics and finance required not demonstrative certainty, but building trust and assessing what was probable.

Britain's "first modern revolution" brought up many pressing questions about the nation's fiscal past, present, and future.[22] In particular, *finding the money*—whether tracking down the recipients of William Jephson's secret service payments, or determining the current state of the nation's revenues and expenditures, or assessing the best future tax strategy—became a paradigmatic problem for many, from administrators to MPs to economic theorists.[23] The stories that follows are about what happened when those people went looking for certain answers—and found them lacking.

II. "To Enquire into the Revenue is Your Best Method," 1689

The Revolution of 1688 and the fall of the aspiring absolutist James II had profound consequences for the way political information was managed in England.[24] In the debates over the granting of revenue to their new monarchs, MPs confronted how little they knew about the taxes levied on the

[20] Carl Wennerlind, *Casualties of Credit: The English Financial Revolution, 1620-1720* (Cambridge, MA: Harvard University Press, 2011), pp. 3-4, 83-92.
[21] Wennerlind, *Casualties of Credit*, p. 85.
[22] This article provides a different, though not necessarily contradictory, take on Steve Pincus's broad claim that "that there was a revolution in political economy in 1688-89." See *1688: The First Modern Revolution* (New Haven: Yale University Press, 2009), esp. p. 368.
[23] For a different take on these intersections, see Colin Brooks, "Taxation, Finance and Public Opinion, 1688-1714" (Ph.D. Diss., University of Cambridge, 1970), pp. 1-16.
[24] On the relative "absolutism" of the later Stuart monarchs, see: John Miller, "The Potential for Absolutism in Later Stuart England," *History* 69, no. 226 (Jan., 1984): 187-207; Timothy Harris, *Revolution: The Great Crisis of the British Monarchy, 1685-1720* (London et al.: Allen Lane, 2006), ch. 5; Pincus, *1688*, 118-220.

English people and how those funds were spent. They also confronted the fact that what information existed lay not with them but with a few individuals whose probity could not be taken for granted. An older, highly personal apparatus of information management was challenged by a distrustful Parliament hungry for more numbers.

Finance was, of course, not a new concern in English legislative politics. Parliament's right to control the revenue granted to the monarchy dated back for centuries. At several moments during the tumultuous seventeenth century, MPs expressed interest in developing the informational capacity needed to really exploit that cherished right. Analysis of the annual needs of the government was undertaken during the Interregnum, and helped shape the financial settlement that followed Charles II's Restoration.[25] Parliamentary auditing made a first appearance soon thereafter thanks to opponents of Charles II's favorite the Earl of Clarendon. In 1667-8, Clarendon's adversaries established the Brooke House Commission to look into administrative failures by Clarendon's allies that were believed to have caused expensive disasters in the Anglo-Dutch war.[26] Throughout the Restoration period, though, most of the numerical momentum built up in Parliament stalled. Parliamentary analysis of monarchical revenues and expenditures disappeared during the reigns of Charles II and James II, despite the heightened analysis that preceded the Restoration. Both kings had been voted large revenues for life, meaning the question of ordinary revenue only needed to be addressed comprehensively once per reign. Parliament's unfamiliarity with financial questions was exacerbated by the extreme infrequency of Parliaments, which, for example, sat only once between 1681 and 1689. The financial autonomy of the Crown grew in parallel, particularly in the 1680s, when booming trade brought increasingly robust Customs duties.

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[25] Henry Roseveare, *The Financial Revolution 1660-1760* (London and New York: Allen Lane, 1991), pp. 6-7.
[26] Clayton Roberts, *The Growth of Responsible Government in Stuart England* (Cambridge, UK: Cambridge University Press, 1966), pp. 175-6, 182-3; E. A. Reitan, "From Revenue to Civil List, 1689-1702: The Revolution Settlement and the 'Mixed and Balanced' Constitution," *The Historical Journal* 13, no. 4 (Dec., 1970): 571-88; Henry Horwitz, *Parliament, Policy and Politics in the Reign of William III* (Newark, DE: University of Delaware Press, 1977), p. 59; Henry Roseveare, *The Treasury 1660-1870: The Foundations of Control* (London/New York: Allen & Unwin/Barnes & Noble, 1973), pp. 46-74.

As a result, Crown ordinary revenues climbed from £1.2 million in 1670 to £1.9 million when James II took the throne in 1685.[27] The experiment in parliamentary auditing undertaken in 1668 also came to nothing, as Charles II came to the defense of the key target, Sir George Carteret. Parliamentary audit was not seen again until the 1690s.

Parliament's fiscal awareness was further compromised by the diffuse mechanisms by which governmental finances were managed. Autonomous individuals, or "undertakers," administered many of the major economic functions of government, including tax collection, public borrowing, and military payment and supply.[28] The private nature of English public finance prior to 1688 was mirrored in the way financial information was communicated to the legislature. Few MPs at the time were competent in the complexities of financial calculation, and many had little reason to care. Most MPs conceded Parliamentary stewardship of financial information to a selected few, such as William Jephson and especially Sir Robert Howard.[29] An executive placeholder and MP since just after the Restoration, Howard had acquired the lucrative position of Auditor of the Receipt in the Exchequer in 1673. In that position, he served as the primary broker of information between Parliament and the Lower Exchequer, the main clearinghouse for government funds.[30] If MPs wanted financial numbers—and this was certainly not a regular occurrence before 1688 anyway—they had to ask for them from individuals like Howard.

The Exchequer itself was an elaborate machine for producing financial data, but whether that information was usable by the public was an entirely different matter. The Exchequer's proud but peculiar methods of accounting, developed to safeguard the King's money, were highly opaque

[27] Reitan, "Revenue to Civil List," pp. 571-572.
[28] Clay, *Public Finance and Private Wealth*, pp. 40-111.
[29] Roberts, *Responsible Government,* p. 169; P. G. M. Dickson, *The Financial Revolution in England: A Study in the Development of Public Credit, 1688-1756* (London et al./New York: Macmillan/St. Martin's Press, 1967), p. 254.
[30] On Howard, see: H. J. Oliver, *Sir Robert Howard (1626 – 1698): A Critical Biography* (Durham: Duke University Press, 1963); Florence R. Scott, "Sir Robert Howard as a Financier," *PMLA* 52, no. 4 (Dec., 1937): 1094-1100.

to outsiders.[31] That was even true when protocols were followed exactly, and by 1688, exactitude was rare. The rigor with which ideal Exchequer procedure was followed had deteriorated under Howard's watch.[32] The processes for distilling information for use by legislators were conducted especially carelessly. For example, the position of Clerk of the Pells was expected every half-year to make a "General Declaration" to Parliament of all the receipts and payments to and from the Exchequer. By the early 1690s, the current Clerk, William Wardour, was at least three years delinquent in this Declaration.[33] Few seemed particularly concerned.

Several factors therefore converged to limit the relevance of numerical knowledge in English legislative politics before 1688, most especially the individualistic and monopolistic nature of financial information management and the fiscal autonomy brought to the Crown by lifetime revenue grants and commercial prosperity. The Revolution destabilized all this. Debating numbers, relatively unfamiliar to a generation of MPs, became suddenly a regular part of Parliamentary business, initiated by the problem of the Revolution's financial settlement and sustained by the problem of funding a new war with France. Parliament's numerical awakening began very shortly after the landing of Prince William of Orange. In December 1688, a makeshift Convention was tasked with establishing the constitutional terms under which William and Mary would rule. As that Convention transformed into the first post-1688 Parliament, the monarchs' financial settlement emerged as a pivotal question.[34] At this point, the MPs encountered a fundamental challenge. They began to realize how little they knew. On the first day of the Convention Parliament (February 26,

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[31] For a contemporary depiction of how Exchequer procedures ideally worked, see: William Lowndes, "The Course of th[e] Exchequer on th[e] Receipt side," 1685, Hyde Papers, BL Add. MS 15,898, ff. 100-109. See also: Chandaman, *English Public Revenue*, pp. 281-302; Roseveare, *Treasury: Foundations*, 46-51.

[32] Roseveare,*Treasury: Foundations*, p. 50; Baxter, *Development of the Treasury*, pp. 120-1.

[33] Lowndes reported that Wardour's General Declaration "is behind for some years." (See Lowndes, "The Course of th[e] Exchequer," BL Add. MS 15,898, ff. 106[v]-107[r].) For an example of Wardour's General Declarations, see BL Landsdowne MS 1,215, ff. 29-39.

[34] Jennifer Carter, "The Revolution and the Constitution," in *Britain after the Glorious Revolution 1689-1714,* ed. Geoffrey Holmes (London/New York: Macmillan/St. Martin's Press, 1969), pp. 39-58; Reitan, "Revenue to Civil List"; Clayton Roberts, "The Constitutional Significance of the Financial Settlement of 1690," *The Historical Journal* 20, no. 1 (Mar., 1977): 59-76.

1689), the debate on monarchical supply proceeded without much apparent concern for financial particulars. The next day, MPs pointed out that the simplest solution, namely renewing James II's ordinary revenues permanently, also put the nation in "danger of falling into the misfortune of the last two governments." More complicated solutions, though, required knowing what existing revenues actually were. "I find there will be occasion of discourses, what the Revenue is?" suggested merchant MP William Love. "Therefore I move, that Howard may give you the Revenue. When all is before you, you may consent to such a Revenue as may make the king great to all the world." Spirited calls for financial information came from Edward Seymour, a key Tory supporter of William III: "If we settle the Revenue, I would enquire into it; if you know not the value of what is given, you cannot do it effectually. To enquire into the Revenue is your best method."[35]

Seymour's cries did not go entirely unanswered. Robert Howard offered a preliminary "Computation of the several Branches of the Revenue" on March 1, 1689, with subsequent detail on expenditures and the Excise later in the month.[36] Early confusion magnified Howard's informational power, as he "delivered in such Accompts and Estimates, as he conceived were necessary for the Service of the House."[37] The MPs remained at Howard's mercy at first, having no experience interrogating the numbers reported to them.[38] Soon, though, MPs began to make more frequent and pointed numerical demands. While some may have used such requests as a stalling tactic, the importance of better financial knowledge was increasingly apparent to many.[39] The Whig Henry Capel criticized those who were willing to allow such major decisions to be made on informational faith. "The Book of Rates, the Act for Excise, we do not yet know," Capel cautioned, emphasizing how much uncertainty surrounded major revenue sources like the Excise. He continued with a

[35] Grey, *Debates*, Vol. 9, December 1688 to January 1690, pp. 123-5.
[36] William Cobbett, ed., *The Parliamentary History of England, from the Earliest Period to the Year 1803*, Vol. V, 1688-1702 (London: Printed for T. Hansard, 1809), cols. 150-151, 187-191.
[37] *Commons Journal*, Vol. 10: 1688-1693, p. 55.
[38] Reitan, "Revenue to Civil List," p. 575; Shaw, *CTB: Vol. 9, 1689-92*, pp. xxiv, xxxviii.
[39] Roberts, "Financial Settlement," p. 70.

soon-familiar refrain. "There are complaints of the ill administration of them; now is the time to correct it… It is not a time to name the Revenue now."[40]

This message of caution was heeded. In mid-March 1689, the House of Commons passed a bill that only continued current revenue collection until June. March 20 featured a spirited debate in the Commons about the Crown's requisite ordinary revenue.[41] At moments, contentious arguments about what qualified as ordinary versus military expenditure drifted into more abstract territory, as MPs debated how best to assess the baseline peacetime revenue of the previous two kings. The veteran Whig William Sacheverell argued that expansions in regular military spending and pensions, fueled by the "severe way of management" introduced in the Customs in the 1670s, made it necessary to go all the way to the late 1660s for a baseline. The busy moderate William Garway suggested that it was perhaps better not even to try to project from old figures. "We cannot say the Revenue will stand to 1000, or 10,000l.," he said, "there being several variations of the Customs in several Years."[42] Such methodological musings were rudimentary, but do show how fiscal conundrums forced MPs to think critically about making deductions from numerical data.

The House ultimately fixed upon a peacetime revenue figure of £1.2 million pounds, the amount settled upon Charles II in 1660. Over April 1689, the House turned to the question of government expenditure only after this level for ordinary revenue had been set. After discussing different governmental needs, the Commoners agreed that ordinary expenses amounted to more than £1.7 million, well beyond the £1.2 million level for income. This prompted the House to undertake an even more searching look at the revenue question, and they learned for example that half of all monarchical revenues were already tied up in pre-existing obligations like pensions,

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[40] Grey, *Debates*, Vol. 9, p. 157. The Book of Rates specified per-unit rates at which commodities subject to Customs and Excise were taxed. See G. N. Clark, *Guide to English Commercial Statistics 1696-1782* (London: Offices of the Royal Historical Society, 1938), pp. 8-9.
[41] *Commons Journal*, Vol. 10: 1688-1693, p. 56; Grey, *Debates*, Vol. 9, pp. 176-180.
[42] Grey, *Debates*, Vol. 9, pp. 177-8.

interest, and departmental backlogs.[43] From April to June, the Commons largely ignored these fiscal questions, through some combination of irritation, distraction, and deliberate delay. This sluggishness in settling the revenue question frustrated King William, who voiced his anxiety before the Commons on June 28. The King's speech prompted consideration of a new supply bill in July, which came to little. In March 1690, Parliament finally returned to the matter purposefully. By May 1690 Parliament settled upon a reasonably stable plan that granted King William certain Excise taxes for life and Customs for four years.

The anxiety of the revenue debates in 1689-90 initiated a new era of legislative concern with financial matters. In the wartime context of the 1690s, the need for temporary funding was unending, and so money debates were constant. Parliament was not about to surrender the newfound command it was gathering over financial information. In the debates on supply during March 1690, the MP Paul Foley offered a succinct formulation of what had become a powerful mantra among many, both Whig and Tory: "I would give this King Money, but not by a Rule, because we have given other Kings. I stand upon it, to have more reason from the accounts before we give Supply."[44] The institutional realization of this principle was the Commission of Public Accounts. Foley was one of its first members.

III. Misadventures in Public Accounting

Parliament's anxious handling of the supply question prompted new expectations about what Parliament ought to know, and deserved to know, about the government's finances. Some MPs began to demand that the Commons have its own infrastructure for managing fiscal data. Their goal was an autonomous Parliamentary account of all public funds, built from the ground up. The vehicle chosen was the Commission of Public Accounts, a body of Commoners that sat in two extended

[43] Shaw, *CTB: Vol. 9, 1689-92*, pp. xxxix, xliv-xlvi.
[44] Grey, *Debates*, Vol. 10, 13.

stretches from 1691 to 1697 and from 1702 to 1713. By attempting to reconcile the nation's entire financial administration in a single, external account, the Commissioners created a model of the values by which they hoped government to work. Yet, building a comprehensive public account turned out to require more than asking the right list of people to open their books and doing unproblematic arithmetic. Public accounting was fraught with uncertainty. The Commission's anxious struggles over governmental information embodied paradigmatic problems of knowledge in 1690s politics, problems that not only shaped administrative practice and political culture, but ultimately epistemological ideas about calculation itself.

Parliament's interest in interrogating monarchical power was not new. MPs had fought over the previous century to defend a constitutional "right of inquiry" into the failings of Crown agents. The abortive efforts in Parliamentary auditing in the 1660s had instilled an earlier generation of MPs with new attitudes about Parliament's right to demand executive accountability.[45] Yet, the failed Brooke House Commission had not left lasting mechanisms for critiquing executive information. Subsequent administrative transformations meant that the task of drawing up a comprehensive public account in 1691 was a new problem with different challenges than had been encountered a quarter-century earlier. In some areas, like Exchequer accounting, the intervening years had witnessed declining administrative care. Yet, the growth of new state capacities in areas like public borrowing and the Navy caused new analytical problems of their own. A more powerful military-fiscal state was not necessarily easier to account for.[46]

It was a military matter, indeed, that first renewed calls for taking public accounts. The new war with France had barely begun when some became concerned about impropriety in its management. In October 1689, MPs assailed agencies like the Victualling Office, the Admiralty Board, and the Army provisioners for Ireland. Waste-conscious Tories like Edward Seymour and

[45] Roberts, *Responsible Government*, p. 261; Roseveare, *Treasury: Foundations*, pp. 49-56.
[46] Chandaman, *English Public Revenue*, pp. 6-7, 287-95.

Christopher Musgrave found common cause with Whigs who feared the continued infection of Stuart placemen. The Commons appointed two select committees to investigate.[47] This pilot project fueled further enthusiasm for a comprehensive investigation into public funds, as MPs grew frustrated with the limited account information the new King had conceded. In late May, William proactively attempted to establish a royally-directed accounts commission, though a jealous group of Whigs blocked its creation. The King promised to provide greater access to government accounts later in October, but this failed to satiate Parliament's informational appetites.[48] The pressure for a truly Parliamentary accounts board won out, and both Houses ratified a plan for a Commission of nine Commoners in late December.[49]

The Commission was foremost an organ of Parliamentary inquiry, though its supporters emphasized that the greater transparency provided would make it easier to raise revenues. William III acquiesced to hasten Parliament's military funding grants.[50] From the outset, the Commons jealously guarded their new public accounting function. Despite repeated efforts, the Lords ended up with no input on the Commission. The Lords made moves to add four of their own members to the Commission in late December 1690, which the Commons thwarted by threatening to table a pending money bill.[51] (The Commoners resorted to a similar tacking strategy in 1692, when the Lords tried to add on four non-Parliamentary nominees, including Charles Davenent.)[52] Partisan tensions also threatened to trouble the new institution. Commissioner Robert Harley reported that "some hot words did pass between some" at the Commission's first meeting in early March 1691.

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[47] Reitan, "Revenue to Civil List," pp. 577-9; Horwitz, *Parliament, Policy, and Politics,* p. 38; B. W. Hill, *Robert Harley: Speaker, Secretary of State and Premier Minister* (New Haven: Yale University Press, 1988), p. 20.
[48] Horwitz, *Parliament, Policy, and Politics,* pp. 59-62.
[49] The original nine Commissioners were: Sir Matthew Andrews, Colonel Robert Austen, Sir Samuel Barnardiston, Sir Thomas Clarges, Sir Peter Colleton, Paul Foley, Robert Harley, Sir Benjamin Newland, and Sir Robert Rich. See: Horwitz, *Parliament, Policy, and Politics*, p. 64; J. A. Downie, "The Commission of Public Accounts and the Formation of the Country Party," *The English Historical Review* 91, no. 358 (Jan., 1976): 33-51, esp. pp. 35-7.
[50] Reitan, "Revenue to Civil List," p. 582; Downie, "Commission of Public Accounts," p. 34.
[51] Robert Harley for Sir Edward Harley, 30 December 1690 and 1 January 1690 /1, HMC *Portland*, p. 456. See also: Brooks, "Taxation," p. 118.
[52] *Lords Journal*, Vol. 14, 1691-1696, p. 52.

Less than two weeks in, though, Harley explained that "business now has taken off the edge of our passions and we are fallen to it with calmness and diligence."[53] Whigs like leading vote-getter Sir Robert Rich quickly found common sympathies with their Tory colleagues, like the Oxford clergyman Thomas Clarges.[54]

Their first order of business was to request information. The Commissioners did so through written "precepts," many of which included dozens of subsidiary requests. The Commissioners had a considerable staff of bookkeepers and messengers and a numerical system for tracking over 300 data requests they made by late 1691.[55] Their targets ranged from the most elevated executives to minor clerks and contractors. Among their first requests, issued March 11, were precepts to: three top Excise officials; the Excise Commissioners; the Paymaster General to the Army in both England and Ireland; and the Secretary of War. On May 8 of that year, on the other hand, the Commissioners directed precepts numbered 158-162 to: a Major General in the army; a Bristol merchant; a Covent Garden linen-draper who had a military coat contract; the "Avener" of the Crown stables (the man responsible for feeding the king's horses); and several naval victualers.[56] The Commissioners often pursued a microscopic level of detail. Sir Peter Colleton, for example, took a particular interest in the minutiae of military spending, carefully examining the efficiency of coat tailoring, the pricing of footwear, and the supply of hay for horses.[57] All serious logistical problems and potential areas for waste, to be sure, but also evidence that the Commissioners had to make up rules of relevance as they went along.

The Commission's early procedures spoke to a confidence not only in their own authority but in the competence and willingness of myriad government agents. Precepts were assigned

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[53] Robert Harley to Sir Edward Harley, 12 March 1690/1 and 2 March 1690/1, HMC *Portland,* vol. III, p. 459; Hill, *Robert Harley*, esp. pp. 24-7.
[54] Roseveare, *Treasury: Foundations*, p. 58; Downie, "Commission of Public Accounts," pp. 34-7.
[55] The Commission's minute-books are preserved as BL Harley MS 1,488-1,495. The personal diary of Commissioner Peter Colleton can be found as BL Harley MS 6,837, ff. 164-206.
[56] BL Harley MS 1,488, ff. 4^{r-v}, 72^{v}.
[57] BL Harley MS 1,488, ff. 176^{v}-177^{r}; BL Harley MS 6,837, ff. 172^{r}-173^{r}, 174^{r-v}.

ambitious deadlines, and "accountants," who had to swear verbally to their numbers, were called to testify on short notice. Rarely were any replies offered without incident. Some individuals were simply unwilling to deal with the Commission. William Bridges, a Commissioner of Provisions for Ireland, provided the most dramatic reaction. On May 6, one of the Commission's messengers, Arthur Nicholson, delivered a precept to Bridges, who angrily claimed that there were others "more principally concern'd than himself" in the matter. Bridges then threw the paper in Nicholson's face. When the messenger explained that he had never before been treated this way by a gentleman, Bridges "pluckt out a hand full of money" before asking Nicholson whether he now owed any fees.[58] Expert data-mongers like Robert Howard preferred subtler forms of misdirection, like sending lower officials to answer the Commission so they might claim incomplete knowledge of the requested information. When the Commission made a request for information on fees taken by Exchequer staff, Howard and his underlings adeptly avoided the question for weeks.[59]

More disheartening problems arose when the Commission found that information was not where or in the form they assumed it was, or might never have been recorded at all. Some executives, like Army Paymaster the Earl of Ranelagh, simply lacked the competence or desire to keep the kind of records the Commission demanded.[60] Other respondents regularly had to explain to the Commissioners that they were not the right people to ask. An illustrative example of such informational athletics came in early May, when the Commission hosted William Jephson to inquire about back taxes in Ireland. Jephson rerouted them to the Treasury clerk William Lowndes, who informed them that he knew only of one particular tax backlog in Ireland, and told them to consult Robert Howard for more complete documentation.[61] This kind of run-around was common. Those

[58] BL Harley MS 1,488, f. 68^{v}.
[59] Minutes of the Commissioners of Public Accounts, Vol. II, 4 Sept. 1691 – 3 Oct. 1692, BL Harley MS 1,489, ff. 3^{v}-4^{r}, 13^{r-v}, 27^{v}-28^{r}, 38^{r}; BL Harley MS 6,837, ff. 184^{v}, 190^{v}-191^{r}.
[60] BL Harley MS 1,488, ff. 109^{r-v}.
[61] BL Harley MS 1,488, f. 64^{r}.

who controlled privileged data no doubt used such informational disorder and incommensurability at times to protect their own authority.[62] Confusion, though, was just as often a structural phenomenon. The Commissioners found vague but significant sums paid out through back-channel mechanisms.[63] Particularly troublesome was a massive £20,000 payment of English money to a "Mr. Vanderesch," muster-master of the Dutch forces, for which no authorization could be found beyond a supposed Dutch royal seal.[64] No less frustrating were the many cases where data was unavailable because the practical demands of government did not require it. The Commissioners could not have been pleased to discover that the Treasury did in fact make weekly accounts for many government agencies to assist in cash distributions, but that after that immediate purpose was fulfilled the Treasury "looke upon those acc^{ts}. as wast[e] papers, and keep's them not."[65]

The boundaries between intentional dissimulation and such structural confusion were often very hard to draw.[66] It was not always obvious what data was being withheld, and what information simply might not exist, or at least not be known by those who the Commission expected. Nowhere was this more evident than in the Commission's investigations into William Jephson's Secret Service accounts, with which we began. On June 10, the Commission sent a request to Jephson's clerk, Robert Squib, to bring in copies of answers Jephson had purportedly made to their previous inquiries, along with a catalogue of records left at his death.[67] Two days later, Squib delivered an account of Secret Service payments made by Jephson, but only those to Members of Parliament. The

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[62] On the strategic uses of confusion, see Mario Biagioli's evocative discussion of "The Anthropology of Incommensurability" in *Galileo, Courtier: The Practice of Science in the Culture of Absolutism* (Chicago: University of Chicago Press, 1993), ch. 4.
[63] Michael J. Braddick, *The Nerves of State: Taxation and the Financing of the English State, 1558-1714* (Manchester and New York: Manchester University Press, 1995), pp. 23-5.
[64] BL Harley MS 1,488, ff. 124^{r}, 129^{v}, 133^{v}, 135^{v}, 143^{v}; BL Harley MS 1,489, ff. 14^{v}, 56^{r}; BL Harley MS 6,837, ff. 168^{r}, 169^{v}, 184^{v}. On Van der Esch, see Baxter, *Development of the Treasury*, pp. 55-6.
[65] BL Harley MS 1,488, f. 52^{v}.
[66] Brewer, *Sinews of Power*, p. 223.
[67] BL Harley MS 1,488, f. 99^{r}.

Commissioners were hardly satisfied by that answer, or by a second report Squib later produced.[68] Squib pleaded that the King had instructed Jephson to disclose information only on payments to MPs, and no other state secrets.[69]

The Commission took up the Secret Service issue again with vigor in early September.[70] The vexed Commissioners turned to the Lords of the Treasury, with whom the Commission had early developed a strained and distrustful relationship. Squib had suggested to the Commission that Secret Service money was probably not paid without the knowledge of the Treasury Lords, but that body ultimately proved even less helpful than Squib had been.[71] The Lords explained that they approved the allocation of funds from the Exchequer to Jephson for general Secret Service usage. As to their particular distribution, though, the monarchs "privately entrusted him [Jephson] in that affair without our knowing or being any way privy to the particular uses to which or the particular persons to whom the same were applied." That is, once Jephson got the money, he was the only one, save the King and Queen, who knew where it went. The Lords concluded "we doubt not but it will appear very plain to you that it is not in our power to send you such an account as you desire."[72] The Treasury Lords' claims of ignorance were probably somewhat exaggerated, as at least one member of that group, Chancellor of the Exchequer Richard Hampden, had periodic access to at least part of Jephson's Secret Service ledgers.[73] But whether through lack of knowledge or intentional misdirection, the Treasury Lords offered no further information. The Commissioners found an unsatisfying end to their efforts on November 20, when they received a formal letter from Squib, on the order of the Treasury Lords, admitting that "there were other payments made by Mr. Jephson to

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[68] BL Harley MS 6,837, f. 165^{r}; BL Harley MS 1,488, f. 103^{r}.
[69] BL Harley MS 6,837, f. 165^{v}. Baxter suggests Squib knew more than he let on. (*Development of the Treasury*, pp. 235-6).
[70] Squib attended the Commission to discuss other Treasury affairs. (BL Harley MS 1,488, f. 120^{r}, 171^{r}.)
[71] BL Harley MS 1,489, f. 11^{r}, 21^{v}.
[72] Shaw, *CTB, Vol. 9: 1689-92*, pp. 1313-4.
[73] Based on the published records of Jephson's Secret Service accounts, it appears that the Chancellor of the Exchequer sporadically reviewed Jephson's Secret Service Accounts before passing them on for royal approval. Yet, there is little reason to believe that such audits produced any duplicates or summary accounts for the general use of the Treasury Lords. (See Shaw, *CTB, Vol. 17: 1702*, pp. 528, 534, 547, 560, and 626.)

several Members of Parliament for services relating to the State… the secrecy of them being so absolutely necessary, his Majesty does believe that the House will not desire the Particulars of them."[74]

With such disappointments, though, came a measure of education. The Navy in particular was an area in which the Commissioners confronted the informational complexity that arose in a rapidly developing executive agency. Lord Falkland, First Lord of the Admiralty, explained to the Commissioners early on that naval payments (excluding for victualing, which was different) might be conducted through any of three different methods (by "bill," "book," or "ticket").[75] Often, such lessons were meant to justify why the Commissioners simply could not expect the kind of information they hoped for. Yet some excuses carried serious instructional value. No one did more to tutor the Commissioners than the Treasury clerk William Lowndes, who had rare insight into the conventions of multiple agencies. Between June and November, Lowndes explained to the Commissioners the basics of Exchequer accounting and why Treasury and Exchequer accounts were often incongruent, gave a lesson in the history of the "fictitious loan" as a fund-raising mechanism, and reconciled two major discrepancies (including one of £10,000) between Treasury and Exchequer accounts relating to advances on tax revenues.[76]

Such lessons were nevertheless not immediately what the Commissioners, or especially their Parliamentary audience, were hoping for. In late November 1691, the Commons requested that the Commission submit a first "State of the Income & Issues of ye Publick Revenue," which the Commission provided to both Houses shortly thereafter.[77] That report contained a lengthy, two-part table, summarizing government receipts (on the left) and expenditures (on the right).[78] This debtor-

[74] HMC *Lords, 1690-1*, p. 405.
[75] BL Harley MS 1,488, f. 22^{r}. See also ff. 28^{r}, 32^{r}.
[76] BL Harley MS 1,488, ff. 113^{r}, 153^{v}, 170^{r-v}; BL Harley MS 1,489, f. 14^{v}.
[77] BL Harley MS 1,489, f. 58^{r}.
[78] HMC *Lords, 1690-1*, pp. 356-399.

creditor structure gave order to the informational bedlam the Commission had encountered. Yet that numerical technology also framed the imperfections in the Commission's efforts. The Commissioners had to explain that "this Account is as exact as we have been able to make," and provided several "reasons why it is not more perfect."[79] Critically, the account did not quite balance; the Commission found £18,018,586 in receipts but £18,020,403 in expenditures. The difference of just over £1,800 was modest, and the Commissioner's explained that it was an expected consequence of short-term credit procedures.[80] But it was meaningful that a difference existed at all. The precise balancing of debits and credits was a commanding rhetorical effect of mercantile accounting. When it worked, it testified to an accountant's care and honesty. When it failed, it was an immediate sign something was off.

The Commission's first report was a penetrating commentary on the nation's informational administration, its imperfections notwithstanding. Each of the annoyances the Commissioners encountered in their daily work was echoed in the final report. The Commission spent much time explaining away sloppiness in accounting. When the Lords asked about a specific example of inaccurate accounting by the Paymaster of the Army in Ireland, the Commissioners replied tersely that "as to miscasting of accounts in general, it has given the Commissioners a great deal of trouble, many of the accounts brought before them being greatly faulty."[81] The Commissioners also spoke to more systemic problems. The Commission frankly admitted that the network of individuals responsible for public funds was "so voluminous, that it will require much more time to examine and state" them than was allowed.[82]

[79] HMC *Lords, 1690-1*, p. 400.
[80] HMC *Lords, 1690-1*, p. 392.
[81] HMC *Lords, 1690-1*, p. 433.
[82] HMC *Lords, 1690-1*, pp. 400-1.

The Commission's report revealed that England's emergent military-fiscal state was far from an information state, at least in any centralized sense.[83] The problems of making war and raising money had prompted many ad hoc solutions. New mechanisms of short-term financing posed some of the biggest informational challenges. The Commissioners struggled to pass on to Parliament the technical lessons they had learned from Lowndes about fictitious loans and tallies of anticipation.[84] Many of the state's new fiscal capabilities relied on single individuals for administration, and at the close of the Commission's account, almost £120,000 of public money lay "in the hands" of individual undertakers. Thomas Fox, Receiver of the Customs, held over £75,000, more than was in the Exchequer (£63,000). The Commissioners explained how this complicated their ability to produce a comprehensive public account, citing the potential for "double-charging" of revenues because of certain loans Fox had advanced on Customs receipts.[85] Public money was often hard to find when it spent so much time in private hands.

The Commissioners had hoped to find a government where there was a voucher for every expense and where the accounts ultimately balanced. They did not find it.[86] They imagined a kind of certainty that did not exist, and their incomplete first report reflected that. We should not, though, see that report as "a document of amazing ignorance."[87] By attempting to reconcile England's disorderly fiscal system into a single account, the Commissioners were creating a system of rules by which government was to be evaluated. They were also sharpening a set of computational tools for figuring out when their government failed to live up to those standards. The Commission's first report was an aspirational document. Their account provided an incomplete image of what public

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[83] Two areas which had witnessed improvement in managerial care were the Customs and especially the Excise after the end of tax-farming in 1671 and 1683, respectively. See: Brewer, *Sinews of Power*, pp. 101-114; Braddick, *The Nerves of State*, chs. 3, 5; Miles Ogborn, "The Capacities of the State: Charles Davenant and the Management of the Excise, 1683-1698," *Journal of Historical Geography* 24, no. 3 (July, 1998): 289-312.
[84] See, for example, HMC *Lords, 1690-1*, pp. 410-1.
[85] HMC *Lords, 1690-1*, p. 400.
[86] On the disappointment that could result from getting more, but not necessarily better, information, see Loveman, *Reading Fictions*, pp. 21-3.
[87] Shaw, *CTB: Vol. 9, 1689-92*, p. clxiii.

finances actually were. The model of a complete account, though, became a numerical image of what some Englishmen wanted their government to be. It was also an implicit assertion about the need for exactly that kind of calculation—one that was far from perfect, but which tried to make the most of a profoundly uncertain situation.

IV. "The Accounts Are Amazing Things": Legacies of Public Accounting

Despite the Commissioner's ambitions, some began to question what the Commission's zeal had really achieved. The 1693 bill for renewing the Commission elicited mixed sentiments. Edward Seymour, among the loudest proponents of Parliamentary inquiry into the Crown's revenues in 1689, claimed of the Accounts Commission that "he did not see any good was done by it answerable to what it costs you, which is almost £10,000 per annum."[88] Historians have largely echoed Seymour's ambivalence about the Commission's importance in the development of an efficient and accountable state.[89] Scholars are right to point out that the 1690s enthusiasm for public accounting did not produce modern mechanisms for budgeting or auditing, and may have had only fleeting impact on an administrative culture that became possibly more venal under the Walpolean oligarchy.

Yet historians have understated the connection between these public accounting exercises and enduring changes in the informational capacities of the administrative government. Two such changes are suggestive. A first example came in late 1691 or 1692, when the Treasury began to keep a permanent series of consolidated accounts of annual revenue and expenditure.[90] P. G. M. Dickson notes that this was an exercise in numerical transparency unprecedented not only in England, but

[88] Narcissus Luttrell, *The Parliamentary Diary of Narcissus Luttrell, 1691-1693*, ed. Henry Horwitz (Oxford: Clarendon Press, 1972), pp. 420-1.
[89] For various appraisals of the Commission's impact, see: Shaw, *CTB: Vol. 9, 1689-92*, pp. clxxii; Roseveare, *Treasury: Foundations*, pp. 56-9; Roseveare, *The Treasury: The Evolution of a British Institution* (London: Allen Lane, 1969), ch. 3; Brooks, "Taxation," pp. 117-126.
[90] See Treasury Papers, NA T 30.

anywhere at the time.[91] Both the timing and formal similarities between these new accounts and the first report of the Accounts Commission suggests that Parliamentary pressure was likely critical to the Treasury's new practice.[92] A second key change was the rise of a new primary informational broker between the Commons and the Treasury after 1695, the informal position previously occupied by Robert Howard. That broker, elected an MP and promoted to Secretary to the Treasury in 1695, was William Lowndes. Though often cited as a standard-bearer of rising civil-service professionalism in the late seventeenth century, "Ways and Means" Lowndes was not a lone hero of administrative modernization.[93] His remarkable career was conditioned by the informational politics of the 1690s. When he entered the House of Commons in 1695, Lowndes had already been the Accounts Commission's most important educator. From then until his death in 1724, he was both prized by the Court for his ability to get the King's business done and also trusted by Country critics for his ethical probity and his clarity in conveying information.

More dramatic than such administrative effects, though, was the impact that the efforts of the Commission of Public Accounts had on the place of numerical information in political discourse in the 1690s and beyond. The Commissioners had learned that numerical accounting was a potent analytical tool. The armature of accounting organized disparate information and isolated what potentially valuable data was unavailable, especially when administrative fragmentation or partisan conflict made it difficult to get all the information that might be desired. These lessons were especially seized upon by MPs with "Country" sympathies, led by Accounts Commissioners Robert Harley and Paul Foley. Country MPs, both Whig and Tory, sought to eliminate governmental waste

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[91] Dickson, *Financial Revolution*, p. 46. Compare Theodore M. Porter's assertion that, in the nineteenth and twentieth centuries, a "preoccupation with rules, calculation, and fact-finding is not the essence of a bureaucratic-legal mode, as some would have it, but a defense against… outsiders." See Porter, *Trust in Numbers: The Pursuit of Objectivity in Science and Public Life* (Princeton: Princeton University Press, 1995), p. 194.

[92] Even once the Treasury accounts began to be kept in this consolidated form, the Commission continued to calculate their own autonomous account. (Shaw, *CTB: Vol. 9, 1689-92*, p. clxxiv.)

[93] Baxter, *Development of the Treasury*, pp .198-203, 237-9; Roseveare, *Treasury: Evolution*, pp. 72-3, 80-1; Roseveare, *Treasury: Foundations*, pp. 77-82; Geoffrey Holmes, *Augustan England: Professions, State and Society, 1680-1730* (London et al.: George Allen & Unwin, 1982), pp. 245-6.

and corruption, reform the nation's morals, and curb "Court" autonomy.[94] Country outsiders generally did not hold government places, and so found in arithmetic a tool for making potent conclusions out of asymmetric information.

Changing attitudes about the political place of numbers were evident in those first Commons debates over Secret Service money on December 3, 1691. Frustrated by the failure to unearth Jephson's secrets, one MP reflected on how the balance of numerical power had shifted between Court and Parliament. "The Accounts are amazing things," John Thompson declared. "We were told in the last session, 'Country gentlemen understood not Accounts,' and now, it seems, the Commissioners of the Treasury do not. If they understand not Secret Service, then they are not fit for their places."[95] "Country gentlemen" like Thompson realized that numerical accounts were not only the province of ministerial insiders. They were open to anyone's scrutiny. For ministerial agencies like the Treasury, on the other hand, numerical competence was to be a requirement of responsible governance.

Parliamentarians mobilized their growing accounting acumen to seek greater input into governmental decision-making. For example, MPs began to demand future estimates of military expenditures.[96] At that time, executive agencies rarely projected future monetary needs. Parliamentary pressure, though, forced them to expand their numerical capacities in the early 1690s.[97] Though Commoners accepted the earliest military estimates with little comment, after 1691

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[94] This article does not attempt to make an argument about whether the Country faction in the early 1690s truly constituted a "party," or about the importance of Court-Country animosities compared those between Whig and Tory. The "Country" identifier is used simply to identify a core set of commitments shared by some MPs, like Harley and Foley. On Court-Country politics, see: Dennis Rubini, *Court and Country, 1688-1702* (London: Hart-Davis, 1968); David Hayton, "Moral Reform and Country Politics in the Late Seventeenth-Century House of Commons," *Past & Present* 128 (Aug., 1990): 48-91; Downie, "Commission of Public Accounts."

[95] Grey, *Debates,* Vol. 10, p. 191.

[96] Downie points out that the Commission was not initially intended to improve the government's capacity for estimation and budgeting. ("Commission of Public Accounts," p. 35). Compare: Shaw, *CTB: Vol. 9, 1689-1692*, pp. cxxix-cxxxvii; Hill, *Robert Harley*, pp. 27-8.

[97] One manuscript in the papers of William Lowndes confirmed that "the Estimates and appropriations for the years [1688-1689] were few and imperfect." ("A Computation of the charges for land and sea services from the 5th of Nov.

they began to seriously interrogate the numerical claims put before them.[98] MPs grew ever more creative in their arithmetical criticisms. In November 1693, for example, the Commission of Accounts was asked to give an account of Parliamentary grants for the Navy, with an analysis of what funds had ultimately gone to naval use. They computed that, of just under £6.6 million granted for naval support since 1689, only £4.6 million had actually been paid.[99] The Treasury Lords were forced to provide their own computations to defend against the implication of mismanagement. At times, such computational controversies approached questions of rudimentary accounting theory. In one instance the Commissioners challenged £98,000 in payments that the Treasury had claimed to make in 1690-1691 for naval ordnance, stating that, because such payments were made for the purchase of saltpeter, they "ought not to be so charged until converted into powder and issued for sea-service, except their Lordships intend a double-charge."[100] Arcane points of accounting method, like how to quantify the movement of intermediate materials like saltpeter, gained considerable political import.

It was not uncommon for narrow disputes over accounting figures to implicate much more abstract questions. The sources of confusion that plagued the public accountants—inadequate data, obscure accounting conventions—created space for interpretive controversy. When it was unclear whether anyone could offer a definitive account, both the Court and its critics had to resort to arithmetical speculation. This was evident in another 1693 dispute between the Accounts Commission and Robert Howard. Early in 1693, the Commission had offered an analysis of the monetary resources available to the government to pay for war needs over the next three-to-four years. They found the government had roughly £1.3 million that could be expected "to come in in

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1688 to the last of Decr 1690…" Lowndes Papers, NA T 48/87, ff. 210-213, on f. 210.) See also: Shaw, *CTB: Vol. 9, 1689-1692*, pp. cxiii-cxxiv, cxxix-cxxxvii; Brooks, "Taxation," p. 115.

[98] Grey, *Debates*, Vol. 10, 168-169; Horwitz, *Parliament, Policy, and Politics*, p. 71; Hill, *Robert Harley*, pp. 27-8.

[99] HMC *Lords New Series, 1693-5*, Vol. 1, pp. 12-29.

[100] HMC *Lords New Series, 1693-5*, p. 27. See p. 17 for the Treasury Lords' calculation.

time toward defraying the Charge of the Warr," net of loans.[101] On February 16, Robert Howard pushed back against the implication that the government was quite so flush with cash, arguing that the Commission had made over £1.1 million of "Errors in their Acco[t]," and that the government only had about £172,000 at its disposal. Howard particularly claimed that the Commissioners had incorrectly projected the near-term receipts of various special taxes, such as Customs on East India goods and on sugar, by calculating on the basis of the most recent year's returns. An irregularity in the timing of voyages had meant that an especially large number of ships had come back to England from the West Indies that year. Taking instead an average of the previous four years, Howard estimated that expected sugar duties would be £282,000 below where the Commission predicted.[102] When it came to projecting the future volume of international trade, the combatants had fully entered the realm of economic interpretation—political arithmetic, perhaps.

These 1693 battles were emblematic of the increasing use of speculative numerical polemics in Parliamentary discourse. As those controversies showed, calculations could tell provocative stories even when technically incomplete. Practitioners with a Country perspective honed the suggestive power of accounting in the early 1690s as a moralistic tool, aimed at executive agents who betrayed the public trust for personal gain.[103] Yet, the analysis of accounts proved a flexible political instrument that could be applied from inside the ministerial government as well as from out, by combatants of all partisan affiliations. As political battles over fiscal administration and political economy became defined by the all-encompassing conflict of "Whig" versus "Tory," particularly in the Age of Queen Anne, the computational combat carried out between Howard and the Accounts Commissioners was reenacted with greater intensity and greater analytical creativity, and before a

[101] Robert Howard, "Paper of Exceptions to the Commissioners of Accompts delivered to the House of Commons by S[r] Robert Howard on Thursday the 16th of Ffebruary 1692," 1692/3, BL Harley MS 7,019, ff. 5-8, on f. 5[v].
[102] Howard, "Papers of Exceptions," 1692/3, BL Harley MS 7,019, f. 8r.
[103] See, for example: *A Collection of the Debates and Proceedings in Parliament, in 1694, and 1695. Upon the Inquiry into the Late Briberies and Corrupt Practices* (London: *s.n.*, 1695).

greater, public audience.[104] Scholars have reconstructed how the two great parties sought to actively conquer public opinion, including on matters of political economy, by managing information, spinning news, and "controlling the language by which people gained financial literacy."[105] Calculation was an indispensable part of the propaganda battles of the early eighteenth century, especially in the hands of the age's foremost propaganda maestro—Robert Harley.

The numerical combat that would become familiar by the age of Anne did not depend on a strict two-party structure to develop. That culture of political numbers owed its initial emergence more to the increasing authority of Parliament in the aftermath of 1688, and the insider-outsider dynamics that resulted as the nation's political representatives fought with the state's agents over information.[106] But Whig-Tory party politics unquestionably would take numerical conflict to new heights, both of analytical sophistication and argumentative creativity. Battles over economic calculation vividly demonstrated a tension that Mark Knights has identified in Augustan political culture. Looking specifically at the study of history in the period, Knights argues that the highly adversarial nature of argumentation that characterized the rage of party produced two countervailing effects.[107] On the one hand, the desire for competing parties to win arguments at all costs pushed their spokesmen toward extreme knowledge claims that highlighted the potentially fictitious nature of political discourse. On the other hand, knowledge claims were subjected to relentless scrutiny by the opposing party, and the need to make statements that could better hold up to such vicious criticism pushed both sides toward more penetrating and rigorous analysis.

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[104] The classic study of the all-encompassing nature of Whig-Tory conflict in the early eighteenth century is Geoffrey S. Holmes, *British Politics in the Age of Anne* (London et al./New York: Macmillan/St. Martin's Press, 1967).
[105] Wennerlind, *Casualties of Credit*, ch. 5, on p. 162; Knights, *Representation and Misrepresentation*, esp. pp. 238-48; Downie, *Robert Harley and the Press: Propaganda and Public Opinion in the Age of Swift and Defoe* (Cambridge, UK et al.: Cambridge University Press, 1979).
[106] Compare Porter, *Trust in Numbers*, esp. pp. viii-xi.
[107] Knights, "The Tory Interpretation of History in the Rage of Parties," *Huntington Library Quarterly* 68, nos. 1-2 (Mar., 2005): 353-73, esp. p. 354.

IV. Finding the Money, from Public Accounting to Political Arithmetic

The travails of the Public Accountants had framed fiscal knowledge—who controlled it, how it ought to be made, what standards should be invoked for evaluating it—as an object of political contestation. Robert Harley repeatedly contended that independent Parliamentary institutions ought to be the primary stewards of governmental knowledge on matters like trade and national debt policy. In doing so, he made implicit claims about what the techniques of external auditing and calculation adopted by such representative bodies really could know about the problems of commerce and finance. In early 1693, for example, he wrote to his father about why the Parliamentary Accounts Commission ought to be given greater control over raising a new public loan. Harley suggested that the Treasury, who had "us[e]d ye Com^{rs}. of accounts so unk[i]ndly," ought to allow the Commissioners to "shew their skil[l]s" as the proper stewards of such financial transactions. After all, it was the Commission "who have found out all ye mon[e]y hither to."[108] It is unclear exactly what Harley meant by "finding out the money" in that sparse, scrawled letter. Was he crediting the Commissioners with an administrative success, of having found new or lost streams of revenue? Or was he applauding their ethical and constitutional achievement in having tracked down surreptitious corruption? Or was he speaking more to their analytical "skills" in finding out what the nation's fiscal condition really looked like? The ambiguity, of course, spoke to more than just Harley's terse epistolary style.

For Harley in the early 1690s, advocating public accounting as an instrument of policy required implicitly defending the value of parliamentary oversight of fiscal administration and the validity of external auditing as a tool of fiscal knowledge. None of these points went unchallenged, particularly amidst a raging war with France. England's enemy, after all, had established centralized

[108] Robert Harley to Sir Edward Harley, 9 February 1692/3, Portland Papers, BL Add. MS 70,017, f. 22r. See also: Brooks, "Taxation," pp. 124-5; Hill, *Robert Harley*, p. 32.

control over information under the ruthless command of Colbert.[109] The fiscal challenges England faced were complex, technical matters that many dared not leave to committees of inexperienced Commoners, particularly commoners without command over all the requisite information.[110] Some charged that requests for greater numerical transparency were purely exercises in partisan sabotage or fantasy, and questioned whether the kind of external analysis offered by the Public Accounts commissioners could ever be that reliable. Robert Howard offered a cogent, if petulant, critique in 1693 when he claimed of the Commission's reports that "there was nothing in them but what any clerk of their office should be bound to present you with, but there are several mistakes in them."[111] Howard's snarky point was not one that could be dismissed lightly. How was it possible to defend such external analyses when they were bound to be flawed?

For at least one thinker, Charles Davenant, this question became a guiding intellectual concern. In Davenant, Robert Harley's inchoate perspectives on representative government and the value of information found an ambitious theorist. In a series of writings in the mid- to late-1690s, Davenant voiced many of Harley's ideological concerns, especially a prevailing fear of ministerial corruption and a belief in the administrative efficacy of representative institutions. (Indeed, after 1700 Davenant would become one of Harley's most prized propagandists, and ultimately the mastermind behind the Tory *Mercator*, a newspaper created to support the Tory Anglo-French Commerce Bill in 1713.)[112] Yet the political arithmetician Davenant shared another commonality with the Accounts Commission that was even more vital to his thinking. Both confronted the vexing problems of trying to make politically salient claims about the public's finances on the basis of imperfect data. Those shared frustrations became, for Davenant, the inspiration for a new approach

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[109] On Colbert and French intelligence, see Soll, *Information Master*.
[110] Horwitz, *Parliament, Policy, and Politics*, p. 69; Robert McJimsey, "Crisis Management: Parliament and Political Stability, 1692-1719," *Albion* 31, no. 4 (Winter, 1999): 559-88, esp. pp. 559-72.
[111] Lutrrell, *Diary*, p. 421.
[112] J. A. Downie, *Robert Harley and the Press: Propaganda and Public Opinion in the Age of Swift and Defoe* (Cambridge, UK et al.: Cambridge University Press, 1979), p. 37. On the Anglo-French trade conflict of 1713-4, see Chapter 3.

to the science of political arithmetic. An Excise Commissioner and MP before 1688, Davenant had been on the front lines of fiscal administration in the mid-1680s as a manager of major taxation reforms.[113] But he found himself out of work and out of Parliament after 1688, tarred as a Stuart placeman. It was through his writing that Davenant revived his career in the 1690s. From 1695-8, Davenant wrote prolifically on taxation, trade, the coinage, national credit, and "public virtue," making his name with his 1695 *Essay upon Wayes and Means*. Indeed, it was Davenant who gave political arithmetic its most oft-cited definition, as "the Art of Reasoning, by Figures, upon Things relating to Government."[114]

Scholars have been collectively unsure about what to make of Charles Davenant. Historians like J. G. A. Pocock have seen Davenant as a characteristic "classical republican" critic of England's emerging military-financial complex, while others have cited him as a standard-bearer of state modernization.[115] Similarly, scholars have been mixed on what to make of political arithmetic, as first conceived in the seventeenth century by William Petty, and its impact on the political and intellectual life of the subsequent century. The historical fate of political arithmetic after Petty's death in 1687 looks different depending on how you define the term: as the ambitious science conceived by Petty, or more generically as the use of numerical data in making and debating public policy. On the one hand, scholars like Paul Slack, Terence Hutchison, and Mary Poovey have pointed out that Petty's transformative aspirations for political arithmetic went largely unrealized after his death in 1687,

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[113] D. Waddell, "Charles Davenant (1656-1714) – a Biographical Sketch," *The Economic History Review*, New Series, 11, no. 2 (1958): 279-288. On Davenant's Excise career, see Ogborn, "Capacities of State."

[114] Charles Davenant, *Discourses on the Publick Revenues, and on the Trade of England...*, Vol. 1 (London: Printed for J. Knapton, 1698), p. 2.

[115] On Pocock as a "classical republican" or "neo-Machiavellian" thinker, see: *The Machiavellian Moment: Florentine Political Thought and the Atlantic Republican Tradition* (Princeton: Princeton University Press, 1975), pp. 429-54; Andrea Finkelstein, *Harmony and the Balance: An Intellectual History of Seventeenth-Century English Economic Thought* (Ann Arbor: University of Michigan Press, 2000), ch. 14; Seiichiro Ito, "Charles Davenant's Politics and Political Arithmetic," *History of Economic Ideas* 13, no. 1 (Oct., 2005): 9-36. For Davenant's modernizing perspective on government administration, see: L. J. Hume, "Charles Davenant on Financial Administration," *History of Political Economy* 6, no. 4 (Winter, 1974): 463-77; Brewer, *Sinews of Power*, pp. 78, 144; Ogborn, "Capacities." A kind of intermediate alternative position has been offered by Kustaa Multamäki, who argues that Davenant saw the concerns of classical republicanism as deeply interrelated with a highly nationalistic vision of political economy. See: Multamäki, *Towards Great Britain: Commerce & Conquest in the Thought of Algernon Sidney and Charles Davenant* (Tuusula, Finland: Finnish Academy of Science and Letters, 1999), 149-208.

whether measured by the history of administrative practice, economic methodology, or social thought.[116] Yet other scholars have shown that political arithmetic as a practical, political activity did not die in the eighteenth century, whatever its unfulfilled potential. In a 1996 article, Julian Hoppit contends that political arithmetic "was at least as common after 1700 as before."[117] In both government administration and the making of Parliamentary policy, detailed numbers were regularly invoked on matters ranging from fiscal planning to colonial demography. Numerical calculation was also a common tool of political argumentation out-of-doors. Andrea Rusnock, Joanna Innes, and Jessica Warner have elaborated how political arithmetic thrived as a style of political reasoning and tool for parliamentary lobbying in the eighteenth century, adapted to targets like public health, social policy, and moral reform.[118]

In his fine recent biography of William Petty, Ted McCormick has attempted to reconcile the disjuncture between political arithmetic, as a cutting-edge seventeenth-century science, and political arithmetic, as a generic eighteenth-century practice, by reconstructing Petty's original vision for it. McCormick argues that Petty saw political arithmetic as an instrument of social engineering, particularly in Ireland, aimed at thoroughly "reorienting political practice… to the manipulation of populations."[119] In his view, Petty's followers like Gregory King and especially Davenant refigured his grand, ideological "programme" to a comparatively inert "practice."[120] This tempering was largely a response to changing political circumstances after 1688. "As policy-making centred less and less on

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[116] Slack, "Government and Information," esp. pp. 58, 68; Slack, "Measuring the National Wealth in Seventeenth-Century England," *Economic History Review* 57, no. 4 (Nov., 2004): 607-635; Terence Hutchinson, *Before Adam Smith: The Emergence of Political Economy, 1662-1776* (Oxford and New York: B. Blackwell, 1988), 54; Poovey, *History of the Modern Fact*, pp. 120-43.

[117] Julian Hoppit, "Political Arithmetic in Eighteenth-Century England," *Economic History Review* 49, no. 3 (1996): 516-40, quotation on p. 519.

[118] Andrea Rusnock, *Vital Accounts: Quantifying Health and Population in Eighteenth-Century England and France* (Cambridge, UK and New York: Cambridge University Press, 2002); Joanna Innes, *Inferior Politics: Social Problems and Social Policies in Eighteenth-Century Britain* (Oxford and New York: Oxford University Press, 2009), ch. 4; Jessica Warner, "Faith in Numbers: Quantifying Gin and Sin in Eighteenth-Century England," *The Journal of British Studies* 50, no. 1 (Jan., 2011): 76-99.

[119] McCormick, *William Petty*, 302.

[120] McCormick, *William Petty*, pp. 285-302, on p. 299.

the shadowy comings and goings of a handful of courtiers and more and more on Parliamentary party politics, political arithmetic evolved into a language that could be learned and used by anyone, in or out of power, to advance or to critique any policy."[121]

By reconstructing Charles Davenant's quite different ambitions for political arithmetic, within the specific context of 1690s informational politics, I wish to elaborate McCormick's picture in two ways. First, Davenant's ideas about fiscal administration and his reconception of political arithmetic emerged from the political values and informational vexations he shared with the Country public accountants in Parliament.[122] Like Harley, Davenant in the 1690s espoused a vision of a modern English information state built on the power of Parliamentary oversight, a perspective which helps to explain the seeming discord between Davenant's dual historiographical personalities as both a classical republican theorist and an administrative modernizer. Methodologically, Davenant reshaped political arithmetic by combining Petty's pioneering techniques of data synthesis and estimation with the adversarial accounting strategies of Harley and the Accounts Commissioners. Davenant gave political arithmetic a new analytical function and a new political ambition—it was to be a tool for making politically useful knowledge in the absence of perfect information, for combatting secrecy and administrative disorder. It was to be about finding the money. Second, as will be discussed in Section VI, I wish to show how Davenant's new uses for political arithmetic, and the new political environment in which it was deployed, forced him toward new conceptual and indeed epistemological problems about what made numerical calculations merit belief.

When he began to write on the nation's military and fiscal condition in the mid-1690s, Davenant was aghast at how little the nation's government seemed to know. As he explained in his 1696 manuscript *Essay on Publick Virtue*, England's condition was dire: the public debt had grown to

[121] McCormick, *William Petty*, p. 300.
[122] Peter Buck has shown that Country ideology was vital to novel exercises in political arithmetic in the later eighteenth century, particularly the work of Richard Price. See: "People Who Counted: Political Arithmetic in the Eighteenth Century," *Isis* 73, no. 1 (Mar., 1982): 28-45.

unimaginable heights; trading markets had been lost to Dutch competitors; and the nation's deteriorated silver currency had occasioned a rash recoinage scheme.[123] These calamities were the responsibility of "young and giddy statesmen" (the Whig "Junto") who lacked the far-sightedness to address the nation's problems.[124] Since 1688, the nation's ministerial leaders had never adequately addressed the question of how much the nation could actually afford: "They should have duely weighted the strength, – & Wealth, of this Kingdom in order to know how long, & upon what ffoot, We were able to carry on ye Warr."[125] The expensive mismanagement of the war with France, Davenant argued, testified to the Court's economic ignorance. "If the managers had considered at all or given themselves leasure to enquire into the annuall Income ariseing from Land Manufactures and Trade," he wrote, "...they must soon have found That 5 millions yearly was an expence we could not long continue."[126] Davenant further gave a noteworthy twist to the familiar Tory view that England should emphasize naval combat: a naval strategy was better because it was more intelligible to MPs, especially in numerical terms. "The expences of it were fully known and the accompts easily stated." Courtly schemers, Davenant suggested, "better like infinite expences, which produce Infinite Reckonings and at last no accompt."[127]

Davenant recognized that executive ministers in a fractured, Parliamentary government did not always have incentives to keep good records. But then what options existed for conquering the nation's fiscal ignorance? He admitted that one potential model was to radically consolidate the management of state information under a particular minister. This was, indeed, the model of the enemy. Davenant offered qualified praise of the French system in his *Ways and Means*, which oddly

[123] Charles Davenant, "Essay on Publick Virtue," unpublished MS, 1696, BL Harley MS 1,223, ff. 7-79, esp. f. 14^{v}.
[124] Davenant, "Essay on Publick Virtue" (1696), BL Harley MS 1,223, f. 8^{v}.
[125] Davenant, "Essay on Publick Virtue" (1696), BL Harley MS 1,223, f. 21^{v}.
[126] Davenant, "Essay on Publick Virtue" (1696), BL Harley MS 1,223, f. 38^{r}.
[127] Davenant, "Essay on Publick Virtue" (1696), BL Harley MS 1,223, ff. 38^{v}-39^{r}.

began with a brief survey of French administrative history.[128] Davenant lauded French ministerial greats like Cardinal Richelieu, who "first introduc'd that exact Method which appears in all their Affairs," and Jean-Baptiste Colbert, who "brought… perfection in the Public Revenue."[129] The problem was that the English nation had to know as much, if not more, about the economic condition of itself and its enemies without degenerating into the autocracy of the French "great machine of government."[130] In Davenant's mind, the country needed to expand its intelligence apparatus within Parliamentary constraints. In fact, the nation needed to capitalize on the information-processing capacities of Parliament itself, as he explained in his vision for a new council of trade.[131]

Like the Accounts Commissioners, though, Davenant knew from personal experience that the accountable government he dreamed of was not a reality. His own analytical exercises taught him how England's territorial administrative culture made it profoundly difficult to assess the nation's fiscal condition coherently. Davenant offered a weary disclaimer in his 1698 *Discourses on the Publick Revenues*, echoing the frustrations of the Accounts Commissioners: "The Writer of these Papers has met with extream Difficulty and Opposition, in procuring the sight of the Accompts relating to the Revenue... The Books of the Principal Offices have been in a manner shut up against any Inquiry he desir'd to make; and this has render'd his Work more imperfect."[132] Just like the Commissioners again, Davenant developed creative calculations to work around these informational challenges.

The close affinity between Country "public accounting" and Davenantian "political arithmetic" was evident from Davenant's first published computations. The first numerical arguments in his *Ways and Means* involved reorganizing government "Accompts" about tax revenues

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[128] [Charles Davenant], *An Essay upon Wayes and Means of Supplying the War* (London: Printed for Jacob Tonson, 1695), pp. 5-9.
[129] Davenant, *Essay upon Wayes and Means* (1695), pp. 8-9.
[130] Davenant, *Essay upon Wayes and Means* (1695), pp. 18-19.
[131] Charles Davenant, "Memorial Concerning a Council of Trade," unpublished MS, 1696, BL Harley MS 1,223, ff. 184^{r}-189^{v}.
[132] Davenant, *Discourses on the Publick Revenues* (1698), Vol. 1, p. 266.

to reveal trends over time.[133] Davenant, though, expanded upon such accounting through creative arithmetical manipulations and by combining government data with projections of less certain quantities, like population and trade metrics. An early display of such creativity came in his critique of "poll money," a wartime tax on individuals based on status and occupation, which Davenant suspected was under-producing. He too was trying to find the money, and found computation a vital tool for doing so. Davenant adopted demographic estimation techniques pioneered by Petty and John Graunt in order to project what receipts from the Quarterly Poll tax realistically should have been. The poll legislation specified different amounts to be paid by different social groups, including nobility and gentry, merchants, and other tradesmen. Davenant used hearth tax returns to estimate the number of "Richer Families" eligible for one provision of the tax—800,000 families yielding £373,333. He then used figures for land tax commissioners (a local position reserved for men of status) to estimate the number of wealthier gentleman who would be subject to a different part of the tax—80,000 people yielding £320,000. Adding a rough estimate of the qualified "Tradesmen, Shopkeepers, and Vintners," Davenant concluded the poll should produce £800,000 per year. The actual returns from the Poll Tax in the previous year, around £597,000, missed this projection by over 25%, while current-year returns suggested a shortfall approaching 50%. Such a dramatic deficit could only come from a dramatically flawed policy. "When a Tax yields no more than half what in reason might be expected from it," he argued, "we may plainly see it grates upon all sorts of People."[134] Finding the money was not just a practical question, after all; it spoke to the stability of the polity itself.[135]

Davenant's *Wayes and Means* made clever use of limited data to frame the difference between a political ideal—what the poll tax *should* produce—and the frustrating political realities of his

[133] Davenant, *Essay upon Wayes and Means* (1695), pp. 46-7.
[134] Davenant, *Essay upon Wayes and Means* (1695), pp. 54-5.
[135] Compare Colin Brooks, "Public Finance and Political Stability: The Administration of the Land Tax," *The Historical Journal* 17, no. 2 (Jun., 1974): 281-300.

moment. His 1698 *Discourses on the Public Revenues* took this method of computational criticism to an entirely different level of sophistication. In Discourse III, "On the Management of the King's Revenues," Davenant systematically calculated the difference between expected and the actual produce for some eight different taxes, concluding that the nation was losing £736,075 annually purely as a result of poor management in the king's revenues (**Figure 1a**).[136] It was an amount so large, Davenant suggested, that the nation's fiscal struggles could be solved, and "a great part of the Nation's Debts may be satisfied, by a good Management of the Existing Duties and Revenues already granted."[137] Davenant took advantage of this startling confusion to encourage readers to reflect not only on their fiscal circumstances, but on the powers of computation. "Political Arithmetic may peradventure be an uncertain Guide in all these Matters; and he shall desire to follow her no more, if she leads him into error," Davenant admitted in a bit of satisfied self-deprecation. "But if his Computations should happen to be right, Seven hundred thousand Pound Annual Income, is a Sum not to be slighted, in a Country where 'tis so very difficult to find out Ways and Means of raising Mony."[138]

In the Excise on Beer and Ale, of	£318,000
In the Duty on Malt, of	200,000
In the Duty on Salt, of	38,075
In the Duty upon Leather, of	30,000
In the Duties on Parchment and Paper, of	15,000
In the Duties on Marriages, Births, and Burials, of	26,000
In the Duty on Windows, of	89,000
In the Duties on Glassware, Earthenware, and Tobacco-Pipes, of	20,000
Total, yearly	**£736,075**

Figure 1a. Table summarizing Charles Davenant's calculations showing the "Improvements to be made Annually" in various under-producing parts of the public revenue, from Davenant, *Discourses on the Public Revenues* (1698), Vol. 1, p. 119.

[136] Davenant, *Discourses on the Publick Revenues* (1698), Vol. 1, pp. 65-121, esp. p. 119.
[137] Davenant, *Discourses on the Publick Revenues* (1698), Vol. 1, p. 121.
[138] Davenant, *Discourses on the Publick Revenues* (1698), Vol. 1, p. 120.

Davenant's analysis of the Excise, where he was formerly employed, was especially intricate. Davenant noted that, beginning in the early 1680s (when he began his own service in the Excise), major improvements had been made in the management of the Excise, marked by an increased number of well-trained guagers, independent and upright new Commissioners, and better Treasury oversight. The produce of the Excises taxes had subsequently risen consistently from 1683 to 1689, such that by the end of that period the annual returns from the Excise were over £150,000 greater than at the beginning.[139] He admitted, though, "that the Improvements made in the Six Years of the former Management, did not all arise from the Conduct of the Managers, but in part from the natural Increase of Wealth, and Numbers of People in the Kingdom."[140] He proceeded, "Computing by Political Arithmetick," to assess what proportion of the £150,000 aggregate annual increase in the Excises resulted from each of these three forces. He assigned £9,000 to the increasing "Stock of Wealth" of the nation, £39,000 to the increasing "Numbers of People," and—the critical number—£102,000 for improvements in management.[141]

Davenant was quite vague on how he determined the proportions of the Excise increases attributable to growth in national wealth and population, and it seems likely those figures were little more than round guesses. (He did, it should be noted, rely more heavily on new data from Gregory King on social structure and arable land in composing his analysis of the malt tax). But even if all of Davenant's political-arithmetical estimates were not of high empirical quality, that should not detract from the seriousness of the analytical project Davenant had proposed—to analyze chronological trends in fiscal data and to explain those trends in terms of the separate influence of a range of different, largely independent variables. The calculation amounted to a kind of proto-regression analysis. He followed his analysis of the 1683-1689 Excise returns with an even more elaborate

[139] See the Scheme inserted in Davenant, *Discourses on the Publick Revenues* (1698), Vol. 1, after p. 74.
[140] Davenant, *Discourses on the Publick Revenues* (1698), Vol. 1, p. 95.
[141] Davenant, *Discourses on the Publick Revenues* (1698), Vol. 1, p. 95-6.

exercise concerning the seemingly deteriorated Excise receipts of 1690-1696 (see **Figure 1b**). There, he attempted to decompose the Excise decline from that period into eight different potential factors (not yet including the costs of mismanagement): a change in the standards of measure for beer and ale in 1690; a specific allowance that had been given for changes in Excise assessment procedure; brewers producing beer and ale to higher (alcoholic) strengths to reduce their effective tax burdens; the effect of war-time "Additional Duties" on beer and ale, that might have driven some brewers out of business; an increase of brewing in private homes; the quartering of soldiers; the general decline in trade due to the ongoing war; and, finally, the high price of malt and hops. Deducting the estimated impact of all of these different forces, and making a series of other technical corrections, Davenant concluded that problems of management had still cost the public over £1.1 million.

	1690	1691	1692	1693	1694	1695	1696	Totals
The Alteration of Measure	20,000	21,000	21,000	20,000	19,000	18,000	17,000	136,000
The Tenth Allowance	10,000	11,000	12,000	11,000	10,000	9,000	8,000	71,000
The Additional Duties	8,000	9,000	30,000	27,000	26,000	26,000	26,000	152,000
The Drink Brew'd of extraordinary Strength	1,000	2,000	3,000	4,000	5,000	6,000	7,000	28,000
The private Brewing	3,000	5,000	7,000	9,000	11,000	13,000	16,000	64,000
The Quartering of Soldiers	3,000	3,000	4,000	5,000	6,000	7,000	8,000	36,000
The Decrease of Trade, Wealth, and People	3,000	5,000	8,000	11,000	14,000	17,000	20,000	78,000
The High Price of Malt and Hops	-	-	5,000	15,000	7,000	5,000	5,000	37,000
Total of the Allowances	**48,000**	**56,000**	**90,000**	**102,000**	**98,000**	**101,000**	**107,000**	**602,000**
The Revenue actually receiv'd, in round Numbers	634,000	555,000	515,000	488,000	475,000	473,000	512,000	3,652,000
The Allowances and the Revenue together	682,000	611,000	605,000	590,000	573,000	574,000	619,000	4,254,000
Revenue answer'd, *Anno* 1689	694,000	694,000	694,000	694,000	694,000	694,000	694,000	4,858,000
Revenue and Allowances together, since 1689	682,000	611,000	605,000	590,000	573,000	574,000	619,000	4,254,000
There appears to be lost... above all reasonable Allowances	**12,000**	**83,000**	**89,000**	**104,000**	**121,000**	**120,000**	**75,000**	**604,000**
From 1691…. to 1696… the Duties upon Strong Drink were doubled within 3 pence, and 3 pence more than doubled on Small Beer: So the Loss would come double to the King, thus		166,000	178,000	208,000	242,000	240,000	150,000	1,184,000
But deduct out of each Years Loss, One 25th part for the 3 pence it wants of being doubled in the Strong, which is sufficient, there being an overplus of 3 pence in the Small		6,640	7,120	8,320	9,680	9,600	6,000	47,360
And the Neat Loss seems to be		**159,360**	**170,880**	**199,680**	**232,320**	**230,400**	**144,000**	**1,136,640**

Figure 1b. Table, showing "A SCHEME, shewing in what Proportion the Eight fore-mentioned Heads may every Year have affected the Revenue of Excise," adapted from Davenant, *Discourses on the Publick Revenues* (1698), Vol. 1, after p. 102.

Davenant's computational strategy was fundamentally built to overcome informational obstacles, developing incisive political arguments from inadequate data. Like the imperfect early

efforts of the Commission of Public Accounts, Davenant's computations enacted a political ideal, modeling what the accounts of a well-informed and ethically upright government ought to look like. At the same time, Davenant's creative calculations constituted a substantial innovation in political-economic methodology, as his explorations in estimation and extrapolation, his use of proxy variables, and his efforts to control for multiple different economic variables deserve mention in a deep history of "econometric" thinking.[142] Indeed, Davenant has been credited with authoring (or co-authoring) one of the first truly quantitative laws in political-economy, his "Law of Demand."[143] In a 1699 treatise, he included a brief but evocative table (see **Figure 1c**) that provided a relationship showing how a "defect" in the harvest of grain in any given year would raise the price of corn in a given proportion. As in all of his calculations, the numerical picture he painted had a distinctive political message. Bad harvests were extremely costly to the nation, and became increasingly more punitive as the harvest got worse. To mitigate such dangers, Davenant argued for building "publick Store-houses" which would save grain in times of plentiful harvest for sale in times of want.[144]

[142] Joseph A. Schumpeter explicitly describes the practitioners of "political arithmetick" from Petty to Davenant to French successors like Quesnay as "econometricians." (See Schumpeter, *History of Economic Analysis*, ed. Elizabeth Booty Schumpeter (New York: Oxford University Press, 1961), p. 209. For another suggestive discussion of the "econometric" nature of the political arithmetic of the era, see Richard Stone, "Some Seventeenth Century Econometrics: Consumer's Behavior," *Revue Européenne des Sciences Sociales* 26, no. 81 (1988): 19-41. In modern economics, "econometrics" refers to the unify economic models with empirical data, particularly through the tools of statistical inference. On the nineteenth- and twentieth-century emergence of econometric thinking, which was first conceived as a "creative synthesis of theory and evidence," see: Mary S. Morgan, *The History of Econometric Ideas* (Cambridge, UK and New York: Cambridge University Press, 1990), quotation on p. 1.

[143] Charles Davenant, *An Essay upon the Probable Methods of Making a People Gainers in the Ballance of Trade...* (London: Printed for J. Knapton, 1699), p. 83. On Davenant's authorship of the law, see G. Heberton Evans, Jr., "The Law of Demand–The Roles of Gregory King and Charles Davenant," *The Quarterly Journal of Economics* 81, no. 3 (Aug., 1967): 483-92.

[144] Davenant, *Essay upon the Probable Methods* (1699), pp. 84-5.

We take it, That a Defect in the Harvest may raise the Price of Corn in the following Proportions.

Defect		*above the Common Rate*
1 Tenth	**Raises the Price**	3 Tenths
2 Tenths		8 Tenths
3 Tenths		6 Tenths
4 Tenths		16 Tenths
5 Tenths		45 Tenths

Figure 1c. The table containing the Davenant-King "Law of Demand," relating grain harvests to the price of corn. Adapted from Davenant, *Essay upon the Probable Methods* (1699), p. 83.

Economists, dating to William Whewell and W. S. Jevons in the mid-nineteenth century, have speculated about whether or not the mathematical table Davenant presented was in fact the result of an explicate formulaic law and about what types of mathematical methods might have been used in discerning the relationships.[145] (These historical investigations, indeed, may have played a critical role in developing new ideas about the relationships between economic data and economic theory in the age of classical political economy.)[146] Yet Davenant's actual working methods may have been somewhat more prosaic, if no less innovative, than the mathematical methods (inverse quadratics, cubic functions, the "method of differences") accorded to him by later economists. Davenant's "law" was distilled from agricultural data gathered by fellow political arithmetician Gregory King, but, as G. Heberton Evans has shown, the ultimate formulation of the law derived from Davenant's own critical engagement with King's data, which was recognizably incomplete and questionable in places. On the basis of a careful comparison of Davanent's work and King's own working manuscripts, Evans shows that "Davenant knew of th[e] uncertainty" in King's data "and revised

[145] For a review of the historical interpretations of the Demand Law, and a provocative (though admittedly speculative) argument that the Law was derived through the sophisticated mathematics of the "method of differences" developed by Newton and James Gregory, see: John Creedy, "On the King-Davenant 'Law' of Demand," *Scottish Journal of Political Economy* 33, no. 3 (Aug., 1986): 193-212. See also Morgan, *History of Econometric Ideas*, p. 136.

[146] On the use of numerical data and problems of induction in nineteenth-century political economy, see: Harro Maas, *William Stanley Jevons and the Making of Modern Economics* (Cambridge, UK et al.: Cambridge University Press, 2005), esp. ch. 3.

the data according to some ideas of his own."[147] To the questions of agricultural production and grain prices, Davenant brought the same skills for assessing data, building credible estimates, and discerning numerical patterns that he developed in his critical analyses of tax proceeds. For Davenant, the impetus to describe political-economic relationships through generalizable quantitative relationships—to build prototypes of economic *laws*—emerged out of his experience of trying to make politically salient numerical arguments that transcended the inadequacies of the data he had available to him.

Yet calculating with incomplete information could be a dangerous political, and epistemological, game to play. Davenant quickly found himself criticized for failing to meet a sufficient standard of accountability in his own calculations. A telling example came in 1696, when he drafted two pamphlets (one published) on the East India trade.[148] These writings were prompted by pending legislation to ban the importation of silk and calico textiles from India, measures strongly supported by the dominant Whigs and staunchly opposed by the East India Company (and Davenant).[149] Davenant ambitiously estimated that the East India trade brought an average net profit of £600,000 per year to England, though that wealth appeared to require a net exportation of precious metals.[150] His argument hinged upon hypothetical calculations demonstrating the profitability of re-exporting East Indian goods.[151] Davenant proceeded as follows: "By the best account I have… *England* before the War for some time, one year with another, Exported for this [Indian] traffick, either in Bullion, or our Manufactures, about *per annum* 400,000 *l.* Suppose we

[147] Evans, "The Law of Demand," p. 490.
[148] Charles Davenant, "A Memorial Concerning the East India Trade," 1696, BL Harley MS 1,223, ff. 158^{r}-168^{r}; Davenant, *Essay on the East India Trade* (London: *s.n.*, 1696).
[149] On this conflict, see: W. Darrell Stump, "An Economic Consequence of 1688," *Albion* 6, no. 1 (Spring, 1974): 26-35; Henry Horwitz, "The East India Trade, the Politicians, and the Constitution: 1689-1702," *The Journal of British Studies* 17, no. 2 (Spring, 1978): 1-15; Gary Stuart De Krey, *A Fractured Society: The Politics of London in the First Age of Party 1688-1715* (Oxford: Clarendon Press, 1985), ch. 4; Philip J. Stern, "'A Politie of Civill and Military Power': Political Thought and the Late Seventeenth-Century Foundations of the East-India Company State," *The Journal of British Studies* 47, no. 2 (Apr., 2008): 253-283; Pincus, *1688*, 372-381.
[150] Davenant, *Essay on the East India Trade* (1696), pp. 8, 17.
[151] Davenant, *Essay on the East India Trade* (1696), pp. 30-31.

consume at home the Returns of 200,000 *l.*"[152] This £200,000 in Indian goods *not* consumed at home, Davenant argued, could be re-exported for a 4x return of 800,000, yielding a total value of £1,000,000 per year that flowed into England because of Indian imports. Deducting the original £400,000 in "prime cost," this meant a £600,000 profit per year on average.

Davenant admittedly proceeded by means of vague and loosely justified assumptions. Yet his calculation still made a powerful point by revealing the opaque mechanics of global commerce by way of "Political Arithmetick." Davenant stood by his method. In one far-reaching calculation, Davenant attempted to show the tremendous value England might yield if the Dutch secured a monopoly on the East Indies trade. Noting that the Dutch could manage an approximate profit of around £2.5 million purely on the pepper trade, Davenant reasoned the entire monopoly might be worth £6 million to England's pesky mercantile neighbor. Davenant concluded: "If I am not much deceiv'd in Political Arithmetick, It would bring Yearly a much greater Mass of Treasure to the United Provinces, than is brought into Europe from the Mines of Peru and Mexico."[153]

But such venturesome computations proved an obvious target of criticism for courtly Whig opponents. One critic dismissive of Davenant's adventurous calculations stated curtly that "this Book is filled up with Flourish, and Rhetorick, and Conclusions, from false Hypothesis, that it is not easie at once Reading to grasp it."[154] A more serious criticism came from John Pollexfen, of the freshly-appointed Board of Trade.[155] Pollexfen accused Davenant of relying on mercantile hearsay rather than solid data: "Instead of offering Vouchers to prove this Accompt, it is said, That it must

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[152] Davenant, *Essay on the East India Trade* (1696) pp. 15-16. The italic "*l*" was generally used as the symbol for "pound" (£).
[153] Davenant, *Essay on the East India Trade* (1696), p. 50.
[154] T.[homas] S.[mith], *Reasons Humbly Offered for the Passing a Bill for the Hindering the Home Consumption of East-India Silks, Bengals &c.* (London: Printed for J. Bradford, 1697), p. 10.
[155] Istvan Hont, "Free Trade and the Economic Limits to National Politics: Neo-Machiavellian Political Economy Reconsidered," in *The Economic Limits to Modern Politics*, ed. John Dunn (Cambridge,UK and New York: Cambridge University Press, 1990), 41-120, esp. 95-6.

be clear Gains… because no one versed in Merchandize will deny it."[156] Pollexfen's was the language of accounting; "vouchers" specifically connoted the written records that were necessary to verify accounts. Pollexfen contended that calculations were only as good as the records on which they were based. The fact that Davenant could not account for his own claims suggested that his numbers were corrupted by special interest. Davenant's calculations, like Harley's, were of course driven by political interests, perhaps hypocritical ones.[157] Yet, no one in the computational battles of the 1690s was unassailably correct or always ethical. Pollexfen's criticisms, after all, were insincere in their own way. Given the basically non-existent administrative machinery for gathering trade statistics at that time, there was no way Davenant could have offered vouchers for such an ambitious calculation, a fact which Pollexfen, as a member of the new Board of Trade, would have been well aware of.[158] Whether it was in an abstract work of political arithmetic like Davenant's calculation of East-India trade, or the seemingly more focused auditing work of Public Accounts Commissions, such matters of political calculation were never so ideal.

VI. The Art of Decyphring: Political Arithmetic and Probable Knowledge

By the time he published his two-volume *Discourses on the Publick Revenues, and on the Trade of England* in 1698, Davenant was clear that a level of uncertainty was intrinsic to political deliberation about economic policy, and that many, including those holding power, might try to use that uncertainty to their advantage. "The Councils of a Country are always inquisitive after Truth," he contended, "but to hide it from 'em, and to perplex Things which have Relation to Trade, is the Interest of so many."[159] Holding critical calculations to very high standards of certainty, like Pollexfen did, was a

[156] [John Pollexfen], *England and East-India Inconsistent in their Manufactures* (London, 1697), p. 5.
[157] For one view of the motivations behind Davenant's East India computations, see: D. Waddell, "Charles Davenant and the East India Company," *Economica* 23, no. 91 (Aug., 1956): 261-264.
[158] Clark, *Guide to English Commercial Statistics*, esp. pp. 1-12.
[159] Davenant, *Discourses on the Publick Revenues* (1698), Vol. 1, p. 30.

potent way for such interests to tilt the rules in their own favor.[160] Practitioners of political arithmetic therefore faced a fundamental problem, which was at once political and epistemological. On the one hand, political calculations about revenues and trade were an indispensable way to make cogent and compelling arguments about pressing public questions, especially for relative outsiders. Political arithmetic was vital not only in domestic politics, to figure out what was going on behind the veil of ministerial power. It was also essential for national security, as a way to assess the strength of foreign enemies and allies and for gaining "Intelligence of the Posture of Affairs in those Countries."[161] On the other hand, Davenant's experience fighting with Pollexfen about the East India trade—and the parallel trials of public accountants wrestling with insiders like Robert Howard over fiscal numbers—showed that rough estimations or speculative models, however illuminating of broader processes, simply would not pass muster. Davenant thus needed to salvage political arithmetic as an investigative and political tool designed to make sense of uncertain situations, given that the conclusions it produced could almost never be demonstratively certain.

The solution lay in *probability*, in showing that the conclusions of political arithmetic could justify very high levels of belief even if their informational foundations were shaky. Calculations did not have to be flawless and perfectly vouched for to be meaningful. One pamphlet rebuttal to Pollexfen's criticisms of the *Essay on the East-India Trade*, possibly by Davenant, expressed the essence of this position. Shooting back at Pollexfen's unrealistic demands on the calculations in Davenant's *Essay*, the author wrote in 1696: "I think it does not concern the Truth of the Proposition, That the East-India Trade is Beneficial to the Nation, (though as to the *quantum* it may) whether the Computation in the Essay be exact or no." As for the *Essay*'s specific claims about the monetary benefits of the East India trade, "the certainty of the Sum does not so much concern the

[160] On informational access and political arithmetic, see Warner, "Faith in Numbers," 79.
[161] Davenant, *Discourses on the Publick Revenues* (1698), pp. 9-10. Davenant hinted that a better "computing faculty" might in fact help statesmen to save "a great Expence in Embassies, or Spies in Foreign Courts."

Point in question, as the Proportion."[162] Davenant soon offered a more systematic meditation on the question of whether political computations needed to be certain to be useful, in the form of his essay "Of the Use of Political Arithmetick, in all Considerations about the Revenues and Trade," the first chapter of his 1698 *Discourses*. "In the Art of Decyphring," Davenant wrote, "'tis said where three or four Words, perhaps Letters, can be found out, the whole Cypher may be discover'd. In a great measure, the same holds, in the Computations we are treating of: And *very probable Conjectures* may be form'd, where any certain Footing can be found, to fix our Reasonings upon."[163] Fellow political arithmetician Gregory King, who provided key data for Davenant's exercises and who would become early modern England's best-known demographer, put the matter more bluntly in 1696:[164] "To be well apprized of the true State and Condition of a Nation, Especially in the Two main Articles of it's People and Wealth, be a Piece of Politicall Knowledge… the most usefull, and Necessary… But since the attaining thereof (how necessary & disireable soever) is next to impossible, We must content our selves with such near approaches to it as the Grounds We have to go upon will enable us to make."[165]

Davenant was not the first to argue that useful knowledge should not be cast aside for failing to live up to the strictest standards of certainty. A turn toward *probable* knowledge rather than *certain* demonstration was a prominent feature of intellectual activity in seventeenth-century England across many spheres, from law to natural science to political economy, as Shapiro and Wennerlind have shown.[166] Petty's political arithmetic, in particular, had indeed been grounded in the belief that numerical knowledge did not have to be perfect to be valuable. As McCormick observes, the

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[162] [Anon.; Davenant?], *Some Reflections on a Pamphlet, Intituled*, England and East-India Inconsistent in Their Manufactures (London: *s.n.*, 1696), pp. 7-8.
[163] [Anon.; Davenant?], *Some Reflections on a Pamphlet* (1696), 14. *Emphasis* mine.
[164] On King and his motivations, see: G. S. Holmes, "Gregory King and the Social Structure of Pre-Industrial England," *Transactions of the Royal Historical Society*, Fifth Series, 27 (1977): 41-68; Colin Brooks, "Projecting, Political Arithmetic and the Act of 1695," *English Historical Review* 97, no. 382, (Jan., 1982): 31-53.
[165] Gregory King, "Natural and Political Observations and Conclusions upon the State and Condition of England," in King, *Two Tracts*, ed. George E. Barnett (Baltimore, 1936 [1696]), 13.
[166] Shapiro, *Probability and Certainty*; Wennerlind, *Casualties of Credit*, ch. 3.

defense of "rough, relative proportions," rather than accurate numbers or demonstrative proofs, was a hallmark of Petty's project.[167] In the 1690s, though, the imprecise calculations Petty celebrated simply were not going to stand up under the assault of skilled opponents like Pollexfen, at least not without a more vigorous defense. Justifying the validity of political arithmetic as a tool for making political knowledge therefore became a far greater preoccupation for Davenant than it had been for Petty.

Davenant began to ponder a difficult question: To what degree could the claims of political arithmetic be justified by the numbers themselves? When was it possible to say that a collection of irregular numerical evidence compelled people to believe a set of conclusions derived therefrom? In one instance, for example, he ventured an (admittedly rudimentary) standard for what qualified as a sufficiently good projection of the produce of a future tax: "That Art is therefore to be prais'd, the Rules of which, if rightly follow'd, will show within a Seventh or an Eighth, what any Branch of Revenue shall produce."[168] In a very preliminary way, Davenant was beginning to contemplate the question of statistical confidence. While Davenant certainly did not get very far on the question as a mathematical problem, he would continue to reflect on the underlying epistemological problem throughout his career. It is no coincidence, for example, that his 1699 treatise on commercial policy was entitled *An Essay upon the Probable Methods of Making a People Gainers in the Ballance of Trade*. More pointedly, in a 1705 manuscript pamphlet on the "Free Trade now tolerated between France and Holland," he framed his particular analytical conclusion—that the French had a profitable balance in their trade with Holland—in terms of whether other observers were likely to come to the same conclusions as he did based on available evidence. "And 'tis not improbable," Davenant wrote, "that others will have the same thoughts, when they come to examine & consider what sort of

[167] McCormick, *William Petty*, p. 206; also pp. 177-8, 302.
[168] Davenant, *Discourses on the Publick Revenues* (1698), Vol. 1, p. 27.

Commodities they [the Dutch] carry to and what they bring from France, and upon how an unequal foot the Traffick stands between them."[169]

In analyzing the Franco-Dutch trade balance, Davenant was not only interested in the question of whether it was probable that the French profited in trading with the Dutch, but in the further question of whether it was probable that other people would believe this to be the case on the basis of available evidence. Davenant's somewhat awkward and ambiguous invocation of the category of the "im/probable" was telling.[170] Davenant was not a theorist or mathematician of probability in any formal sense, like his English contemporary John Arbuthnot. But he was implicitly pulling together two different concerns that were both essential to modern probability theory. On the one hand, he was interested in how to interpret numerical data and how to estimate likely outcomes—tax receipts, trade balances—on the basis of it. On the other hand, he was concerned, for practical reasons, about the question of what a given set of data compelled people to believe, about whether "others will have the same thoughts" when presented with the same numbers. In bringing these two concerns together, and pondering the question of what levels of belief were warranted by available numerical evidence, Davenant was stumbling upon a problem that was simultaneously puzzling Europe's most luminous philosophers and mathematicians.

In his *Emergence of Probability*, the philosopher Ian Hacking explains that the modern concept of probability is "Janus-faced." As he puts it: "Probability has two aspects. It is connected with the degree of belief warranted by evidence, and it is connected with the tendency, displayed by some chance devices, to produce stable relative frequencies."[171] He also contends that this characteristic duality stemmed from the historical development of the concept of probability in the period roughly

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[169] Charles Davenant, "A Memoriall Concerning the Free Trade Now Tolerated between France & Holland," unpublished MS, 1705, BL Harley MS 6,798, ff. 44-53, on f. 46^{v}. *Emphasis* mine.
[170] For another contemporary example of the ambiguous usages of the "probable" in discussions of trade and finance, see: *A Probable Calculation of the Annual Income to be Raised by a Tax on Marriages, Burials, and Legacies* (printed, [1690s?]), in Gregory King Papers, NA 64/302, no foliation.
[171] Hacking, *Emergence of Probability*, p. 1.

from 1650 to 1700. In that period, vibrant but intense interest developed around each of the two facets of modern "probability," which he calls respectively "epistemological" and "aleatory." Thinkers like Antoine Arnauld, John Wilkins, and G. W. Leibniz struggled with the questions of epistemological probability as they attempted to develop systems of logic, to assess evidence of providential design, and to measure degrees of proof in questions of law. The concerns of aleatory probability, by comparison, arose in discussions about strategy in games of chance, about how to price government annuities, and about the frequency of births and deaths as measured by political arithmetic. Hacking contends that the modern version of "probability" came into being when these two different sets of questions, the epistemological and the aleatory, came to be understood as two different versions of fundamentally the same question. Hacking identifies several thinkers around 1700 who found themselves wrestling with the two faces of probability at the same time, notably Arbuthnot's 1710 investigations into demographic ratios as evidence of providential design and Jacques Bernoulli's efforts at developing an "art of conjecturing."

Another example, I argue, was Charles Davenant's "art of decyphring." He too became concerned with the problem of how (aleatory) "probability"—referring to the likely outcome of uncertain events, like the collection of a new tax—related to (epistemological) "probability"—referring the degree of confidence or belief merited by available evidence. Hacking notes that the earlier political arithmetic of Petty and John Graunt had contributed in important ways to the study of aleatory probability, as those thinkers attempted to assess the regularity of certain chance processes, like life expectancies, on the basis of collected numerical figures. But Davenant's predecessors, especially Petty, did not seem to have been very interested in the problems of "epistemological" probability.[172] After all, Petty's calculations were targeted at a smaller coterie of

[172] Petty was interested in using numbers to discern underlying laws governing the social world, and was far less concerned about the value of numerical evidence *qua* evidence. In this sense, he was not engaged in the questions of inference central to the modern discipline of statistics. Indeed, McCormick notes that Petty did not intend political

monarchial agents and courtiers, and did not face the relentless partisan scrutiny Davenant did. In Davenant's political arithmetic the questions of epistemological probability became a primary concern; for political reasons, they had to be. Davenant, like Harley and the Accounts Commissioners, wanted to use political arithmetic as an investigative tool to diagnose internal political ills on the basis of available external evidence.[173] Making such claims hold up required assessing the quality of that evidence, and the ability of resulting calculations to convince a broader, and more unforgiving, public. In the post-1688 world, Davenant—and England—could not afford to let such epistemological questions go unnoticed.

We therefore begin and end with stories of people fighting over information they could not get. We began with angry MPs and then the Commissioners of Public Accounts wrestling with the uncertainty surrounding Jephson's Secret Service payments. It proved to be an incredibly frustrating battle, as the Commissioners' efforts were thwarted by a maddening combination of deliberate misdirection and systemic disorder. Yet, that challenge galvanized new ideas about political accountability, encouraged new thoughts on the place of information in governance, and prompted critics to forge new tools of numerical critique. Arguments over accounting data brought English politicians increasingly into effective, if not intended, conversations about abstract questions of method, theory, and even epistemology—like about how the uncertainties of global commerce might affect fiscal planning, or about how reliable the past was as a basis for calculating the future.

In the same way, Davenant attempted to make computational criticisms about taxation and trade policy based on the incomplete public information he had. The uncertainty he faced was also

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arithmetic to be a rigorous "statistical form of social analysis." Statistician Anders Hald writes more bluntly that "Petty did not contribute new methods of statistical analysis." See: McCormick, *William Petty*, pp. 206, 220-1; Hald, *A History of Probability and Statistics and Their Applications before 1750* (New York, 1990), p. 105.

[173] In this way, Davenant was like other seventeenth-century practitioners of the "low sciences" (alchemists, astrologers, physicians) who, Hacking argues, developed new concepts of "evidence" as they tried to diagnose internal processes on the basis of external "signs." See: Hacking, *Emergence of Probability*, chs. 4-5.

in part a result of his own political and professional status, and in part a result of the state of fiscal administration and information management on the eve of the eighteenth century. Davenant had to believe that it was possible to make meaningful computational arguments from imperfect data because imperfect data was all he could get. The frustrations he felt in dealing with inadequate data and incredulous opponents brought him to consider the same kinds of questions about probability that challenged some of Europe's foremost philosophers and mathematicians. Davenant helped make Petty's science of "political arithmetic" more probabilistic and indeed more statistical, in the sense that he made it more concerned with evaluating evidence and assessing whether that evidence merited belief in certain conclusions. Davenant had to be worried about such questions because of everything that those within the state would not, or could not, tell him. To put it another way, it was the state's own inadequacies, real and perceived, that drove forward *stat*istical thinking.

– CHAPTER 2 –

THE GREAT PROJECT OF THE EQUIVALENT

The Anglo-Scottish Union and the Ambivalent Authority of Mathematics in 1706

In the wake of revolutionary upheavals of 1688-9, England's political representatives and commentators had found out how difficult it was to assign distinct numbers to presumably straightforward fiscal questions. What was the English government's revenue in a year? What were the annual financial needs of key government agencies? Where did the public's money get spent? Amidst the nation's next great constitutional transformation, the 1706-1707 Union of England and Wales with Scotland, the dream of making numerical sense out of political-economic disorder was again at the heart of the story. At that moment, a collection of ambitious politicians, financiers, and the odd mathematician came to believe that it ought to be possible to calculate a single, conclusive number in answer to one of the most demanding political-economic problems at that point ever contemplated in the British Isles, and perhaps beyond. Those calculators undertook a project in political arithmetic that made the weary efforts of the Accounts Commissioners appear almost painless, at least technically, and the clever fiscal analyses of Davenant seem almost unrefined. The question at hand was how much it would cost Scotland to enter into a full-scale political Union with England, who exacted far heavier taxes on its subjects in order to service its mounting National Debt. It was, in a way, a matter of putting a price on Scottish nationhood.[1]

[1] The calculation of the Equivalent was not precisely an attempt to place a value on the entire wealth of the nation of Scotland, in the sense that political arithmeticians like William Petty had explored in the previous century. As will be seen, it was both narrower and more technically demanding. It was narrower, in the sense that the Equivalent calculators were only concerned with Scottish tax revenues, not national wealth generally. It was more demanding, though, in the sense that the Equivalent calculation required the teasing-apart of very intricate fiscal accounts and the application of more complicated mathematical procedures than those employed by Petty and others. Nonetheless, the Equivalent was an important chapter in broader histories of national income accounting and macroeconomic analysis. For an example of such earlier "Computations of the Wealth of [a] Kingdom," see William Petty, "Verbum Sapienti; or An Account of the Wealth and Expences of England, and the Method of Raising Taxes in the Most Equal Manner," [1665], published in Petty, *The Political Anatomy of Ireland* (London: Printed for D. Brown and W. Rogers, 1691); Paul Slack, "Measuring the National Wealth in Seventeenth-Century England," *Economic History Review,* New Series 57, no. 4 (Nov., 2004): 607-635.

Unlike the frustrated English Commissioners of Public Accounts, the committee assigned to calculate the value of the so-called "Equivalent" that England was to pay Scotland at the Union did come to a very precise and conclusive number. And that number—£398,085.10*s*.—stuck, at least insofar as it became embedded within the Union Treaty itself, eventually ratified by both English and Scottish Parliaments. But this did not mean that everyone agreed with the figure, or what it stood for. Telling the story of that number helps to uncover a forgotten, epistemological dimension in the fraught history of the formation of the United Kingdom. It also provides acute insight into the contested nature of economic expertise and economic rationality in Britain's age of political, financial, and scientific revolution.

Contemporary observers were attuned to the oddity and importance of that £398,085.10*s*. figure. In late 1706, with the Union Treaty under fierce debate in the Edinburgh Parliament, Scottish Treaty Commissioner Sir John Clerk of Penicuik reported that, that "amongst all the *Articles of Union,* there has been none more talked of, and less understood, than the… *Rise, Nature, and Management of the Equivalents*."[2] In his 1714 memoirs of the Union, George Lockhart of Carnwath explained what he felt was the most important single factor in tipping Scotland's MPs toward Union with England:

> The Equivalent was the mighty Bate; here was the Sum of 398085 Pound Sterling to be remitted in Cash to *Scotland* (tho' the Scots were to pay it and much more back again in a few Years, by engaging to bear a Share of the Burdens… appropriated for Payment of *England's* Debts.) This was a Fund say they sufficient to put *Scotland* in a Capacity for prosecuting Trade, erecting Manufactories and improving the Country: But in Reality here was a swinging Bribe.[3]

For a different national (and indeed imperial) context, see: Alexander Bick, "Governing the Free Sea: The Dutch West India Company and Commercial Politics, 1618-1645" (Ph.D. Diss., Princeton University, 2012), ch. 6.

[2] [John Clerk], *An Essay upon the XV. Article of the Treaty of Union, Wherein the Difficulties That Arise upon the Equivalents, Are Fully Cleared and Explained* ([Edinburgh?]: *s.n.*, 1706), p. 3.

[3] George Lockhart, *Memoirs Concerning the Affairs of Scotland, from Queen Anne's Accession to the Throne, to the Commencement of the Union of the Two Kingdoms of Scotland and England, in May, 1707*… (London: Printed: and Sold by J. Baker, 1714), pp. 212-3.

For Lockhart, the so-called "Equivalent" was the centerpiece in a massively corrupt bargain between the English and roguish Scottish politicians.[4] Yet even the fiercely anti-Unionist Lockhart pointed out that the Equivalent tied together pressing political-economic problems, English and Scottish. These included the desire for a unified tax system, the complications of England's Debt, and the need for investment in Scottish trade and manufacturing. Especially sensitive, Lockhart subsequently noted, were Scottish "Hopes of recovering what they had expended on the *African* Company." Scots longed for restitution for the losses of money and pride suffered in the calamitous "Darien Scheme," a failed 1690s project to build a Scottish trading colony in the American isthmus, which many Scots believed had failed due to inadequate support from King William III.[5]

If the Equivalent was in fact a bribe, Lockhart at least admitted it was a very complicated one. While many modern historians have adopted Lockhart's cynicism about the motivations behind Union, few have adopted his detailed attention to the intricacies of the Equivalent. Most historians have looked upon it purely as a gross monetary payment, building off of Lockhart's conclusions about its effects and largely dismissing the complex story of its intents. Interpretations of the payment have followed broader historiographical contours.[6] In William Ferguson's highly influential revisionist account of the Union as a "political job," the Equivalent was accorded only "secondary

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[4] Robert Burns famously lamented in 1791 how the Scots had been "bought and sold for English gold." As he put it: "The English steel we could disdain, / Secure in valour's station; / But English gold has been our bane— / Such a parcel of rogues in a nation." (Robert Burns, "Such a Parcel of Rogues in a Nation," [1791] in *The Poetical Works of Robert Burns* (Edinburgh/London: William and Robert Chambers/W. S. Orr and Company, 1838), p. 111).

[5] In 1695, the Scottish Parliament chartered a new Company of Scotland Trading to Africa and the Indies, which raised the relatively massive sum of £400,000 from Scottish investors with the promise of building a trading entrepôt between the Atlantic and Pacific Oceans. The idea was largely the product of Bank of England founder William Paterson. By 1700, two attempted expeditions to the isthmus had failed miserably, due to famine and disease among the settlers and military siege by neighboring Spanish imperial forces. Many Scots felt that responsibility for the failure lay with William, who refused to offer logistical or military support for the venture. On Darien, see: David Armitage, "The Scottish Vision of Empire: Intellectual Origins of the Darien Venture," in *A Union for Empire: Political Thought and the British Union of 1707*, ed. John Robertson (Cambridge, UK et al.: Cambridge University Press, with the Folger Institute, 1995), pp. 97-118; Douglas Watt, *The Price of Scotland: Darien, Union and the Wealth of Nations* (Edinburgh: Luath Press, 2007); J. R. Young, "The Scottish Parliament and the Politics of Empire: Parliament and the Darien Project, 1695–1707," *Parliaments, Estates and Representation* 27, no. 1 (Nov., 2007): 175-190.

[6] For an excellent overview of the often politically-charged historiography of the Union, see Bob Harris, "The Anglo-Scottish Treaty of Union, 1707 in 2007: Defending the Revolution, Defeating the Jacobites," *The Journal of British Studies*, 49, no. 1 (Jan., 2010): 28-46.

importance," a technical detail that only mattered as a way for pro-Union Scottish politicians "to secure prestige at home."[7] The more cynical, Namierite analysis of P. W. J. Riley contends that the Equivalent was "a confidence trick" which took money from Scottish taxpayers and repaid it to self-serving politicians.[8] By contrast, Christopher Whatley, who strongly contests the notion that pro-Union Scots were a "parcel of rogues," holds that there was no correlation between those Scottish politicians who benefited from Equivalent payments and those who supported the Union.[9] In his recent account of the Union as a diplomatic contest between aspiring imperial powers, Alan Macinnes argues the Scots were not so much bribed as low-balled; the Equivalent was just one of many pieces of "testimony to inept Scottish negotiation."[10]

Neither Whatley nor Macinnes gives much consideration to the technicalities of the Equivalent. Both, though, have been leaders in placing political economy at the center of Union historiography, a trend which points toward the need for greater attention to the Equivalent. Economistic historians like T. C. Smout have long contended that economic factors—the detrimental effect of English mercantilist policies on Scottish trade, devastating famine in 1695-1699, the Darien debacle—motivated or even forced Union.[11] Recently, historians have reconsidered such determinist arguments, asking instead how Scottish and English people understood their own economic circumstances in 1706. Whatley, on the one hand, contends that Scottish leaders honestly

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[7] William Ferguson, "The Making of the Treaty of Union of 1707," *The Scottish Historical Review* 43, no. 136 (Oct., 1964): 89-110, quotations on pp. 104, 110.

[8] P. W. J. Riley, *The Union of England and Scotland: A Study in Anglo-Scottish Politics of the Eighteenth Century* (Manchester: Manchester University Press, 1978), pp. 239-40. Riley suggests that it was by and large obvious to contemporaries what was going on, so much so that Union supporters in Scotland tried to distract from the business of the Equivalent or muddy the conversation with "highly generalized and dubious assertions incapable of proof."

[9] The most immediate beneficiaries of Equivalent payments would have been major Company of Scotland shareholders. See: Christopher A. Whatley, "The Making of the Union of 1707: History with a History," in *Scotland and the Union 1707-2007*, ed. T. M. Devine (Edinburgh: Edinburgh University Press, 2008), pp. 23-38, esp. pp. 34-5.

[10] Alan I. Macinnes, *Union and Empire: The Making of the United Kingdom in 1707* (Cambridge: Cambridge University Press, 2007), p. 320, also pp. 94-5; Macinnes, "The Treaty of Union: Made in England," in *Scotland and the Union 1707-2007*, ed. Devine, pp. 54-70, esp. pp. 67-8.

[11] T. C. Smout, "The Anglo-Scottish Union of 1707: I. The Economic Background," *Economic History Review*, New Series 16, no. 3 (1964): 455-67

believed Scotland faced an economic crisis so dire that Union was the only responsible solution; Macinnes, on the other, holds that it was in fact the "burgeoning entrepreneurship" among "Scottish commercial networks" across the globe that made Scotland such an attractive target to English imperial visionaries.[12] These competing perspectives have built on the work of intellectual historians like David Armitage, who argues that debates over Anglo-Scottish Union, like those over the Darien Scheme, contributed to an enduring "economic redefinition of empire" in British thought.[13]

Though traditionally overlooked in Union historiography, the Equivalent has been brought to the fore by two recent works. In his 2007 *The Price of Scotland*, Douglas Watt states that "historians have underplayed the significance of the Equivalent."[14] Yet his own conclusions about the £398,085.10*s.* are muddled. On the one hand, he emphasizes that the Equivalent was pivotal to the political-economic deliberations that shaped the move toward Union, calling it "a complex financial mechanism that dealt with a number of important issues at the heart of the Union treaty."[15] Yet his main conclusion follows a more cynical line: the Equivalent was simply a "lump sum dressed in political clothing."[16] Watt notes that "financial mathematics were utilized to assure politicians and the 'public' that the sum was equitable," but suggests such calculations were purely for optical effect.[17] By contrast, accounting scholar Crawford Spence places computation at the center of the

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[12] C. A. Whatley, "Economic Causes and Consequences of the Union of 1707: A Survey," *The Scottish Historical Review* 68, no. 186, Part 2 (Oct., 1989): 150-181; Whatley, "Salt, Coal and the Union of 1707: A Revision Article," *The Scottish Historical Review* 66, No. 181, Part 1 (Apr., 1987): 26-45; Whatley, "The Issues Facing Scotland in 1707," *Scottish Historical Review* 87, Supplement, *Union of 1707: New Dimensions*, edited by Stewart J. Brown & Christopher A. Whatley (2008): 1-30; Macinnes, *Union and Empire*, quotation on p. 11, and Part III, "The Primacy of Political Economy, 1625-1707"; Macinnes, "The Treaty of Union: Made in England."

[13] David Armitage, *The Ideological Origins of the British Empire* (Cambridge, UK et al.: Cambridge University Press, 2000), ch. 5, quotation on p. 148; Armitage, "The Scottish Vision of Empire."

[14] Watt, *Price of Scotland*, pp. 220-242, quotation on p. 238. Watt's *Price of Scotland* is primarily a history of the Company of Scotland. Watt argues that understanding the Equivalent—an effective "shareholder bail-out with cash provided by a foreign government"—is essential to understanding the critical connections between the fortunes of the Company of Scotland and the Union (p. 220).

[15] Those issues were "in particular tax, debt and the Company of Scotland." (Watt, *Price of Scotland*, p. 221.)

[16] Watt, *Price of Scotland*, pp. 222, 230.

[17] Watt, *Price of Scotland*, p. 229.

story.[18] Building upon an evocative literature in "socio-historical accounting research," Spence's excellent 2010 article identifies many key themes in the history of the Equivalent: the intersection of calculative practices and political ideology, the confusions surrounding the calculations, and the problems afflicting accounting as a political technology.[19] Yet while he presents the Equivalent as a case study in the trans-historical relationship of accounting to the "development of new political programmes," this chapter seeks to understand how the connection between calculation and political authority was constructed in historical time.[20]

The debates over Union were implicitly arguments about economic epistemology, in particular the political authority of mathematical reasoning. I argue that the Equivalent was a political statement about the value and necessity of calculation itself. It was a statement that better calculation made for a better—more powerful, more prosperous, more just—nation. Two people in particular voiced the political-epistemic motivation behind the Equivalent. The first was the Scottish financier William Paterson, one of the age's greatest financial "projectors" and the visionary behind the triumphs of the Bank of England and the disasters of the Darien Scheme. The second was Dr. David Gregory, Savilian Professor of Astronomy at Oxford, ardent Newtonian, and one of the most prominent Scottish-born mathematicians of his day. This odd couple formed the heart of the expert committee appointed to calculate the Equivalent, and both were active in justifying the calculation as the Union Treaty came under public scrutiny in late 1706. Both were great advocates for the importance of mathematical thinking in political life, though their sentiments stemmed from

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[18] Crawford Spence, "Accounting for the Dissolution of a Nation State: Scotland and the Treaty of Union," *Accounting, Organizations & Society* 35, no. 3 (Apr., 2010): 377-92.

[19] "Socio-historical accounting research," heavily influenced by Foucault and pioneered by Peter Miller, Christopher Napier, and others, has explored the role of "calculative practices" in broader processes of political, economic, and social change. For an introduction to this research, see: Peter Miller and Christopher Napier, "Genealogies of Calculation," *Accounting, Organizations, and Society* 18, nos. 7-8 (Oct.-Nov., 1993): 631-647; Peter Miller, "Governing by Numbers: Why Calculative Practices Matter," *Social Research* 68, no. 2 (Summer, 2001): 379-396; Christopher J. Napier, "Accounts of Change: 30 Years of Historical Accounting Research," *Accounting, Organizations & Society* 31, nos. 4-5 (Jul.-Aug., 2006): 445-507.

[20] Spence, "Accounting for the Dissolution of a Nation," p. 389.

different sources. Paterson believed that sound understanding of the mathematics of finance constituted a paradigmatic form of mercantile knowledge, the elite kind of knowledge that was essential to national improvement and long-term prosperity for Scotland, England, or Britain. Gregory had long anchored a network of Scottish Tory philosophers and physicians who believed that mathematics, exemplified by Newtonian theory, held the answers to myriad intellectual and social problems, from medicine to chronology to governance. Gregory brought this "Tory Newtonian" enthusiasm to the project of the Equivalent, applying algebraic tools and his knowledge of infinite series to the analysis of financial value—and to the problem of making a just Union.

The financier and the mathematician contended that there was a true political good to be had, especially for the Scots, in getting the numbers right. But this message did not necessarily translate well to the emergent Scottish "public" that contemplated the pending Union.[21] The intense debates over the Equivalent in fall and winter 1706 testified to the political indeterminacy of such public calculations. As in the tale of public accounting told in Chapter 1, the story of the Equivalent reveals both the sources of enthusiasm for calculation in British political life at the dawn of the eighteenth century, and the obstacles that faced any attempt to make a computational dream a political reality. Once the final Equivalent calculations were ratified by the Treaty Commissioners and printed—or, as it often turned out, *mis*printed—as part of Article XV of the Union Treaty, those numbers became subject to a vast array of creative readings, reconstructions, and criticisms. Pro-Union pamphleteers tried to justify the legitimacy of the Equivalent by fabricating their own logic for how the calculation was created. Anti-Union polemicists turned the calculation inside-out to show that the Equivalent was no permanent investment in Scottish prosperity, but a meager loan that would have to be quickly repaid. A variety of factors fed into this public ambivalence. Some

[21] On the development of the Scottish "public" and its role in the Union, see: Karin Bowie, "Popular Opinion, Popular Politics and the Union of 1707," *The Scottish Historical Review* 82, no. 214, Part 2 (Oct., 2003): 226-260; Bowie, *Scottish Public Opinion and the Anglo-Scottish Union, 1699-1707* (Woodbridge, UK and Rochester, NY: Royal Historical Society/Boydell Press, 2008).

were almost mundane, like typographic errors. Yet others were deeply conceptual, like whether the Equivalent was better understood as a loan or a tool for "improvement" (what might be called, in more modern terms, an investment), and what the relationship might be between the two.[22]

Perhaps the most intractable impediments facing the public acceptance of the Equivalent calculations, though, related to the political definition of economic knowledge itself. The project of the Equivalent promised to compensate the Scots immediately for a series of higher tax payments to be made over many years in the future. The deal was, admittedly, one of selling out the future for the sake of the present. This brought with it deep constitutional confusions—could present generations bind the future in this way? It also prompted difficult questions of value, in particular the problem how to assess the *present* value of money to be paid or earned in the *future*. One such valuation problem exemplified the debate at hand in 1706: Consider an annuity, which promises to pay out a set amount of money (say £100) every year for many years. What is the difference in value between an annuity that pays out £100 every year for a long but fixed period, like 99 years, and one that pays out £100 forever (a *perpetuity*)?[23] Mathematical elitists like William Paterson strenuously argued that the 99-year annuity and the perpetuity were worth effectively the same amount on the

[22] "Improvement" was a common refrain in eighteenth-century British culture, which carried various connotations including aesthetic and social refinement, moral reform, economic progress, environmental transformation, and even imperial conquest. For an introduction to aspects of this discourse, and particularly the intersections between economic, natural, and moral connotations of "improvement," see: David Hancock, *Citizens of the World: London Merchants and the Integration of the British Atlantic Community, 1735-1785* (Cambridge, UK and New York: Cambridge University Press, 1997), pp. 279-381; Richard Drayton, *Nature's Government: Science, Imperial Britain, and the 'Improvement' of the World* (New Haven and London: Yale University Press, 2000), esp. ch. 3; Simon Schaffer, "The Earth's Fertility as a Social Fact in Early Modern Britain," in *Nature and Society in Historical Context*, edited by Mikuláš Teich, Roy Porter, and Bo Gustafsson, (Cambridge, UK et al.: Cambridge University Press, 1997), pp. 124-47; Lawrence Klein, "Politeness and the Interpretation of the British Eighteenth Century," *Historical Journal* 45, no. 4 (Dec., 2002): 869-898, esp. pp. 875.

[23] The question of valuing annuities has been given some attention in historical scholarship, including in the literature on the history of probability. Much of the attention, though, has been paid to the problem of assessing so-called "life annuities," annuities that promised to pay out until the death of the holder (or of multiple holders or beneficiaries). Valuing such annuities involved projecting life expectancies, and so those particular annuities played a critical role in the history of demography and vital statistics, as well as to the history of life insurance. Less attention has been given to the narrower technical question of valuing fixed-term annuities by compound-interest mathematics. On life annuities, see: Ian Hacking, *The Emergence of Probability: A Philosophical Study of Early Ideas about Probability, Induction, and Statistical Inference*, 2nd ed (Cambridge, UK and New York: Cambridge University Press, 2006 [1975]), ch. 13; Lorraine Daston, *Classical Probability in the Enlightenment* (Princeton: Princeton University Press, 1988), pp. 50, 112-122, 138-42. On the history of life insurance in the period, see Geoffrey Wilson Clark, *Betting on Lives: The Culture of Life Insurance in England, 1695-1775* (Manchester and New York: Manchester University Press, 1999).

basis of strict mathematical rules. But this hardly the common view. Perpetuities typically sold for substantially more than very-long annuities. To many, including even Paterson's own pro-Union colleagues, this was just good sense.

The 1706 dispute about the value of the distant future provides, like the St. Petersburg Paradox in Lorraine Daston's study of *Classical Probability in the Enlightenment*, a distinctive window into the epistemological concerns of a particular historical moment.[24] It was not just a problem within financial mathematics, but *about* financial knowledge. It marked a moment when people had to choose between different, justifiable definitions of what it meant to be rational. But this debate about the economic value of the future was also a debate about political values for the future. Paterson and Gregory felt the failure of most people to understand the mathematics was indicative of the collective ignorance that was holding the nation back commercially. Others, though, did not want to believe the mathematicians over their own traditional sense of value and fairness. For many Scots, to accept the Equivalent was not just to sacrifice Scottish nationhood to the English, it was also to sacrifice their political autonomy to the rule of experts, and to the tyranny of mathematics.[25]

I. The Great Project of the Equivalent

The generic concept of an "equivalent," a kind of targeted diplomatic or political compensation, predated the eighteenth century, and had not always carried the mathematical or economic

[24] Daston, *Classical Probability*, pp. 68-106. For another example of such seemingly unambiguous mathematical truths that were slow to be accepted in early modern England, see the discussion of the "impossible" nature of negative and imaginary numbers in Helena Pycior, *Symbols, Impossible Numbers, and Geometric Entanglements: British Algebra through the Commentaries on Newton's* Universal Arithmetick (Cambridge, UK et al.: Cambridge University Press, 1997), esp. pp. 64, 88.

[25] In his 2002 *Rule of Experts: Egypt, Techno-Politics, Modernity* (Berkeley et al.: University of California Press, 2002), Timothy Mitchell has explored the connections between expertise, computational practice, and political power in colonial and post-colonial Egypt. Mitchell's focus is the twentieth-century invention of the modern "economy," a process which he argues was driven by forces outside the identified "economy" itself. The conceptualization of the Equivalent might usefully be seen as an early-eighteenth-century precursor (on a much more limited scale) of the process Mitchell explores in the twentieth century. Mitchell's description the invention of the twentieth-century "economy" might well be applied to the Equivalent: "These 'extraeconomic' origins of the economy made possible new forms of value, new kinds of equivalence, new practices of calculation, new relations between human agency and the nonhuman, and new distinctions between what was real and the forms of its representation." (p. 5)

connotations it would take on in 1706. By the late seventeenth century, "equivalents" were known to have been offered as a variety of diplomatic subsidy, for example between the King of France and Flanders, and the King of Denmark and the Duke of Holstein.[26] Or so recalled George Savile, Marquess of Halifax, who in 1688 published the most prominent discussion the concept would be given prior to 1706. In *The Anatomy of an Equivalent*, the political wit and gadfly Halifax carefully dissected the historical and legal "nature of an equivalent," in an effort to discredit a controversial "equivalent" proposal then under discussion.[27] In 1687, James II had pushed to repeal various penal laws that limited the rights of non-Anglicans, in particular the Test Acts of 1673 and 1678, in order to secure greater toleration for Roman Catholics.[28] The King and supporters had attempted to allay fears that repealing these laws would bring the demise of the Established Church, promising to offer some "equivalent" assurance of the Church's security in place of the Tests. (Notably, other words—"equipollent," "expedient"—were also used to describe that proposed deal).[29] Halifax, an opponent of James's pro-Catholic designs, drafted a "masterly" pamphlet in which he defined what a "true equivalent" was in order to demonstrate why James's proposed "equivalent" for the penal acts failed to live up to that definition.[30] Halifax's *Anatomy*, which would be republished in a revised form in 1706, helped make "equivalent" into a term-of-art in the lexicon of Augustan politics.[31] While Halifax discussed the deeper (and, notably, French) history of the term, he also ironically disparaged

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[26] The payment of subsidies from more powerful to less powerful nations were a common aspect of early-modern diplomacy, and indeed an important financing mechanism for many smaller states, as Christopher Storrs shows of Savoy. See: Storrs, *War, Diplomacy and the Rise of Savoy, 1690-1720* (Cambridge, UK and New York: Cambridge University Press, 1999), ch. 2.

[27] [George Savile, Marquis of Halifax], *The Anatomy of an Equivalent* ([London?]: *s.n.,* 1688).

[28] The acts required that all civil and military officeholders and all members of Parliament receive the sacrament and swear an oath denying transubstantiation.

[29] Mark N. Brown, "The Works of George Savile Marquis of Halifax: Dates and Circumstances of Composition," *Huntington Library Quarterly* 35, no. 2 (Feb., 1972): 143-157, esp. pp. 148-9.

[30] For information, see: H. C. Coxcroft, "The Works of George Savile, First Marquis of Halifax," *English Historical Review* 11, no. 44 (Oct., 1896): 703-730, quotation on p. 719; Watt, *Price of Scotland*, p. 222.

[31] [Anon.], *The Anatomy of an Equivalent by the Marquess of Halifax: Adapted to the Equivalent in the Present Articles, 1706* ([Edinburgh]: *s.n.*, 1706).

it as a kind of political-linguistic fad.[32] It was but "an extraordinary *Word* to furnish the Coffee-Houses and fill the Pamphlets," little more than an attempt at "softening an *harsh Proposition* by a *plausible Term*."[33]

The most familiar invocation of the "equivalent" idea by the early eighteenth century had not been monetary in nature. The idea of a massive, financial Equivalent, as realized in 1706, was an early-eighteenth-century elaboration on a late-seventeenth-century concept. Monetary reimbursement for the Scots had been mooted in the abortive Union negotiations that took place in 1702-03, when a figure of £10,000 per year was apparently discussed.[34] The 1702-03 negotiations, though unsuccessful at the moment, helped set the groundwork for the 1706 discussions, framing key, unanswered problems that needed to be solved before Union could be realized. Chief among these were political-economic issues pertaining to the integration of trade, unification of taxation, and compensation for the Company of Scotland. In the years between the two sets of negotiations, commentators recognized that commercial benefits would be a vital part of the compensation received by the Scots for sacrificing constitutional autonomy. One such commentator was Charles Davenant, who had been appointed secretary to the English Commissioners for the abortive 1702-1703 Union talks.[35] As Davenant put in 1705 manuscript memorial on the benefits of Union: "We can give Scotland no Equivalent for joining in our Settlement of the Succession, but a free Communication of our Trade, which among them must be popular."[36] Prior to 1706, there had

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[32] Watt in particular emphasizes the religious-political resonances of the term: "The term 'equivalent' was therefore on the lips of the chattering classes of London during the Revolutionary crisis of 1688-9. When it was resurrected in the early 18th century… it was not a neutral term, but one that reminded Scots and English of the dangers of a Catholic revival and the necessity of safeguarding Protestantism." (*Price of Scotland*, p. 222)

[33] Halifax, *Anatomy of an Equivalent* (1688), p. 1.

[34] Watt, *Price of Scotland*, pp. 222-225; Macinnes, *Union for Empire*, pp. 94-5.

[35] Davenant had lobbied hard for this post as Union Secretary, citing his commercial knowledge as the key qualification: "The time I have spent in the study of Trade, may peradventure qualify me in some measure for this Employment; And I dare venture to assure your Lordshippe, that if I were in it, I should ease the Commissioners of a great deal of Pains & Trouble, which will not be thought a Boast to those who are acquainted with my Industry." See Charles Davenant to [Lord Godolphin?], 5 September 1702, Hatton-Finch Papers, BL Add. MS 29,588, ff. 177-178, quotation on f. 178^{r}.

[36] Charles Davenant, "A Memorial Relating to an Union between England & Scotland," MS Copy (dated 31 January 1704[5]), Portland Papers, BL Add. MS 70,038, ff. 19-22, on f. 19^{v}.

already been discussion about how to repay Scotland fairly for what the nation would give up at the Union and attempts to relate that question of compensation to broader questions of commercial development. The precise way in which these constitutional, diplomatic, and political-economic concerns were united into one "advanced" Equivalent was an invention of 1706. As we will see in Section II, the person most responsible was William Paterson.[37]

In the new Treaty negotiations of 1706, the most immediate reason cited for an expanded Equivalent was the problem of unifying English and Scottish taxation. When the Commissioners from England and Scotland got down to the business of negotiating terms in late April 1706, they very quickly turned to the question of fiscal and commercial integration. On April 25, the English proposed that "that there be the same customs excises and all other burdens & taxes, and the same prohibitions restrictions & regulations of trade throughout the united kingdom of great Britaine."[38] Accounts showing the debts and revenues on both nations were requested, but the Commissioners quickly recognized the complexity of the matter at hand. The Scottish Commissioners struggled to produce accounts comparable to the English figures, and in turn found it difficult to decipher the dizzying numbers they received from their English counterparts. In early May, Commissioner John Clerk of Penicuik recounted in his diary how the Scottish Commissioners needed expert assistance to make sense of the English fiscal accounts: "Accordingly we met at my Lord Glasgow's & continued upon them a great part of that night but cou'd not make much out of them. The next two days therafter by the Help of Doctor Gregory, we came to some understanding about them."[39] The Scottish commissioners returned to the talks armed with this new mathematical knowledge, and submitted a paper to their English colleagues on May 9 that stated: "in regard several of the Funds

[37] Contemporaries in 1706 would sometimes use comparative terms like "advanced" to distinguish the 1706 Equivalent, presumably, from earlier compensation proposals. See, for example: Dupplin to [Godolphin], 25 October 25 1706, Godolphin Correspondence (Scotland), BL Add. MS 28,055, ff. 324r.
[38] John Clerk, "Journal of Proceedings of the Commissioners for the Treaty of Union," Vol. 1, Entry for 25 April 1706, Clerk Papers, NAS GD18/3132, f. 21.
[39] Clerk, "Journal," Vol. 1, Entry for 25 April 1706, NAS GD18/3132, f. 21.

relating to the Customs are already appropriated for the Payment of Debts properly belonging to *England*, It is proposed, Than an Equivalent be allowed for them." The English Commissioners, being "so desirous" of "an entire Union between the two Kingdoms," agreed to such a payment the following day.[40] Yet the agreement-in-principle to some kind of compensatory equivalent was only the beginning. As John Clerk wrote to his father on May 11, the many vexing political-economic considerations at issue left the fate of the Union highly uncertain:

> Oũr affairs are just upon a crysis and the balance lies to[o] even that it is scarcely possible to gũesse whither it will incline towards an union or against one. for the English upon the one hand insist to[o] much upon an equality of all taxes & we upon the other, for some forbearance in oũrs, that I cannot tell which will yeald to the other.[41]

The first exchange of financial figures kicked off what Clerk of Penicuik called the "great project of the Equivalent," which was brought to completion through the remainder of May and June by a specially-appointed, "committee consisting of 6 who were to adjust all with the greatest exactnes, so as to be answerable for what they did."[42] The committee included the secretaries for the English and Scottish Commissioners, Dorington and Nairn, respectively, as well as two English representatives by the name of Townsend and Taylor. Most critical in the calculation, though, were the two appointed Scottish experts, Paterson and Gregory. On June 25, 1706, the Commissioners read a lengthy paper revealing the long efforts of this crack calculating committee, which concluded that the appropriate value for the Equivalent payment was £398,085.10*s*. The final figure was the result of very intricate calculations. It first used the past tax revenues in both countries to project the respective proportions of taxes each country would pay under a unified tax system. It then determined what proportion of future Scottish taxes would thereby be directed toward the servicing

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[40] *The Minutes of the Proceedings of the Lords Commissioners for the Union of the Kingdoms of England and Scotland, The Treaty for Which Began on the Sixteenth Day of* April*, 1706. and was Concluded the Twenty Second Day of* July *Following* (London: Printed for Charles Bill, and the Executrix of Thomas Newcomb, 1706), pp. 26-7.
[41] John Clerk (Younger) to Sir John Clerk (Elder), 11 May 1706, Clerk Papers, NAS GD 18/3131/13, f. 1r.
[42] Clerk, "Journal," Vol. II, NAS GD18/3132, f. 107. Clerk's use of "project" here is noteworthy given the loaded nature of that term.

of pre-existing English debts. Finally, it employed the exponential mathematics of compound interest to compute the present value of those future payments, using the current valuations of very long-term annuities in Scottish markets (15 years' 3 months' purchase, equal to an interest rate just about 6.5%) as a guide. The paper also outlined how those payments were to be paid out: first, to provide compensation for the original capital invested in the Company of Scotland, with interest; secondly, to repay outstanding debts of the Scottish government; and, with the remainder, to pay for a recoinage of Scottish money to the English standard and to create a fund for "Encouraging and Promoting the Fisheries and … other Manufactories and Improvements."[43]

There are several features of the Equivalent calculation (which is presented in schematic form in **Figure 2a**) that are noteworthy. First, the primary empirical basis for the calculation was a highly detailed, tax-by-tax analysis of current English public revenues, which estimated the future produce of some 38 different revenue sources, usually by taking a "medium" or average of the previous three years. These ranged from: the traditional backbones of the English revenues, the Excises on beer and ale and the Customs (or, formally, "Subsidies of Tonnage and Poundage"), estimated at £286,000 and £257,000 respectively; to the recently-instituted land-tax, estimated at nearly £2 million; to various temporary wartime taxes, including both a duty on French shipping estimated to produce £81 per year and a regularly-renewed tax on "malt, mum, and cyder" officially projected to produce £650,000 per year (but which, as a memorandum noted, "in most Years… proves deficient").[44] A similarly detailed set of accounts was also developed to provide "A State of the Debts of the Kingdom of England."

[43] This computation was printed as part of the official versions of the Union Treaty and the Minutes of the Treaty Commissioners that were circulated in England and Scotland in 1706. For example, see: *The Minutes of the Proceedings of the Lords Commissioners for the Union* (1706), pp. 61-68.
[44] *Minutes of the Proceedings of the Lords Commissioners* (1706), p. 62.

	England Annual	Scotland Annual	Present Value
Customs:			
Total per Annum	£1,341,559	£30,000	
For Civil Government	253,514	5,669	
Unappropriated for Debts	25,480	570	
Customs Appropriated for Debt:			
Coffee Duty: to June 1710	116,475	2,605	7,577
Impositions: to August 1710	706,471	15,798	47,506
2/3 Subsidy: to September 1710	160,000	3,578	11,251
1/3 Subsidy: for 98 Years	79,619	1,780	27,145
Total Customs Appropriated for Debt	£1,062,565	£23,761	
Total Customs	**£1,341,559**	**£30,000**	**£93,479**
Excise:			
Total per Annum	£947,602	£33,500	
For Civil Government	269,837	9,539	
Unappropriated for Debts	85,581	3,026	
Excises Appropriated for Debts			
For 99-year and Perpetual Annuities	192,400	6,802	103,731
From 1692: For 99 Years	132,433	4,682	71,004
For the Bank of England	137,460	4,860	70,866
For Lottery Tickets	104,624	3,699	56,410
Excises on Low-Wines	25,267	893	2,597
Total Excises Appropriated for Debts	£592,184	£20,936	
Total Excise	**£947,602**	**£33,500**	**£304,606**
Total Equivalent			**£398,085. 10s.**

Figure 2a. Table, summarizing the Equivalent calculation, from *The Minutes of the Proceedings of the Lords Commissioners*, pp. 61-68.

These revenue and debt projections were not only a testimony to the rapid proliferation of new taxes and new public debts raised during the Anglo-French wars. They were also a sign of the substantial developments the English government had made in fiscal information-management since the early 1690s, and the development of new expectations about what kind of information would be made available outside secretive executive offices and the inner circles of the monarchy. There were many uncertainties and irregularities in such English accounts of public revenue and debt that would have been open to dispute from a highly-skilled viewer. Yet the difference between the quality of

fiscal information available for parliamentary and even public consumption in 1706 versus that in 1689 was dramatic. Without the public accounting conflicts of the 1690s and the changes in administrative culture they helped stimulate (discussed in Chapter 1), the calculation of the Equivalent would not have been possible or, more precisely, would not have been thinkable. The relative precision of the English accounts figures was highlighted by the comparative lack of information available on the Scottish side. At the time, the majority of the Scottish public revenues came from taxes that were "farmed," or sold out to private undertakers for a fixed fee: £33,500 (sterling) for the Excises on beer and ale and £28,500 for the Customs. These farm fees were basically all the Scottish data the calculators had to work with. The Committee of Six bemoaned these limitations in an interim report made to the Union Commissioners, a copy of which ended up in the papers of William Lowndes.[45] The calculating committee explained their need for more detail on what goods were subject to Customs and Excise in Scotland, what level of duties were assessed on those goods (according to English weights and measures), and what those duties produced annually in Scotland "upon a Medium of some years."[46] Yet they also admitted that they were not optimistic about getting that data. "We crave leave humbly to observe…," they wrote, "That as the Customs of Scotland are now manag'd, there seems to us to be no prospect of obtaining what we have thus humbly laid before your Lordships, as necessary for our present information."[47] The Excises, they explained, were under a "like uncertainty."[48]

The six calculators did their best, though, providing the Commissioners with a partial calculation that summarized "all that at present we are able to doe, under these difficulties."[49] That calculation, which mapped out the first major steps in the ultimate Equivalent calculation, compared

[45] "Report from the Six Persons to Whom the Equivalent was Referr'd," [May-June 1706], Copy, Lowndes Papers, NA T48/22.
[46] "Report from the Six Persons," NA T48/22, f. 1v.
[47] "Report from the Six Persons," NA T48/22, f. 1v. They went on to explain the reason: "Those Dutys being now and for some time past let to ffarme, at a certain Annual Rent, for the whole, to persons not accountable for the produce."
[48] "Report from the Six Persons," NA T48/22, f. 2r.
[49] "Report from the Six Persons," NA T48/22, f. 2v.

three-year average returns for English Customs and Excise to the farm fees for the Scottish taxes, and used those proportions to begin estimating what annual Scottish contributions would be to various English debts. Much remained to be done, and decided, between this interim stage and the final calculation, including the major question of how to convert future annual payments into one present value. The deliberation and care with which the six calculators thought through the calculation, evident in their interim report, is suggestive of a second key thing to observe about the Equivalent. Simply, it was an incredibly demanding technical computation, the architecture of which was considerably more intricate than it might otherwise have been. The calculators did not just lump together all English revenues and all Scottish revenues, take the ratio of the two, and apply that to the current outstanding English national debt. (This would have resulted in a total figure of just under £337,000, all else being equal.)[50] Instead they carried out a much more fine-grained analysis in which they looked at different taxes individually, assessing what proportion of each separate tax went to servicing debts, rather than other fiscal uses.[51] The calculators also looked deliberately at *how long* various English taxes were expected to last, noting that many of the war-time taxes had fixed life-spans and expired as soon as 1710. The Equivalent calculation critically combined into one number the impact of taxes with very short time horizons, as little as three to four years, and those that were appropriated for ninety-nine years, or even forever.

It is certainly true that aspects of the Equivalent calculation were "negotiated," as Watt argues, in the sense that alternative, justifiable interpretive choices could have been made in how the calculation was done.[52] While the sources provide only brief glimpses into what the Equivalent's computation-by-committee looked like on a day-to-day basis, exploring choices that the committee might plausibly have made provides insight into the political and analytical give-and-take at play

[50] This hypothetical reconstruction, and those that follow, are discussed in **Appendix 1**.
[51] These sorts of technical intricacies were not trivial, given that, for example, a much higher percentage of Customs taxes (79%) were appropriated for paying debts than were Excise taxes (62%).
[52] Watt, *Price of Scotland*, pp. 225, 230.

behind the numbers.[53] Some choices, like the choice not to lump all taxes together but instead to separate out only those taxes that were responsible for servicing the National Debt, hypothetically increased the final size of the Equivalent (from £340,000 to £398,085). Yet other disputable choices would have had the effect of reducing the final figure. For example, the ratio between English and Scottish tax revenues, upon which the nations' relative shares of England's National Debt was apportioned, was calculated using only *existing* Scottish revenue levels (namely £30,000 for Customs and £33,500 for Excise), not what Scottish revenues were projected to be *after* the English tax rates were imposed there (projected to be £50,000 for both Customs and Excise). Had the latter figures been used, the final size of the Equivalent would have risen to over £610,000. But it is critical to see that these were negotiations *through* calculation and not negotiations *in spite of* calculation. Within the parameters that the agreed to work with, the calculators worked hard to get the numbers right as they saw them. In matters of calculation, John Clerk's observation about the efforts of the Treaty Commissioners was very apt: "It is scarce possible that oũr people in Scotland can belive with how much application, zeal & honesty this affaire is manadged by all persons, and if I had not been eye witness to it, I had never believe it."[54] In particular, the one element of the calculation that has been pointed to by scholars as demonstrating the "negotiated" character of the Equivalent calculation, namely the 15 years' 3 months' purchase rate for valuing the long-term payments the Scottish would be making, does not seem to have been especially arbitrary at all.[55]

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[53] The importance of meetings as sites of political decision-making, information exchange, and the making of economic knowledge has recently been explored by Alexander Bick. In his history of the Dutch West India Company, Bick writes that "meetings provide a particularly useful lens on the practice of politics, defined as the give-and-take of negotiation on specific policies by individuals and groups with divergent priorities or interests." See: Bick, "Governing the Sea," ch. 1, quotation on p. 25.

[54] John Clerk (Younger) to Sir John Clerk (Elder), 11 May 1706, Clerk Papers, NAS GD 18/3131/13, ff. 1[r-v].

[55] Watt writes: "The discount rate was set at 6.6 per cent, or in the parlance of the early 18th century, 15 years and three months purchase. Any analyst who has worked in the financial markets will know that a calculation of this nature can be manipulated by flexing the discount rate… to produce an answer that is close to the one that 'feels' right." (*Price of Scotland*, p. 229) Watt's perspective not only fails to acknowledge the particular historical reasons behind the choice of "discount rate," but also anachronistically imports a modern picture of financial calculation into an early-modern context. As we will see in greater depth in Section II, the rate the calculators used was relatively well-known rate, based on the market prices on very long annuities in Scotland. There were good reasons at the time to argue that this was not

The Equivalent that emerged by in the summer of 1706 was, therefore, no simple figure. It rendered into one number several of the most pressing issues facing both nations: the commensuration of the two nation's systems of taxation, the reconciliation of their respective currencies, national indebtedness, the costs of Scotland's failed imperial designs, Scotland's scarcity of money, and the need for "improvement" in that country's trade and manufacturing. The calculation also took on more abstract and disputable mathematical problems, like the appropriate methods for calculating the time value of money. It was, quite simply, one of the most ambitious and creative exercises in political arithmetic that had then ever been carried out. It was an exercise that would have been entirely outside the capacities of nearly all the Commissioners, and one that would have been almost unimaginable even twenty years earlier. To take seriously the computational exertion that went into the Equivalent is not to dismiss the degree to which the figure was a political bargain, nor is it to deny that, in some cases, the payment may have had the effect of a bribe. But it is to recover the peculiar historical conditions that made such a strange calculation thinkable.

II. William Paterson and the Costs of Ignorance

The most outspoken and influential advocate for the key epistemological commitment underlying the Equivalent—the idea that the value of an incorporating Union was something that could be calculated—was the banker William Paterson. Indeed, David Armitage describes Paterson's support for incorporating Union in 1706-7 as a kind of computation: in reaction to the failures at Darien, Paterson and like-minded Scots "came to calculate that their vision of empire could only be realized by Union, and within a British state."[56] This was even truer than perhaps Armitage intended. For Paterson, the Equivalent of 1706 was the realization of a sustained political-economic project that

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the most accurate rate to use. Paterson had already argued earlier in 1706 that a figure of 5% (or 20 years' purchase), roughly the long-term interest rate in England rather than Scotland, was perhaps better, a choice that would notably increase the size of the Equivalent calculation (all else equal, to just over £500,000). But such arguments stemmed from deeper theoretical instabilities, and not just from cynical attempts to manipulate the numbers.

[56] Armitage, "Scottish Vision of Empire," p. 118.

dated to the failure of the Darien Scheme. Since that calamity, he had contended that what Scotland needed was a calculated national "oeconomy," a centrally-directed program of economic modernization that made up for what Scotland lacked in imperial might with the financial power of credit-money and the analytical power of political arithmetic. Paterson argued consistently that the English ought to pay some form of compensation for impairing the Company of Scotland's investment at Darien. Yet his broader program should not be dismissed as purely one of self-interested marketing. Paterson's arguments did not just offer a way to save the Company of Scotland. They offered a way to save Scotland by converting Scotland into a company, and by getting Scots to think like savvy merchants.

Though his most notable achievements—the foundation of the Bank of England, the ill-fated Darien Scheme—occupy a greater place in the history of private enterprise than the history of governance, Paterson was nonetheless a persistent and creative political thinker. He was one of many entrepreneurial figures of his day, like Charles Davenant, for whom public welfare, private profit, and personal gain were inextricable. Though born in Scotland, Paterson pursued these conjoint concerns on both sides of the border between England and Scotland, and attempted to apply his distinctive political-epistemic vision to the governmental challenges of both nations (and, eventually, the one united kingdom they would become). Paterson felt that both the English and Scottish governments suffered from deep failures of ministerial ignorance and administrative disorder, which produced tremendous financial waste, compromised the nations' credit at home and authority abroad, and jeopardized their security in tense geopolitical times. This was a central message in Paterson's 1701 manuscript *Letter to King William III*, a document in which Paterson attempted to resurrect the failed plan for a colony in Panama by pitching it to William as a prospectively *British* project.[57] Paterson explained that his goals in the letter were three-fold, but very

[57] William Paterson, "Letter to King William III," unpublished MS, November-December 1701, BL Add. MS 88,618 B.

much entwined: to resuscitate his plan for a West Indian entrepôt; to heal English public credit; and to mend the relationship between England and Scotland.[58] At the same time, the *Letter* carried a clear, elitist message about the organization of political power in England. The single thing that England needed most was the trusted leadership of knowledgeable, expert ministers, guided by advanced political-economic principles.

Like the "Country" writings of Davenant in the 1690s, Paterson contended that the nation had been under poor and wasteful government since the 1688 Revolution, and that such "material disorder, and Distractions" had jeopardized the nation's fiscal and military security.[59] Public finance was of special concern. In Paterson's mind, "Money, which Commands all things, can never be sufficiently, and Effectually had in this Nation" except through a diligent management of public credit.[60] For Paterson, the gravest threat to national fiscal security was not the corrupt intentions of "designing ministers," as they were for Davenant and Country politicians, but rather general sloppiness, profligacy, and ignorance. He lamented that a "very Considerable part of Your Majesty's Revenue [is] usually Lost and given Away, in dear, and bad Bargains, High Interests of Money, Discompts, Premiums, and other Extortions."[61] The nation remained in need of "New and wholesome Reforms" in the business of government in order to effect the broader ambitions of the Revolution.[62] To Paterson, England had become so accustomed to ignorant leadership, and at the same time so inundated with partisan arguments, that few people had the capacity to identify, let

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[58] Paterson's 1701 *Letter*, like his original scheme for a colony at Darien, also had a broad geopolitical agenda Namely, he sought to find a way to allow England (or Britain) to check the growth of universalizing Bourbon power in the western hemisphere and to benefit from western empire without falling into imperial overreach. See: Armitage, "Scottish Vision of Empire," pp. 112-4.

[59] Paterson, "Letter to King William III" (1701), BL Add. MS 88,618 B, f. 2^{v}.

[60] Paterson, "Letter to King William III" (1701), BL Add. MS 88,618 B, f. 2^{v}.

[61] Paterson, "Letter to King William III" (1701), BL Add. MS 88,618 B, f. 3^{r}.

[62] Paterson, "Letter to King William III" (1701), BL Add. MS 88,618 B, f. 12^{v}. The nation of course had fallen into dire constitutional and administrative conditions prior to the Revolution. "Yet at the time of the Revolution," Paterson recalled, "all this was not only skind over, by leaving the weak and infirm parts of the Constitution." Paterson clarified, though, that it was not just that the government continued to be infested by the presence of an "Antirevolution" (namely, Jacobite) party, but that rather the "worst parts of the two sides, the Antirevolution, and Revolution Party thus blended together, [and] have managed matters for these Last thirteen years." (Paterson, "Letter to King William III" (1701), BL Add. MS 88,618 B, ff. 5v-6r.)

alone trust, genuinely sound political guidance. The result (and here Paterson betrayed his own individual experience) was that productive projects for improving public credit or commerce were ruined because people reflexively doubted the intentions behind them. Paterson mourned the "Vast Sums of the Treasures of this Nation" which had been "needlessly Wasted" because of the "rendring of so many of your Majesty's Designs, either altogether, or in great part In-Effectual," a symptom of a broader ill, the "weakening of the hands of your Ministers and Councils at Home."[63]

To put it simply, Paterson felt that the nation needed to put more trust, and thereby power, back into the hands of those people who actually knew what they were doing—people, of course, like himself.[64] Paterson's writings read at times like manifestos for an almost Platonic form of elitist government-by-the-knowing:

> Mankind are commonly divided into three parts; The first thereof, are those, who understand of themselves; The second tho not of themselves, yet when it's Explained; The Third, neither understanding by themselves nor by an Explaination; Of the two Last the World is Almost wholy made up, But of the first sort or rate, there are att best but few in any Country.[65]

Paterson was not an all-out absolutist or Colbertian, but rather was offering one perspectives on the wrenching problems of partisanship that concerned many in his day. His point was that the endemic distrust that plagued political deliberation in the age, and the consequent reluctance to place sufficient authority in the hands of knowledgeable individuals, was making it impossible to take decisive action on pressing political-economic problems.[66]

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[63] Paterson, "Letter to King William III" (1701), BL Add. MS 88,618 B, f. 2^{v}.
[64] For example, Parliament needed to stop voting temporary, stop-gap taxes to cover the costs of war and government, and instead to vote substantial, permanent revenues that could be subjected to sound central management. (Paterson, "Letter to King William III" (1701), BL Add. MS 88,618 B, f. 10^{r}.)
[65] Paterson, "Letter to King William III" (1701), BL Add. MS 88,618 B, ff. 11^{r-v}.
[66] Paterson was not sold on the Parliamentary vision of political knowledge, of the sort pitched by Harley and Davenant in the 1690s. "For it is not from the Collective wisdom of great, and unwieldy Societies," Paterson wrote, "But from the Capacity, and Genious of particular persons, that all the greatest and most considerable things that ever were in the world, have been, or reasonably can be expected to be produced." (Paterson, "Letter to King 1,223William III" (1701), BL Add. MS 88,618 B, f. 14^{r}.)

This was no less true in Scotland than in England, as Paterson explored in an ambitious pamphlet entitled *Proposals & Reasons for Constituting a Council of Trade*, published in Edinburgh in 1701.[67] The pamphlet was targeted explicitly to a Scottish audience and began by lamenting the "the Injustice and Inequality of our Treatment" at the hands of the English.[68] Yet the pamphlet echoed many themes from his *Letter to King William*. A similar testament to the value of elitist governance, his *Council of Trade* proposed to restore a level of national care and "oeconomy" to Scottish commerce by passing control of it to a centralized council.[69] That body would not only direct all aspects of Scottish commercial and fiscal policy, but command a large fund of public money for the improvement of trade, manufacturing, resource production, and public welfare. Some of that money was to come from the English government—as compensation for the loss of the Darien colony.

For Paterson, the heart of the issue was that a proposal like his *Council of Trade* seemed almost dead before it was born, because no one was capable of trusting its intentions. Paterson urged readers to consider his plans with fairness, hoping that any reader "will consider the weight and consequence of the Things, and be as willing and industrious in finding out Equivalents, and Expedients, as to make Objections."[70] Just as he hoped for readers who would not jump to negative conclusions, so he hoped that his planned Council of Trade would be free of ignorant, helpless, or

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[67] William Paterson, *Proposals & Reasons for Constituting a Council of Trade* (Edinburgh: *s.n.*, 1701). This pamphlet has been occasionally (mis)attributed to Paterson's countryman and financial innovator John Law. The pamphlet is highly unlikely to have been Law's, having been produced in the shadowy period of Law's life between his escape from prison in 1695 and the beginning of a prolific period of political-economic writing beginning in 1704. On the attribution to Law, and arguments against it, see: *The Writings of William Paterson, Founder of the Bank of England; with Biographical Notices of the Author, His Contemporaries, and His Race,* edited by S. Bannister, Vol. 1 (London: Effingham Wilson, 1863), "Preface," [unpaginated]. On Law's life during the period, see: Antoin E. Murphy, *John Law: Economic Theorist and Policy-Maker* (Oxford: Clarendon Press, 1997), ch. 5.

[68] Paterson, *Council of Trade* (1701) "Introduction" (unpaginated), p. [v].

[69] John Robertson places Paterson's *Council of Trade* within an emergent political-economic tradition indicative of Scotland's early Enlightenment. He connects Paterson's plan to a similar project of William Seton, and places both in conversation with alternative plans for Scottish economic revitalization offered by Andrew Fletcher, Robert Sibbald, and John Law. See: Robertson, *The Case for Enlightenment: Scotland and Naples 1680-1750* (Cambridge, UK et al.: Cambridge University Press, 2005), ch. 4, esp. pp. 171.

[70] Paterson, *Council of Trade* (1701), "Introduction," [p. vii]. The generic use of the term "Equivalents" is of course noteworthy here.

biased men, "such as will be apt to… find many Faults, but mend none."[71] Paterson was aware that many readers might consider his proposal too susceptible to corruption, or just a ploy for his further self-promotion. Yet, as in his *Letter to King William*, he explained that this was the wrong thing to worry about when it came to public affairs. For Scotland, like England, the problem was not venality but stupidity. "It may be safely affirmed, that where a Peny shall be in danger by Wilful Fraud or Bankrupsie of Councellors of Trade, there will be at least Ten if not Twenty, so by Ignorance, Presumption and Neglect," Paterson exclaimed. He justified this with a telling bit of hypothetical evidence: "And if one may judge by the practice everywhere, Insurance might sooner be found at one *per cent per Annum*, for the first, then at Ten, perhaps then Twenty *per cent* for the last."[72]

Paterson's metaphor of buying insurance against ignorance was not the only time he would apply financial logic to matters of governance. His *Council of Trade* laid out a plan for a thorough restructuring of the Scottish economy and Scottish politics, described as a kind of financial project. "The Trade, Industry and Improvements of this Kingdom are but too plainly and visibly reduced to such circumstances," Paterson wrote, "as that it will be found altogether Irretrievable, but by a National Council of Trade, and a National Fund of Money."[73] Paterson's political innovation—a new Council of Trade—and his economic innovation—a "National Fund of Money"—were two sides of the same coin. Credit underwrote authority, and vice versa. In his plan, the new central Council would administer the collection of £1,000,000 in new Scottish tax revenues, including a one-fortieth (2.5%) tax on land transactions, new taxes on manufactures and lawsuits, control of all charitable donations made in the country, and a radical 10% tax on the sale of grain.[74] A fixed amount would be paid to the Crown, but then all revenues raised above that would then be contributed to a "Fund which will by much, be the most National, that ever was established or

[71] Paterson, *Council of Trade* (1701), "Introduction," [pp. ix-x].
[72] Paterson, *Council of Trade* (1701), "Introduction," [p. ix].
[73] Paterson, *Council of Trade* (1701), p. 43.
[74] Paterson, *Council of Trade* (1701), pp. 6-10.

thought on in this Kingdom."[75] To that fund would also be added a contribution from the Crown "near, if not quite equivalent to the Losses of our Company," in compensation for Darien.[76] This National Fund would be put to multiple uses under the knowing direction of the new Council of Trade. Paterson was hopeful that, though not as good as "a Capable and successful Person or Genius in the Fundamental Matters of Trade and Improvement," which Scotland had as yet unfortunately lacked, such a learned council would help to provide Scotland with the level of "oeconomy" it sorely needed.[77] In addition to repaying Company of Scotland stockholders, the Fund would be put to work in a range of improvements, including: policing beggars and employing the poor in government workhouses, erecting national granaries to insure against famines, improving mining and manufactures, and the developing domestic salt production to aid Scottish fishing.[78]

Paterson did more than just explain his designs for a better-informed government. He actively practiced the style of reasoning he advocated. His *Council of Trade* pamphlet was rich with political-economic calculations that both justified his proposed policies and demonstrated the kind of skilled reasoning he felt the Scottish government ought to be employing. The pamphlet's opening pages were a summary exercise in political arithmetic, in which Paterson framed the severe challenges facing Scotland. The massive importation of gold and silver into Europe over the past two centuries, Paterson explained, had led to an eight-fold increase in the price of goods and labor and, in turn, a seven-eighths decrease in the value of wealth held. This was a major problem for countries like Scotland which, particularly in the wake of the Darien Scheme, had no access to the mines of the Indies and thus no way to replenish scarce money supplies.[79] What is more, since the

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[75] Paterson, *Council of Trade* (1701), pp. 39-40.
[76] Paterson, *Council of Trade* (1701), pp. 40, 188. Note again the use of "equivalent."
[77] Paterson, *Council of Trade* (1701), p. 58.
[78] Paterson, *Council of Trade* (1701), pp. 15-26, 42-4. Recall that Davenant had also proposed government storehouses for grain in his *Essay upon the Probable Methods*.
[79] On the importance of this "scarcity of money" problem in political-economic thought in the era, and particularly on new ideas about public credit, see Carl Wennerlind, *Casualties of Credit: The English Financial Revolution, 1620-1720* (Cambridge, MA: Harvard University Press, 2011), ch. 1.

union of Crowns with England in 1603, Scotland had "really lost above a third part of its People, and no less than Sixteen in thirty of its other value about a Hundred Years ago," or some 3,000 people and £150,000 (sterling) per year, "a great part of which dead loss hath been drawn to, and Centred in *England*, as the seat of our Government."[80] Later in the pamphlet, he provided more robust calculations detailing the benefits of his new Council of Trade plan. One set of figures built upon estimates of total national consumption among the rich and poor in Scotland in order to explore the efficacy of different taxation strategies and argue for the benefits of his radical grain tax.[81] In an even more elaborate computation, Paterson showed that, based on historical levels in Edinburgh and Leith, the Scots collectively paid £135,000 annually for poor relief, a recurring burden to be absorbed by the new National Fund.[82]

After 1701, Paterson continued to promote his position that Scotland and England needed centralized management of their national trade and revenue, guided by political arithmetic and mercantile expertise. In a brief pamphlet of 1704 or 1705 on the advantages of a setting up a "Company or National Trade" in Scotland, he reminded readers that:

> Poverty is the disease of this Nation, and the source of the many distempers and incumbrancies it laboureth under; it ought to be the business of those, who are invested with the Government of this nation, to appoint a *Council of Trade*, composed of Gentlemen of the best Sense, and Merchants of the greatest Experience within the Kingdom, for contriving a Scheme of Trade.[83]

He took this theme even farther in a pamphlet dated April 9, 1706—before the Union negotiations began in earnest—entitled *An Inquiry into the Reasonableness and Consequences of an Union With Scotland*, published in London. Paterson presented the deliberations of a fictitious English discussion club, the "Wednesdays Club in Friday Street," on the prospects of an incorporating Union with

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[80] Paterson, *Council of Trade* (1701), "Introduction," p. [iii]. In other words, Paterson was particularly worried about how the Union of Crowns had led to an imbalanced migration of people and money from Scotland southward.
[81] Paterson, *Council of Trade* (1701), pp. 51-4.
[82] Paterson, *Council of Trade* (1701), pp. 62-5.
[83] "T. W. Philiopatris" [William Paterson], *An Essay Concerning Inland and Foreign, Publick and Private Trade; Together with Some Overtures, Shewing How a Company or National Trade, May be Constituted in Scotland, with the Advantages Which Will Result Therefrom* ([Edinburgh]: *s.n.*, [1704 or 1705?]), p. 1.

Scotland.[84] In particular, he offered an extended discussion of the problems that might arise in trying to combine the two nations under a single tax system—and how to solve those problems by means of a repayment, or Equivalent, which would double as a new fund for national improvement.

In the *Inquiry*, Paterson laid out a schematic, twelve-point plan for a proposed union, the supposed product of the Wednesdays Club's deliberations.[85] The scheme ("Heads" 1-7) called for a unification of the two nations as "Britain," under one monarch (Queen Anne), with shared Houses of Commons and Lords, but with no change to either governance or municipal law. Heads 8-9 specified that there be a "free Communication and Entercourse of Trade, between all parts of this *United Kingdom*," and recognized that "as a necessary Consequence of this free Communication… there be the same Home and Foreign Excises, Customs, and other Taxes."[86] The final three points addressed how to make that commercial union equitable. Head 10 proposed Scotland be allowed a reprieve on paying the land tax at the English rate.[87] The following Head offered a more radical balancing measure: "Her Majesty will… consent that a Rent-charge of 30,000 *l. per Annum* by Quarterly payments, may be made upon her Royal Revenue, until a Sum of 600,000 *l.* to be raised thereupon, and allowed to the Kingdom of *Scotland*, as an equivalent for the present Debts of *England*, shall come to be repaid."[88] The final Head, number 12, specified three targets where this *£*600,000 "equivalent" was to spent. First, it was to be "applied to refunding the Expences, and Losses of the *Indian* and *African Company* of *Scotland*." Second, it was to go to repaying Scottish public debts. Lastly, "the remainder" was to go to a familiar target—"a Fund for Imployment and

[84] "Lewis Medway" [William Paterson], *An Inquiry into the Reasonableness and Consequences of an Union With Scotland* (London: Printed, and Sold by Ben. Bragg, 1706).
[85] Paterson, *Inquiry into the Reasonableness* (1706), pp. 91-4.
[86] Paterson, *Inquiry into the Reasonableness* (1706), pp. 92-3.
[87] Paterson, *Inquiry into the Reasonableness* (1706), p. 93. There was not the same pressure to make land taxes equal between Scotland and England because land taxes did not impact on commercial activity as Customs and Excises did. The question of how to apportion land taxes on Scottish lands was, though, among the technical problems at issue in negotiating and executing the Union. See, for example: "Proporĉon of Scotch Land Tax," [1706?], Lowndes Papers, NA T48/22.
[88] Paterson, *Inquiry into the Reasonableness* (1706), p. 93.

Maintenance of the Poor, Supporting, Promoting and Encouraging the Manufactures, Fisheries, Products and Improvements of that End of this Island."[89]

Paterson's early 1706 scheme for a £600,000 "Equivalent" was a reconfiguration of his 1701 idea of providing Scotland with a so-called "National Fund." While Paterson's calculation for the value of this preliminary Equivalent, £600,000, had little of the technical detail later attained in the official analysis, it did establish the framework for what such a calculation would look like. Paterson began his calculation with a general estimate of English revenues, amounting to £5,610,000 annually, followed by a similar "estimate of what *Scotland* may produce when upon the foot of the present Taxes of *England*," which he reckoned at £216,000. He then provided a more detailed table laying out the current state of the English National Debt, roughly £21 million. Deducting £30,000 per year from the projected Scottish revenues for the costs of ordinary government in that country, he determined that Scotland could be expected to annually contribute £186,000 toward paying down the English National Debt, compared to £5.6 million pounds annually paid by English taxpayers. This represented a ratio of approximately one-to-thirty (£186,000 to £5.6 million). Taking one-thirtieth of the total English National Debt of £21 million, Paterson deduced that the Scots were taking on a burden of £700,000. After a rough discount for the fact that some of this "Equivalent" was offset by allowing the Scottish lower land taxes, Paterson came to a final figure of £600,000.[90]

Paterson glossed over a variety of technical issues that would become major points of concern for the Committee of Six calculating the Equivalent a few months later.[91] But the basic idea was there: compute the taxes Scotland expected to pay under the English system, calculate the ratio between those expected Scottish taxes and their English counterparts, and then figure out

[89] Paterson, *Inquiry into the Reasonableness* (1706), p. 94.
[90] Paterson, *Inquiry into the Reasonableness* (1706), pp. 102-109.
[91] For example, he lumped together all the potential taxes the Scots would undertake and did not separate out which tax revenues were or were not dedicated to servicing debts, a key distinction in the later Equivalent computation. Nor did he deal computationally with the fact that certain of the English taxes were not permanent taxes, but scheduled to expire within the next four-to-five years.

proportionally how much of the English National Debt Scotland would be assuming. While Paterson was not especially concerned with numerical precision, he was interested in some speculative, theoretical issues lurking behind the computation. For example, he suggested that, under certain conditions, it was reasonable to argue that the full value of this preliminary Equivalent was not just £700,000, but actually as much as £900,000 or even £1 million.[92] In particular, he argued that the size of the Equivalent was highly sensitive to assumptions about interest rates. In a rather elliptical argument, Paterson contended that the value of the Equivalent would increase by as much as £210,000 if the interest rates in Scotland, around 6.5%, fell to the 5% levels current in England. This claim stemmed from a critical financial-mathematical relationship that would have been almost instinctual for Paterson, the banker and public-credit engineer. That principle held that the present value or "ready money" of long-term streams of future payments were inversely proportional to prevailing interest rates.[93] The general thrust of Paterson's claim would have made some sense to contemporaries familiar with one rule-of-thumb that, as interest rates decreased, the value of future incomes (including, perhaps, land rents) went up.[94] But far fewer readers likely would have been able to make sense of how Paterson concocted the £210,000 figure.

For Paterson, this was a big part of the problem facing his multiple nations. The fact that the logical financial principles he invoked were not more widely understood was indicative of the general political-economic ignorance holding those countries back. There was, after all, a vital distinction to be made between the mass of people with basic commercial sense, and those who

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[92] Paterson, *Inquiry into the Reasonableness* (1706), pp. 102-109.

[93] If Scottish interest rates went down from 6½% to 5%, the value of the Equivalent would increase in inverse proportion, from £700,000 to £910,000, a total of £210,000.

[94] Josiah Child and John Locke had an intense argument in the early 1690s about precisely the question of whether or not the value of land increased in inverse proportion to interest rates. The Tory Child, who advocated for reductions in interest rates, argued that it did, while Locke suggested that that expected relationship did not bear out in fact. H. J. Habakkuk provides an excellent summary of the argument, and argues on the basis of available empirical evidence that Locke was basically right—land value in seventeenth-century England did remain basically steady, around a rate of 20 years' purchase, even as interest rates dropped over the period. Davenant and Archibald Hutcheson would later espouse Child's view. See: H. J. Habbakuk, "The Long-Term Rate of Interest and the Price of Land in the Seventeenth Century," *Economic History Review*, New Series 5, no. 1 (1952): 26-45.

really understood commerce, or, "betwixt meer Buyers and Sellers, and Merchants, as taken in an extended Sence."[95] It was the knowledge of the "Merchant… in an extended sense" that was a precondition for national prosperity. For Paterson, practical financial mathematics constituted an essential form of true mercantile knowledge. This did not mean that he felt all true merchants (and politicians) ought to be able to do algebra. But the modestly-educated banker did want his compatriots to understand the basic rules of compound interest, and to believe what they had to say about what things were worth.

While by no means easy, the "ready money" calculations of which Paterson spoke were not entirely novel either. Accounting historians have shown that Renaissance thinkers like the Florentine merchant-politician Francesco Pegolotti (c. 1340) and the mathematician Luca Pacioli (1494) had long since begun exploring the implications of compound interest.[96] The Dutch polymath Simon Stevin, furthermore, had developed discount tables for use in "ready money" problems in 1582. Several English instructional texts on the matter had sprouted up in the 1610s, notably Richard Witt's 1613 *Arithmeticall Questions: Touching the Buying or Exchange of Annuities*.[97] Witt's text included multiple different tables or "breviats" showing the effects of compound interest on £1 at different interest rates from 5-10%, including by half- and quarter-years. Witt's textbook provided narrative (not algebraic or formulaic) instructions for how to execute various practical compound-interest and valuation problems, built around a series of fifteen modular "Directions" that could be combined in

[95] Paterson, *Inquiry into the Reasonableness* (1706), p. 149.
[96] Michael E. Scorgie, "Evolution of the Application of Present Value to Valuation of Non-Monetary Resources," *Accounting and Business Research* 26, no. 3 (Jun., 1996): 237-248, esp. pp. 238-240.
[97] R[ichard] W[itt], *Arithmeticall Questions: Touching the Buying or Exchange of Annuities, Taking of Leases for Fines or Yearly Rent, Purchase of Fee-Simples, Dealing for Present or Future Possessions, and Other Bargaines and Accounts* (London: Printed by H. L. for Richard Redmer, 1613). In his preface "To The Reader," Witt mainly advocated the use of such arithmetical techniques for purposes of commercial profit, but did close with a sentiment that would become far more pervasive a century later: "Perswade thyself, Arithmeticke is profitable, not only to men in their private affairs, but also in the Commonwealth-businesses; as well in time of War as Peace." ("To the Reader," unpaginated). As Scorgie notes, it is quite likely based on his name that Witt had Dutch connections.

sequential fashion. The "third Direction," for example, explained how "To finde what 1^{li}. Annuity, to endure for any number of years is worth, to be paid for presently in ready money":

> To find the Numerator, take the same course which was shewed in the last Direction to find the Numerator there.
> Then take for Denominator the Number in the Table, which standeth against the number of years for which the Annuity is to endure.
> So you shall have an improper Fraction of pounds, that will shew what 1^{li}. Annuity, to endure the time given, is worth in ready money.[98]

The kinds of computations laid out in Witt's "Directions" were certainly not elementary, even for the relatively numerate. But the technical knowledge was available—it had been for nearly a century—and the fact that so few in England or Scotland seemed to grasp its implications was what bothered Paterson. His 1706 *Inquiry* was punctuated with didactic discussions about the kind of foundational mathematics that would have been available in Witt's primer. At one point in the fictitious dialogue, Paterson explained the poor state of Scottish commerce by analogy to a wasteful family. As one of Paterson's characters, "Mr. May" explained, it was hardly surprising at all that "*Scotland* comes to be so low," given the punitive mathematical consequences of compound interest over time. "Considering their circumstances," Paterson's Mr. May was "amazed" that the nation had survived as long as it had:

> For instance, let us suppose, two persons, or Families of 100 *l. per an.* each. The one increasing, and the other, consuming but only to the value of one hundred pence yearly, at the rate of 6 *per Cent, per An.* for one hundred years continuance. Pray what do you think would be the difference of those two Estates at the determination of that time?[99]

One of May's colleagues in the "Wednesday Club" was quick to offer the learned answer: "By this Table of Logarithmes (says Mr. *Grant*) I find the Estate of the gainer increased to about 250 *l. per Annum*, but that of the other utterly consumed, and he about 800 *l. in Debt*."[100]

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[98] Witt, *Arithmeticall Questions* (1613), pp. 6-7. Note that the "third Direction" built upon the "last Direction," number two of fifteen. The remaining instructions similarly built upon previous ones.
[99] Paterson, *Inquiry into the Reasonableness* (1706), p. 82.
[100] Paterson, *Inquiry into the Reasonableness* (1706), p. 82.

In one especially pedantic moment, Paterson expounded on one fundamental consequence of the mathematics of compound interest—that money earned in the very distant future was of very little value in the present. Amidst the discussion of how the proposed £600,000 Equivalent was calculated, Wednesday Club member "Mr. North" voiced a (largely *non-sequitur*) concern that the calculations were not distinguishing carefully between very long debts, with terms of around 100 years, and debts with no termination date, or "perpetuities."[101] Though he did not really explain what this distinction had to do with the Equivalent calculation, Mr. North worried that this oversight would lead to the entire calculation being "easily overthrown."[102] One of the other Club members, Mr. Brooks, took North's question as an opportunity to teach his naïve colleague about how compound interest worked. "Pray what difference in the [Years] Purchase do you believe there is between 98 years, and that of a Perpetuity? (says Mr. *Brooks*)."[103] North responded with what he thought was common commercial wisdom: "I have often heard there is at least 5 or 6 years Purchase difference (replied Mr. *North*)." In other words, as far as North understood, perpetuities usually sold for a lot more than 98-year annuities, as much as 30-40% more.[104] To Brooks, this made no mathematical sense. A 98-year annuity and a perpetuity had almost exactly the same value, even if the "fancies of people" said otherwise. "But by the rules of Compound Interest," Brooks explained,

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[101] There were several places in which the question did impinge on the calculation of the Equivalent. First, much of the English National Debt was in the form of annuities, so such valuation issues mattered for calculating the total size of the English National Debt. Second, and more importantly, was the abstract question of how to think about the future tax obligations the Scots were taking on. In a sense, the Scots were going to agree to take on the higher English taxes *forever*, and so it made sense to value those future payments according to the same rules one used for valuing *perpetuities*. Yet, many of the specific taxes had fixed terms. Even more critically, the basic interest rate Paterson invoked for valuing the future Scottish tax payments of 6.5% was the effective rate on long-term Scottish annuities, *not* perpetuities. So it seems that some may have felt that this was a mismatch, and that the rates used should have been those suitable for perpetuities. These concerns would recur in later discussions about the Equivalent.

[102] Paterson, *Inquiry into the Reasonableness* (1706), p. 109. One possible explanation for North's concern is that Paterson's pamphlet was intended to deflate arguments he had already encountered while discussing the "Equivalent" plan in person. While there is no reason to believe the "Wednesday Club" actually existed, it is certainly reasonable to think that Paterson discussed his ideas before publishing them in the *Inquiry*.

[103] Paterson, *Inquiry into the Reasonableness* (1706), p. 110.

[104] This assumes the perpetuity sold for around 20-22 years' purchase and the 98-year annuity for around 15-16 years' purchase This is to say that, commonly, a 98-year annuity paying £100 per year for 98 years would have been valued at roughly £1,500-1,600, and a perpetuity paying £100 per year forever would have been valued at roughly £2,000-2,200. These valuations are rough estimates, but it is worth noting that in the official Equivalent calculation, long-term annuities were valued at 15¼ years' purchase.

"there is not six Weeks Purchase difference between a Rent-charge for 98 years, and that of a perpetuity, at an Interest of 6 ½ per Cent."

According to the mathematics of financial value, 98 years and eternity were practically the same—a mere six *weeks'* purchase different—no matter how business was usually done in Scotland. According to the mathematical logic Paterson was invoking, this was more or less correct.[105] But it was also a radical claim—that people ought to believe the counterintuitive findings of a mathematical calculation over custom and even common sense. In 1706, Scots may have had plenty of reasons to rationally believe something owned forever was worth far more than something owned for 98 years. After all, the most common model for reasoning about value was landed property. To hold a piece of land for a fixed-term of 98 years was to have a lease; to hold a piece of land forever was to be a landowner.[106] In Paterson's eye, though, such customary ideas about value were mere "fancies," a testament to the collective ignorance of the whole British nation when it came to vital matters of trade, finance, and national improvement. His plan for an Equivalent, on the other hand, embodied the kind of sound reasoning the nation needed, the shrewd logic of a "merchant in an extended sense." For Paterson, the Equivalent was not just a bail-out or a bribe. It was a financial and mathematical realization of a way of thinking about governance, in which the process of calculation was not just a secondary question, but precisely the point. Whether the nation was England, Scotland, Britain, Paterson felt that his nation needed to be *calculating* its political future.

[105] Mr. Brooks may have understated the point somewhat. Purely in terms of the strict mathematics of compound interest, at least in modern form, the difference was more like 1.5 weeks, not 6. On this, and annuity valuation more generally, see **Appendix 2.**

[106] The question of valuing temporary versus perpetual income came up in the valuation of landed properties, as Habakkuk has explored with regard to monastic lands. See Habakkuk, "The Market for Monastic Property, 1539-1603" *Economic History Review*, New Series 10, no. 3 (1958): 362-380, esp. pp. 365-368; Scorgie, "Evolution of the Application of Present Value," p. 241.

III. The Mathematical Authority of Doctor David Gregory

Paterson's was not the only perspective on the political necessity of quantitative thinking reflected in the final form taken by the £398,085.10*s*. To understand the striking rigor and precision of the final figure, it is necessary to look to Paterson's calculating college, Dr. David Gregory. Indeed, in the Scottish debates on the Union Treaty in late 1706 it was to Gregory, and not Paterson, whose explanations Scots of various political leanings favored in trying to understand what the Equivalent meant. The two colleagues did share critical similarities. Both were, in a sense, Britons *avant la lettre*, Scottish by birth but living much of their professional lives in England and building careers and networks that thoroughly bridged the two nations.[107] Both men, in their own ways, promoted of a kind of imperialism for mathematics, advocating the value of applying mathematical analysis to broader national concerns. But Gregory's mathematical values stemmed from a largely different source than Paterson's. Gregory was an impeccably educated university mathematician with a sterling reputation, formerly Professor of Mathematics at Edinburgh and since 1691 holder of the prestigious Savilian Professorship of Astronomy at Oxford. He was also an avowed Tory and a devout Episcopalian. Gregory was indeed a leading "Tory Newtonian," one of an outspoken group of Scottish Episcopalian natural philosophers, mathematicians, and physicians who aggressively championed the value of Newtonian mathematics in solving human problems, from the medical to the political to the spiritual.[108]

Born in 1659 in Aberdeen, David Gregory was the son of a laird and the nephew of James Gregory (1638-1675), also a very gifted mathematician whose work on topics like the "quadrature" (area) of trigonometric curves and the properties of infinite series had a critical, if underappreciated,

[107] On the influence of the Union on forging a new sense of collective Britishness, see Linda Colley, *Britons: Forging a Nation, 1707-1837* (New Haven: Yale University Press, 1992), pp. 11-18.
[108] Anita Guerrini, "The Tory Newtonians: Gregory, Pitcairne, and their Circle," *The Journal of British Studies* 25, no. 3 (Jul., 1986): 288-311.

influence on Newton.[109] David (like James) was educated at Marischal College, Aberdeen and the University of Edinburgh, where in 1683, before even taking his M.A., he was offered the chair of mathematics left vacant by his uncle's early death.[110] Over the ensuing decade, Gregory's relationship with the Edinburgh faculty became strained, in part because of his unorthodox pedagogical choices, but more proximately because of his religion and politics.[111] Refusing to assent to the Presbyterian religious tests required of university faculty as part of the Scottish revolutionary settlement of 1688-9, Gregory left Edinburgh.[112] He relocated to Oxford, a haven of Toryism and Anglicanism, where he earned his lofty chair thanks to a favorable recommendation from Isaac Newton.[113]

Beginning in the late 1680s, an influential group of "Tory Newtonians" coalesced around Gregory and his Scottish friend Archibald Pitcairne, a renowned physician whose extreme commitments to episcopacy and monarchy far surpassed Gregory's, approaching overt Jacobitism. Their circle stretched from Edinburgh to Oxford to Leiden, where Pitcairne was briefly Professor in the early 1690s. As Anita Guerrini has shown, the tight-knit group of (almost entirely) Scottish Episcopalians, many of whom were students of Gregory or Pitcairne, encompassed some of the most important scientific and medical thinkers of the era.[114] These included: the mathematician John Keill, who published the first popular exposition of Newton in 1702; the physiologist and philosopher George Cheyne; and (more peripherally) the probability theorist, physician, and future Scriblerian John Arbuthnot. This group shared a broad commitment to applying mathematical

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[109] On James Gregory, see: D. T. Whiteside, "Gregory (More Correctly Gregorie), James," in *The Complete Dictionary of Scientific Biography* (*DSB*), ed. Charles Coulston Gillipsie et al., updated edition, Vol. 5 (Detroit: Charles Scribner's Sons, 2008[1972]), pp. 524-30; Antoni Malet, "Studies on James Gregorie (1638-1675)," (Ph.D. Diss., Princeton University, 1989).

[110] For David Gregory's life, see D. T. Whiteside, "Gregory, David," in *DSB*, Vol. 5, pp. 520-2.

[111] In his teaching, Gregory was an aggressive advocate of the current and sometimes controversial ideas advocated by the likes of Descartes, John Wallis, and later Isaac Newton, seeking "conscientiously… to impart to his students basic insights" of the seventeenth century's "new science" in areas like optics, astronomy, and mechanics. (Whiteside, "Gregory, David," *DSB*, vol. 5., p. 520.)

[112] Guerrini, "Tory Newtonians," pp. 295-6.

[113] Guerrini, "Tory Newtonians," p. 298.

[114] Guerrini, "Tory Newtonians." Among Guerrini's major objectives in this article is to challenge the notion that support for Newtonian ideas was heavily correlated with Whig politics, as argued in Margaret C. Jacob, *Newtonians and the English Revolution 1689-1720* (Ithaca: Cornell University Press, 1976).

reasoning, and specifically Newtonian principles, to the study of myriad natural, social, and even theological problems. Medicine was one major target. Pitcairne and students like Cheyne and James Keill (John's brother) sought to develop a Newtonian physiology or "iatromathematics." By explaining bodily processes, like glandular secretion, through Newtonian models of short-range attractions and probabilistic methods of reasoning, these physiologists hoped to create what Cheyne once called, by analogy to Newton's great work, a *Principia Medicinae Theoreticae Mathematicae*.[115] Other attempts at mathematical conquest were even more inflammatory, like that of John Craig, a Scottish Episcopalian and student of Gregory's who brought the imperialism of mathematics to theology, and particularly religious history.[116] In his 1696 *Theologicae Christianae Principia Mathematica*, Craig sought to assess the likelihood of past religious events through mathematical analysis of the operation of historical testimony, measuring how such probabilities varied with the number of witnesses or the passage of years. Analyzing how collective suspicion of past events grew over time, Craig projected the second coming of Christ would come in 3050, the year when his calculations said the belief in the Gospels would reach zero.

As Simon Schaffer has argued, for a monarchist and fiercely anti-Presbyterian like Pitcairne, the turn to mathematics had a political message. Pitcairne—and, Schaffer suggests, Gregory—felt the events of the Glorious Revolution marked an "unleashing of fanatic power in civil society," exemplified by the Presbyterian enthusiasm that so disrupted the Scottish universities.[117] Pitcairne saw the "prescription of 'mathematical' authority as a cure for enthusiast mob-rule," contrasting "mathematics," however vaguely defined, to "philosophy," which bred factionalism and

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[115] Guerrini, "Tory Newtonians," pp. 302, 309-310; Guerrini, "James Keill, George Cheyne, and Newtonian Physiology, 1690-1740," *Journal of the History of Biology* 18, no. 2 (Summer, 1985): 247-266; Simon Schaffer, "The Glorious Revolution and Medicine in Britain and the Netherlands," *Notes and Records of the Royal Society of London* 43, no. 2 (Jul., 1989): 167-190, esp. pp. 172-7; Stephen M. Stigler, "Apollo Mathematicus: A Story of Resistance to Quantification in the Seventeenth Century," *Proceedings of the American Philosophical Society* 136, no. 1 (Mar., 1992): 93-126, esp. pp. 95-98, 103-110.
[116] Craig's *Principia* was written in 1696 but published in 1699. See: Stephen Stigler, "John Craig and the Probability of History: From the Death of Christ to the Birth of Laplace," *Journal of the American Statistical Association* 81, no. 396 (Dec., 1986): 879-887; Schaffer, "The Glorious Revolution and Medicine," p. 179; Stigler, "Apollo Mathematics," p. 94.
[117] Schaffer, "The Glorious Revolution and Medicine," p. 172.

fanaticism.[118] For Presbyterians and low-Church Whigs, though, the kind of "dogmatic mathematical elitism" espoused by Pitcairne and Craig was indicative of the dangerous patriarchalism they felt characterized Episcoplians and Jacobites.[119] The insistence of Pitcairne and his followers on the "'tyranny' of mathematics" over history, experience, and common wisdom brought them into sharp conflict with the followers of Whig physician Thomas Sydenham, who promoted clinical medicine based in empirical observation and practical intervention.[120] The most scathing rebuttal came courtesy of Edward Eizat, whose 1695 satire *Apollo Mathematicus: or the Art of Curing Diseases by the Mathematicks, According to the Principles of Dr Pitcairn* harangued Pitcairne for his belief that mathematical deduction was a better guide to human health than the doctor's trained eye. The human body, Eizat contended, was not a machine, and "Mathematical Spectacles" only obscured its workings, leaving Pitcairne struggling like "a blind Mare in a quag-mire" to understand human well-being.[121] "Did ever any thing more wild or extravagant enter into the Mind of Man," Eizat exclaimed, "than to imagine that this speculative Science, that goes all by Demonstration, shall be of use in a practical Art founded on Experience?"[122]

Other exercises at the promotion of mathematics from the friends of Pitcairne and Gregory were not so extreme. Exemplary was the work of John Arbuthnot, a Scottish-born Episcopalian who published one of the earliest English texts on mathematical probability in 1692.[123] In 1701,

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[118] Schaffer, "The Glorious Revolution and Medicine," pp. 173, 176. On earlier connections between the policing of authoritative knowledge and of political order during the Restoration, see Steven Shapin and Simon Schaffer, *Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life*, 1st Paperback Ed. (Princeton: Princeton University Press, 1989 [1985]), ch. 7. Shapin and Schaffer give particular attention to contemporary fears about "fanaticism" and its destabilizing effects on both politics and natural knowledge, noting that the term "fanatic" entered common parlance in English around the moment of the Restoration in 1660 (p. 285).
[119] Schaffer, "The Glorious Revolution and Medicine," pp. 179-80; Stigler, "Apollo Mathematicus."
[120] Schaffer, "The Glorious Revolution and Medicine," p. 179.
[121] Eizat, *Apollo Mathematicus* (1695), p. 105; quoted in Stigler, "Apollo Mathematicus," p. 113.
[122] [Edward Eizat], *Apollo Mathematicus: or the Art of Curing Diseases by the Mathematicks, According to the Principles of Dr Pitcairn* ([Edinburgh]: *s.n.*, 1695), p. 18; also quoted in Stigler, "Apollo Mathematicus," p. 114.
[123] Arbuthnot's earliest work on probability was adapted from Dutch mathematician Christiaan Huygens. Notably, in 1710 Arbuthnot would write an influential article using a probabilistic analysis of sex ratios to argue for the presence of divine providence. See: John Arbuthnot, "An Argument for Divine Providence, Taken from the Constant Regularity

Arbuthnot published his *Essay on the Usefulness of Mathematical Learning*, in which he catalogued the many positive influences mathematics had "on all useful Learning, as well as the concerns of the Publick."[124] Notably, Arbuthnot argued that mathematics was "not only the great instrument of private commerce, but by it are (or ought to be) kept the public accounts of a nation… Those that would judge or reason about the state of any nation must go that way to work."[125] The place of mathematical thinking in the "concerns of the Publick" was arguably more pertinent for Scotland than England. Scotland's political-economic development, and the role of academic learning therein, was a major topic of interest for members of the Scottish-Episcopalian scientific orbit. One example was the Edinburgh Professor of Medicine Robert Sibbald, the founder of the Royal College of Physicians in Edinburgh in 1681 and key associate of Pitcairne before a political falling-out around the Revolution.[126] Sibbald's 1698 manuscript *Discourses Anent the Improvements May Be Made in Scotland for Advancing the Wealth of the Kingdome* argued for the vital importance of "the increase of professours of sciences & Arts" as a means of enriching the country.[127]

David Gregory was very much of this moment, interested in promoting the value of cutting-edge mathematics as a tool for widespread scholarly and national improvement. In 1687, he drafted a manuscript memorandum "To the Committee of Parliament for visiting Schools and Coledges," arguing for a widespread increase in mathematics instruction in Scotland. Since "Parliament had laid down such measures for encouraging trade and Manufactures," Gregory explained, "it is highly reasonable that such parts of learning be encouraged in our universitys as chiefly tend to advance

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Observed in the Births of Both Sexes," *Philosophical Transactions of the Royal Society of London* 27, no. 328 (1710): 186-190; Hacking, *Emergence of Probability*, ch. 18.

[124] [John Arbuthnot], *An Essay on the Usefulness of Mathematical Learning, in a Letter from a Gentlemen in the City to his Friend in Oxford* (Oxford: Printed… for Anth. Peisley, 1701), p. 1.

[125] Arbuthnot, *Essay on the Usefulness of Mathematical Learning* (1701), p. 28.

[126] Schaffer, "The Glorious Revolution and Medicine," p. 174, 190. Schaffer explains that Pitcairne, a staunch opponent of the Williamite Revolution, fell out with Sibbald after the Revolution because Sibbald chose to reconcile with the new regime after 1688.

[127] Robert Sibbald, "Discourses Anent the Improvements May Be Made in Scotland for Advancing the Wealth of the Kingdome," 1698, NLS Adv. MS 33.5.16, esp. ff. 79^{v}, 29^{r}. (Note, MS is misbound; ff. 76-93 should precede ff. 23-75).

those, which with the common Consent of Mankind are Mathematiques."[128] He not only encouraged broad instruction in geometry and arithmetic, which were "absolutely necessary for a Nation with anything of trade or Manufacture," but also particularly mentioned the need to educate students in infinite series. Gregory even made a point of explaining the need to allow university Professors of Mathematics—and not the university Regents, with whom Gregory might have had a number of reasons to be frustrated—to play a key role in examining degree candidates because, after all, "of the sober arts sever[al] are Mathematical, of which the Regents know nothing."[129]

After his move to Oxford, Gregory drifted away from the hot-tempered Jacobitism of Pitcairn toward the moderate Toryism of men like Arbuthnot and Henry Aldrich, dean of Christ Church. Gregory had capitalized on the favor of the Whiggish Isaac Newton to find his position at Oxford, and once there combined a more pragmatic perspective on Scottish politics with a healthy suspicion of the post-Revolution Scottish government. [130] It was this combination of perspectives that Gregory brought to his work with the Equivalent. An expatriate Scottish Episcopalian and mildly disaffected Tory, he was hardly a natural champion of Anglo-Scottish Union, a primarily Whig project in both Scotland and England that was looked upon with suspicions by both English Tories and Scottish "Cavaliers" or Jacobites.[131] Yet Gregory also remained critically interested in the

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[128] David Gregory, "To the Committee of Parliament for Visiting Schools and Coledges," 1687, Gregory Papers, Folio C, EdinUL Dc. 1. 61, item no. 215, ff. 747-50, on f. 749.

[129] Gregory, "To the Committee of Parliament for Visiting Schools and Coledges," EdinUL Dc. 1. 61, item no. 215, f. 750.

[130] Guerrini, "Tory Newtonians," pp. 301-2. Guerrini notes that Gregory and like-minded friends found that drinking claret from Bordeaux made for a particularly pleasing way to protest Presbyterian predominance. Drinking French claret did carry pro-French and Jacobite resonances.

[131] There were a variety of reasons for Tories and/or Jacobite interests in both England and Scotland to oppose Union. Some of these might have been cynically political, as the 1706 Union plan was primarily engineered by Whigs, which was reason enough to oppose it for some English Tory politicians. (On these dynamics, see P. W. J. Riley, "The Union of 1707 as an Episode in English Politics," *English Historical Review* 84, no. 332 (Jul., 1969): 498-527). Yet concerns about monarchical succession and ecclesiastical security were also major motivations. Supporters of the House of Stuart opposed sacrificing any further autonomy on the Succession, particularly in Scotland. Staunch Anglicans in both countries may have feared that the Union would further entrench the dominance of the Presbyterian Kirk in Scotland, undermining the position of the Anglican Church in Scotland and potentially strengthening the dissenting interest in England. The pull of religious interests was a complex matter, as evident in the fact that Presbyterian opponents of Union in fact feared that an incorporating Union might jeopardize the security of the Scottish Kirk. For a discussion of

problem of Scotland's improvement, and came—like John Arbuthnot—to accept that Union with England might be the best way to accomplish that.[132] Most importantly, though, Gregory was no absent-minded mathematician. He had grown up in a heated academic atmosphere in which the problems of knowledge and political order were seen as deeply entwined, immersed in the potent Tory-Newtonian belief that mathematics could solve almost any problem.

If Paterson was responsible for laying the main conceptual groundwork for the Equivalent, it was most likely Gregory who gave the calculation its unique character: rigorous, intensive, and deeply mathematical. As we saw in Section I, Gregory was among the first people that the Scottish Union Commissioners called in to make sense of the complex English accounting data, and Gregory seemed to have taken his role as a special advisor very seriously. In June 1706 he drafted a detailed series of queries to Sir Humphrey Mackworth, a Welsh-English MP, industrial entrepreneur, and fellow High-Church Tory, about the constitutional and administrative incorporation that had occurred at the Union of England and Wales (presumably 1536).[133] From the computation of the Equivalent in the spring, through the heated public debates in the fall of 1706, "the Doctor" was a pivotal figure in explaining and justifying that complicated program in mathematical governance, prized by Scottish political leaders for his integrity and clarity.[134] Gregory brought academic mathematics to the Equivalent calculation, particularly his knowledge of algebra and infinite series.

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some of these ecclesiastical copmlexities, see: David Macree, "Daniel Defoe, the Church of Scotland, and the Union of 1707," *Eighteenth-Century Studies* 7, no. 1 (Autumn, 1973): 62-77.

[132] Arbuthnot published a pro-Union sermon, crafting an economic justification for Union around a verse from Ecclesiastes—"Better is he that Laboureth and aboundeth in all Things, than he that boasteth himself and wanteth Bread" (ch. 10, ver 27). See: [Arbuthnot], *A Sermon Preach'd to the People, at the Mercat Cross of Edinburgh; on the Subject of Union* ([Edinburgh?]: *s.n.*, 1706). On Gregory-Arbuthnot connections, see Michael Fry, *The Union: England, Scotland and the Treaty of 1707* (Edinburgh: Birlinn, 2006), pp. 256-7.

[133] Mackworth was born in Shropshire, and at different times in his career sat as MP for Cardiganshire in Wales and Totnes in Devon. He was also an influential early member in the Society for Promoting Christian Knowledge. See: [David Gregory], "Querys to Sr Humprhey Mackworth June 1706," Gregory Papers, Quarto A, EdinUL Dk. 1.2.1, item no. 49.2, f. 50.

[134] An exchange of letters in November 1706 was exemplary. On November 1, Scottish Union Commissioner David Nairne, writing from London, lamented to the Earl of Mar in Edinburgh that he did "regrait that Dr. Gregorie was not there [Edinburgh] about the Equivalent," alluding to Gregory's ability to explain the calculation. On November 3, Mar wrote back, saying "I wish the Doctor were here himself." Also: Sir David Nairne to the Earl of Mar, 1 November 1706, HMC *Mar & Kellie*, p. 307; Mar to Nairne, 3 November 1706, HMC *Mar & Kellie*, p. 310.

While most of the day-to-day efforts that went into the computation of the Equivalent remain largely hidden from historical view, one manuscript in Gregory's papers at the University of Edinburgh provide a vivid picture of his mathematical contribution to the Equivalent project and the conceptual problems at play in those computations.[135] Covered in disorganized decimal numbers and arithmetical scrapwork, the manuscript is a valuable relic of computation-in-practice.[136]

The manuscript calculation concerned one specific technical aspect of the Equivalent calculation: how to calculate the "ready money" cost (present value) to Scotland of taking on a set of temporary taxes appropriated by the English Parliament to serve war-time needs, all of which were projected to expire in different months in the year 1710. For example, a 15% duty on imported muslins and other goods had been levied in 1704 to secure a £700,000 loan at 6% interest, and was set to expire June 24, 1710.[137] The Equivalent calculators collected past data on the produce of these taxes in England, and used the ratio of past tax revenues in the two nations to project how much Scotland would pay under these taxes after the Union. For example, the English were estimated to pay £116,475 yearly for the muslin tax, which implied, proportionally, that Scotland would pay £2,605.[138] Calculating this proportion was not especially complex, but the more challenging mathematical problem involved how to determine the "present worth" of those new taxes for Scotland. If Scottish taxpayers, for example, agreed to accept a new Customs tax on muslins costing

[135] Spence, "Accounting for the Dissolution," p. 384.
[136] Untitled Calculations, Gregory Papers, Quarto A, EdinUL Dk. 1.2.1, item no. 49.3, f. 51r-v. It is not entirely clear when the calculations were produced, though it was certainly not before late May or June, after the committee had taken a first cut at the computation. It may have been carried out somewhat later, for example during the intense scrutiny given to the Equivalent computations in the Scottish Parliament and press during the fall of 1706. But regardless of the precise dating, the calculation was certainly part of the process of creating and vetting the Equivalent in 1706 of which Gregory played a central part.
[137] See *Minutes of the Proceedings of the Lords Commissioners,* pp. 66, 68.
[138] The calculators compared their estimate for total English Customs revenues (£1,341,559 p.a.) with their estimate for total Scottish Customs revenues (£30,000 p.a.), and applied the same ratio to the specific tax in question. That is: £1,341,559/£30,000 = £116,475/£2,605.

£2,605 per year through June 1710, how much money did that represent in 1706, as one lump sum? What difference did it make if the tax terminated in June 1710 or August 1710?[139]

As we saw in Section II, the problem of the present value of future payments was one about which William Paterson had strong and pedantic opinions—the strict mathematics of compound interest were superior to the conventional years'-purchase heuristics. In his manuscript calculation, David Gregory was at work on a similar project, though to a much finer degree of mathematical refinement. The specific function of that manuscript was to go through the various different Customs and Excise taxes that expired in different months of 1710, to calculate their present worth using the most powerful and rigorous mathematical tools Gregory had available to him. Critically, he assumed an interest rate of 6%, not 6.55%, as the final Equivalent calculations did. The verso of the manuscript laid this out in a table (**Figure 2b**), showing four different buckets of taxes ending in 1710, and comparing the present value of those taxes according to the methods being used "By the Equiv." and by a second method, which Gregory labeled (somewhat mysteriously) "By Mr. H."[140]

[139] As some critics of the Equivalent calculation would point out, there was a serious political issue at play as well—just because these taxes were scheduled to expire in 1710 did not mean that the new British Parliament would not renew them. One anti-Union pamphleteer would later comment: "Whereas, tho by the Acts of England they are imposed for no longer time; yet it's not to be doubted but they will be continued longer." ([Anon.], *An Essay upon the Equivalent. In a Letter to a Friend* ([n.p.]: s.n., 1706), p. 5.)

[140] It is not clear who "Mr. H" is, or whether Mr. H. was in fact a real person, or what role he had to play in the calculation of the Equivalent. It is possible that Gregory was responding to a series of calculations carried out by someone else, either involved in the calculation or checking it from the outside, and was attempting to reconstruct that person's logic. It is also possible that "Mr. H" might refer not to a specific person's calculation, but to a text or method of a calculating that Gregory was drawing upon in making up his own calculations (i.e., "By Mr. H" can be read as "according to the method of Mr. H's book," or something similar). It is also unclear whether the document was written with the recto first or the verso first; in other words, whether the table on the verso represented the results of the calculations on the verso, or the jumping-off point.

		By the Equiv.	By Mr. H.
2605 £	per Annum from 25 March 1707 to 24 June 1710 is worth	**7577** £	**7490** £
15798	per Annum from 25 March 1707 to 1 August 1710 is worth	**47506**	**46480**
3578	per Annum from 25 March 1707 to the 30 Septr. 1710 is worth	**11251**	**11001**
893	per Annum from 25 March 1707 to for 3 years & 3 months is worth	**2597**	**2567**
		68931	**67538**
		67538	
		1393	

Figure 2b. Table, adapted from the manuscript calculations in the Gregory Papers, Quarto A, EdinUL Dk. 1.2.1, item no. 49.3, f. 51[v].

On the messier recto side of the document, Gregory worked through the computations that produced the second of these valuations, that of the mysterious "Mr. H." The method employed was hardly standard in commercial affairs, or even in the comparatively advanced exercises in fiscal arithmetic carried out in contemporary pamphlets on the National Debt. Gregory's computations proceeded from an *algebraic* formula, rather than from interest tables or other forms of estimation, like a years' purchase approach.[141] At a time when even decimal arithmetic—which Gregory's computation also relied on extensively—was uncommon, the direct invocation of algebra in practical financial calculation was remarkable. The algebraic formula, which Gregory scrawled in the upper left corner of the page, was the following:

$$\frac{1}{r-1} - \frac{1}{r^t \times r - 1}$$

[141] For evidence that algebraic problems of compound interest and annuity valuation were indeed matters of contemporary attention in mathematical circles, see: Thomas Watkins, "Rules for Correcting the Usual Methods of Computing Amounts and Present Values, by Compound as well as Simple Interest; and of Stating Interest Accounts," *Philosophical Transactions of the Royal Society of London* 29, no. 340 (1715): 111-127. Watkins was a Fellow of the Royal Society, and his article represents the most serious algebraic and theoretical treatment of valuation problems from the period. While I have been unable to give serious treatment to Watkin's work in this dissertation, I plan to explore it further in an expanded study on the mathematical value of time in the financial revolution.

The basics of the formula are clear. The variable *r* refers to an interest rate, while *t* is time. The notation is recognizably modern, with the exception of the second denominator— $r^t \times r - 1$ —which would more likely be $r^t \times (r - 1)$ in modern usage. Allowing for that notational adjustment, the formula is the modern algebraic formula for calculating the net present value of a stream of annual payments assuming an interest (or "discount") rate *r*, over time *t*.[142] The mere presence of this formula was interesting, showing that Gregory brought the tools of algebraic reasoning to the problem of the Equivalent.

On the remainder of the recto side of the manuscript, Gregory worked out this formula as it applied to a variety of different time periods between three and four years in length. Critically, he assumed an interest rate of "6 per Cent.," which was not the rate used in the Equivalent calculation (about 6.55%). The first term of the formula $(\frac{1}{r-1})$ was the same regardless of the value of *t*, equaling "16.66667," as Gregory wrote at the top right of the page. The middle of the page was filled up calculating the second, more intricate term $(\frac{1}{r^t \times r - 1})$ for a variety of different values of *t*: $3, 3\frac{1}{4}, 3\frac{1}{3}, 3\frac{1}{2}, 4$. He then consolidated these findings at the bottom of the page (**Table 2c**):

"The present worth of an Annuity of one pound at 6 per Cent"

	£	
3 years	**2.6731**	
3 1/4 ---	**2.8754**	**2.908**
3 1/3 ---	**2.9422**	**3.007**
3 1/2 ---	**3.0749**	**3.1445**
4 ---	**3.4651**	

Figure 2c. Table, adapted from the manuscript calculations in the Gregory Papers, Quarto A, EdinUL Dk. 1.2.1, item no. 49.3, f. 51r.

[142] One other slight notational oddity is that *r* in this formula does not represent just the interest rate but rather 1 plus the rate. That is, if the interest rate is 6%, *r* = 1.06, not 0.06.

The middle column of Gregory's table represented the decimal results of his calculation using the algebraic formula above. Applying the formula $\frac{1}{r-1} - \frac{1}{r^t \times r-1}$ with $r = 1.06$ and $t = 3$, for example, produced 2.6731; for $t = 3¼$, it produced 2.8754, and so on. Taking these numbers calculated on the recto, and multiplying them by the figures that made up the left-hand column of the table on the verso (**Figure 2b**), Gregory derived the figures for the column labeled "By Mr. H" on that chart.

Annual Amount	Tax Duration	No. of Years	Annual Amount	x	Valuation (*Table 2c*)	=	Present Value	"By Mr. H."
2605 £	per Annum from 25 March 1707 to 24 June 1710 is worth	3 1/4	£ **2605**	**x**	**2.8754**	=	**7490**	**7490** £
15798	per Annum from 25 March 1707 to 1 August 1710 is worth	3 1/3	**15798**	**x**	**2.9422**	=	**46481**	**46480**
3578	per Annum from 25 March 1707 to the 30 Septr. 1710 is worth	3 1/2	**3578**	**x**	**3.0749**	=	**11002**	**11001**
893	per Annum from 25 March 1707 for 3 years & 3 months is worth	3 1/4	**893**	**x**	**2.8754**	=	**2568**	**2567**
							67541	**67538**

Figure 2d: Table relating **Figures 2b-c**, showing how the figures on the recto and verso of the Gregory Papers manuscript relate. From Gregory Papers, Quarto A, EdinUL Dk. 1.2.1, item no. 49.3, ff. 51r-v. Note that the totals or the two rightmost columns do not exactly add up, likely the function of a rounding error.

In the far right column of the chart on the verso (see **Figure 2d**), Gregory listed three numbers—2.908, 3.007, 3.1445—inserted in between the lines representing the computations of the "The present worth of an Annuity of one pound at 6 per Cent" according to his algebraic formula. Those figures represented the valuation rates assigned to the various short-term tax obligations in the "By the Equiv." column in the table on the verso. Namely, these figures indicated how those obligation were valued *in the actual Equivalent calculation*. For example, the 2.908 was derived from the collection of taxes expiring June 1710: dividing the total present worth of those taxes assigned "By the Equiv.," equal to £7,577, and dividing it by the projected annual value of those tax obligations, £2,605, the answer was approximately 2.908. Gregory was therefore comparing side-by-side the valuations assigned to the tax obligations according to his algebraic formula (middle column of **Figure 2c**), assuming a 6% interest rate, and according to the figures produced by the Equivalent

calculators, which assumed a 6.55% rate. He could show, for example, that the algebraic formula suggested a £1 annuity for 3¼ years ought to be worth 2.8754, while the same £1 annuity was valued by the Equivalent calculators at 2.908. A minor discrepancy.

There are many things that are uncertain about this strange manuscript. It is unclear when it was dated, or who "Mr. H" was, or whether the recto was logically prior to the verso, or the other way around. Gregory may have been checking someone else's work using a different computational approach, or may simply have been testing to see what happened to the Equivalent values using an alternate interest rate assumption of 6%. Regardless of the specific function of that document, several conclusions can be gleaned from it. First, Gregory's computational scribbling demonstrates that, in 1706 and specifically in the computation of the Equivalent, elite mathematical thinkers were developing and applying algebraic tools to the problems of finance, and particularly to the problems of valuing future incomes. Second, it demonstrates the intensive level of mathematical thought that went into not only calculating the Equivalent in the first place, but checking the results and testing the impact of potential changes in certain parameters, like the use of a 6% interest rate. Indeed, more subtly, Gregory's scrap paper gives yet another piece of evidence of the epistemological negotiations, even conflicts, that were going on within the very Equivalent calculation itself. As we saw in Section II, William Paterson's vision for an Equivalent was a kind of political manifesto for a way of thinking about financial value. Paterson viewed the Equivalent through the lens of a conflict between the old-fashioned "fancies of people" and the improving power of mathematical analysis, and his seminal test-case of this conflict came in a question of annuity valuation. In his messy manuscript calculations, David Gregory was playing his role in a similar—if far more technical and less overtly political—conflict. Gregory's calculations were not just about applying algebra to a familiar algebra problem. They were about applying algebraic formulae to a problem—the valuation

of annuities—that was more commonly done in other ways. Gregory was enacting his own belief, forged in the fire of Tory Newtonianism, in the political power of mathematical rationality.

IV. Reading the Equivalent: The Political Indeterminacy of Calculation

The Equivalent envisioned and calculated by Paterson, Gregory, and company was a technically painstaking and politically elitist statement about growth, reform, and fairness. It marked the intersection of separate strands of enthusiasm about the political power of mathematical learning. On the one hand was Paterson's radical reformist plan to improve the nation through mercantile and computational expertise; on the other was Gregory's Tory-Newtonian appreciation of the fundamentally mathematical order that governed—or ought to govern—heavens, bodies, and nations. But the Equivalent, and the image of mathematical authority it stood for, was not an easy sell, particularly to the Scottish political public. Many factors—from the calculation's technical intricacies to typographical errors in published versions of it—complicated the political message behind the Equivalent. More deeply, Scots had to decide whether they were willing to put political faith in something they could not understand, and to believe that the calculations of itinerant financiers and mathematicians could explain what was best for Scotland.

Between the conclusion of Treaty negotiations in late July 1706, and the Treaty's final approval by the Scottish Parliament in mid-January 1707, the terms of the Union were a subject of extensive discussion in various forms—from Parliamentary debate to pamphlet publishing, from petitioning in the outlying constituencies to full-fledged rioting in Edinburgh. Karin Bowie has shown that the making of Union in Scotland was not simply a series of backroom deals carried out against a backdrop of mass apathy or hostility on the part of the Scottish people. Rather, the debates about the Union Treaty both reflected and advanced the creation of a new public political culture in

Scotland.[143] Furthermore, matters of political economy—the Darien disaster, Anglo-Scottish free trade, the dire condition of Scottish trade and manufacturing, Scotland's shortage of money—were central to such popular discourse about Anglo-Scottish relations.[144] As such, the Equivalent was of serious public concern during the Union debates.[145] But it was a matter of serious confusion as well. Outside commentators on the Union, both pro and con, had a hard time making sense of the Equivalent. Collectively, critics of the Union Treaty did not share a single, coherent position on matter. It was, after all, hard to argue that a massive payment to some number of Scottish people was inherently unappealing. Anti-Union writers nonetheless found a number of elements to question: Who was going to get paid, and in what order? Would the Equivalent really contribute meaningfully to the improvement of Scotland? Were the calculations accurate and trustworthy? The one official Equivalent calculation evoked many different political interpretations.[146] The messy ways in which contemporary Scots read the Equivalent calculation demonstrates the comparatively unsettled place of economic calculation—a highly abstruse political language to most at the time—within Scottish politics at the dawn of the eighteenth century.

Many things made the Equivalent unclear, confusing, and even threatening to Scottish public audiences. One such challenge appears almost humorously trifling—typographical errors. Union supporters like David Nairne worried that there had been many "errors in writting or printing the

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[143] Bowie, "Popular Opinion, Popular Politics"; Bowie, *Scottish Public Opinion*.

[144] Scottish addresses, petitions, and pamphlets criticizing the incorporating Union in 1706 built upon the ideas and rhetorical strategies of a Scottish "Country" tradition which, since 1699, had actively supported a so-called "federal"—but not incorporating—union with the English. As Bowie notes, popular anger about the Darien Scheme was central to the galvanization of this Country sentiment, as many Scots felt that the Scheme's failure was the fault of William III—a monarch that some Scots had never accepted to begin with. 21,000 people, for example, signed a "Country" petition in 1700 regarding English mistreatment of the Darien venture; included among them was Archibald Pitcairne. See: Bowie, "Popular Opinion," esp. pp. 231-232.

[145] Watt, *Price of Scotland*, p. 228.

[146] Crawford Spence has argued that the widespread incapacity of the Scottish political public to accurately and faithfully interpret the Equivalent computations, as evident in the 1706-7 pamphlet war, represents the general challenges or even "impossibility" of accounting as a political technology. I have found his work an extremely useful guide. (Spence, "Accounting for the Dissolution of a Nation," esp. pp. 384-7).

equivalents" in published versions of the Treaty.[147] As printers failed to faithfully reproduce the figures as they had been intended by the calculating committee, typographical irregularities led to visible inconsistencies, like the failure of a column of numbers to add up to its stated total. Union opponents looked upon these manifest mistakes as objects of concern or opportunities for criticism. In reference to the set of Equivalent calculations he was looking at, the anonymous author of one *Essay upon the Equivalent* observed that "in the Summing of the Annual Incomes and Revenues of *England*, there is an Error of 125200 lib."[148] While he admitted that this computational error actually benefited the Scottish, the existence of such an irregularity bespoke a bigger worry:

> Either the Overseers of the Press, or the Accomptants have been at no great pains in the said Accompts; and if they have fallen into such a great Mistake in the addition of a few Articles; what Error may they not commit, in calculating of Proportions, valuing Annuities, &c. in doing of which, very troublesome and tedious Rules of Arithmetick are made use of.[149]

Union advocates tried to talk their way out of these seemingly superficial errors. John Clerk, a Commissioner himself and one of the most technically astute of the pro-Union propagandists, tried to reassure readers that a correct, authoritative version of the calculation did in fact exist. "No Body can be answerable for faults in the Printing or Transcribing the Minutes of the *Treaty*," Clerk explained, "but when the *principal Calcul* that was adjusted at *London*, comes to be produced, all Difficulties of that sort will be cleared."[150] Whatever Clerk's claims to the contrary, such typographic errors were emblematic of more systemic problems. Such errors showed that available channels for political communication were incapable of transmitting complicated numerical messages with a high degree of fidelity. In simpler terms, printers just did not seem to care very much about getting the numbers right. Printed writings on the Equivalent very often had mistakes in the most familiar and

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[147] Sir David Nairne to the Earl of Mar, 1 November 1706, HMC *Mar & Kellie*, p. 307. In that letter, Nairne admitted that he had not been able to review any of the specific copies of the calculations that were circulating in Scotland. I have as yet been unable to identify the specific erroneous copies that gave rise to these typographical concerns.
[148] [Anon.], *An Essay upon the Equivalent. In a Letter to a Friend* ([Edinburgh]: *s.n.,* 1706), p. 3.
[149] [Anon.], *Essay upon the Equivalent* (1706), p. 3.
[150] [John Clerk], *A Letter to a Friend, Giving an Account How the Treaty of Union Has Been Received Here…* ([Edinburgh]: *s.n.,* 1706), p. 32. Note that "calcul" was often used for "calculation" in Scottish dialect.

high-profile number of them all, the "398085" total value. The abovementioned *Essay on the Equivalent* had the number misprinted at different points as "398093" and "398084."[151] John Clerk's *Letter to a Friend* contained a misprint—"398088"—in the very sentence following his explanation of why typographic errors should not be a cause for concern.[152] One anonymous pamphlet, entitled *A Letter to a Member of Parliament, Anent the Application of the 309885 Lib: 10 Shil: Sterl: Equivalent*, got the number wrong in the title.[153] Plenty of other examples could be cited.[154] However much the likes of Gregory cared about the faultless mathematical precision of the Equivalent calculations, others in the Scottish political community (at least the printers) were not concerned enough about the value of precision to avoid making even the most blatant of errors.

This problem lay at the core of the Equivalent debates. The different people involved in calculating and transmitting and reading and interpreting and approving the Equivalents were not playing with a common set of rules or expectations. This was even truer when it came to computational practices and conceptual assumptions than it was with typography. The financial-mathematical principles at issue in the Equivalent calculation were complicated, sophisticated, even arcane. Outside readers brought their own interpretive tools and assumptions to bear on the figures that had been produced, and did not necessarily come to the same conclusions the Committee of Six did. Interpretive confusions and conflicts were evident even between writers on the same side of the issue. In the second part of his *Essay at Removing National Prejudices*, written before the Union Treaty terms were finalized, the pro-Union Daniel Defoe challenged the proposals in the *Inquiry into the Reasonableness and Consequences of an Union With Scotland* (which he may well have known to be

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151 [Anon.], *Essay upon the Equivalent* (1706), pp. 19, 23.
152 Clerk, *Letter to a Friend* (1706), p. 32.
153 [Anon.] *A Letter to a Member of Parliament, Anent the Application of the 309885 Lib: 10 Shil: Sterl: Equivalent; With Consideration of Reducing the Coin to the Value and Standard of England* ([Edinburgh]: s.n., 1706).
154 [William Black], *Short View of our Trade and Taxes, Compar'd with What These Taxes May Amount To After the Union, Even Tho' Our Trade Should not Augment One Sixpence* ([Edinburgh?]: *s.n.*, [1706]) p. 3; [James Donaldson?], *Considerations in Relation to Trade Considered, and a* Short View of Our Trade and Taxes*, Compared with What These Taxes May Amount to After the Union, &c. Reviewed* ([Edinburgh?]: *s.n.*, 1706), p. 18.

Paterson's). Defoe rejected the idea of a £600,000 "Equivalent" as part of the Union—but that was because he interpreted the *Inquiry* as proposing Scotland ought to loan £600,000 *to* the English to help them pay their public debts, not the other way around.[155] Defoe thought this needlessly harsh.

Once the Treaty terms were revealed in summer 1706, public analysts on both sides of the Union debate translated the Equivalent figures in a range of creative ways. One pro-Union pamphlet, entitled simply *The Equivalent Explain'd*, formulated its own logic for how the Equivalent was calculated.[156] The pamphlet began by repeating the official line on why the Equivalent was necessary: "*England* did agree to repay to *Scotland*, the Equivalent of what *Scots* Money should be employed for paying of *English* Debt."[157] But the explanation for how the Equivalent was computed bore only the most superficial relationship to the painstaking efforts of Gregory, Paterson, and their colleagues. The author explained that the annual amount Scotland was projected to pay towards pre-existing English debts, "being computed at large in *Scotland*'s Favour, was found to amount towards 26536 lib. *Sterl.* yearly." Valuing this annual cost "at the highest Value of Publick Funds, tho in Perpetuity, *viz.* at 15 Years Purchase," the author determined that the Equivalent "could at most amount to 398085 lib."[158] These numbers were almost entirely imagined, concocted by the author to conform to his own assumptions. The Explainer assumed that the calculation followed a basic years'-purchase approach (it did not), and further assumed the valuation was done at a rate of 15 years' purchase (wrong again: the long-term rate the calculators used, when they needed it, was 15¼ years). He then back-solved to determine the annual amount that Scotland was projected to contribute to the English debts—supposedly £26,536 annually. None of those key assumptions accurately reflected the practices of the Committee of Six. (What is more, £26,536 was probably a

[155] [Daniel Defoe], *An Essay at Removing National Prejudices Against a Union with Scotland… Part I* (Edinburgh: *s.n.,* 1706), pp. 44-5.
[156] [Anon.], *The Equivalent Explain'd* ([Edinburgh?]: *s.n.*, [1706].
[157] [Anon.], *The Equivalent Explain'd* (1706), p. 1.
[158] [Anon.], *The Equivalent Explain'd* (1706), p. 1-2. Note the comment "tho in Perpetuity," which betrayed the author's uneasiness with using valuation rates for fixed-term public debts and applying them to perpetual burdens.

typographic error for £26,539, which is the value of £398,085 divided by 15.) In short, the *Equivalent Explain'd* explained the Equivalent through an almost complete computational fabrication. Yet it was a telling fiction all the same. The author assumed that the Equivalent followed familiar methods for placing present values on long-term streams of payments—the years' purchase approach, assuming a round multiplier of 15 years' purchase—most likely because he was not conversant in, or even acquainted with, the more advanced mathematics employed by Gregory and his colleagues.

Given that mutual intelligibility was so elusive among those who supported the Union, it is hardly surprising that opponents of Union found even more to disagree about when contemplating the Equivalent.[159] Opponents of the Treaty found any number of criticisms to level, many of which had little to do with the calculations themselves. The Country political theorist Andrew Fletcher, for instance, worried about whether the Scottish would actually get paid, given the vast disparity in Parliamentary representation proposed by the Treaty (45 MPs for Scotland to be added to the 513 existing for England and Wales). "It is very far above the Power of the Scots in that United Parliament," Fletcher worried, "to force the English to pay their Equivalent."[160] Another common criticism was that the Equivalent could not make up for the tremendous commercial cost incurred by dissolving the Company of Scotland and foregoing any future wealth it might have generated.[161] It was a compelling argument given the intensity of popular anger over Darien since the beginning of the century.[162] The most sweeping criticism was exemplified by Robert Wylie, who dismissed the notion that the Scots could ever be fully compensated for what they were giving up. "And how can

[159] See also: Spence, "Accounting for the Dissolution of a Nation," p. 387.
[160] [Andrew Fletcher], *State of the Controversy Betwixt United and Separate Parliaments* ([Edinburgh]: *s.n.*, 1706), p. 18.
[161] [Fletcher], *State of the Controversy* (1706), p. 17; [Anon.], *An Essay upon the Equivalent* (1706), pp. 5-6; [Roderick Mackenzie], *A Full and Exact Account of the Proceedings of the Court of Directors and Council-General of the Company of Scotland Trading to Africa and the Indies, With Relation to the Treaty of Union, Now Under the Parliament's Consideration* ([Edinburgh]: *s.n.,* 1706).
[162] Somewhat more iconoclastic, perhaps, was the argument that, insofar as it was a compensation for Darien, the Equivalent was "a Bargain that concerns that particular Society," namely the Company of Scotland, "and can never be understood or reckoned as an Equivalent to the Nation, for engaging in the Debts of England." See: [William Black?], *Some Considerations in Relation to Trade, Humbly Offered to his Grace Her Majesty's High Commissioner and the Estates of Parliament* ([Edinburgh?]: *s.n.*, 1706), p. 11. The authorship of this pamphlet is highly problematic. See Bibliography for further discussion.

the *English* ever give unto the *Scots* an Equivalent for their Resign'd Sovereignty, which can never be alienated by Delegates?" Wyllie wrote. "I believe some Merchants may be fond of that they call *Communication of Trade*, but what can they expect from it but Drudgerie under the *English*?"[163]

Several critics of the Union chose to take on the technicalities of the Equivalent directly. Daniel Defoe, a prominent pro-Union propagandist, reported that suspicion about the Equivalent gave rise to a flurry of critical computations within the Scottish Parliament itself beginning in October 1706. Defoe recounted that Treaty opponents railed against the "intolerable and unjust burdens" that the Union was going to place on the Scottish, and claimed that the Treaty's advocates "mocked them with the notion of an equivalent."[164] In response, Defoe recalled, Union critics had begun to try to create their own numbers to justify these charges that the Equivalent was fundamentally unfair or fell disproportionately among the Scottish people. "They pretended to make calculations upon the proportions of the said equivalent," Defoe wrote. "And some, indeed, brought in their own rough draughts of disproportions." This numerical chaos led Scottish MPs to desire to "enter upon more exact calculations, and examine the matters of fact," which led to the appointment of a special Parliamentary committee for examining the calculations within the Treaty.[165] The MPs sought even more outside help, in the form of "two very able accomptants, or arithmeticians," Dr. James Gregory, Professor of Mathematics at Edinburgh—David's brother—and Dr. Thomas Bower, Professor of Mathematics at Aberdeen.[166]

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163 [Robert Wylie], *A Letter Concerning the Union, with Sir George Mackenzie's Observations and Sir John Nisbet's Opinion upon the Same Subject* ([Edinburgh?]: *s.n.*, 1706), p. [6].
164 Daniel Defoe, *A History of the Union between England and Scotland*, Later Edition (London: Printed for John Stockdale, 1786 [1709]), p. 296.
165 Defoe, *History of the Union* (1786 [1709]), p. 296.
166 Defoe, *History of the Union* (1786 [1709]), p. 296-7. See also: *Minuts of the Proceedings in Parliament*, Nos. 6-8, 19-23 October 1706 (Edinburgh: Printed by the Heirs and Successors of Andrew Anderson, 1707). Interestingly, Thomas Bowar appears to have been granted the Professorship at Aberdeen earlier in 1706, over James Gregory. The latter had attracted a fair amount of attention for the position, perhaps by virtue of his surname. In May 1706, Archibald Pitcairne wrote to the Earl of Mar asking Mar to endorse Bower for the Aberdeen chair over the younger Gregory, writing that: "Our education is more than ruin'd already by raw, ignorant boys, and that it makes not one sufficient for a mathematical professor by having the surname of Gregorie, Dr. Gregorie is my worthy friend, but I hate monopolies." (Dr. Pitcairn[e] to the Earl of Mar, 10 May 1706, HMC *Mar & Kellie*, p. 261).

In early December, with the assistance of the two professor-auditors, the "Committee for Examining the Calculation of the Equivalent" (not to be confused with the original Committee of Six who did the calculation) reported to the broader MPs that "they find that the Computation of the Equivalent mentioned in the Article is just, and that the Calcul is exact."[167] But this process of peer review did not forestall other public calculators from publishing their own computational critiques. One line of argument gained particular momentum, namely the idea that Equivalent was nothing more than a short-term loan to be repaid in a relatively short term of years, with no great value to the Scottish people.[168] In a short but computationally sophisticated pamphlet entitled *An Essay upon the Equivalent*, one author presented a precise, step-by-step table showing that the Equivalent would be repaid in 13 years according to the rules of compound interest.[169] The author assumed 6% interest, and that the Scots would be effectively paying £44,697 annually in Customs and Excise toward the English National Debt, per the *Minutes* of the Treaty Commissioners.[170] The author walked year-by-year through the repayment, deducting £44,697 from the outstanding balance each year, and then adding the 6% interest to the interim total to determine a new year-end balance.

This clever argument in the *Essay upon the Equivalent* demonstrated how the complex Equivalent calculation could be read in very different ways, dependent on the assumptions of the reader. The *Essay* assumed a 6% interest rate, rather than the 6.55% assumed by the Equivalent calculators. It also did not acknowledge, as the Equivalent calculators did, that many of the taxes the Scottish would be taking on were expected to end in 1710.[171] But these minor considerations were far less important than what was a far more significant interpretive choice the author of the *Essay* made—simply, the choice to *think about* the Equivalent as a loan. To a modern eye, the author of the

[167] *Minuts of the Proceedings in Parliament* [Scotland], No. 34 (7 December 1706).
[168] See also: Spence, "Accounting for the Dissolution of a Nation," pp. 385-6.
[169] [Anon.], *An Essay upon the Equivalent* (1706), pp. 7-8.
[170] For the relevant figures, see *Minutes of the Proceedings of the Commissioners* (1706), pp. 66-7.
[171] Not recognizing the different tax lifespans did make it seem like the Equivalent would be "repaid" especially quickly.

Essay was carrying out almost the same kind of compound-interest calculation that the Equivalent calculators themselves had done, but in reverse. Both were using compound-interest mathematics to translate streams of future payments into present sums, or vice versa. But in 1706, the gestalt-switch between using compound interest to turn future into present, on the one hand, and using compound interest to turn a present into future, on the other, was not easily reversible.

Such problems of financial translation were even more evident in *Some Considerations in Relation to Trade*, often attributed to William Black but possibly the work of (or with the assistance of) Andrew Fletcher, which also attempted to deconstruct the lump-sum of the Equivalent into a kind of loan.[172] The pamphlet concluded with a table entitled "A Stated Accompt, by which it appears, that the Sum of 398085 lib. 10 sh. *Sterling*, given by *England* to *Scotland* as an Equivalent for engaging to pay their Debts, is repaid by *Scotland* with Interest at 6 per cent. per annum, in less as Eleven Years."[173] (See **Figure 2e** below.) The author (Black/Fletcher) took a different computational approach than the author of the *Essay,* setting up a double-entry or "debitor-creditor" style account. Strikingly, Black/Fletcher assumed not compound interest, but *simple interest*. On the "Debitor" side of the account was how much Scotland would *get* from the Equivalent: the £398,095.10*s*. the Scottish would get upfront, plus 11 years of 6% on that sum (£23,885 per year for 11 years, or £262,736 total). The total "Debitor" side was £660,821. The "Creditor" side was the value of what Scotland had to *pay* for the Equivalent. This amounted to £44,697 yearly for 11 years, or £491,667, plus the amount that the English could earn over that period on the yearly payments the Scottish made. So the value of the first year's payment of Scottish taxes was not just £44,697, but that

[172] As discussed in the bibliography, the attribution of *Some Considerations* is highly questionable. There is strong manuscript evidence that Fletcher either helped produce the key debt-repayment calculation in *Some Considerations*, or at the very least read it and considered it very carefully. In the Fletcher of Saltoun papers, the main calculation is reproduced *exactly*, under the title "A Calcull How the Equivalent of 398085.10.0 is Exhausted," reproducing the debitor-creditor form (though sequentially not side-by-side). The calculation looks like a working calculation, not a straight reproduction from another source, which suggests that either Fletcher played a hand in making it, or had access to it from the author prior to publication. For the manuscript calculation, see: Fletcher of Saltoun Papers, NLS MS 17,499, f. 144.

[173] Black?, *Some Considerations* (1706), p. 15.

amount plus 11 years of 6% (simple) interest, or an additional £29,500. (The second year's payment was worth £44,697 plus 10 years of 6% interest, and so on). After 11 years, the total "Debitor" side added up to £668,667, more than repaying the total upfront value of the Equivalent (£660,821).

***Scotland* is Debitor**	*Lib. St.*	*sh.*	*d.*
Paid so much by *England*	398,085	10	
11 Years Interest at 6 *per Cent*.	262,736	8	5
	660,821	18	5
***England* is overpaid**	**7,845**	**1**	**7**
	668,667	**0**	**0**

***Scotland* is Creditor**				
"So much payable Yearly by *Scotland*":				*Lib. St.*
Out of the Customs	23,761			
Out of the Excise	20,936			
"In all"	44,697			
"For 11 Years… the principle"				491,667
"11 Years Interest of our first Years Payment, at 6 *per Cent*."	29,500	0	0	
"10 Years Interest of 2d. ... Payme	26,818	3	9	
"9 Years of the 3d. Payment"	24,136	7	4	
"8 Years of the 4th. Payment"	21,454	11	0	
"7 Years of the 5th. Payment"	18,772	14	7	
"6 Years of the 6th. Payment"	16,090	18	2	177,000
"5 Years of the 7th. Payment"	13,409	1	10	
"4 Years of the 8th. Payment"	10,727	5	4	
"3 Years of the 9th. Payment"	8,045	9	?	
"2 Years of the 10th. Payment"	5,363	12	9	
"1 Years of the 11th. Payment"	2,681	16	4	
Total				**668,667**

Figure 2e. Table, Adapted from the "Stated Accompt, by which it appears, that… [the Equivalent] is repaid by *Scotland* with Interest at 6 per cent. per annum, in less as Eleven Years," in Black, *Some Considerations* (1706), p. 15. The same calculation is found in: "A Calcull How the Equivalent of 398085.10.0 is Exhausted," Fletcher of Saltoun Papers, NLS 17,499, f. 144.

Crawford Spence observes that, in the use of a simple-interest calculation in *Some Considerations* to analyze the compound-interest (or "discounted cash flow") calculations in the Equivalent, "like was therefore, not being contested with like." The mismatch, Spence suggests, provides evidence "that the financial mathematics underpinning the Equivalent may have been sufficiently complex as to perplex most opponents of the union."[174] The complications went deeper than just perplexity or lack of expertise on the part of the anti-Unionists, though. Rather, the mistranslations and indeterminacies involved in the public readings of the Equivalent were indicative

[174] Spence, "Accounting for the Dissolution of a Nation," p. 386.

of deeper uncertainty surrounding the nature of financial value and how to calculate it amidst Britain's financial revolution. Was compound interest really a better way to interpret the Equivalent "repayment" than simple interest? What did it mean to think about the Equivalent as a loan to be repaid, rather than a fund for national improvement? Was it better to think in terms of familiar years'-purchase techniques, or new algebraic ones? Was a 98-year annuity really worth almost as much as a perpetuity? Part of what made the Equivalent so confusing to so many was that there were not standard or familiar answers to these questions. The Equivalent calculators were making an argument about what the answers were, not relying on common wisdom. And that, indeed, was one of the biggest questions of them all. Who was it that should be answering these questions?

V. Conclusion: "It is Not Arithmetick Only That Can Make a Man Understand"

As they went back and forth arguing about the accuracy of the Equivalent calculations and the efficacy of Union policies for Scottish commerce, dueling pamphleteers wrestled with the question of who was qualified to speak on such matters. Critics of the Union produced many calculations to dismantle and discredit the Equivalent and other fiscal implications of the Union Treaty, but they also found that doing so made them subject to numerical pummeling of their own. William Black (possibly with Fletcher) felt this especially poignantly.[175] The diligent arithmetical criticisms he had made about the Equivalent and the impact of higher taxes in Scotland were classed as "Misrepresentations, and ill grounded Jealousies" by a sharp-witted computational opponent, probably James Donaldson.[176] The latter developed crafty, if somewhat disingenuous, computations

[175] In addition to Black, *Some Considerations*, see Black, *Short View of our Trade and Taxes* (1706).
[176] Donaldson, *Considerations in Relation to Trade Considered* (1706), p. 3. On the attribution of this pamphlet, see P. N. Furbank and W. R. Owens, "Defoe and the Tippony Ale," *The Scottish Historical Review* 72, no. 193, Part 1 (Apr., 1993): 86-89.

of his own, intended to point out holes in Black's reasoning.[177] Ultimately, Donaldson's agenda was not so much even to provide a legitimate argument about the economic benefits of the Union, but to make Black look bad, and tar him with the brush of misrepresentation. Donaldson's great conclusion was that: "Whatever skill our Author [Black] may have in matters of his own vocation, he seems to be no great Mathnmatitian (*sic*)."[178]

Black shot back with yet another pamphlet, in which he tried to call Donaldson to account for his computational trickery. Black pointed out that, in giving "his Judgment upon these Papers," his combatant had "pass[ed] by the several Heads contin'd in them, which I think is the Substance," instead going straight for "the Calculs."[179] For Black, the numbers were only part of his message, not the message himself, and for Donaldson to treat them as such was simply dishonest. But this did not mean Black ceded the numerical ground entirely; one did not have to be a "great Mathnmatitian" to speak political truth with numbers. Here, Black echoed a kind of "Country" approach to computation, reminiscent of Davenant's early writings and no doubt influenced by the Scottish brand of "Country" political rhetoric characteristic of Andrew Fletcher. Black encouraged his opponent to take a closer look at the real meaning of his figures: "If he takes a second View (tho the Author [Black] be no great Mathematician) he will find that all these are as real as his Imaginary Mathematical Calculs."[180]

It seems Black and Donaldson might have gone on forever arguing, in large part because the questions were so undetermined and the rules of engagement so lax—a dynamic that will be explored in greater detail in Chapter 3. Yet beneath what appeared to be a highly unproductive form

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[177] Donaldson, *Considerations in Relation to Trade Considered* (1706), pp. 13-14. Donaldson in particular challenged Black's claim that aggregate Customs and Excises paid by Scotland would increase dramatically under the imposed Union rates. ([Black], *Some Considerations* (1706), p. [16])
[178] Donaldson, *Considerations in Relation to Trade Considered* (1706), p. 14. The misspelling of "mathematician" is noteworthy.
[179] [William Black], *Remarks upon a Pamphlet, Intitled* The Considerations in Relation to Trade Considered, and a Short View of Our Present Trade and Taxes Reviewed. ([Edinburgh?]: *s.n.,* 1706), p. [1].
[180] Black, *Remarks upon a Pamphlet* (1706), p. 3.

of argumentation was an argument about the very nature of political calculation. For the anti-Unionist Black, like for the computational critic Charles Davenant, calculation proved a vital tool for critiquing and undermining the supposedly authoritative claims made by those in power. It was not so important that the computations themselves were unassailably certain, as for Black the mathematics came second to the message. For the pro-Union Donaldson, it was enough to show that naysayers like Black did not know what they were doing when it came to the calculations. After all, the pro-Unionists already had their own set of authoritative computations to rely on, those that created the Equivalent. What Donaldson needed to show was that the nation was better off forgetting the uninformed and misrepresentative numbers produced by critics, and leaving the calculating to the mathematicians.

The argument over the Equivalent, therefore, were not about just whether the numbers were correct, but what made financial numbers correct and, critically, who within the polity had the right to make claims on correctness. The notion that the calculating should be left to the experts was an unsettling conclusion for many, even for some in support of Union. For instance, Daniel Defoe, Robert Harley's man-on-the-ground in Edinburgh, worried that Paterson's computational elitism had just become too much to handle. Defoe explained to Harley on November 26 that he had been called before the Scottish Parliamentary committee examining the Equivalent, "where I understand Mr Paterson is to be also." While admitting he had not seen much of Paterson in action yet, Defoe relayed that had not heard good things about him: "that Gentleman is full of Calculates, figures and Unperforming Numbers, but I see nothing he has done here nor does any body Elce speak of him but in Terms I Care not to Repeat."[181] A more poignant, and less snarky, reflection on the problem was offered by David Nairne, Secretary to the Scottish Union Commissioners and, with Paterson and David Gregory, the third Scottish member of the Committee of Six calculators. In a November

[181] Daniel Defoe [to Robert Harley], 26 November 1706, Letter no. 69, in *The Letters of Daniel Defoe,* ed. George Harris Healey (Oxford: Clarendon Press, 1955), pp. 160-162.

1 letter from London to the Earl of Mar in Edinburgh, where there was public rioting against the pending Union Treaty, Nairne lamented how many Scots seemed unable to understand the tremendous commercial benefits they were going to receive from the Union. "For my part I am convinced," Nairne asserted, "if that very particular were understood it would turn the mob on the other side."[182] In particular he worried that the very technicality of the Equivalent had so confounded people that it hindered support for the Union. "This leads me to regrait that Dr. Gregorie was not there about the Equivalent," Nairne lamented.

But Nairne admitted that even he was not sold on the idea that such vital questions about Scotland's commercial future should be delegated to experts like Paterson or Gregory. "These two may be men of letters and figurs," he noted, "but if they are not acquented with… the practicall part of business and even the custome of this place soe that they know the grounds upon which things were done, its impossible they can understand what they are about."[183] The commitment of both men to the governance of mathematics left them out of touch with commercial and political realities, in particular those specific to Scotland itself. Nairne cited that most telling example, namely the problem of valuing "anuitys at soe many years purchase." Nairne admitted he did not share his colleagues' comfort with the idea that fixed-term or life annuities (that is, annuities that expired on the death of their owner or owners), however long their horizon, were really priced "too low" in the public markets, and instead ought to be thought of as worth almost as much as "perpetuitys." Paterson, it appears, had continued to press the patronizing point from the *Inquiry* that the public consistently undervalued long-term annuities, pricing them around 15 ½ years' purchase rather than 20: "Mr. Paterson will help to confound this for he talked of 20 per cent. (*sic*) when the daily practise

[182] Nairne to the Earl of Mar, 1 November 1706, HMC *Mar & Kellie*, p. 307.
[183] Nairne to the Earl of Mar, 1 November 1706, HMC *Mar & Kellie*, p. 307.

on the Exchange is 15 ½."[184] Whatever "there notion or there reason or the practise of other countries may make them [Paterson and Gregory] think anuity[s]… are too low," Nairne explained, that was not how things were done in Scotland, or even perhaps in London. Whatever the math said, "All that are here know that they are full price."[185]

Nairne then offered a most telling comment. "So your Lordship may easyly judge from this," he wrote to Mar, "it is not arithmetick only that can make a man understand the equivalent."[186] That is, the problems that made the Equivalent difficult to understand went far deeper than simply the intricacies of the arithmetic. They were matters of theory, even belief. To accept that a 99-year annuity ought to be worth almost exactly the same amount as a perpetual one was not just a question of doing the mathematics. It was a question of believing what the mathematics said—or, more precisely, believing the people who said what the mathematics said—over custom and experience. In 1706, that seemed to some like a pretty radical idea.

The Act of Union was ultimately approved by the Scottish Parliament on January 16, 1707 (and in England shortly thereafter). This was not until the Treaty had undergone substantial and drawn out debate in the Parliament, including on Article XV, whose complicated clauses took multiple sessions to work through. (The first clause was approved December 7; the second, third, fourth, and sixth on December 26; the seventh clause, which concerned the actual calculation of the £398,085.10*s*., took even longer).[187] The intensity of the consideration of Article XV, within the Scottish Parliament and without, makes it hard to argue that the calculations were understood by the

[184] Nairne to the Earl of Mar, 1 November 1706, HMC *Mar & Kellie*, p. 307. "Per cent." here is clearly an error, and should be read as "years' purchase" instead.
[185] Nairne to the Earl of Mar, 1 November 1706, HMC *Mar & Kellie*, p. 307. It is unclear based on the context of the letter whether Nairne was talking about London, where he was writing from, or Scotland, which was the proximate topic of conversation.
[186] Nairne to the Earl of Mar, 1 November 1706, HMC *Mar & Kellie*, p. 307. Douglas Watt quotes this line from Nairne as an evidence that those involved with the calculation, like Nairne, acknowledged that the Equivalent was not in fact the consequence of rigorous computation, but instead a "negotiated" figure. This is a misreading of Nairne's message.
[187] Young, "Scottish Parliament and the Politics of Empire," p. 188.

Scots and their political representatives as either automatic or unimportant.[188] While the disputes about the technical calculation of the Equivalent did not ultimately affect the final number, £398,085.10*s.*, public protests and the critical efforts of economic polemicists did motivate at least one pivotal revision to the Treaty, a special adjustment to the rates at which Scottish ale was taxed under the new Excise system.[189]

Many politically-attentive Scots probably never came around to the legitimacy of the Equivalent calculation, nor understood its most basic technicalities, nor felt comfortable with the elitist message it carried. Yet it seems likely that the Equivalent, and the debates about it, helped to make that latter idea—that better calculation made a better nation—slightly more present, or slightly more unavoidable, in British political culture. For one, the debates over the Equivalent forced open debate about many of the rather technical points involved in that calculation, debates which may well have increased general familiarity with the kinds of mathematics involved. The Anglo-Scottish "Equivalent" no doubt gave new significance and energy to the generic concept of an "equivalent," and the idea that different economic objects and enterprises might be compared to one another in commensurable terms through calculation. In 1719-20, for example, an anonymous pamphleteer would propose a radical scheme to deal with Britain's National Debt, whereby the government would sponsor a series of semi-governmental monopoly companies to control effectively all of the nation's trades, natural resources, and overseas possessions, and use the shares of those companies

[188] It is worth noting the substantial power that was placed in the hands of the Parliamentary Committee appointed to examine the Equivalent calculation, and the influence of that Committee on the passage of the Treaty during the crucial months of late 1706 and early 1707. Young points out that the Committee was dominated by the so-called *Squadron Volante*, a 25-strong political faction whose support was crucial the Treaty's ultimate approval. (Young, "Scottish Parliament and the Politics of Empire," pp. 187-190.)

[189] English Excise protocols specified two different tiers of Excise taxes on beer and ale, based on the strength (alcohol content) of the drink in question. Scottish brewers generally brewed their "two-penny" or "tippony" ale to a strength somewhere in between the two levels common in England. Under English Excise procedures, the standard Scottish drink would have been subject to the higher of the two Excise rates, which was felt by many Scots to be heavily punitive. Negotiations led to the creation of a third, intermediate tier of taxation for Scottish ale. This was among the issues at play in the debate between Black and Donaldson, and was touched upon in writings by Defoe. On these issues, see: Daniel Defoe to Robert Harley, [13?] November 1706, Letter no. 62, *Letters of Daniel Defoe*, ed. Healey, pp. 145-7; Defoe to Harley, 22 November 1706, Letter no. 67, in *Letters of Daniel Defoe,* ed. Healey, pp. 155-8; Furbank and Owens, "Defoe and the Tippony Ale"; Bowie, *Scottish Public Opinion*, pp. 136-7, 157.

to repay the National Debt. The name of that pamphlet: *An Essay for Discharging the Debts of the Nation, by Equivalents.*[190]

Even more importantly, the ratification of the Equivalent as part of the Union Treaty created a kind of massive mathematical legacy project for the new British government to deal with. Endless practical and interpretive problems arose regarding how actually to institute the Equivalent.[191] Paying it was proved even harder than calculating it.[192] Many Equivalent creditors, people who had claims on the Equivalent payments went unpaid for a decade and more. A particular collection of such Equivalent creditors (or, more accurately, speculators who had bought up the Equivalent claims of others) earned the right to incorporate as the "Equivalent Company" in 1718.[193] Three years later cut a Parliamentary deal to begin a new banking business in Scotland.[194] That enterprise, Royal Bank of Scotland, still exists. Paterson's Equivalent Scheme did, in an unanticipated way, lead to a further financialization of Scottish commerce. Furthermore, the endless frustrations wrought by the Equivalent became a kind of creative force of their own in British

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[190] [Anon.], *An Essay for Discharging the Debts of the Nation, by Equivalents: In a Letter to The Right Honble Charles, Earl of Sunderland. And the South-Sea Scheme Consider'd* (London: Printed for J. Noon… J. Roberts… and A. Dodd, 1720).

[191] One of the more adventurous claims made in the Union Treaty concerned a so-called "rising Equivalent," a promise that, if Scottish Excise and Customs taxes turned out to exceed the levels projected in the original Equivalent calculation, they would be refunded to the Scottish. This proved basically impossible to administer, and no rising Equivalent payments were ever made. (See, for example, Spence, "Accounting for the Dissolution of a Nation," pp. 387-9; "To the Rt. Honble. The Noblemen Barons and Commissioners for Borroughs Representing Scotland in the Parliament of Great Brittain, 'The Memorial and Representation of the Commissrs. of the Equivalent,'" [1712-13?], RBS EQ/23/5). At one point at least, it seems like the alternate argument was also made: the Scottish should potentially be required to refund some of the Equivalent because the Customs and Excise revenues from Scottish territories were falling short of the Equivalent estimates. See, for example, "Memorial About the Equivalent," 1711, RBS EQ/23/1.

[192] For a contemporary discussion of the complications of actually distributing the Equivalent, and arguments over whether it ought to be paid in specie or other forms of credit, see [James Smollett?] to [?], late 1707, Ogilvy Papers, NAS GD205/36/13. See also, Watt, *Price of Scotland*, p. 241.

[193] On the matter of after-market speculation in Equivalent debts, note, for example: In January 1721, while under investigation for his role in the disastrous South Sea Scheme, South Sea Company cashier Robert Knight provided a summary of the holdings in his estate, which included £3,000 in "Equivalent Stock." This was larger than his holdings in either the Bank of England or East India Company. (Minutes of the Court of Directors of the South Sea Company, Vol. 6, entry for 23 January 1720/1, BL Add. MS 25,499, f. 135^{v}.)

[194] The Equivalent Company met with continued resistance from the Bank of England, who worried about encroachments on their banking rights. The banking privileges of the Equivalent Company/Royal Bank of Scotland were ultimately restricted to Scotland only. On such arguments, see, for example: "Memorial Concerning the Opposition offered by the Bank of England to the Draught of a Warrant for a Charter to Incorporate the Proprietors of the Scots Equivalent Debentures, Referred by the Right Honourable the Commissioners of the Treasury to His Majesty's Attorny General July 1719," Taylor Collection, NLS MS 68, ff. 12-19.

governmental culture, touching the careers of many of the players in the political numbers game for years to come. A Parliamentary Committee composed in 1715 to look into the inadequate management of the Equivalent numbered among its members William Lowndes, John Aislabie (who would be Chancellor of the Exchequer during the South Sea Scheme), David Dalrymple (Lord Advocate of Scotland), Robert Walpole, and Archibald Hutcheson, to name only a few.[195]

Some people, indeed, found careers more directly touched by the "Great Project of the Equivalent. Doctor David Gregory, for instance, was awarded command over the Scottish Mint—no small honor, given that the comparable job in England had once been given to Isaac Newton. But perhaps the person whose political career was most directly shaped by the novel Equivalent project was a Scottish commercial accountant who had, by 1706, made a minor name for himself as a book-keeping expert for the Livorno Company and the English army. His name was John Crookshanks. Following the Union, Crookshanks found a new job helping to integrate the Scottish taxation system into the English. By late 1708, the Customs Commission in London became so frustrated trying to make sense of the "great Backwardness and Confusion" in the Scottish Customs records, that they requested that the Lords of the Treasury promote Crookshanks, "who hath the Character of a very knowing able & Experienced Accomptant," into a new position as Accountant General of the Customs for all of Britain, relocating him to London.[196] Crookshanks continued to be deeply involved in working out the fiscal complications of the Union through the next decade. These included proposing new methods for cutting down on tax evasion in the vital Scottish tobacco trade, and in managing and explaining the ongoing problem of the "Equivalent," a matter

[195] "A List of the Committee upon the Equivalent," 1715, RBS EQ/23/5. The complications that arose concerning the Equivalent in 1715 are also discussed in [Sir David Dalrymple] to [Hugh Dalyrmple] (unsigned), 23 August 1715, Hamilton-Dalymprle Papers, NAS GD110/1254/8.
[196] Presentment of the Commissioners of the Customs, 27 November 1708, NA T 1/110, f. 126. See also: Commissioners of the Customs of North Britain to John Crookshanks, 30 December 1708, NA T 1/110, ff. 226-7.

which, in Crookshanks's own words, "at that time very few understood."[197] Crookshanks's command over the "intricate Affair" of the Equivalent was vital to earning the favor of a variety of key Whig politicians in the 1710s, from the Earl of Halifax, to David Dalrymple, to Robert Walpole, and to making him one of the Whig's favored pundits on matter of "Trade and Revenue."[198]

It would be too much to argue that it was the Equivalent that gave the savvy accountant Crookshanks the idea that, as he put it in a 1718 pamphlet, "Truth and Numbers are always the same."[199] But the experience with the Equivalent did clearly shape his financial thinking. In his 1718 *Seasonable Remarks*, for example, he severely criticized his nemesis Archibald Hutcheson for claiming that £120,000 in annual public revenues that was redirected to cover the Civil List was effectively a £2.4 million addition to the National Debt, claiming that Hutcheson did not have sufficient evidence even to support the £120,000 annual figure, let alone the £2.4 million present value. "I am surpriz'd," Crookshanks jabbed, "that he should have determin'd a certain Equivalent for an uncertain Sum."[200] Moreover, it also would not be overreaching to suggest that it was the Equivalent that put Crookshanks in a professional position even to be talking publicly about "Truth and Numbers" at all. The "Great Project of the Equivalent" created a great need for people who could make sense of the kinds of calculations that went into it, even if very few understood or even agreed with the claims of those calculations in the first place. The Equivalent needed the likes of John Crookshanks—highly knowledgeable mercantile minds with great command of financial mathematics—and created new places for those kinds of people within the day-to-day operations of British government. It seems that Paterson got his wish after all.

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[197] "Case and Petition of John Crookshanks," in CamUL, Ch(H) Letters 1415; "North Britain: An Account of the Tobacco Imported and Exported since the 1st May 1707 to the 29 Septemr. 1711," 15 November 1711, NA 1/139, f. 102; Price, "Glasgow, the Tobacco Trade, and the Scottish Customs," p. 11.
[198] "Case and Petition of John Crookshanks," in CamUL, Ch(H) Letters 1415, no foliation.
[199] See "Introduction," p. 1.
[200] [John Crookshanks], *Some Seasonable Remarks on a Book Publish'd in the Month of July, 1718* (London: *s.n.*, 1718), p. 7.

– CHAPTER 3 –

A CALCULATED BALANCE

International Trade, Party Politics, and Economic Epistemology in 1713

In its very first issue in May 1713, the polemical trade newspaper *Mercator* optimistically asserted the power of numerical facts to settle political controversy. The paper, backed by the incumbent Tory ministry and written largely by Charles Davenant and Daniel Defoe, was founded to defend government efforts to negotiate more open trade with France in the aftermath of the War of Spanish Succession.[1] The *Mercator* sought to overturn what it saw as a widespread misconception that trading with France made Britain poorer according to the principle of the "balance of trade." The key to discrediting "these false Glosses and Misconstructions," the *Mercator* explained, was a "plain Recital of Fact," especially in numbers. Freer trade with France would benefit national wealth because England stood to earn more from the exports it sent to France than it paid for goods imported from its traditional enemy. All it took to see this was a careful numerical calculation. "Take a Medium of any three Years for above forty Years past," Davenant and his collaborators instructed, "and calculate the Exports and Imports to and from *France*, and it shall appear, the Balance of Trade was always on the *English* side."[2]

The *Mercator*'s computational promise was reminiscent of the self-assured numerical proclamations offered by William Paterson in his discussions of the Equivalent in 1706 and by Davenant himself in his 1690s exercises in Country political arithmetic. But the claim in *Mercator* no. 1 was remarkable, both for its confidence and its consequences. To begin, it was a massive

[1] Robert Harley, nominally "Whig" but Country-minded in the 1690s, had held key positions as Speaker of the House of Commons and Secretary of State in a the Whig government under Godolphin and Marlborough in the early years of the 1700s, before falling out with those two and resigning from his governmental posts in 1708. Thereafter he was a key leader of the Tory opposition, rising to Chancellor of the Exchequer in 1710. Harley became Lord Treasurer (as Earl of Oxford) and effective first minister in 1711, after a major electoral victory in late 1710 secured control for the Tories. Davenant's partisan trajectory followed Harley's rather closely, and indeed Davenant remained a key publicist for Harley throughout the early 18th century.

[2] *Mercator*, no. 1 (May 26, 1713), recto.

argumentative bluff. At the time it was published, the Tory calculators did not in fact have a clear set of numbers that justified the claims they were making, claims that contradicted basically all of the *prima facie* evidence accumulated over the previous half-century. The *Mercator*'s assertion about the calculation of the balance of trade was more a statement of the possibilities of quantitative economic analysis than of its achievements. Yet those numerical aspirations—as had so often been the case—proved hard to realize. In the ensuing year, the *Mercator* had struggled mightily to convince Britons of the benefits of Anglo-French trade, never producing the definitive calculation it had initially promised. Tory analysts discovered that the kind of calculation that they envisioned was not necessarily the kind that other concerned political observers desired or were willing to accept. The *Mercator*'s Whig opponents also claimed that they could settle the question of the French trade with calculations of their own, which followed very different standards from those of the *Mercator*. What resulted was a protracted and vicious public dispute over the interpretation of economic statistics, which distilled and magnified the major political-epistemological problems at issue in the previous quarter-century of computational combat. The fight was not only between two competing economic ideologies or agendas, but two competing notions of what made economic knowledge; it was a dispute as much about what numbers *could* say, as about what they said. This chapter is a story of that clash—and how it consolidated the place of numbers in British politics.

The debate in question concerned a pending Treaty of Commerce that proposed to effectively eliminate tariff barriers between England and France. The Tory government under Robert Harley (now Lord Oxford) wished to establish freer Anglo-French trade as part of the Peace of Utrecht, which was to end the second of two nearly decade-long wars with France. The contest over the Treaty of Commerce played out on different planes, and scholars have told a variety of disjoint stories about what was at stake. For one, the question of Anglo-French trade was one of many highly contentious and visible partisan conflicts fought out at the peak of Whig-Tory tensions

in the years between the 1710 Sacheverell affair and the coronation of King George I in 1714. Scholars have noted that the Treaty controversy was a high-water mark of Whig-Tory tactical maneuvering, a veritable "set-piece of expert political sabotage and recovery."[3] The fate of the Treaty promised to tip the balance of power between the two parties, and thus had profound ramifications for the era's great partisan controversies: the terms of the Anglo-French peace, the future of the Anglo-Scottish Union, the security of the Church of England, and most especially the royal succession.[4] Party conflicts were fought out not only in Parliament, but in the burgeoning and ruthless political press.[5] At that moment, partisan hatred and distrust burned so intensely that many Whigs seemingly would have stood up against any position held by a Tory, and vice versa, regardless of whether the question at issue had any bearing on deeper ideological conflicts. But the apparently petty and slanderous nature of political conflict at the moment were also empowered by the extremely high political stakes that many felt were at play, stakes no less than the continued success and meaning of the 1688 Revolution itself.[6]

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[3] Perry Gauci, *The Politics of Trade: The Overseas Merchant in State and Society, 1660-1720* (Oxford and New York: Oxford University Press, 2001), ch. 6, quotation on p. 234. See also: Geoffrey Holmes and Clyve Jones, "Trade, the Scots, and the Parliamentary Crisis of 1713," *Parliamentary History* 1 (1982): 44-77, esp. pp. 50-1, 61-4; B. W. Hill, *Robert Harley: Speaker, Secretary of State and Premier Minister* (New Haven: Yale University Press, 1988), ch. 15.

[4] On the "rage of party," see Geoffrey S. Holmes's magisterial *British Politics in the Age of Anne* (London & New York: Macmillan/St. Martin's, 1967). See also: Geoffrey Holmes, "The Sacheverell Riots: The Crowd and Church in Early Eighteenth-Century London," *Past & Present* 72 (Aug., 1976): 55-85; Holmes and W. A. Speck, eds. *The Divided Society: Parties and Politics in England 1694-1716* (London: Edward Arnold, 1967); Speck, *Tory & Whig: The Struggle in the Constituencies* (London/New York: Macmillan/St. Martin's, 1970); Gary Stuart De Krey, *A Fractured Society: The Politics of London in the First Age of Party 1688-1715* (Oxford: Clarendon Press, 1985); Halliday, *Dismembering the Body Politic*, chs. 8-9; John Miller, *Cities Divided: Politics and Religion in English Provincial Towns, 1660-1722* (Oxford et al.: Oxford University Press, 2007), chs. 12-13.

[5] J. A. Downie, *Robert Harley and the Press: Propaganda and Public Opinion in the Age of Swift and Defoe* (Cambridge et al.: Cambridge University Press, 1979), esp. ch. 8; P. B. J. Hyland, "Liberty and Libel: Government and the Press during the Succession Crisis in Britain, 1712-1716," *English Historical Review* 101, no. 401 (Oct., 1986): 863-888; Heinz-Joachim Müllenbrock, *The Culture of Contention: A Rhetorical Analysis of the Public Controversy about the Ending of the War of Spanish Succession, 1710-1713* (Munich: Wilhelm Fink Verlag, 1997).

[6] Mark Knights writes that the trial of the High Church cleric Henry Sacheverell in 1710 demonstrated that the Revolution of 1688 was "not a revolution complete but a revolution that was still contested 20 years after its central event of the flight of one king and the crowning of another." The nature and stakes of factional conflict during and following the 1710 Sacheverall Affair have been recently appraised in a special issue of *Parliamentary History* 31, no. 1 (Feb., 2012), entitled *Faction Displayed: Reconsidering the Impeachment of Dr Henry Sacheverell*, ed. Mark Knights. See in particular: Knights, "Introduction: The View from 1710," pp. 1-15, quotation on p. 2; Brian Cowan, "The Spin Doctor: Sacheverell's Trial Speech and Political Performance in a Divided Society," pp. 28-46.

Yet scholars have also understood the controversy over the Commerce Treaty in terms of more sweeping economic and intellectual trajectories, rather than the more momentary concerns of party politicking. Perry Gauci has recently cited the 1713 debate as a landmark moment in an emergent, mutual relationship between commerce and governance in Britain, signaling the coming-of-age of trading interests as voices in the determination of public policy.[7] More traditionally, historians have pointed to the 1713 debate as a climactic moment in the development and formalization of eighteenth-century *mercantilist* political economy, which also, according to some, marked the death-knell for a forgotten seventeenth-century tradition of free-trade liberalism.[8] The ascendance of the mercantilist way of thinking was evident in one imperative that obsessed writers and representatives on both sides of the Treaty debate—the need to maintain a positive national "balance of trade." Long recognized as one of the unifying principles of mercantilism, the balance-of-trade concept translated the mechanics of mercantile accounting to the transactions between nations: like a trader who bought more than he sold, a nation that imported more than it exported had to make up the difference in specie money, decreasing its real wealth. Though they disagreed on where certain trade-balances stood and how best to ameliorate them, it seemed that Whigs and Tories in 1713 agreed on this "fundamental maxim" of the "mercantile system," which Adam Smith would later rail on as being "intricate" yet also "embarrassing" and "fruitless."[9]

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[7] Gauci, *Politics of Trade*, ch. 6.

[8] The collected writings in the Whig newspaper the *British Merchant*, a response to the *Mercator* begun in August 1713, are especially described as having "long served as a text-book of mercantilist economics." (G. N. Clark, *Guide to English Commercial Statistics,* 1696-1782 (London: Office of the Royal Historical Society, 1938), p. 18). On mercantilist theory, and the role of the 1713 debate thereupon, see: Eli Heckscher, *Mercantilism*, trans. Mendel Shapiro, Revised 2nd Edition, 2 Vols. (London: George Allen & Unwin, 1955 [1931]); E. A. J. Johnson, *Predecessors of Adam Smith: The Growth of British Economic Thought* (London: P. S. King & Son, 1937), esp. ch. 8; D. C. Coleman, "Mercantilism Revisited," *The Historical Journal* 24, no. 4 (Dec., 1980): 773-791; Andrea Finkelstein, *Harmony and the Balance: An Intellectual History of Seventeenth-Century English Economic Thought* (Ann Arbor: University of Michigan Press, 2000), esp. pp. 247-253. On the 1713 debate as the culmination of an earlier "free trade" political-economic alternative, see: William J. Ashley, "The Tory Origin of Free Trade Policy," *The Quarterly Journal of Economics* 11, no. 4 (Jul., 1897): 335-371; Joyce Oldham Appleby, *Economic Thought and Ideology in Seventeenth-Century England* (Princeton: Princeton University Press, 1978), esp. pp. 248-252.

[9] The idea that the balance of trade constituted one of, if not *the*, fundamental tenet of mercantilism can be traced to Adam Smith. See: *An Inquiry into the Nature and Causes of the Wealth of Nations*, ed. Edwin Canaan (London: Methuen, 1904 [1776]), bk. IV, ch. 1, quotation in IV.1.10. See also Coleman, "Mercantilism Revisited," pp. 774-7.

So how does the story of the 1713 debate, as an occasion of enduring thinking about political economy, relate to the story of the debate as yet another trial in the great Whig-Tory game?[10] As D. C. Coleman asked in a 1976 article: if the controversy was primarily a battle of factional (or, for that matter, self-serving) agendas, "what, then, should be attributed to the battle of figures and the notorious obsession with the so-called 'theory of the balance of trade'?"[11] Beginning with Coleman, scholars have ventured to square this interpretive circle by examining how economic heuristics like the balance of trade functioned in political debate. Coleman contends that the balance-of-trade concept was not a modern, testable kind of economic "theory," but a nationalist slogan that gave politicians a way to integrate the regulation of overseas trade into the discussion of broader geopolitics.[12] More cynically, Joyce Appleby argues that balance-of-trade theory functioned as a political smokescreen, which Whig politicians used in order to justify more active intervention in the regulation of trade.[13] Doohwan Ahn has reexamined the debate within the history of political thought, arguing that Tory and Whig attitudes toward the probity of trading with France and also Holland reflected their divergent understandings of the interaction of political liberty and economic prosperity.[14] The most ambitious attempt to bring together the party-political and the political-

[10] On the need for historians to overcome the apparent discord between macroscopic stories about big ideas and the microscopic dynamics of elite politics, see: Peter Lake and Steve Pincus, "Rethinking the Public Sphere in Early Modern England," *The Journal of British Studies* 45, no. 2 (Apr., 2006): 270-292.

[11] D. C. Coleman, "Politics and Economics in the Age of Anne: the Case of the Anglo-French Trade Treaty of 1713," in *Trade, Government and Economy in Pre-Industrial England: Essays Presented to F. J. Fisher*, edited by D. C. Coleman and A. H. John (London: Weidenfeld and Nicolson, 1976), quotation on p. 196.

[12] Whigs and Tories shared a "common attitude of mind," which "viewed the nation's total commerce as an aggregation of separate, national quasi-political 'trades' all participating in a conflict over an international cake of a more or less fixed size." (Coleman, "Politics and Economics," pp. 205-6.)

[13] Appleby claims that "to ideological, not intellectual, causes should be attributed that triumph of balance-of-trade thinking." (*Economic Thought and Ideology*, pp. 268-279, quotation on p. 270.)

[14] Doohwan Ahn, "The Anglo-French Treaty of Commerce of 1713: Tory Trade Politics and the Question of Dutch Decline," *The History of European Ideas* 36 (2010): 167-80. Ahn argues that the Tory leaders Oxford and Bolingbroke remained committed to a "neo-Roman" view of politics, which held that permanent national power and wealth could only be founded upon the stability of a free, land-owning citizenry. Tories were unafraid of France's threat to England as a commercial (and not just military) rival because they did not believe that a nation could find long-term prosperity under the caprice of an autocratic government. In the Tory view, Britain's greatest commercial rival was its republican counterpart: the Dutch Republic. For the Tories, balance-of-trade logic framed how damaging it was to Britain to have the Dutch, rather than the British, carrying out lucrative re-export trades to and from France.

economic has been made by Steve Pincus, who argues that divergent ideas about political economy—and its implications for imperial policy—were at the very heart of Whig-Tory fissures.[15]

These historians have proposed a variety of instrumental and ideological functions that balance-of-trade reasoning served for Augustan Britons. Yet, historians have failed to examine why it was that the participants in the Anglo-French trade debate became so deeply fixated upon accurately *calculating* the balance of trade. The year 1713 was a watershed moment in the history of economic quantification, as D. C. Coleman calls it, "the first big argument about a major piece of English economic policy in which was deployed that familiar modern weapon: statistics."[16] The numbers were not merely a superficial gloss of apparent rigor atop a cynical factional dispute. Members of both parties aggressively asserted that the question of Anglo-French trade could and should be decided *by the numbers*. Nor could this numerical confidence, furthermore, be explained as a consequence of a pervasive "mercantilist consensus" about the balance of trade. As Pincus has shown, such a consensus never seems to have existed, whatever Adam Smith may have led us to believe. "Britons living in the seventeenth and eighteenth centuries… did not agree on fundamental economic principles," including one critical axiom foundational to balance-of-trade theory—the idea that global commerce was a "zero-sum" game.[17] Yet they did seem to agree, increasingly, on the value of settling political-economic questions through numerical analysis.

To explain the public flurry of calculations on Anglo-French trade in 1713, we must understand why Britons of different political parties had become so attracted to numerical

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[15] Pincus has also noted the failure of historians to integrate partisan politics with broader economic and intellectual-historical narratives: "Scholars have either insisted that there was a single coherent British imperial policy over which there was little party conflict, or there was party conflict that had little to do with imperial policy." See: Steve Pincus, "Addison's Empire: Whig Conceptions of Empire in the Early 18th Century," *Parliamentary History* 31, no. 1 (Feb., 2012): 99-117, quotation on p. 100; Pincus, "Rethinking Mercantilism: Political Economy, the British Empire, and the Atlantic World in the Seventeenth and Eighteenth Centuries," *The William and Mary Quarterly* 69, no. 1 (Jan., 2012): 3-34; Pincus, *1688: The First Modern Revolution* (New Haven and London: Yale University Press, 2009), ch. 12.

[16] D. C. Coleman, "Politics and Economics," p. 196. On the history of trade statistics more generally, see: Faith M. Williams, "The Origin and Development of Modern Trade Statistics," *Quarterly Publications of the American Statistical Association* 17, no. 134 (Jun., 1921): 732-742; Clark, *Guide to English Commercial Statistics*.

[17] Pincus, "Rethinking Mercantilism," quotation on p. 28.

calculation as a form of political argumentation. The answer lies in the nature of party politics, and in the different anxieties members of those two parties had come to form about the economic changes Britain was experiencing. In the debate over the Commerce Treaty, both Tories, who supported freer trade with France, and Whigs, who wished for continued restrictions against French trade, claimed at some point that numerical calculation was the *only* definitive means of assessing the benefits of Anglo-French trade. This numerical enthusiasm was not the result of a pre-established conception of the essential *objectivity* of numerical data that was shared by both parties. Numerical objectivity as a political ideal—whereby numbers came to imply "the subordination of personal interests and prejudices to public standards"—was something that had to be created.[18] In fact, the 1713 controversy became a "battle of figures" because the key voices for the Tories and the Whigs saw different *political-epistemic virtues* in numerical calculation, and those visions converged to make both sides of the argument focus on the numbers.[19] Tory polemicists argued that an expert calculation of the nation's trade balance was necessary to protect Britons from popular misrepresentations advanced by self-serving commercial and partisan interests. Their Whig opponents countered that plain-spoken numbers justified what had long been known by mercantile common-sense, namely that the French trade was detrimental to Britain.

Over the year-plus debate on the Commerce Treaty, participants found that it was extremely hard to produce the kinds of figures they had hoped would settle the dispute authoritatively. But we should not take this to mean, as many previous scholars have, that "the figures were meaningless when they were not fraudulent, and in either event were almost certainly wrong."[20] The standards

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[18] On the politics of numerical objectivity in the modern world, see Theodore M. Porter, *Trust in Numbers: The Pursuit of Objectivity in Science and Public Life* (Princeton: Princeton University Press, 1995), esp. pp. 3-8, 74-78, quotation on p. 74.
[19] My conception of "political-epistemic virtues" derives from the discussion of "epistemic virtues" in Lorraine Daston and Peter Galison, *Objectivity* (New York: Zone Books, 2007). Daston & Galison describe how "epistemic virtues earn their right to be called virtues by molding the self" while simultaneously shaping the standards by which new knowledge is evaluated and codified (p. 41.) "Political-epistemic virtues" might be understood as attempting to mold an entire polity, while setting standards by which to evaluate what knowledge might be sufficient for making political decisions.
[20] Coleman, "Politics and Economics," p. 196; Clark, *Guide to English Commercial Statistics*, p. 18.

for evaluating what made computations honest or correct were in the making. The public arguments over balance-of-trade calculations in 1713 replayed and refined the practical-epistemological arguments that we have already seen in the Davenant-Pollexfen argument about the profitability of the East India Trade, or the fight between "William Black" and James Donaldson over Anglo-Scottish tax policy and interpreting the Equivalent. Behind the dueling balance-of-trade calculations were deeper questions about what it meant to know something about commerce. Was trade a matter requiring expert analysis or simply common wisdom? Did the play of self-interest compromise the potential for trustworthy commercial knowledge? Should numerical calculations be trusted because they were comprehensive and rigorous or because they were transparent and intelligible?

The Tories and Whigs in 1713 proposed very different answers to these questions. To a large degree, the political-epistemic commitments voiced by members of the two parties predated 1713, suggesting longer continuities in party attitudes toward economic knowledge. The elitist vision espoused by the Tory *Mercator*, with its abiding desire to "undeceive the people" and deep attention to numerical method, echoed elements of the pre-1688 Tory political economy of Josiah Child and Dudley North, Davenant's 1690s political arithmetic, and even the "Tory Newtonian" mathematics of David Gregory.[21] The Whigs' rebuttal, which emphasized the transparency of numbers and the value of mercantile experience over intricate analysis, built upon patterns of commercial reasoning espoused by earlier Whigs like Pollexfen, and combined them with the fashionable Whig social and political commentary of *The Specator* and Lord Shaftesbury. The underlying contrasts between Tory and Whig thinking were most evident in their radically different attitudes toward *interest*, and the effect interest had on the possibility of making reliable political knowledge. By attending to such questions of practical epistemology, we can deepen our understanding of the nature of party conflict

[21] The motif of "undeceiving" can be seen, for example, in *Mercator*, no. 1 (May 26, 1713), recto and *Mercator*, no. 47 (September 8-10, 1713), verso, but was also evident in Defoe's pro-Union writings in 1706. See: Karin Bowie, "Popular Opinion, Popular Politics and the Union of 1707," *The Scottish Historical Review* 82, no. 214, Part 2 (Oct., 2003): 226-260, on p. 256.

in the early eighteenth century. The epistemological tensions of the Anglo-French trade dispute further illuminate the depth of the chasm between Whigs and Tories in the Augustan age, suggesting that the divisions extended to how the parties conceived of what it meant "to know."

At the same time, the episode is as much about the generic dynamics of two-party intellectual conflict, as it is about the specific commitments of the parties involved. The particular constellation of claims made by the two sides in 1713 owed much to momentary circumstances—who was in power, the constituencies in play, the data at hand—and the positions taken in that year were not always perfectly in line with claims made before or after. The fight was often an opportunistic one, in which the need to embarrass or discredit the opponent far outweighed any demands of intellectual consistency. Yet that form of political dispute, in the no-holds-barred arena of the rage of party, was itself extremely productive of new thinking about political economy and the nature of political-economic knowledge. The most remarkable feature of the story is how the two parties converged upon new, shared patterns of political discourse despite—and in fact *because of*—their differences. Both parties proposed numerical calculation as a mutually intelligible medium for having political disputes. Mary Poovey has argued that the early eighteenth century witnessed a decline in enthusiasm for numbers as the archetypal "facts" upon which to build sound political knowledge, due to concerns about making shared knowledge in a commercial republic racked by diverse interests.[22] The story of 1713 suggests that the opposite was true—the more contentious the political conflict, the more diverse the interests, the more entrenched the numbers became.

I. A "Battle of Figures"? The 1713 Treaty of Commerce

Preliminaries of peace between Great Britain and France were signed in October 1711, beginning the end of the War of Spanish Succession. Many among Britain's political and mercantile

[22] Mary Poovey, *A History of the Modern Fact: Problems of Knowledge in the Sciences of Wealth and Society* (Chicago and London: University of Chicago Press, 1998), ch. 4, esp. pp. 146-7, 156.

communities shared a vague sense that ending the war promised to bolster the nation's commerce.[23] Yet it remained unclear exactly what global trade ought to look like in a postwar world. As Pincus puts it, "while almost all of the participants in the party political wrangling over the War of the Spanish Succession agreed that Britain was a trading nation, they disagreed, and disagreed vociferously, about the proper nature of that trade."[24] The prospect of Anglo-French peace brought divergent commercial ideologies and commercial to the fore. Trade between England and France had been curtailed almost continuously for fifty years, beginning with a series of French prohibitive tariffs initiated in the 1660s.[25] The prospect of re-opening trade between the two countries had been mooted in 1697 and 1709, though negotiating impasses and the resurgence of warfare had quickly blocked those efforts. By early 1712, the Tory ministry under first minister Lord Oxford (formerly Robert Harley) and Secretary of State Lord Bolingbroke began to see the re-establishment and regulation of Anglo-French commerce as a critical objective of their peace negotiations.[26] Tory leaders, heavily informed by the political-economic writings of Charles Davenant, looked to generate national wealth by cultivating vibrant trading pathways between places where goods were cheap and purchasers willing to pay dearly for them.[27] Opening the French trade not only promised to unveil vital new targets for English goods and re-exports, but also promised to stifle the trading opportunities of the Dutch, whom the Tories felt were Britain's greatest commercial rival.[28] Adding to the Tory enthusiasm for a trade deal was the desire to capitalize on the peace to generate popular support for the Oxford ministry. In June 1712, Queen Anne (whose personal politics tended to be

[23] Gauci, *Politics of Trade*, pp. 236-7. In this summary, I have generally followed Gauci's illuminating study.
[24] Pincus, "Addison's Empire," pp. 100-1.
[25] The most significant English prohibitions had been raised in 1678. In the mid-1680s, the pro-French government of James II had begun to roll back many of the English barriers, but the outbreak of war in the 1688 froze Anglo-French commerce.
[26] On the administration of peace negotiations and their political fallout, see B. W. Hill, "Oxford, Bolingbroke, and the Peace of Utrecht," *The Historical Journal* 16, no. 2. (Jun., 1973): 241-263.
[27] Pincus, "Addison's Empire," pp. 102-5.
[28] Ahn, "Anglo-French Treaty," pp. 175-180.

strongly Tory) gave a lengthy speech proclaiming the tremendous contributions the imminent peace would make to national welfare, paying particular attention to its commercial benefits.[29]

Over the remainder of the year, representatives of towns, companies, and trades addressed the Queen and her ministers offering thanks for their attention to trade and making special requests for consideration. For the Tory government, taking credit for the economic benefits of the French peace meant taking responsibility for balancing these disparate interests. In early 1713, an increasingly angry stream of pleas began to flood into the Council of Trade and the Privy Council. West Indian planters expressed concern about potential French prohibitions on English sugar, while silk and woolen manufacturers feared competition from French industries. Amidst this rising chorus of complaints, the media-savvy Oxford continued to publicize the value of renewed trade with France. Following the signing of treaties of both peace and commerce at Utrecht on March 31, pro-ministry publications like the *Gazette*, *Post Boy*, and Defoe's *Review* published news of post-Treaty celebrations, reprinted pro-Treaty petitions, and laid out extensive arguments in favor of Anglo-French commerce.[30] Trade policy became a matter of intense factional dispute in the spring of 1713 as MPs were faced with whether to put into effect key provisions of the Utrecht Commerce Treaty. Though the approval of Parliament was not constitutionally required to ratify treaties, the Houses did have to modify domestic laws to make the Treaty operative, particularly adjusting the levels of Customs charged on French goods. The Tory ministry began soliciting Parliamentary authorization on May 2, in the form of a bill suspending all extra taxes raised on French wine imports since 1696. This "Wine Bill" garnered heated objections from several lobbying groups, including Iberian traders and woolen manufacturers. Those interests feared that a renewal of French wine imports would

[29] The Queen's speech emphasized the potential acquisition of Gibralter and Minorca, greater security from French piracy, and especially new concessions in the western hemisphere. (Gauci, *Politics of Trade*, p. 238.)
[30] Gauci, *Politics of Trade*, pp. 236-40.

decrease British appetites for wines from Portugal, England's most-favored trading partner since the 1703 Methuen Treaty, and thereby jeopardize reciprocal Portuguese demand for English woolens.

A week later, the ministry began drafting a comprehensive "Commerce Bill" to put the French Commerce Treaty into effect. Whig writers and representatives quickly set about attacking the expansion of French commerce.[31] A surplus of factors likely encouraged the intense party response, including the partisan loyalties and Dissenting religious views of many of London's overseas traders, Whig antipathy toward France and the peace settlement generally, and the potential to defeat a major point of Tory policy.[32] Deeper concerns of political-economic principle also fueled the party's vehement opposition. In the early eighteenth century, Whig economic thinkers like Bernard Mandeville, John Oldmixon, and Henry Martin had begun to formulate a vision of political economy in which national prosperity was to be found in the products of human labor, not the strategic movement of goods. With this in mind, such Whigs deeply feared the prospect of commercial competition with the French, whose vast quantities of cheap labor meant they could undercut British prices and impoverish British manufactures.[33] Tory propagandists attempted to tame such public dissent by emphasizing the value of French markets for British exports and dismissing anti-French polemics as works of self-interested special pleading or partisan sabotage. Critical to these public relations efforts was the establishment in late May of a party newspaper on trade, the *Mercator*, under the direction of the Tories' top commerce advisor, Inspector-General of Imports and Exports Charles Davenant, and propaganda maestro Daniel Defoe.[34] Propaganda

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[31] Gauci, *Politics of Trade*, pp. 240-8.

[32] On the political and religious affiliation of different constituencies within London's trading community, see Gary Stuart De Krey, *A Fractured Society: The Politics of London in the First Age of Party 1688-1715* (Oxford: Clarendon Press, 1985). De Krey notes, for example, that the Iberian and Levant traders were disproportionately Whigs and religious Dissenters. (See ch. 3).

[33] Pincus, "Addison's Empire," pp. 105-110.

[34] Contemporaries initially assumed that Defoe was primarily responsible for the *Mercator*, though were certainly aware of Davenant's likely influence. There is no question that the bulk of the technical computation was likely Davenant's work, though it is safe to assume both Defoe and Davenant played important roles in the paper's production over time. For an illuminating contemporary illustration of contemporary Whig attitudes toward the *Mercator*'s producers, as well as their

efforts on both sides gained wide public circulations, though both Whig and Tory writers especially targeted independent or moderate-Tory MPs whose voting on the matter was likely to swing the issue in Parliament.[35]

The spring and early summer saw a firestorm of debate, petitioning, and information-gathering in and out of the doors of Parliament. MPs in both Houses frantically grasped for any evidence that seemed relevant to the question of the Commerce Treaty, from historical Customs data to the records of past commercial negotiations to the opinions of renowned merchants. Even questions of an administrative nature posed challenges for the politicians.[36] It was not obvious, for example, what it would mean to reset all tariff levels in both countries in just proportion to how they had stood at some past date like 1664, as the Treaty proposed.[37] MPs and the broader reading public were assailed with petitions and pamphlets from competing corporate and geographic interests, like the Sheffield iron masters who craved French markets or the cloth manufacturers in Colchester who were terrified of competition from French clothiers.[38] They also had to take into consideration the global impact of French trade on Britain's trade with many other regions, like Portugal, the Levant, or the East Indies.[39] Different interest groups focused upon different political-economic considerations in their pleading. Whereas, for example, London's Company of Clockmakers had argued against opening trade with France by emphasizing how many people their art employed and

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Tory party patrons, see [Anon.], *A Letter to the Honourable A—r M—re, Com—r of Trade and Plantation* (London: Printed for J. Roberts, 1714), pp. 24-5.

[35] Gauci, *Politics of Trade*, p. 165; Pincus, "Addison's Empire," p. 101. My thanks to Noah McCormack for his thoughts on the audience for the Whig and Tory propaganda exercises.

[36] For an example of the complexity at play simply in understanding the various tariffs in play, see the Report from the Customs to the Treasury on the French Trade, 1713, NA T 64/305.

[37] "Letter from Mr Secry St John of the 8th Inst relating to a Tarif and Treaty of Comerce with France," 9 May 1712, Copy, National Archives CO 389/22, ff. 102-108, esp. f. 104. Coming to a precise picture of the tariffs governing English exports in France had been a persistent problem in contemplating potential trade treaties ("Letter from Samuel Eyre to Earl of Stamford," 27 May 1709, Copy, Parliamentary Archives, HL/PO/JO/10/6/232, ff. 83-4).

[38] Gauci, *Politics of Trade*, p. 239.

[39] D. A. E. Harkness, "The Opposition to the 8th and 9th Articles of the Commercial Treaty of Utrecht," *The Scottish Historical Review* 21, no. 83 (Apr., 1924): 219-226.

its high cash-profit margins, the Levant Company warned that opening the French trade would upset a vital trade pathway that sent England's woolens to Turkey in exchange for Turkish raw silk.[40]

So where, amidst these chaotic interests and economic principles, was the consideration of the balance of trade? The question of Britain's overall balance of trade with France was a critical, but not exclusive, factor for many in the initial deliberation on the Commerce Treaty. Occasional charts of import-export data among the government records suggest that key administrators responsible for the Anglo-French Treaty, like Secretary of State Henry St. John, were cognizant of balance considerations.[41] Early in 1713, critics of the Commerce Treaty began to cite a numerical *Scheme of Trade* from 1674 showing that England historically carried a negative import-export balance with France of nearly £1 million.[42] A further source of numerical enthusiasm came from some Parliamentarians themselves, who demanded an incredible volume of information from government agencies like Customs Commissioners and the Commissioners of Trade and Plantations in May.[43] The MPs' ravenous initial requests for data no doubt stemmed from a variety of motivations, including the attention being given the 1674 *Scheme*, the need to call certain government agencies to account, and even a desire to stall the progress of the Treaty by swamping proceedings in paper.[44]

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[40] "The Humble Presentation of ye Master, Wardens & Assistants of ye Company of Clockmakers," Original 6 June 1709, Copy May 1713, Parliamentary Archives HL/PO/JO/10/6/233, ff. 128-129, quotation on f. 128^r^; "Petition of the Governor and Company of the Merchants Trading in the Levant," 2 June 1713, and the [Mr.?] Cooke, Treasurer to the Levant Company, Speech in the House of Lords, 2 June 1713, HMC *Lords New Series: 1712-1714*, pp. 113-120.

[41] See, for example a brief chart apparently appended to a letter from St. John to the Council of Trade and Plantations in May 1712, showing figures for the total imports and exports between England and France for 1699-1701. The figures match those given in a report by Charles Davenant as Inspector-General of Imports and Exports in 1711. See "Letter from Mr Secry St John of the 8th Inst relating to a Tarif and Treaty of Comerce with France," 9 May 1712, Copy, NA CO 389/22, ff. 102-108, specifically f. 108.

[42] On the data and attitudes about French trade from the 1670s, see Margaret Priestley, "Anglo-French Trade and the 'Unfavourable Balance' Controversy, 1660-1685," *The Economic History Review*, New Series 4, no. 1 (1951): 37-52.

[43] On one day, May 19, they made demands for four specific years of import and export figures between England and France (years ending in 1663, 1665, 1686, and 1699), along with details of all proposed projects for commerce treaties over the previous fifteen years. The following day, they requested careful explanations regarding what was covered under the French tariff regulations of 1664, and extended their request for trade balance figures to include Holland, Italy, Portugal, and Hamburg. (*Lords Journal, Vol. 19: 1709-14*, pp. 542-5.)

[44] Gauci, *Politics of Trade*, pp. 244-5.

The balance of trade was certainly among the analytical and argumentative resources available to those contemplating the Commerce Treaty in early 1713. Nonetheless, it was hardly predestined that the controversy would become as heavily fixated on quantifying that balance as it ultimately became. The history of the balance-of-trade principle over the previous century, indeed, shows that the fate of the balance theory in the early eighteenth-century was hardly obvious. Three features of that history are critical. First, the balance of trade was a flexible idea that was invoked to very different argumentative ends throughout the seventeenth century. Different generations had their own visions of what the balance of trade meant and why it was significant. Second, the balance of trade, as an explanatory model of commerce, and the balance of trade, as a computational practice, were related but ultimately distinct things. Not every thinker who invoked the balance concept had an interest in actually calculating it. Those who did produce balance calculations in the seventeenth century had different attitudes about what made a computation from those of the calculators in 1713. Finally, the balance theory was not hegemonic throughout the century, and contemporaries were not unaware of its limitations. By 1713, government officials had become well acquainted with the irregularities in the data available to calculate it. Many theorists, further, had critiqued not only the balance idea, but the zero-sum picture of commerce it implied.

The kernel idea behind the balance of trade had been floated at least as early as the 1350s, when a simple reckoning of imports and exports had been created to assess the health of the English wool trade.[45] The idea motivated some initial government interest in measuring imports and exports as early as the 1560s, and was explored more systematically in the 1581 *Discourse of the Commonweal of This Realm of England*. Enthusiasm for the idea swelled in the 1610s, when government officials began to compute summary import-export balances, prompted by concerns about the fragile health of the

[45] Later analysts like William Petty and Abraham Hill cited this 1354 calculation, likely passed on by Edward Misselden. For examples, see: "Calculations on the Wool Trade," Abraham Hill Papers (on Trade), BL Sloane MS 2902, f. 112; '3 Ballances of the Trade of England," William Petty Papers (Statistical), BL Additional MS 72,890, ff. 100-105. See also: Clark, *Guide to English Commercial Statistics*, pp. xi-xii.

nation's woolen exports.[46] In the 1620s, the balance of trade became widely publicized as a new imperative for commercial policy. In that decade, England experienced a sharp decline in woolen exports, a growing scarcity of money, and rampant unemployment and labor-related violence.[47] In 1622, King James I arranged official debates on the crisis, which hinged on the question of whether low levels of specie were ultimately cause or effect of the general commercial misery.[48] The trader and assay master Gerard de Malynes contended that the Crown ought to carefully fix exchange rates to prevent English money from fleeing to Continental markets. In response to such arguments for currency control, Edward Misselden and Thomas Mun looked to the balance of trade as a new model of the causality of international commerce.[49] They contended that the movement of precious metals was the consequence and not the driver of the international movement of goods.[50] If England's stock of gold and silver declined, they argued, it was because the nation imported more foreign goods than it exported and had to pay the difference in cash.[51]

The 1620s theorists fostered a range of equivocal views on whether it was important, or possible, to calculate truly accurate balance-of-trade figures. On the one hand, Misselden was quite enthusiastic about the possibility for a "science" of trade based on computational estimates of trade balances.[52] Mun, though, seemed only to care that a figure for England's balance of trade could be

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[46] Lionel Cranfield, newly appointed surveyor-general of the Customs in 1613, attempted a basic reckoning of the excess of exports over imports in London, a project continued shortly thereafter by John Wolstenholme. Indeed, the actual term "balance of trade" was probably coined in 1615-6 in a series of debates in the English Privy Council, perhaps by Francis Bacon. For an example of the balance calculation for 1613, see "3 Ballances," BL Add. MS 72,890, ff. 100-105. See also: Clark, *Guide to English Commercial Statistics*, pp. xi-xvi; Slack, "Government and Information," pp. 40-1, 51-2; Appleby, *Economic Thought and Ideology*, p. 38.

[47] Poovey, *History of the Modern Fact*, pp. 69-70; Finkelstein, *Harmony and the Balance*, pp. 54-55.

[48] On the controversy, see: Heckscher, *Mercantilism*, vol. II, pp. 248-54; Appleby, *Economic Thought and Ideology*, pp. 35-51; Poovey, *History of the Modern Fact*, pp. 66-91; Finkelstein, chs. 2-5.

[49] Both Misselden and Mun had ties to the East India Company, and sought solutions to England's commercial woes that did not necessitate rigidly regulating the export of specie, which was critical for doing business in Asia.

[50] In Appleby's words, the novel polemicists of the 1620s were responsible for "the planting of the insidious idea that there were laws affecting human activity that knew no royal sovereign." (Appleby, *Economic Thought and Ideology*, p. 47.)

[51] Mun instructed that "the ordinary means therefore to encrease our wealth and treasure is by Forraign Trade, wherein wee must ever observe this rule; to sell more to strangers yearly than wee consume of theirs in value." (Thomas Mun, *England's Treasure by Forraign Trade* (London: Printed by J. G. for Thomas Clark, 1664 [written 1623?], p. 11.)

[52] See E[dward] M[isselden], *The Circle of Commerce. Or The Balance of Trade, in Defence of Free Trade* (London: Printed by Iohn Dawson, for Nicholas Bourne, 1623), pp. 126-30, quotation on p. 130. His *Circle of Commerce* included a rudimentary

calculated to sufficient precision to guide policy analysis, noting that because of the likely problems with available data, "it is not expected that such an account can possibly be drawn up to a just balance."[53] Gerard Malynes, perhaps expectedly, was downright hostile about the value of ever trying to compute numerical balance figures. In his mind, any attempt to capture an accurate, momentary picture of commercial circumstances—of a single merchant let alone an entire nation—was a fanciful "conjecture."[54]

Over the next half-century, economic crises and governmental objectives prompted sporadic interest in the practical calculation of the balance of trade. Within government administration, trade councils were appointed to undertake a "true" or "perfect" balance of trade calculations in 1622, 1650 and 1668. In each instance, their progress was limited.[55] After 1660, political-economic writers gave new vitality to the balance concept by combining it with an active, paternalistic image for monarchical government. The most important example came from Privy Councilor Samuel Fortrey, whose 1663 *Englands Interest and Improvement* provided King Charles II with a program for increasing the nation's "store and trade."[56] Fortrey argued that the nation needed a strong monarch to check selfish commercial interests and pursue the nation's collective good, as the French had recently done by prohibiting many English goods. To underscore this point, Fortrey provided a calculation of sixteen different groups of commodities annually imported from France, showing ominously that "it appears that our trade with France, is at least sixteen hundred thousand pounds a year, clear lost to this kingdom."[57] Fortrey's computation marked the beginning of over a decade of mercantile anxiety

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calculation of England's aggregate trade balance with the rest of the world, based on aggregate Customs revenues. Misselden estimated aggregate imports and exports by multiplying total Customs revenues by 20.

[53] Mun, *England's Treasure*, pp. 208-9; Poovey, *History of the Modern Fact*, p. 78.

[54] Poovey, *History of the Modern Fact*, pp. 76-7; Finkelstein, *Harmony and the Balance*, p. 89.

[55] Slack, "Government and Information," pp. 52-3.

[56] Sam[uel]. Fortrey, *Englands Interest and Improvement. Consisting in the Increase of the Store, and Trade of this Kingdom*. (Cambridge: Printed by John Field, Printer to the University, 1663), pp. [ii], 1.

[57] Fortrey, *England's Interest*, pp. 22-25, quotation on p. 25.

over declining demand for English woolens and anger over France's anti-English trade policies.[58] Merchant publicists began to press Charles II's government especially hard to redress the unfair conditions of Anglo-French trade in the mid-1670s. In late November 1674, fourteen reputable London merchants produced a *Scheme of Trade* showing that England had a negative trade balance with France amounting to £965,128. The critical figure of the (nearly) £1 million negative balance "found wide acceptance in current economic phraseology," becoming a rallying cry for anti-French sentiment and helping to motivate a stringent tariff policy against French goods that predominated from 1678 up through 1713.[59] Unlike Mun, Fortrey and the 1674 *Scheme*-makers were more interested in making a point about the magnitude of one of England's specific trade balances (with France) than about the mechanism of the balance itself. But they took minimal effort to justify the source of their figures, which would have failed to meet the standards of numerical credibility invoked in 1713—precisely because those standards were not yet in place.

Up until 1688 interest in producing new or alternative calculations of the nation's trade balances was diminished, both within government and among external commentators. The government of Charles II appears to have made one isolated attempt at coming to an updated trade balance in the year 1679, though that effort, and subsequent ones in the 1680s, proved abortive.[60] The 1670s-80s also witnessed an array of political-economic voices questioning the calculability of the balance of trade, its value as a guide to policy, and its fundamental implications about the nature of money and the problems with luxury.[61] Cutting-edge thinkers like William Petty and Josiah Child

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[58] On anxieties about Anglo-French trade in the Restoration period, see Priestley, "Anglo-French Trade."
[59] Priestley, "Anglo-French Trade," p. 40.
[60] The account, entitled "An Accompt of the Revenue of His Maties. Customes in the severall Ports of England for One year from Michaelmas 1676 to Michaelmas 1677," was included with the import-export figures for 1662/3 and 1668/9 in that volume that is now BL Additional MS 36,785. The volume passed through Davenant's hands when he was in the Inspector-General's office.
[61] On the emergence of critical alternatives to the balance of trade concept, particularly in the 1670s-80s, see: Ashley, "Tory Origins"; Appleby, *Economic Thought and Ideology*, chs. 7-8; G. L. Cherry, "The Development of the English Free-Trade Movement in Parliament, 1689-1702," *Journal of Modern History* 25, no. 2 (Jun., 1953): 103-119; Slack, "The Politics

began to contemplate the "theoretical pitfalls in calculating a trade balance based on visibles in a complex international trading system," while government administrators debated whether balance-of-trade considerations ought to outweigh fiscal concerns in the making of policy.[62] New voices, like those of John Houghton and Nicholas Barbon, contended that material consumption, including the purchase of imported luxuries, might be a powerful driver of economic growth, an evident contradiction to the usual conclusions of balance-of-trade theory.[63]

When the balance idea, and especially an interest in calculating it, returned to prominence in administrative practice and political-economic writing in the mid-1690s, it did so as a result of the new informational culture that emerged in the aftermath of the Revolution (as discussed in Chapter 1). A heightened interest in gathering data on imports and exports for public use became evident in 1695-6, coinciding with the vigorous debate on the deteriorating state of the nation's silver coinage and the formation of a new Council on Trade and Plantations. Political thinkers of various partisan leanings contended that computing the balance of trade ought to be a central responsibility of government trade oversight.[64] Though he was aware of the theoretical pitfalls of calculating the trade balance, Charles Davenant advocated the practice—like that of composing an account of governmental revenue and expenditure—as a way to produce a better-informed, less secretive, and more trustworthy government.[65] New interest in calculating the balance of trade in the 1690s was as

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of Consumption and England's Happiness in the Later Seventeenth Century," *The English Historical Review* 122, no. 497 (Jun., 2007): 609-631.

[62] For quotation, see Slack, "Government and Information," p. 53. See also: C. D. Chandaman, *The English Public Revenue 1660-1688* (Oxford, 1975), pp. 16-20; Slack, "The Politics of Consumption," p. 617.

[63] Slack, "The Politics of Consumption."

[64] For a succinct but illuminating example of how contemporaries in the 1690s thought about the relationship between the balance of trade and the state of coinage, see Abraham Hill, "Reflections on the Current Coin," (1695) Abraham Hill Papers (on Trade*,* BL Sloane MS 2,902, ff. 21-6. For a perspective on the administrative and political virtue of tracking the nation's trade balances, see: [John Pollexfen], *A Discourse of Trade, Coyn, and Paper Credit: And of Ways and Means to Gain, and Retain Riches* (London: Printed for Brabazon Aylmer, 1697), esp. pp. 2-3, 55-6.

[65] Davenant linked the need of a prospective trade council to calculate the trade balance with its requisite authority to oversee administrative officials and records. See Davenant, "Memorial Concerning a Council of Trade," unpublished MS, 1696, BL Harley MS 1,223, f. 188^{v}.

much the result of new ideas about information and good governance as the result of theoretical commitments about political economy.

A new political appetite for trade data, on the part of the new Board of Trade as well as Parliament, quickly outstripped the capacity of existing administrative structures like the Customs Commission.[66] To feeds those demands, a new office of Inspector-General of Imports and Exports was created in 1697, first occupied by experienced Customs clerk William Culliford, followed by Davenant in 1703. The foundation of the Inspector-General's office created an apparatus for managing national trade data that was unprecedented among European contemporaries. Yet, the Inspector-General's office also brought analysts face-to-face with the tremendous practical and theoretical difficulty of actually calculating the balance of trade consistently.[67] Available Customs data was much more reliable for the quantities of goods moved than for their valuations, for example. Other irregularities in the data posed even greater threats. Davenant, for instance, became highly frustrated by English textile merchants who deliberately misstated the volume of woolens they shipped out of the country to fool their competitors into thinking foreign markets were oversupplied.[68] In 1711, Davenant drafted a lengthy report to the Commission of Public Accounts detailing the nation's trade balances with seven different trading partners for 1699-1704, as well as the difficulties he had run into getting a definitive picture of where those balances had stood historically.[69] He specifically questioned the conclusions of the 1674 *Scheme of Trade*, pointing out irregularities in the way the *Scheme* priced imports versus exports, and planting the seed of the idea that there were serious analytical reasons to doubt that the Anglo-French trade balance was strictly negative. Yet, Davenant offered an even more adventuresome thought on balance of trade reasoning

[66] For an attempt by the new Board of Trade to evaluate the nation's trade balances, see "Estimate of the Present State of the Trade of England," 1697, Abraham Hill Papers, BL Sloane MS 2902, ff. 115-116.
[67] Clark, *Guide to English Commercial Statistics,* pp. 3-17.
[68] Clark, *Guide to English Commercial Statistics,* p. 15.
[69] Charles Davenant, *A Report to the Honourable the Commissioners for Putting in Execution the Act, Intitled,* An Act, for Taking, Examining, and Stating the Publick Accounts of the Kingdom, Part I (London: *s.n.*, 1712).

as well. He noted that, in two years which were sometimes cited as proving England's negative trade with France (1663 and 1669), a strict calculation of imports and exports with all nations suggested that England had an overall negative trade balance with the rest of the world. This implied that England had been impoverished by its overseas commerce in general during those years, an absurd conclusion to anyone who was aware of England's thriving commercial traffic during those years. "Here will arise a Question," he reflected, "how far the Excess between the Exports and Imports may be deem'd a certain Rule whereby to judge, whether a Country gets or loses by its Trade."[70]

Shortly before the outbreak of the Anglo-French commerce controversy, then, the very person tasked with tracking the nation's trade balances was questioning how legible that metric even was. Davenant, as we will see, did ultimately retain a belief in the value of balance-of-trade analysis, but of a sophisticated, perspicuous kind. In particular, the Tory's chief political-economic analyst continued to generally support the premise that the world's aggregate wealth was finite, however complicated the many commercial linkages through which it moved. But that deeper premise—which seemed to make the calculation of trade balances both achievable and vitally necessary—was itself not even universal by the early eighteenth century. As Pincus has argued, many key Whig voices from John Locke onward seriously questioned the idea that the world's wealth was fixed.[71] "Radical" Whig thinkers like Henry Martin began to entertain the provocative notion of "infinite economic growth."[72] Such a commitment, it might seem, would have rendered irrelevant the use of static, finite analytical tools like the merchant's balance as a guide to national commercial policy.

Therefore, by the time Parliament got down to debating the Treaty of Commerce in May 1713, there were plenty of available reasons why politicians and propagandists would have chosen *not* to concern themselves with the question of the balance of trade—from extremely problematic

[70] Davenant, *Report to the Honourable the Commissioners* (1712), pp. 45-6.
[71] Pincus, "Addison's Empire," pp. 105-110; Pincus, "Rethinking Mercantilism," pp. 26-28.
[72] Pincus, "Addison's Empire," p. 106.

data to extreme doubts about the basic economic worldview it embodied. As MPs began to make furious demands for different kinds of information relating to the Treaty, including import-export figures, many of these problems resurfaced. The Customs Commissioners began explaining very early on the hurdles that they faced in serving the informational demands of the Parliamentarians. Figures for early years like 1663 and 1665 had been irretrievably lost in the Great Fire; figures for ports outside of London were consistently spotty; the relevant officers had far better knowledge of the volume of goods imported and exports than what any of them were worth.[73] The inability of government agents to provide definitive answers to MPs' inquiries no doubt was a source of embarrassment for the Tory ministry.[74]

Through the months of May and early June 1713, procedural votes in Parliament suggested the ministry still held the upper hand despite the intensity of opposition. Yet, when the bill to enact the key provisions of the Commerce Treaty came up for final vote in the Commons on June 18, it was defeated 194 to 185, with more than seventy identifiably Tory MPs voting along with the entire Whig party against the bill.[75] This only marked the beginning of the public controversy over the French trade, though. Two key factors kept the matter very much alive in the public conversation through 1713 and beyond: the possibility that the Treaty might be reintroduced at a later time and the popular elections looming in late summer and fall. Tory journalists dismissed the rejection of the Commerce Bill as a momentary error of Parliamentary judgment forced by Whiggish scheming, while their Whig counterparts tried to consolidate their victory in the Commons by convincing nationwide voters of the dangers that had been averted by rejecting the Treaty. Into the autumn of 1713, the frenetic Commerce Treaty debate settled into an intense, rhythmic battle between Whig

[73] HMC *Lords New Series: 1712-14*, pp. 95-6.
[74] For an example of attempts to reconcile embarrassing confusions in available data, see the papers collected in NA 64/274.
[75] On the political specifics of the bill and the voting in Parliament, see Geoffrey Holmes and Clyve Jones, "Trade, the Scots, and the Parliamentary Crisis of 1713," *Parliamentary History* 1 (1982): 44-77, and Gauci, *Politics of Trade*, 248-253.

and Tory propagandists. Despite the widespread criticisms of balance-of-trade reasoning, and the many practical challenges that came with trying to calculate it, the polemical struggle became largely fixated on the problem of quantifying the Anglo-French trade balance. And it was not the pressure of some kind of "mercantilist consensus" that made both Tory and Whig writers focus on the calculation. The 1713 controversy became the unprecedented statistical brawl it did because both parties wanted to make the fight about the numbers.

II. What We Call Universal Commerce: A Tory Epistemology of Trade

Commercial polemicists for both the Whigs and the Tories embraced the quantification of the balance of trade because they discerned critical virtues in numerical computation as a political-epistemic practice. On the one hand, Tory commentators, especially the official *Mercator*, felt that the mechanics of international trade were a subtle and complex subject of inquiry. The inescapable role of self-interest made it difficult to trust many claims of commercial knowledge, especially those offered by merchants themselves. Honest, expert oversight was necessary to conquer widespread popular misconceptions, like the supposed unprofitability of Anglo-French trade, fostered for decades by special interests. In matters of commerce, numbers could be powerful but dangerous. Skilled computation, backed up by rigorous evidence, was necessary to protect the credulous public from calculated frauds. For the Whiggish pamphleteers that countered the *Mercator*, on the other hand, the most reliable commercial knowledge derived from the nation's deep stock of collective mercantile wisdom. The Whigs were far less concerned that self-interest would breed deception, but argued that interest itself was a powerful guide for understanding how commerce worked. They instead feared that the public, and especially Parliament, would opt for the supposed authority of pedantic, mercenary experts and secretive accounts over their own common sense. Numbers, therefore, provided a means to justify what they saw as widely-held commercial beliefs. It was

ultimately the convergence of these two competing practical epistemologies—what might be called the "elitist" Tory vision versus the "commonsensical" Whig one—that explains what Coleman termed that "battle of figures" in 1713.

In September 1713, as the dispute between the *Mercator* and its Whig opponents was entering its greatest intensity, the authors recalled the paper's original goals. "This is the Reason and true Original of this Paper: The *MERCATOR*'s Business is to restore Men to their right Knowledge of these Things; to undeceive the abused People; to detect the abominable Falshoods that are spread about for private Designs among them; and to Inform them rightly in Things wherein they are abused and misled."[76] The nation was in desperate need of the *Mercator*'s skilled guidance because selfish interests pursuing their own "private Designs" had systematically fostered deceptive ideas about trade. As the very first *Mercator* put it in its very opening line, "Misrepresentations of Publick Affairs are so much the Refuge of our Enemies, and have been so successful in imposing upon our own People, that Justice requires the first should be detected, and Compassion requires the last should be undeceived."[77] The fear of misrepresentation was common among an English political class wrestling with the anxieties of participatory politics after 1688.[78] The growing importance of political discourse out-of-doors had created new spaces for the circulation of misleading claims. "All the Arguments used without doors have appear'd insufficient" to actually clarify the state of the nation's trade, the *Mercator* explained. "And our Disputes being managed by the Interests and Passions of Men, have rather serv'd to perplex those things *which were clear*, than to inform."[79]

The primary deception that the *Mercator* intended to fight was the "Notion or Opinion which has been too generally received, *That the Trade with France has always been carried on to the Disadvantage of*

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[76] *Mercator*, no. 47 (September 8-10, 1713), verso.
[77] *Mercator*, no. 1 (May 26, 1713), recto.
[78] Historian Mark Knights writes: "The period thus witnessed an experiment in representation, but also, in the eyes of many contemporaries, one in misrepresentation through slander, political lying, and partisan factions." (*Representation and Misrepresentation in Later Stuart Britain* (Oxford: Oxford University Press, 2005), quotation on p. 3.)
[79] *Mercator*, no. 1 (May 26, 1713), recto.

England." For the Tories, commercial matters were particularly susceptible to misrepresentation because of the public's collective confusion about overseas trade. "It must be acknowledged to be something wonderful," *Mercator* no. 1exclaimed, "that a Nation who drives the greatest Trade in the World… should be so very ignorant of their real share in one of the most considerable Branches of that Trade, as not rightly to know whether they Get or Lose by it."[80] The relationship between various trades and national welfare was highly complex and irreducible to superficial principles or mercantile know-how. [81] This was explained in the June 1713 issue of the *General History of Trade*, written by *Mercator* collaborator Daniel Defoe:[82]

> Take our People in the respective Branches of Trade, which they are severally and apart bred to… and in this they are knowing enough, at least enough to carry on their own business, and for their own advantage: But where shall you find a Man knowing in what we call Universal Commerce? Where are the Heads turn'd for the General Advantage of their Country, by seeing into the Scale of the World's Trade? These are rarely to be found.[83]

Understanding "Universal Commerce" was no easy matter, the Tory writers argued. Indeed, the difficulty of understanding trade in its totality had long been a central tenet of Tory political-economic thinking, even before 1688. The East India Company kingpin and Tory spokesman Josiah Child, for example, had opened his widely-read 1681 *Treatise* on the East-India trade with a comment on the complexity of trade that prefigured Defoe's:

> That trading Merchants, while they are in the busie and eager profession of their particular Trades, although they be very wise and good men, are not always the best Judges of Trade, as it relates to the power and profit of a Kingdom. The reason may be, because their Eyes are so continuously fixt, and their Minds intent upon what makes for their peculiar Gain or Loss, that

[80] *Mercator*, no. 1 (May 26, 1713), recto.
[81] Commerce was one of the earliest areas in which expert testimony was invoked in settling legal disputes, as merchants were called upon under common law to testify to "what constituted accepted and normal practice" in trade matters. See Barbara J. Shapiro, *A Culture of Fact: England, 1550-1720* (Ithaca and London: Cornell University Press, 2000), p. 18.
[82] [Daniel Defoe], *A General History of Trade, and Especially Consider'd As It Respects The British Commerce*…, nos. 1-4, (London: Printed for J. Baker, June-September, 1713).
[83] [Defoe], *General History of Trade*, no. 1 (June 1713), p. 13.

> they have no leisure to expatiate, or turn their thoughts to what is most advantagious to the Kingdom in general.[84]

Child cited the intricacy of national trade, and its general illegibility to practicing merchants, as an argument against dangerously meddling with the monopoly rights of the EIC in response to the self-interested pleading of merchant "interlopers."[85] It was an argument that Davenant picked up in his own mid-1690s writings in favor of the EIC, where he argued against making any "alteration in so considerable a Branch of our Foreign Commerce" before lengthy contemplation had been given by the ablest observers to "the universal Posture and Business of the Nation."[86] Davenant's opinions on the complexity of universal commerce were not limited to his East India writings. In his 1711 report to the Public Accounts Commissioners, for example, he explained at length that Britain's many entangled trades formed a "Riddle," a "Knot" to be untied only through careful examination.[87]

In 1713, the Tory writers turned especially to naturalistic analogies as a way to evoke the complexity of international trade, Defoe for example comparing trade to "Blood in the Veins."[88] Anatomical analogies were a common motif of early-modern political economy; in 1713 the Tories mobilized them specifically to justify the difficulty of trade as an analytical problem. "There are oblique Branches of Trade, and a secret Circulation of Commerce, like the small capillary Veins in the Body, which tho' they are imperceptible even by the most curious Anatomist, are yet… equally essential to convey the Spirits through the whole...," *Mercator* no. 64 explained. "So there are divers Parts of our Commerce with France which are imperceptibly to many carried on through other

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[84] "Philopatris" [Josiah Child], *A Treatise Wherein is Demonstrated I. That the East-India Trade is the Most National of All Foreign Trades…* (London: Printed by J. R. for the Honourable the *East-India* Company, 1681), p. 1. My thanks to Steve Pincus for drawing my attention to Child's attitudes toward economic knowledge.
[85] On Child's positions and the debates over the EIC monopoly more broadly, see: Philip J. Stern, "'A Politie of Civill and Military Power': Political Thought and the Late Seventeenth-Century Foundations of the East-India Company State," *Journal of British Studies* 47, no. 2 (Apr., 2008): 253-283, esp. pp. 267-274; Steve Pincus, *1688: The First Modern Revolution* (New Haven and London: Yale University Press, 2009), pp. 372-381.
[86] Davenant, *Essay on the East India Trade* (London: *s.n.*, 1696), p. 57.
[87] Davenant, *Report to the Honourable the Commissioners* (1712) p. 47.
[88] Defoe, *General History of Trade*, no. 1 (June, 1713), pp. 5-6.

Countries."[89] Naturalistic images were a common rhetorical strategy for Tory controversialists in Augustan foreign policy controversies.[90] For writers like Davenant and Defoe, analogy to the discoveries of the "new science" was one way to show that foreign trade was a topic requiring especially disciplined, expert consideration.[91]

The public's ignorance of "Universal Commerce," the Tory writers argued, stemmed from an unfounded confidence that trade was easy to understand. "People conversing among Merchants, and seeing a little Exchange Alley business done, presently fancy themselves capable of judging the General Interest of Trade," Defoe lamented, "without having entred into the Nature, the Causes, the Originals, and the Prospects of things." This kind of flippant treatment of a complex subject would not have passed in other areas of technical knowledge. Such a naïve presumption of competence often shaded into deliberate duplicity. "As in other Parts of Learning, a superficial Knowledge of Letters serves to make a Man a Pedant, but not a Scholar; a superficial Knowledge of Medicine, serves to make a Man a Mountebank, but not a Doctor; a superficial Skill in Musick, may make a Ballad Singer, but not a Musician; so a superficial Knowledge of Trade, may make a Man a Stock-jobber, but not a Merchant."[92] By invoking the figure of the jobber as a foil to the truly knowledgeable merchant, Defoe played upon widely-held fears of the false wealth and dishonest dealings of Exchange Alley.[93]

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[89] *Mercator* no. 64 (October 17-20, 1713), verso. On the uses of circulatory imagery in political economy, see Natasha Glaisyer, "'A Due Circulation in the Veins of the Publick': Imagining Credit in Late Seventeenth- and Early Eighteenth-Century England," *The Eighteenth Century* 46, no. 3 (2005): 277-297.

[90] Müllenbrock, *Culture of Contention*, ch. 4, esp. p. 177.

[91] On Defoe's and the "New Sciences," see: Simon Shaffer, "Defoe's Natural Philosophy and the Worlds of Credit," in *Nature Transfigured: Science and Literature, 1700-1900*, edited by John Christie and Sally Shuttleworth (Manchester and New York: Manchester University Press, 1990): 13-44; Ilse Vickers, *Defoe and the New Sciences* (Cambridge, UK and New York: Cambridge University Press, 1996), esp. ch. 5 on his *General History of Trade*.

[92] Defoe, *General History of Trade*, no. 1 (June, 1713), p. 18.

[93] Defoe was a vocal critic of the deceptive practices of stock-jobbers and other fraudulent "projectors." See, for example: [Daniel Defoe], *An Essay Upon Projects* (London: Printed by R.R. for Tho. Cockerill, 1697), pp. 29-30, 49; [Defoe], *The Anatomy of Exchange-Alley: Or, A System of Stock-Jobbing* (London: Printed for E. Smith, 1719); Sherman, *Finance and Fictionality in the Early Eighteenth Century: Accounting for Defoe* (Cambridge et al: Cambridge University Press, 1996).

While trade was a complex matter, it was also, in the *Mercator*'s eyes, a topic that was especially susceptible to the assault of factual evidence. The first *Mercator* presented its argumentative strategy in militant terms. The delusion about the French trade, the authors explained, "is a strong Enemy, so it must [be] dealt with in a forcible manner; and therefore Argument and Perswasions shall not be so much made use of here, as Demonstrations, Matters of Fact, authentick Vouchers, clear Documents, and such like irresistible Weapons."[94] This arsenal of evidentiary tools hinted at the varied cultural influences that fed the *Mercator*'s implicit standards of what made credible knowledge. "Demonstrations" evoked a traditional, philosophical kind of argumentation that sought unassailable certainty through logical deduction.[95] "Matters of Fact," as Barbara Shapiro has cogently argued, spoke to the traditions of the English Common Law, but perhaps also to new standards of observation and experimentation in areas like natural philosophy that borrowed from legal traditions.[96] "Authentick Vouchers" were also legal forms of evidence, but more specifically connoted the paper records necessary to account for mercantile transactions.[97] This array of weapons reveals the multitude of intertwined cultural influences behind the elevation of "fact"-based knowledge in the early eighteenth century. It also shows the all-out nature of political argumentation at the time. For the *Mercator*, Britain's people and their representatives were under assault by selfish interests peddling misinformation. Facts were to be their defense. But facts were not self-evident; as in the conception of "matters of fact" under the Common Law, commercial facts had to be justified by evidence.[98] In the Tory view, skilled judgment was required to discern the true facts from a mess of chaotic and potentially misleading claims.

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[94] *Mercator*, no. 1 (May 26, 1713), recto.
[95] Steven Shapin & Simon Schaffer, *Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life* (Princeton: Princeton University Press, 1985), ch. 4.
[96] For different perspectives on "matters of fact" in law, natural philosophy, and political economy, see: Shapiro, *Culture of Fact*; Shapin & Schaffer, *Leviathan and the Air-Pump*, ch. 2, esp. pp. 22-26; Poovey, *History of the Modern Fact*, pp. 97-120.
[97] On the use of "authentic documents" as forms of legal evidence, see Shapiro, *Culture of Fact*, p. 12.
[98] Shapiro, *Culture of Fact*, Ch. 1, esp. pp. 9-11.

III. What Every Boy upon the Exchange Knows: A Whig Epistemology of Trade

Whig opponents of the French Commerce Treaty took issue with the *Mercator*'s attempts to claim authority over the nation's understanding of foreign trade. In a series of polemical pamphlets and then, after August 7, in the *British Merchant* newspaper, an army of Whig pamphleteers presented an argument for the extreme danger of the French trade.[99] The Whig writers represented a range of backgrounds and skills: the "polite" journalist Richard Steele; trained Whig hatchet-man John Oldmixon; the wealthy Levant merchant Theodore Janssen; the lawyer and trade theorist Henry Martin.[100] Like the ministerial Tories, the Whig opposition felt that misleading information gravely threatened their position. Their concern, though, was that those holding the political reins and their hired pens would exploit their political trust and informational power to convince legislators to undertake a policy at clear odds with common wisdom.

The Whigs frequently lampooned the arrogance of the *Mercator* in presuming to overturn generations of commercial good sense on the basis of its own hubristic analysis.[101] One anonymous Whig pamphlet reflected disparagingly on how "the confident Authors of the *Mercator*" had sought to "contend with a General receiv'd Notion, that the Trade to France was always Prejudicial."[102] The particularly vitriolic *Torism and Trade Can Never Agree*, likely by Oldmixon, sarcastically lamented the fate that was going to befall those behind the *Mercator* (he especially suspected Davenant) for presumptuously setting themselves up as authorities on trade. "To contradict the Experience of fifty Years Commerce and to give no better Authority than his own bare Word for it," Oldmixon wrote,

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[99] Whig propagandists were loosely coordinated by key leaders like Harley's old foe Lord Halifax. See: Charles King, ed. *The British Merchant, or, Commerce Preserv'd,* 3 vols. (London: Printed for J. Darby, 1721), vol. 1, pp. xvi-xix; Gauci, *Politics of Trade*, pp. 248, 256.

[100] On the contributors to the *British Merchant* in particular, see, King, ed. *The British Merchant* (1721 ed.), vol. 1, pp. xiv-xv.

[101] Shapin & Schaffer note that the gentlemanly natural philosophers of the mid- to late seventeenth-century had come to see *modesty* as an essential moral attributes of credible observers of nature. (*Leviathan and the Air-Pump*, pp. 65-9.)

[102] [Anon.], *Letter to the Honourable A—r M—re* (1714), p. 18.

"must end in the most terrible Mortification."[103] The *British Merchant* often insulted its Tory counterpart for its presumptuous "air of Authority," noting in one instance how the *Mercator* spoke of the poor state of French woolen manufacturing "with such an Air of Confidence, that one would almost believe there is no Mutton at all in *France*, or that their Sheep wore no Fleeces."[104] What made the *Mercator*'s authoritative pretensions especially threatening was that they were supported by governmental resources. Charles King, who compiled a "methodized" edition of the serial *British Merchant* in 1721, reflected on the Whigs' precedent fears: "As this Author [the *Mercator*] had a Knack of writing very plausibly, and they who employ'd him, and furnish'd him with Materials, had the Command of all Publick Papers in the Custom-House; he had it in his power to do a great deal of Mischief, especially amongst such as were unskill'd in Trade."[105]

Like the Tories, the Whigs also turned to the facts, specifically drawing a sharp contrast between solid facts and "the *Mercator's bare Word*."[106] Whig polemicists celebrated distinct attributes of the "factual," particularly its clarity and accessibility. A self-conscious expression of this came in one of Joseph Addison's satirical pamphlets about the mythical character "Count Tariff," a personification of the Tory position on French trade. In his *Late Tryal and Conviction of Count Tariff*, Addison chronicled the fictional "Proceedings in the Cause of Goodman *Fact*, Plaintiff, and Count *Tariff*, Defendant."[107] While Tariff accused Fact of disrespecting the authority of his betters, Fact claimed that he did nothing but "TO SPEAK THE TRUTH AND NOTHING BUT THE TRUTH."[108] Addison lauded his character of Goodman Fact as much for the way he communicated as for what he communicated. "Goodman *Fact* is allowed by every Body to be a plain-spoken

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[103] [John Oldmixon], *Torism and Trade Can Never Agree. To Which is Added, an Account and Character of the Mercator…* (London: Printed, and Sold by A. Baldwin, 1713), p. 32.
[104] *British Merchant*, no. 1 (August 7, 1713) recto; no. 33 (November 24-27, 1713), verso. See also *British Merchant*, no. 21 (October 13-16, 1713), recto.
[105] King, ed. *British Merchant* (1721 ed), vol. I, p. x, xii.
[106] [Anon.], *A Letter to a West-Country Clothier and Freeholder, Concerning the Parliament's Rejecting The French Treaty of Commerce…* (London: Sold by J. Baker, 1713), pp. 8.
[107] [Joseph Addison], *The Late Tryal and Conviction of Count Tariff* (London: Printed for A. Baldwin, 1713), p. 1.
[108] [Addison], *Late Tryal and Conviction of Count Tariff* (1713), p. 10.

Person, and a Man of very few Words," he wrote. "Tropes and Figures are his Aversion. He affirms every Thing roundly, without any Art, Rhetorick, or Circumlocution."[109] If the Tories envisioned their "facts" as weapons, meant to compel by force, the Whigs envisioned theirs to compel by clarity, universality, and self-evidence.

Many of the Whig opposition writers preferred to base their arguments not on specific facts, but rather on the common stock of commercial wisdom. Rather than seeing trade as a complex analytical or even scientific problem, as Defoe did, the Whig polemicists emphasized the importance of mercantile experience. One pamphlet contended that the basic operations of the balance of trade, and the resulting conclusion that England lost by its trade with France, were among the rudiments of an effective commercial education, known by any "trading Merchant of Common Sense or Common Honesty" from their early days. "Don't every Boy upon the *Exchange* know," he asked, "that the One Article of Wines from *France*, will more than Balance all that we can send them; and that for the Overplus… must be so much Money put into their Pockets?"[110] The same author suggested that more specific political-economic precepts, like the dynamics of England's trade with favored-nation Portugal, might not depend on more than basic reason. "Can Common Sense without Knowledge of Trade," he asked, "imagine the *Portuguese* will take off One Fourth Part of the Manufactures we send them, when we will not take One Fourth of the Wines they send us?"[111]

This appeal to "Common Sense" was more than just an opportunistic move to capitalize on the weight of prevailing opinion. As Sophia Rosenfeld has recently argued, Whig commentators since 1688 had celebrated the common wisdom of the British people. Common sense, they suggested, was a national characteristic that not only distinguished the British from their slavish

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[109] [Addison], *Late Tryal and Conviction of Count Tariff* (1713), p. 2. Poovey argues that a plain-spoken style of writing, derived from patterns of mercantile communication, was an essential part of the elevation of factual reasoning in the seventeenth century. Her signal example is the writing of Thomas Mun. (*Modern Fact*, pp. 66-91). See also: Sophia Rosenfeld, *Common Sense: A Political History* (Cambridge, MA: Harvard University Press, 2011), pp. 28-31.
[110] [Anon.], *Remarks on a Scandalous Libel, Entitil'd* A Letter from a Member of Parliament, &c., Relating to the Bill of Commerce, (London: Printed for A. Baldwin, 1713), p. 4.
[111] [Anon.], *Remarks on a Scandalous Libel* (1713), p. 12.

French enemies but in fact made the British republic possible.[112] The Whig political and aesthetic theorist Lord Shaftesbury reflected on this in 1709.[113] "As for us Britons, thank Heaven, we have a better sense of government delivered to us from our ancestors…," Shaftesbury wrote. "We understand weight and measure in this kind and can reason justly on the balance of power and property. The maxims we draw from hence are as evident as those in mathematics."[114] Britons' political common sense was the result of both national inheritance and collective experience. As Shaftesbury explained, "Our increasing knowledge shows us every day, more and more, what common sense is in politics."[115] Four years later, Whig political economists argued that Britons' common understanding extended to matters of trade as well. Like Shaftesbury, reputed merchant and trade writer Theodore Janssen emphasized how the most fundamental commercial knowledge could be summarized in basic "General maxims" that were logically compelling but "which are assented to by every body."[116]

The key to the Whig's practical epistemology of trade was the confidence that factual data about trade and commercial common sense told the same story. Both stood in stark contrast to the authoritative epistemic position assumed by the Tories. On the one hand, "facts" were contrasted to "Tropes and Figures," to "Art, Rhetorick, or Circumlocution." The very first issue of the *British Merchant*, for instance, criticized the opposing *Mercator* for reasoning "by heaps of comparative and

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[112] Rosenfeld, *Common Sense*, ch. 1. The belief in the ability of common people to be effective judges of facts was also an important foundation of the jury system under common law (Shapiro, *Culture of Fact*, pp. 25-6).
[113] On Shaftesbury's political connections, see Klein's introduction in Shaftesbury, *Characteristics of Men, Manners, Opinions, Times*, ed. Lawrence Klein (Cambridge et al.: Cambridge University Press, 1999), pp. xv-xx; Klein, *Shaftesbury*, ch. 7.
[114] Anthony Ashley Cooper, 3rd Earl of Shaftesbury, "Sensus Communis, an Essay on the Freedom of Wit and Humour in a Letter to a Friend," (1709) in Shaftesbury, *Characteristics of Men, Manners, Opinions, Times*, ed. Klein, p. 50. See also pp. 37-8.
[115] Shaftesbury, "Sensus Communis" (1709), pp. 50-1.
[116] [Theodore Janssen], "General Maxims in Trade, Particularly Applied to the Commerce Between *Great Britain* and *France*," (1713), in King, ed. *British Merchant* (1721 ed), vol. I, pp. 1-42, quotation on p. 1. For citations of Janssen's pamphlet, see *Guardian* no. CLXX (September 25, 1713); *British Merchant* no. 10 (September 4-8, 1713), recto. For another example of discussions of trade "maxims," see *British Merchant* no. 29 (November 10-13, 1713).

superlative words, without any determinate Sense or Meaning."[117] At the same time, the Whigs could contrast the haughty intellectual pretensions of the Tories to common sense and practical experience. Only a few years before, the Whig Shaftesbury had suggested that common sense and philosophy were effectively in competition when it came to matters of politics and morality. "The truth is… honesty is like to gain little by philosophy or deep speculations of any kind," he wrote in 1709. "In the main, it is best to stick to common sense and go no further."[118] Pamphleteers in 1713 applied this dichotomy to political economy, suggesting that the matter of the Commerce Treaty came down to a choice between fastidious philosophizing and common sense. As one author asked: "Is Theory better than Practice, and Sophistry stronger than Experience?"[119] John Oldmixon put it most viciously when he called out Davenant for trying to elevate trade to a level of philosophical study. The Tory expert was little more than a "Theorist, who talks of Trade in the *Park* as a Mathematician does of Navigation on *Hampstead* Hill," Oldmixon charged. "Yet because he can marshal up three or four Ranks of Numbers, which are like so many magical Figures to certain Politicians, because he has acquir'd a little Mercantile Court, he is made much of as a Person extreamly well acquainted with Trade: Nevertheless I will lay him as much Money as he is worth, that he cannot fit out a Ship for *Newfoundland*, nor make out an *Invoice* for *Virginia*."[120]

Though Oldmixon and his Whig associates railed against Davenant's mathematical elitism and "magical Figures," they did not dismiss the political-economic importance of proper calculation.

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[117] *British Merchant*, no. 1 (August 7, 1713), p. 1. Theodore Janssen also disparaged the computations of the Treaty supporters by saying that: "To magnify our Exports, or diminish our Imports, by comparative and superlative Words, serves for nothing but to amuse the Ignorant. The Balance, the Balance of both, is the only thing that can demonstrate our Profit or our Loss." ("General Maxims," in King, ed. *British Merchant* (1721 ed.), vol. I, p. 38.) The specific critique of the use of "comparative and superlative words" recalled the key methodological precept of William Petty's "political arithmetic." For Petty's description, and earlier invocation of the idea by a key Whig political economist, see: William Petty, *Political Arithmetick*… (London: Printed for Robert Clavel, 1690), "Preface," esp. pp. [x-xi]; [Henry Martin], *Considerations upon the East-India Trade* (London: Printed for A. and J. Churchill, 1701), p. [i].
[118] Shaftesbury, "Sensus Communis" (1709), p. 61.
[119] [Anon.], *Remarks on a Scandalous Libel* (1713), p. 4.
[120] Oldmixon, *Torism and Trade Can Never Agree* (1713), pp. 25-6.

Whigs like Richard Steele in fact contented that numerical reasoning was a special tool not only for economic reasoning, but social fair-dealing and political conversation. In an early edition of the *Guardian* in 1713, Steele described a fictitious family, the Lizards, who embodied the ideal traits of a genteel landowning family in a commercializing world. The eldest son and heir, Sir Harry Lizard of Northamptonshire, was particularly praised for his quantitative way of thinking. Though not an accomplished conversationalist, Lizard was a "very fine Gentleman," Steele explained, owing in no small part to his ability to calculate profit-and-loss. That skill allowed him, "in a much shorter time than is usual" to become a "Master of the Question before him." Critically, that benefitted more than just his own bottom-line: "The same Capacity, joined to an honest Nature, makes him very just to other Men, as well as to himself."[121] Facility in calculation, Steele suggested, was not only the mark of a man skilled in business, but a trait befitting a gentleman. It was the foundation of honest discourse, a trustworthy language of numbers that linked the landed and the mercantile classes. Harry Lizard's computational pursuits extended beyond just profit-and-loss accounting, to what might be termed political arithmetic.[122] The "Landed man" was deeply interested, for example, in the mathematical relationships between land values and international trade. For Steele, that kind of intensive, technical computation was not necessarily an overbearing or pedantic style of reasoning. Nor was it a task demanding professional expertise. Arithmetic analysis, for Steele, was one of the foundations of gentility and responsible civic participation.

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[121] Steele, *The Guardian* no. 6 (March 18, 1713), recto.

[122] One vignette is illuminating: "I took an Opportunity in his Presence, to ask an Intelligent Woollen-draper, what he gave for [his] Shop…. I was answer'd, Ninety Pound a Year. I took no Notice, but the Thought descended into the Breast of Sir *Harry*, and I saw on his Table the next Morning, a Computation of the value of Land in an Island, consisting of so many Miles, with so many good Ports; the value of each part of the said Island, as it lay to such Ports, and produced such Commodities. The whole of his working was to know why so few Yards, near the *Change*, was so much better than so many Acres in *Northamptonshire*, and what those Acres in *Northamptonshire* would be worth, were there no Trade at all in this Island." (Steele, *The Guardian* no. 6 (March 18, 1713), verso.)

IV. The Problem of Interest as a Problem of Knowledge

Did the competing visions of economic knowledge that were presented by the Tory and Whig sides actually reflect meaningful differences in their political values? Did the two sides really celebrate different "political-epistemic virtues," rather than simply adopting rhetorical stances necessary for their momentary agendas? The two sides of course had to play the contextual hands they were dealt. The Tories held ministerial power at the time, and capitalized on the perceived authority and the access to information to which that entitled them; the Whigs were forced to take an oppositional stance, but had the *prima facie* numerical evidence (the 1674 *Scheme*) and a body of anti-French popular opinion on their side. Starting from these different endowments, the political disputants were forced by partisan pressure to think in new and more conscious ways about what made credible knowledge. Epistemic positions crystallized in the course of polemical argumentation.

Yet, there were fundamental fissures in the way the two parties understood human nature and reacted to economic change which were evident well before the specific arguments of 1713. The most telling divide between the Whigs and Tories concerned what might be termed the *problem of interest*. The two parties reacted differently to the challenge of reconciling the disparate and potentially competing interests of the nation's many businesses, localities, and social groups. They especially differed in their views of the relationship between interest and knowledge when it came to affairs of wealth and trade. Neither side strictly rejected the pursuit of individual or corporate gain as anathema to the public good.[123] As Albert Hirschman has explained, by 1700 many people had come to embrace the collective benefits of the individual pursuit of gain, acknowledging a set of productive, motivational human "interests" that stood in contrast to the immoral, potentially

[123] As J. A. W. Gunn put it, by the later seventeenth century, "all but the most rigidly traditional mercantilists were prepared to find virtues in the rational pursuit of interest." (J. A. W. Gunn, *Politics and the Public Interest in the Seventeenth Century* (London and Toronto: Routledge & Kegan Paul/University of Toronto Press, 1969), esp. pp. 205-265, quotation on p. 214.) See also Steve Pincus, "Neither Machiavellian Moment nor Possessive Individualism: Commercial Society and the Defenders of the English Commonwealth," *The American Historical Review* 103, no. 3 (Jun., 1998): 705-736.

destructive "passions."[124] Yet, early eighteenth-century Britons had only begun to wrestle with the question of interest as an epistemological problem. Anxiety remained about how interest might hinder the making of conclusive and honest knowledge, especially about commerce. As Steven Shapin recounts, a cornerstone of the new standards for natural-philosophical knowledge negotiated in the later seventeenth-century was that truthful knowledge be necessarily *disinterested*.[125] That is, scientific observation, like legal testimony, could only be considered credible if those offering it had no personal (especially financial) stake in the ultimate judgment. This was a standard which posed obvious problems to those seeking, or demanding, trustworthy knowledge about economic phenomena like the patterns of international trade, the evaluation of the quality of goods, or the movement of prices and exchange rates.[126] After 1688, economic challenges prompted Britons to grasp for alternative standards for legitimacy in knowledge of "Trade & Revenue" that did not demand disinterestedness.

By 1713, Whigs and Tories had staked out distinctive positions on the question of interest and the feasibility of economic knowledge. On the one hand, Tory voices, even well before the *Mercator*, had expressed sincere doubt that commercial knowledge-claims might be at once truthful and reflective of private interests. This concern was evident in 1691, for example, in the preface to the first edition of the *Discourses Upon Trade* by Dudley North, a valued fiscal advisor to Kings Charles II and James II and key Tory trade theorist of the 1680s.[127] The author of the preface (likely Dudley's brother Roger) lauded Dudley, writing that he "speaks impartially of Trade in general,

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[124] Albert O. Hirschman, *The Passions and the Interests: Political Arguments for Capitalism before its Triumph*, 20th Anniversary Ed. (Princeton, NJ: Princeton University Press, 1997 [1977]).
[125] Shapin, *Social History of Truth*, pp. 83-84; Shapiro, *Culture of Fact*, pp. 28-32.
[126] Mary Poovey, argues that not everyone looked upon the interested claims of merchants with doubt. Citing Robert Boyle and Royal Society historian Thomas Sprat, Poovey points out that some early-modern observers felt that mercantile methods of communication in fact provided ideal models for transmitting trustworthy knowledge, in part because of the profit motivations. She agrees, though, that attitudes toward the epistemic effect of self-interest were highly varied. (*Modern Fact*, pp. 115-120.)
[127] Notably, North was a strong opponent of raising tariffs on French wines to prohibitive levels. He has been widely cited as one of the seventeenth-century thinkers most committed to "free trade" and most advanced in developing systematic, self-regulating models of trade. See: Ashley, "Tory Origins"; William Letwin, *The Origins of Scientific Economics: English Economic Thought 1660-1776* (London: Methuen, 1963), ch. 7; Finkelstein, *Harmony and the Balance*, ch. 12.

without warping to the Favour of any particular Interest." This was a great virtue, because "it hath been observed formerly, when Merchants have been consulted, and the Questions concerned only Trade in general, they agreed in Opinion; but when opposite Interests were concerned, they differed *toto caelo*."[128] Davenant took this perspective even further in his 1698 *Discourses*, explaining that one of the key factors motivating the need for better economic information and more penetrating political arithmetic was the obscuring effect of interest. When it came to trade, Davenant wrote, "the Councils of a Country are always inquisitive after Truth, but to hide it from 'em, and to perplex Things which have Relation to Trade, is the Interest of so many." Davenant proposed an enlightening solution. "A true Accompt of the Balance of Trade would set all this aright, and shew what Trafficks are Hurtful, and what are Beneficial to the Nation," he postulated, "but probably this Balance is no way to be found out, but by Political Arithmetick."[129] Skilled calculation offered the best means available of teasing apart the intersecting threads of interest that so veiled the general knowledge of trade. "Perhaps this Art alone"—political arithmetic—"can shew the Links and Chains by which one Business hangs upon another, and the dependence, which all our various Dealings, have each upon the other."[130]

Over two decades later, the *Mercator* echoed this discomfort. In an early issue, the *Mercator* reflected on special petitioning by Turkey merchants and lamented "what Absurdities they may run when they submit to that MEAN Error, which is now so much the common Practice, (viz.) of mingling private Interests and Matters of Commerce with Affairs of the State, making Trade a Party-Cause."[131] The Tory commentators not only feared the political consequences of intermingling private interests with public policy, but were specifically aware of the "Absurdities" of knowledge

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[128] [Dudley North], *Discourses upon Trade; Principally Directed to the Cases of the Interest, Coynage, Clipping, Increase of Money* (London: Printed for Tho. Bassett, 1691), p. [v].
[129] Charles Davenant, *Discourses on the Publick Revenues, and on the Trade of England*, Vol. 1 (London: Printed for J. Knapton, 1698), pp. 29-30.
[130] Davenant, *Discourses on the Publick Revenues* (1698), Vol. 1, p. 31.
[131] *Mercator* no. 5 (June 2-4, 1713), recto.

that resulted. Figuring what was truly in the "Interest of Trade" was profoundly difficult, and not just for the nation as a whole, but even for particular individuals or constituencies.[132] In discussing a flurry of petitions that contained seemingly unfounded rumors about the quality of French woolens, the *Mercator* explained how Britain's changing financial landscape made it confusing to figure out what interests were driving commercial knowledge-claims:

> Some People think the Number of Petitions may be of use to them, whether the Substance or Matter of those Petitions may appear or not; and therefore the same Persons having Interest in divers Companies by their Stocks, have been found busily promoting Complaints and Petitions of the same kind, from the said several Bodies or Companies, however differing or remote from one another in their Interest the Affairs of the said Company have been.[133]

In other words, the increasing entanglement of interests made possible by joint-stock investment meant that companies or lobbying groups might make claims about commercial affairs which had little to do with their own business concerns, driven by concerns in other companies.

Such interlocking profit motives, particularly when further jumbled with the concerns of political faction, meant that many commercially-engaged Britons might even become misguided about what was really in their own best interests. The *Mercator* cited the example of the Virginia Company, who presumably stood to gain tremendously from a Commerce Treaty that opened up French markets for Virginia tobacco. "The *MERCATOR* will not take upon him to say… that all the Virginia Merchants are for the Bill of Commerce," read *Mercator* no. 70. "That it is their true interest, as Virginia Merchants, is undeniable… But we must not think it strange at this time to see men act against their True interest, and without the Use of their Wits."[134] It was not just difficult to know, or to convince people of, what was the best for Britain as a whole; it was a trying matter to convince individual Britons what was best for them alone.

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[132] For references to the "Interest of Trade," see for example: *Mercator* no. 19 (July 4-7, 1713) verso; no. 62 (October 13-15, 1713) recto.
[133] *Mercator* no. 7 (June 6-9, 1713), verso.
[134] *Mercator* no. 70 (October 31-November 2, 1713), recto.

The Whig attitude could hardly have been more different. Interest did not obscure true commercial knowledge. In fact, the operation of self-interest was the soundest foundation for understanding how trade worked. This attitude emerged as one of the epistemic pillars of Whig political economy in the 1690s. Board of Trade member John Pollexfen made this point precisely in 1697. "Hopes of Gain may be said to be the Mother of *Trade,*" he wrote. "Therefore in Considerations of *Trade* and *Coyn*, Arguments from Interest ought to be taken for as good Proof as Demonstration."[135] This assumption of the transparency and honesty of self-interest became a major weapon in the argumentative arsenal of the Whig opponents of the French Commerce Bill. There was simply no way, the Whigs argued, that so many different British merchants and tradesmen would oppose the opening of French trade if they truly stood to benefit by it.

"Interest never lyes," John Oldmixon asserted. "If *Merchants*, *Clothiers*, &c. were not sure the *French* Trade on the *Mercator's* Foot would ruin us, no Faction, no Party could prevail on them to interrupt the general Joy of the Nation on the late *Peace*."[136] The aphorism "interest never lyes" became shorthand for this essential assumption in the Whigs' commercial epistemology.[137] The phrase, likely borrowed by the English around the 1640s from the writings of the Duke of Rohan, a French Huguenot, began as an axiom for evaluating the diplomatic motivations of competing nations. In the hands of Marchamont Nedham in the late 1650s, the phrase became more broadly applied to the interplay of competing factions in domestic politics, as Nedham argued that an assumption that political actors rationally pursued their own self-interest could serve as a foundation for strategic political analysis.[138] In the hands of the Whig political economists of the early

[135] Pollexfen, *Discourse of Trade, Coyn, and Paper Credit,* p. 2.
[136] Oldmixon, *Trade and Torism Can Never Agree* (1713)*,* p. 31.
[137] See also [Anon.], *Remarks on a Scandalous Libel* (1713), p. 4.
[138] J. A. W. Gunn, "'Interest Will Not Lie': A Seventeenth-Century Political Maxim," *Journal of the History of Ideas* 29, no. 4 (Oct.-Dec., 1968): 551-564, esp. p. 557.

eighteenth-century, the phrase became a fundamental basis for making and testing knowledge about how commerce worked.

V. Scheming: the Dynamics of a Computational Controversy

In the summer of 1713, the Tory supporters of the French Commerce Treaty and their Whig opponents both seized upon the calculation of the Anglo-French balance of trade. Yet they had different reasons to believe that numerical reasoning was argumentatively expedient and politically virtuous. The Tory *Mercator* promised that an expert computation of the trade balance would help to undeceive the people and their political representatives from a long-standing myth perpetrated by selfish mercantile and party interests. The *Mercator* strove not only to show why Whiggish claims were wrong, but to impress upon the British people the deep risks they ran in believing such frauds. The Tory paper was especially interested in computational methodology, as a way to show that it was they, and not the Whigs, who could claim trustworthy command over matters of trade.[139] Their Whig opponents, on the other hand, felt that the economic numbers had long spoken for themselves, supporting the common-sensical idea that trading with France was detrimental to Britain's welfare. It was largely because the two sides were working with different notions of why numbers were valuable and how they ought to work in public decision-making that they were able to engage in such an intense computational controversy.

It was the Tory side that was responsible for setting the full-fledged computational controversy in motion with their attempts to discredit the myth of the 1674 *Scheme of Trade*.[140] The *Mercator* set out "to expose the Arts and Contrivances" by which the British people had come "to

[139] This emphasis on method, as opposed to purely "matters of fact," is vaguely reminiscent of the position taken by Thomas Hobbes in his dispute with Robert Boyle over Boyle's air-pump. (Shapin & Schaffer, *Leviathan and the Air-Pump*, esp. p. 145).

[140] This initial Tory enthusiasm for calculating the trade balance calls into question Appleby's claim that the balance of trade doctrine was primarily a device of an emergent Whig oligarchy concerned with justifying more interventionist economic policies. See Appleby, *Economic Thought and Ideology*, pp. 268-71.

receive it as an uncontroverted Truth, that we lost by that Trade."[141] In 1674, the *Mercator* contended, a nefarious party of men had wished to create discord between the King and his subjects, and so had produced misleading figures meant to paint a negative picture of the nation's trade and derail the King's efforts at closer diplomatic relations with France.[142] What was especially problematic was that, almost forty year later, this calculated deception was still being "made use of as the Fundamental, the Test or Touchstone of the French Trade, and as an unquestion'd Authority."[143] The frauds in this "Touchstone," the *Mercator* claimed, were extensive. The *Scheme* relied on data from extremely misleading years.[144] It also intentionally excluded goods from Asia, Turkey, and the American plantation colonies re-exported to France. For particular items, the *Mercator* noted, the *Scheme* simply misstated the quantities grossly, as in the claims that the English imported some 150,000 pounds of wrought silks or 11,000 tons of wine from France, numbers totally unjustified by the Customs-House books. The *Mercator* offered a preliminary computation based on a first batch of Customs figures provided to MPs in May, suggesting that the Scheme's nearly £1,000,000 negative trade balance was very far from accurate. England's negative balance was no worse than £269,000 in 1663 and £433,000 in 1669, the *Mercator* argued, and that was before a series of vital but complicated adjustments were made to the figures. In fact, "by a just and true Account," the *Mercator* argued, "the English Trade had the Gain."[145] The *Mercator* went on to promise an "exact Calculation" of the real balance of trade, which would provide conclusive evidence that the Scheme was a "design'd Collusion and Prevarication."[146]

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[141] *Mercator* no. 2 (May 26-28, 1713), recto.
[142] See also *Mercator* no. 11 (June 16-18, 1713), recto.
[143] *Mercator* no. 2 (May 26-28, 1713), recto.
[144] The calculation of exports relied on figures from 1668, the lowest possible year for English exports because of new French duties imposed in 1667, while the data for imports from France came from 1674, when import levels were historically high.
[145] *Mercator* no. 2 (May 26-28, 1713), verso.
[146] *Mercator* no. 11 (June 16-18, 1713), verso.

Over the following two months, the *Mercator* offered an array of targeted, critical calculations aimed to address specific fears about trade with France. These pointed calculations did not yet constitute a complete balance account. Yet, they used arithmetic to make proportional or comparative arguments that gave the public reason to question the "Common-places of their Party-Instructors."[147] One such commonplace was the idea that freer trade with France would ruin the English silk weaving industry. *Mercator* no. 9 presented an account showing the average silk imports from 1707-9 from Germany, Italy, Holland, Spain, the "Streights," and Venice. The argument was that the total English market for imported silk textiles (not above £33,000 per year) was not even 1/30th of the volume of silks manufactured domestically. In other words, the English silk weaving industry was so robust that allowing silk imports from France could hardly threaten it.[148] An argument in the following issue attacked the misconception that opening up trade with France would decrease English imports of wine from Portugal and therefore jeopardize Portugal's reciprocal demand for English woolens. The *Mercator* made the simple point that the English exported over £2 million in woolens to Portugal in exchange for only about £200,000 worth of wine, meaning that the Portuguese demand for English textiles was far too large to depend on a one-to-one exchange of woolens for Port wine.[149] Many of the *Mercator*'s would follow a similar model: disputing familiar conceptions about trade by carefully translating those conceptions into numerical terms and revealing their absurd implications.

Early on, the *Mercator* was indeed most focused on—and most successful at—using calculations to critique pre-existing truth-claims rather than to justify new ones. This was particularly evident when new data came available to the public. The *Mercator* promptly seized upon new Customs data in mid-June to show that the Whig's prized *Scheme* had overstated the French imports

[147] *Mercator* no. 27 (July 23-25, 1713), recto.
[148] *Mercator* no. 9 (June 11-13, 1713).
[149] *Mercator* no. 10 (June 13-16, 1713).

just at the Port of London by over £721,000.[150] The Tories did not immediately use the new Customs reports to offer their own balance calculation. But those new figures did provide resounding evidence that the well-publicized 1674 *Scheme* could not be based on "exact Accounts from the Custom-House Books," though it was claimed "to be exactly Calculated."[151] For the *Mercator* and its Tory backers, revealing that the opposition has been passing a false document—indeed, a "forgery"—was a damning indictment.[152] The falsity of the Scheme demonstrated the danger of trusting self-interested testimony. Just as forging a bill of exchange threatened to undermine the networks of credit on which financial wealth depended, the falsification of technical data threatened the immature mechanisms of representative governance.[153]

As the battle over the balance of trade proceeded, the *Mercator* accused that the Whigs more generally of undermining the very foundations of orderly political discourse with their immoderate mode of argumentation.[154] Instead of solid facts, Whiggish arguments relied on forged papers, baseless accusations, and, what was perhaps the scariest of all, "the Opinion of the People."[155] They specifically broke one of the most critical standards of gentlemanly behavior by accusing the *Mercator* and its supporters of falsehood without providing clear justification. "They give *they Lye* to the most just Calculations made by the best and ablest Hands, and acknowledged in the House of Commons to be right," the *Mercator* charged angrily, "and this they do without so much as descending to Particulars, or telling wherein those Calculations are wrong."[156]

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[150] *Mercator* no. 11 (June 16-18, 1713), verso.
[151] *Mercator* no. 11 (June 16-18, 1713), verso.
[152] For examples, see *Mercator* no. 32 (August 4-6, 1713), recto; no. 35 (August 11-13, 1713), recto; no. 42 (August 27-29), recto; no. 66 (October 22-24), recto; no. 83 (December 1-3), verso.
[153] On the fear of forgery, see Randall McGowen, "Knowing the Hand: Forgery and the Proof of Writing in Eighteenth-Century England," *Historical Reflections/Reflexions Historiques* 24, no. 3 (Fall, 1998): 385-414; "From Pillory to Gallows: The Punishment of Forgery in the Age of Financial Revolution," *Past & Present* 165 (Nov., 1999): 107-140.
[154] See particularly *Mercator* nos. 32-47 (August 4 – September 10, 1713).
[155] *Mercator* no. 36 (August 13-16), recto.
[156] *Mercator* no. 32 (August 4-6, 1713), recto. For a discussion of "giving the lie" as the greatest affront against the honor of a gentleman in early modern England, with a discussion of the implications for intellectual argument, see Shapin, *Social History of Truth*, pp. 107-114.

The fact that the Whigs made so little effort to "descend to Particulars" and critique the *Mercator*'s claims on a focused analytical level was, in the *Mercator*'s eyes, evidence that the Whigs could not be trusted. In early fall, the *Mercator* came to argue that mastery of computational method, perhaps even more than accurate factual data, was the foundation on which trustworthy commercial knowledge was built. *Mercator* no. 49 presented a detailed algorithm to this effect, demonstrating what it would take to produce a balance-of-trade calculation that could garner a sufficient level of certainty. A series of corrections would need to be made to the superficial Customs data: exports would have to be adjusted to include French-bound exports from London inaccurately recorded in the Customs data; re-exports from the outlying ports would have to be included; valuations of imports would have to be corrected; the profits and employment generated for the English in shipping goods to and from France would have to be included. This methodological discussion served as a kind of computational threat, suggesting that "if the People who talk so loud of our Loss by the French Trade" ever carried out such an accurate calculation, they would soon see how baseless their fears were.[157] With these warnings, though, the *Mercator* did more than simply shift the burden of proof back upon their Whig opponents. By discussing methodology, or, in their words, "all the just rules by which such a thing can be computed," the *Mercator* signaled that it was actually the Tory calculators that understood enough to render judgment on the trade balance. [158]

The different political-epistemic attitudes of the two parties were evident in what each side was more afraid of: the Tory *Mercator* dreaded popular delusions authored by selfish interests, particularly on paper; its Whig opponents feared the supposed authority of mercenary experts. This distinction was immediately evident in August, when the Whigs began to engage most systematically in technical controversy through their new publication, the *British Merchant*. The new paper went straight after the *Mercator*: "My principal Care shall be to detect the Frauds and Cheats of the

[157] *Mercator* no. 49 (September 12-15, 1713), verso.
[158] *Mercator* no. 55 (September 26-29, 1713), verso.

Mercator, by which he imposes upon the People."[159] The *Mercator* was an especially dangerous adversary because he claimed a monopolistic "Air of Authority" over the analysis of trade, grounding that authority in a mendacious treatment of evidence.[160] Calculation proved a potent tool for challenging the *Mercator*'s claims to honesty and authenticity. The Whig authors demonstrated their own computational acumen in issue no. 4, taking apart a lengthy calculation offered in *Mercator* no. 26 that claimed that England had re-exported £500,000 of foreign goods to France in one year from 1686-7. The computation followed a familiar strategy: it simply borrowed the *Mercator*'s numbers regarding the quantities of goods exported, and recalculated the total value of those exports using different prices for various products. The conclusion was that the value of the re-exports in 1687 was less than £176,000*,* not even two-fifths of the sum claimed. "Is this then one of the *Mercator's* indisputable *Vouchers*?" the paper asked. "Is this his way of proving Facts by *clear Documents*?"[161]

The *British Merchant*'s common refrain, indeed, was that the *Mercator* had failed to live up to its own lofty standard of knowledge, claiming to rely on factual evidence while actually making claims solely on authority. The Whigs took pleasure in pointing out that the *Mercator* could not prove many of its key claims, for example that English exports to France were more profitable than the Customs records reflected because of how such goods were retailed in France.[162] But it was the *Mercator*'s failure to prove one point that the Whigs attacked more than any other: the Tory paper's

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[159] *British Merchant* no. 1 (August 7, 1713), recto. It was commonly a Whig, rather than a Tory strategy, to direct *ad hominem* polemics towards political journalists rather than politicians themselves. (Müllenbrock, *Culture of Contention*, p. 167).

[160] *British Merchant* no. 3 (August 11-14, 1713), recto.

[161] *British Merchant* no. 4 (August 14-18, 1713). Quotation on verso. The Whig writers continued to hammer away at these claims of the volume of re-exports to France. See *British Merchant* no. 5 (August 18-21, 1713) and no. 7 (August 25-28, 1713).

[162] English manufactures were sold in France on a "commission" basis, allowing English merchants to reap most of the retail profits on those goods once they were sold to French consumers, or so the *Mercator* claimed. The *British Merchant* disagreed, noting that "the *Mercator* will never be able to prove it." (*British Merchant* no. 13 (September 15-18, 1713), recto.)

inability to produce an actual calculation of the balance of trade in any year which showed that the French trade benefitted Britain.[163] As its Whig opponents put it:

> The *Mercator*, at his first setting out, affirm'd, *That the Trade between* England *and* France *was ALWAYS beneficial to this Kingdom,* and that this should be prov'd by a CALCULATION of the Exports and Imports between both Countries, in which it would appear the Balance was always on the *English* side... Tho his Paper comes out thrice every Week, and has done so for five Months together, has he ever yet produc'd the Account of any one Year? And till this is done, ought not all his Readers to throw him aside for an Impostor?[164]

By fall 1713, it was therefore the Whig opponents of the Commerce Treaty, and not the ministerial *Mercator*, that were making the loudest calls for an authoritative calculation of the Anglo-French balance of trade. "Upon the whole matter, I think, an exact Account of Exports and Imports is the only infallible way to shew whether we have gain'd or lost by our Trade with France," read *British Merchant* no. 12.[165] There were many tactical reasons for the Whigs to adopt this position, including that the data available made their numerical case far easier to make. But this methodological position echoed a political principle—it did not take an expert authority to compute the trade balance, whatever the complications in the data. All that was needed was a bit of mercantile know-how and the tools of common arithmetic.

The Whigs seized the opportunity to do what their opponents had not. In quick succession, Whig publications presented two assertive calculations showing both what the Anglo-French trade balance had been in a representative year (1685-6), and showing a projection of what the balance would likely stand at after a French commerce treaty had been passed. In late September, *British Merchant* no. 14 presented an extensive "ACCOUNT of the Imports and Exports to and from ENGLAND and FRANCE, From Michaelmas 1685. To Michaelmas 1686."[166] The four-page

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[163] For example: *British Merchant* no. 13 (September 15-18, 1713), recto.
[164] *British Merchant* no. 20 (October 9-13, 1713), recto.
[165] *British Merchant* no. 12 (September 11-15, 1713), verso.
[166] *British Merchant* no. 14 (September 18-22, 1713). See also King, ed. *British Merchant* (1721), vol. 1, pp. 282-305.

account, relying on Customs figures presented to Parliament earlier that year, walked item-by-item through a dizzying array of goods, from 42 barrels of anchovies imported into London (equaling £15.15*s.* total) to over 115,000 lbs. of wrought silks (just under £289,000 in value). The account totalled over £1,284,000 in French imports for that year, set against only £514,000 exports. The negative balance was not the £1 million loss implied by the 1674 *Scheme*, though the Whig paper provided several reasons why the balance would be worse than the £770,000 implied.[167] More importantly, though, it demonstrated that the Treaty's opponents need not rely on the old *Scheme* to justify their position. For good measure, a different Whiggish publication, Richard Steele's *Guardian* (issue no. 170), presented a one-page calculation estimating that by 1713 the balance likely stood at an even worse level of £1.45 million. The two computations placed the burden of argumentation squarely back on the Tories. "It is time now for the *Mercator* either to falsify that Account," *British Merchant* no. 16 stated, "or to produce one of other Years which is sufficient to balance so great a Loss."[168]

The Whigs had called the *Mercator*'s bluff. The *Mercator* had originally pointed to the availability of Customs data as clear evidence that their Whig opponents preferred to argue from interested hearsay and popular myth instead of solid evidence. This was not an easy position to sustain once the *British Merchant* had actually followed the *Mercator*'s advice to "search the BOOKS."[169] The *Mercator* was left in the familiar but tricky position of trying to discredit a transparent calculation on complicated technical grounds. The *Mercator* found several points on which to criticize the *Guardian*'s more speculative figures, claiming that the balance of trade was more complicated than the Whigs claimed it to be, and that the *Guardian*'s calculations relied on an

[167] These included the incredible volume of clandestine goods shipped in from France (estimated at 1/3 of total imports, or £428,000), and the likelihood that re-exports of foreign goods through England would likely be disallowed by any Commerce Treaty. See *British Merchant* no. 15 (September 22-25, 1713).
[168] *British Merchant* no. 16 (September 25-29, 1713), verso.
[169] *Mercator* no. 36 (August 13-15, 1713), verso.

amateur understanding of the science of commerce. One of the *Mercator*'s most creative calculations came among this series of attacks against the *Guardian*, as the paper crafted a clever arithmetical model that revealed the absurd implications of its opponents computations. Issue no. 58 contended that, if the *Guardian*'s projections for future French imports were true, the British government could expect to generate unprecedentedly high revenues solely on the Customs on French goods. A numerical table reproduced the *Guardian*'s projections for French imported goods, then multiplied those volumes by the (relatively low) tariff levels specified by the proposed Commercial Treaty. When added together, the conclusion was that the *Guardian* had stumbled upon some £1.17 million in public revenue, an amount that exceeded "all the rest of the Duties payable upon the whole British Trade, both to and from all the world."[170] This deft computation not only allowed the *Mercator* to display his numerical acumen, but also placed the opposing *Guardian* in an unsavory position, that of the deceitful projector. "If the *Guardian* is not to be praised then for the best Projector of the Age, who has found out such a Fund as has not been heard of before," the *Mercator* mocked, "let any one judge."[171]

The "New Scheme" for the year 1685-6, presented in *British Merchant* no. 14, provided a more serious challenge for the *Mercator*. The Tory journalists admitted that the "New Scheme" did not rely on falsified volumes of goods imported and exported, as the 1674 *Scheme* had done.[172] Instead, they relied on more inconspicuous forms of deception, which in turn required more detailed and technical forms of critique. *Mercator*s no. 60 and 61, for example, argued that the year 1685-6 was a prejudiced year on which to base a balance-of-trade calculation because it was a rare year during which English tariffs against France were reduced, and so English consumers had presumably rushed to buy newly-available items from France. The paper also presented several

[170] *Mercator* no. 58 (October 3-6, 1713), recto.
[171] *Mercator* no. 58 (October 3-6, 1713), verso.
[172] In particular, the *Mercator* accused its opponent of manipulating the valuation of those goods that come in multiple qualities and sizes. (*Mercator* no. 60 (October 8-10, 1713), recto.)

extensive lists of goods that the *British Merchant*'s "New Scheme" valued incorrectly, like calicoes and leather.[173] The *Mercator* justified many of these specifics by reproducing letters from commercial experts. Issue no. 66 included testimony on pricing mistakes from authors entitled "Wholesale Grocer" (on French prunes), "Silversmith" (on French silver plate), and "Calf-skin" (on leather).[174] A final area of criticism was the most potent and the most difficult to prove. The *Mercator* argued at length that the Whiggish "New Scheme" failed to capture abundant English exports to France that were re-routed through other countries or misreported at the Customs Office as intended for other destinations, for example some £300,000 of English goods carried annually through Holland.[175]

The *Mercator* drafted a collection of larger calculations and tables that revealed the aggregate impact of these varied mistakes on the *British Merchant*'s overall balance of trade calculation (see **Figure 3a.**). A computation in issue no. 61 began with the "New Scheme" figure for French imports (£1.28 million), and, finding £375,000 in mistakes relating to imports inflated by the choice of year (e.g. for linens, prunes, and salt) and for incorrect prices (e.g. wine, brandy, silks, and paper), reduced the total French imports to a value of just over £900,000.[176] Issue no. 63 turned to exports, presenting a multi-folio chart in five-columns that included systematic comments by the *Mercator* on whether the prices in the "New Scheme" were reasonable.[177] Issue no. 65 pressed this revision even further, taking the "New Scheme" figure for exports of £742,000, and added £400,000 for trade carried through Holland and Flanders, £50,000 for exports of corn, £64,200 for retailing, and £500,000 for profits on shipping. The result was almost £1.8 million in total exports to France,

[173] *Mercator* no. 60 (October 8-10, 1713), recto-verso.
[174] *Mercator* no. 66 (October 22-24, 1713).
[175] *Mercator* no. 64 (October 17-20, 1713), verso.
[176] *Mercator* no. 61 (October 10-13, 1713), verso
[177] *Mercator* no. 63 (October 15-17, 1713).

which, set against a revised figure for French imports of only about £900,000, implied that it was England who held the balance of trade in their favor by nearly £900,000.[178]

The *British Merchant*'s "New Scheme": Year ending September 25, 1686		*Source*
Imports from France (*negative*)	(£1,284,420)	*B.M.* no. 14
Exports to France	514,137	"
Total Balance of Trade, per *British Merchant* (*negative*)	**(£770,283)**	
The *Mercator*'s Corrections to the "New Scheme"		
Imports from France, per "New Scheme"	(£1,284,420)	*B.M.* no. 14
Plus: Biases related to choice of year and mispricing	374,867	*Mercator no. 61*
Plus: Other adjustment	19,649	See note (*)
Corrected Imports from France (*negative*)	(£889,904)	
Exports from France, per "New Scheme"	514,137	*B.M.* no. 14
Plus: Biases for mispricing of goods	227,940	*Mercator* no. 63
Plus: Trade to France via Holland	300,000	*Mercator* no. 65
Plus: Trade to France via Flanders	100,000	"
Plus: Additional exports of corn	50,000	"
Plus: Profits on retailing in France not accounted for	64,200	"
Plus: Profits on shipping	500,000	"
Corrected Exports to France	£1,756,277	
Corrected Total Balance of Trade, per *Mercator*	**£866,373**	

Figure 3a. Table comparing the "New Scheme" for Anglo-French imports and exports for the year ending September 25, 1686, as proposed in *British Merchant* no. 14, and *Mercator* nos. 61-65. (*) Note that the *Mercator*'s total corrections in the figures for French imports sum to £374,867 in *Mercator* no. 61, but the total corrected figure for exports in *Mercator* no. 65 is listed as £889,904, a minor discrepancy of £19,649 that I have been unable to resolve.

It was a powerful conclusion, no doubt, but also one that required many lines of detailed corrections that were difficult to prove and explain in simple terms. The Whig reaction to the *Mercator*'s corrections was swift and unforgiving.[179] The *British Merchant* turned the *Mercator*'s authoritative voice against the Tory paper, showing how its artful computations contradicted commercial experience and common sense. In one instance (issue no. 19), the *British Merchant* rushed to the defense of the import projections offered in *Guardian* no. 170 by demonstrating that those figures were well within commonsensical bounds. A telling example addressed the question of linen

[178] *Mercator* no. 65 (October 20-22, 1713).
[179] See e.g. *British Merchant* nos. 19-28 (October 6 – November 10, 1713).

textiles. The *Guardian* had estimated French imports at £600,000 per year, a figure which the *Mercator* had attempted to discredit. The *British Merchant* countered with a numerical gut-check based on a simple demographic relationship: "It is generally believ'd there are seven Millions of People in *Great Britain*, and will the Value of 600000 *l.* in Linen (not above 1 *s.* and 8 *d.* ½ for every Head in *England*, for Shirts, Sheets and all sorts of Linen) be thought extravagant?"[180] The *British Merchant* took what fifty years earlier had been a rather arcane kind of numerical analysis, the political arithmetic of population, and had presented it as common wisdom. This was the essence of the Whig style of numerical argumentation—to use calculation in support of good sense, while suggesting that calculation itself was not an expert but a widely accessible skill. The Whigs assailed their Tory opponents for taking advantage of their privileged political position to impose interpretive judgments on the public, even hinting that the Tory government might have falsified records.[181]

Amidst these unforgiving computational exchanges, the *Mercator* began to argue that the Customs House data could not be taken at face value as a reflection of the state of commerce. Reflecting on the ridiculous nature of the Whigs claims about importations of French goods, *Mercator* no. 64 exclaimed: "Do they think the Gain or Loss of a French Trade is to be Ballanced in the Custom-House Books! Well may the Authors acknowledge they do not understand what they are doing!"[182] Consequently, the *Mercator* became increasingly interested in revealing all of the different acts of subterfuge undertaken by merchants to evade tariffs, deceptions which threatened the integrity of all available trade data.[183] Not only were English goods re-exported to France through neighboring countries like Holland and Flanders, the *Mercator* argued, but merchants intentionally mis-recorded the destination of goods to avoid export prohibitions, listing goods

[180] *British Merchant* no. 19 (October 6-9, 1713), verso.
[181] See *British Merchant* no. 15 (September 22-25, 1713), recto; no. 21 (October 13-16, 1713), recto; no. 22 (October 16-20, 1713), verso.
[182] *Mercator* no. 64 (October 17-20, 1713), verso.
[183] On smuggling and tariff evasion, see for example: Lawrence A. Harper, *The English Navigation Laws: A Seventeenth-Century Experiment in Social Engineering* (Morningside Heights, NY: Columbia University Press, 1939), ch. 9; Linda Colley, *The Ordeal of Elizabeth Marsh: A Woman in World History* (New York: Pantheon, 2007), pp. 94-113.

intended for France as instead headed toward the vague region of the "Streights."[184] These betrayed Davenant's long experience in dealing with numerical fraud as Inspector-General. At first, this computational doubt was presented as a justification for why an expert analysis was necessary to correct the superficial data. "It seems very hard and unfair," reflected *Mercator* no. 77, "that even from the Custom-House it self, no just Estimate can be made of the Trade; but that it shall be so carried on in Masquerade by the Merchants, that the Nation it self do not see what they are doing; and, as appears, Men are made willing to throw away the best Branches of their Commerce, for want of knowing what they really are."[185] Over time, this sentiment hardened into avowed skepticism about the possibility of calculating a balance of trade at all. A later issue put it bluntly: "No Accounts from the Custom-house can give a true Scheme of the Trade to France, or so much of a Scheme as to make a rational Conjecture from."[186]

Why did the *Mercator* effect such a dramatic about-face regarding the necessity and feasibility of calculating the Anglo-French trade balance? To the Whigs, the *Mercator*'s rather sudden rejection of computing the balance of trade was an act of sheer hypocrisy. "What a strange Creature is the *Mercator*?" reflected the *British Merchant*. "One while all for the *Custom-House* Accounts, and for proving the *French* Trade beneficial by those infallible Vouchers: This has been promised in many of his Papers. At another time, *it is impossible to make any Conjecture of the* French *Trade by any Accounts from the* Custom-House. They are found now to be against him, therefore this is the Doctrine of him and his Masters."[187] The Tories, their opponents claimed, rejected the Customs figures because the numbers were not on their side.

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[184] See *Mercator* no. 82 (November 28 – December 1, 1713), no. 84 (December 3-5, 1713).
[185] *Mercator* no. 77 (November 17-19, 1713), verso.
[186] *Mercator* no. 82 (November 28 – December 1, 1713), recto.
[187] King, ed. *British Merchant* (1721 ed.), vol. II, p. 51. For an example of a similar criticism, see [Anon.], *A Letter to the Honourable A—r M—re*, p. 19.

This was a potent accusation in the heat of the Treaty argument in 1713, most certainly. But it is hardly satisfactory as a historical explanation of why the *Mercator* gave up on trying to produce a definitive balance calculation. The Tory journalists had, after all, made several very compelling arguments about why the Customs-House data was at least unreliable—the challenges of pricing, misreporting in the records, re-exportation—if not in fact hiding a positive balance on the English side. Economic historian Margaret Priestley has used more modern statistical analysis to show that, at least for the 1660s-'70s, contemporary perceptions that French imports greatly exceeded English exports ought to be seriously questioned.[188] An especially telling bit of evidence regarding the irregularities in the Customs data emerged a few years after the Treaty dispute. After Davenant died in 1714, he was replaced as Inspector-General by none other than Henry Martin, the "ignorant Lawyer" and Whig "hireling" who was among the most important contributors to the *British Merchant* (and to "radical Whig" political economy generally).[189] Martin, given the daunting task of providing a consolidated account of the nation's trade balances from the beginning of his office in 1697 to 1714, came to a familiar conclusion. "It may reasonably be inferred," Martin explained in 1718, "that we can never come at the knowledge of the values bought and sold by England by the values imported and exported according to the entrys. And if so the balance of trade… is not possible to be known."[190] Faced with the frightening reality of the messy Customs figures, Martin took an even more skeptical position than the *Mercator* had.

Martin's comments suggest that the interesting question is not so much why the Tory *Mercator* gave up on their promise to offer a conclusive balance calculation, but why they thought it was fitting to offer one in the first place? Davenant, after all, was keenly aware of the challenges the Customs data posed. The *Mercator*'s initial optimism about calculating the balance of trade reflected

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[188] Priestley, "Anglo-French Trade," esp. pp. 48-52.
[189] *Mercator* no. 93 (December 24-26, 1713), verso, and no. 153 (May 13-15, 1714), verso.
[190] Henry Martin, "Observations upon the Account of Exports and Imports for 17 Years Ending at Christmas 1714 Delivered in to the Board of Trade 1717/8," in Clark, *Guide to English Commercial Statistics*, pp. 62-9, quotation on p. 68.

the authors' understanding of the political role of technical knowledge. They conceived a balance-of-trade calculation to be a rigorous, comprehensive, expert matter that needed not only a merchant's understanding of global trade, but an administrator's sensitivity to the biases of government data and a philosopher's subtlety of thought. In other words, though Davenant and his collaborators recognized the difficulties inherent in calculating the balance of trade, they also believed that they were the only ones with the skills and access to do it. The problem was that it proved effectively impossible to produce a computation that lived up to these standards within the rapid, vitriolic arena in which the controversy played out. The subtle numerical criticisms the *Mercator* relied upon to challenge the *prima facie* evidence of a negative Anglo-French trade balance were highly technical and difficult to follow. They often relied on insider knowledge unavailable and unfamiliar to the reading audience, like the fact that goods listed in the Customs records as being shipped to the "Streights" were generally rerouted to France. The Tory paper was forced to try to sustain its elitist standard of economic calculation in the face of an opponent who offered a much more accessible alternative.

After October 1713, Tory journalists stuck consistently to the position that the balance of trade was not reliably calculable from the Customs-House data. But this did not mean that they abandoned numerical data as a key argumentative resource. Rather, they explored an alternative computational strategy seemingly better suited to the political context in which they were fighting. Beginning in *Mercator* no. 68, in late October, the authors began regularly presenting effectively raw data describing the specific English products currently being exported to France. *Mercator* no. 76, for example, concluded with a simple chart showing the English goods sent to France on the single day of November 13.[191] The paper continued to publish these unadorned figures through the very final issue, no. 181.[192] The purpose of the figures was to demonstrate how, even without the benefits of the Commerce Treaty, France represented a vibrant market for English products. But the strategy

[191] *Mercator* no. 76 (November 14-17, 1713), verso.
[192] *Mercator* no. 181 (July 17-20, 1713), verso.

was a new one for the *Mercator*. Instead of presenting complicated, heavily interpreted computations that demonstrated their authors' competence, the paper opted to present fresh, uncomplicated data that required little explanation. In taking an effectively positivistic stance, the *Mercator* hoped to offer something even more legible and unassailable than their Whig combatants.

VI. Conclusion: the (Self-)Rule of Numbers

At the beginning of the dispute on French trade in the spring and summer of 1713, it was entirely possible that one of the two sides would have simply refused to engage in numerical combat. The Tories might have shied away from calculating the balance of trade from the start because the superficial numerical evidence was against them. The Whigs might have simply harped upon anti-French sentiments, or repeated the popular refrain that England lost in the French trade without entertaining new calculations, or held off on calculating because their opponents had the position of political authority and better access to the requisite data. But for the Tories, it was precisely because the superficial evidence was misleading that expert calculation was necessary. And for the Whigs, it was because their opponents held the authoritative high-ground that calculation was required to legitimize common wisdom. The fact that the two sides of the conflict had such different computational visions made it possible for them to undertake such a heated and sustained fight over numerical specifics. The two parties, though, were forced to adapt both their computational arguments and their computational ethics to meet the challenges of active partisan dispute.[193] Theirs was a world in which there was no room to be wrong, where incorrectness was fraud, and wrong numbers were forgeries. This merciless environment forced members of both parties to ponder, if often self-servingly, the nature of economic knowledge. The solidity of different kinds of evidence,

[193] As Lake and Pincus point out, some British thinkers around the turn of the eighteenth century, like John Locke and Daniel Defoe, had come to ponder whether in fact the "cut and thrust of debate" might "lead, in itself, to the discovery of a truth distinct from the positions initially enunciated by the disputants." (Lake and Pincus, "Rethinking the Public Sphere," pp. 290-1.)

the rightful purveyors of commercial expertise, the explanatory value of conceptual models like the balance of trade—these questions of practical epistemology became very live and very public.

In a sense, no one won this dispute. The argument petered out for a variety of reasons. Parliament was dismissed in August, and the elections in late summer and fall of 1713 returned another Tory majority, despite the defeat on the Commerce Treaty and thanks in part to the Oxford ministry's passable handling of trade affairs. The Oxford ministry was careful not to incite public uproar by re-introducing the French Commerce Bill too quickly. Instead, the ministry cautiously attempted to clarify the specifics of the Commerce Treaty through negotiations with France and to seek terms more agreeable to powerful interests, like the Iberian and Mediterranean traders. While these efforts seemed to be gaining positive momentum by spring 1714, a confluence of events halted any political possibility of a French Commerce Treaty. In June, one of the ministry's key trade negotiators, Arthur Moore, was assailed in Parliament for reaping personal financial profits from his official responsibilities. Diplomatic relations between France and Britain were crippled by disagreements over Newfoundland and the Spanish West Indies. Finally, the death of Queen Anne on August 1, 1714, and the subsequent transition to a Whig-dominated ministry under the new King George I, brought the matter to a final close.[194] Political contingencies brought the Whig-Tory computational battle to an end. Yet, as Perry Gauci put it, "neither side could provide a satisfactory case to disprove the claims of their rivals."[195] Despite the inconclusive nature of the computational dispute, and despite the Tories' avowed skepticism about computing a balance of trade, the controversy in no way diminished enthusiasm for numbers. In fact, it seemed to do the opposite. Even after arguing that the Anglo-French trade balance was incalculable, the Tories continued to bombard readers almost daily with raw figures showing English exports to France.

[194] Gauci, *Politics of Trade*, pp. 259-70.
[195] Gauci, *Politics of Trade*, p. 244.

The 1713 controversy was a kind of victory for calculation itself. That is, the controversy encouraged the idea that Britain as a polity stood to be healthier if more people thought mathematically. The real promise of computation came in its potential to conquer a much deeper political problem faced by Whigs and Tories alike. Scholars from J. G. A. Pocock onward have elaborated how Britons in the early eighteenth century felt themselves living in a crisis of epistemic authority and social order.[196] The growth of political participation, press freedom, and urban association increased the frequency and density of social interactions, while the emergence of divisive forces like political parties and competing economic interests made those interactions evermore competitive and potentially dishonest.[197] As Sophia Rosenfeld has put it, the most pressing social and political quandary of the day was "how to hold a heterogeneous society together with a minimum of force."[198] Thinkers grasped for new ways to comprehend human behavior and new techniques for carrying out civil conversations, searching for anything that might give faith that a stable polity was possible without the oversight of such once-sovereign institutions like the monarchy or Church.[199] Natural human sociability, politeness, rationality, "common sense"—all have been identified as ways that contemporary Britons sought to answer this challenge.[200]

At the core of many of these new socio-political ideals was the hope that, if it were possible to discern some common principles governing the way diverse individuals acted, it would be possible to have mutually intelligible conversations that could lead to stable political deliberation. Mary Poovey argues that this quest for "self-rule" led eighteenth-century thinkers away from

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[196] J. G. A. Pocock, *The Machiavellian Moment: Florentine Political Thought and the Atlantic Republican Tradition* (Princeton, NJ: Princeton University Press, 1975), esp. chs. 13-14.
[197] Lawrence Klein describes the key dynamic well: "The decline of inherited discursive and cultural institutions and the rise of new ones posed problems of authority and legitimacy. For some, the continued and apparently unstoppable development of the Town induced a nightmare of unsupervised association and rampant conversability." (*Shaftesbury*, p. 11)
[198] Rosenfeld, *Common Sense*, p. 24.
[199] Klein, *Shaftesbury*, pp. 9-12.
[200] Frederick C. Beiser, *The Sovereignty of Reason: The Defense of Rationality in the Early English Enlightenment* (Princeton: Princeton University Press, 1996); Klein, *Shaftesbury*; Rosenfeld, *Common Sense*, ch. 1.

numerical measurement and calculation, which they associated with an authoritative, rather than sociable, approach to governance.[201] This narrative, though, neglects the many instances in which Augustan Britons looked directly to numbers as the basis for an effective kind of self-rule. As we have seen throughout the chapter, trade polemicists of both parties called upon numerical arguments in their attempts to persuade a broad readership. Over time, the need to make arguments that were widely intelligible affected the computational strategies of both parties. The challenges of political disputation in this "post-Courtly" but "pre-professional" world did not cause Britons to dismiss numerical reasoning, but simply to think in new ways about what numbers ought to do.[202]

At moments surrounding the 1713 trade controversy, thinkers on both sides spoke rather explicitly about why numerical reasoning might play an essential role in bringing order to their unstable political world. The Tory *Mercator,* typically suspicious of how commercial and political motivations might lead to dishonesty, suggested that calculation might be critical to protecting British people from the self-interested claims of others by allowing people to accurately assess their own true interest. While the Tories remained highly suspicious of the ability of complicated numbers to deceive the inexperienced, they were increasingly confident that simple, targeted numerical data ought to be convincing to everyone, whatever webs of interest they found themselves entangled in. One representative instance came when the *Mercator* attempted to convince the Virginia tobacco merchants of why they clearly ought to support freer French trade. *Mercator* no. 70 presented statistics showing that, over three different periods of less than two months in 1713, London exports of tobacco to France had grown robustly. That was a numerical message that ought to be compelling to anyone whose livelihood depended on moving tobacco. "If the Virginia Merchants… can look on these Accounts, and then say they are against opening the Trade with France, they must be Infatuated in a manner that no Men of Trade ever were before them," the *Mercator* argued.

[201] Poovey, *Modern Fact*, ch. 4, esp. pp. 146-7, 156.
[202] Klein, *Shaftesbury*, p. 9.

Indeed, "it will be an eminent Proof… that the Prepossession of Parties has over-ruled both their Reason and their Interest."[203] Numerical argumentation was a check to the sorts of negative passions and misinformation that clouded the true assessment of self-interest. At the same time, outside observers might use arithmetical reasoning to assess the interests of others and predict their likely behaviors, as when the *Mercator* constructed accounting arguments to explain why certain tariff duties encouraged unscrupulous traders to smuggle.[204] While Tories like Davenant were not yet willing to valorize "interest" as the foundation of political cognition as some Whigs did, they were willing to suggest that computation might at least make possible a reckoning of all the different interests Britons sought.

The Whigs had their own image of how numerical reasoning might form the basis for a stable and mutually agreeable form of political conversation, exemplified by the character of Harry Lizard in Steele's *Guardian*. If the Tories saw calculation as a means for settling accounts between the disparate interests, some Whigs contended that calculation could prove that the nation's many different social groups and commercial agendas were in fact mutually reinforcing. Throughout 1713, the Whigs were adamant that the interests of the nation's traders were closely aligned with those of landowners, and sought to show this by calculating the benefits of certain trades for different social groups. It was a potent rhetorical gambit, for sure, intended to win over the support of aristocratic and gentry MPs. But it also produced provocative calculations and new ways of thinking about economic value. A particularly influential example of this came from the high-powered Turkey merchant Theordore Janssen, whose influential *General Maxims on Trade* provided a computational model tracing the benefits to be gained by the various classes of British society from a sale of 100 English woolen broad-cloths.[205] "It would certainly be worth the while of any Gentleman to

[203] *Mercator* no. 70 (October 31-November 2, 1713), verso.
[204] *Mercator* no. 80 (November 24-26, 1713).
[205] [Theodore Janssen], *General Maxims on Trade,* in King, ed. *British Merchant* (1721 ed.), vol. 1, pp. 155-162.

understand the whole Progress of a Manufacture from its Commencement to its Consumption, and how much it pays to the Subsistence of the People," Janssen began.[206] He proceeded to walk through the various labor expended and materials used to make the 100 broad-cloths, and the various profits and wages to be further gained for the 2,200 pounds of Turkish raw silk that could be purchased in exchange for the English woolens. Janssen carefully showed that, for every 2,200 pounds of Turkish silk thus imported to England, nearly £4,673 was paid "to the Land-holders, the Labourers, and the Crown" of Britain. Key to Janssen's argument was the fact that the nation's landowners not only benefitted from the initial purchase of raw materials (like wool) raised on British land, but also benefitted from the employment of the nation's laboring class (which decreased poor relief), the increased purchasing power of those employed in manufacturing, and lower taxes due to increased crown revenue from Customs.

Janssen's calculation converted a basic mercantile accounting calculation into a socio-economic model showing the positive interrelationships between the nation's laboring, landowning, and mercantile classes. It achieved, to some degree, what Davenant had once promised of political arithmetic, namely to reveal the interconnections of an increasingly complex commercial polity, to "shew the Links and Chains by which one Business hangs upon another, and the dependence, which all our various Dealings, have each upon the other."[207] The two parties differed sternly on just how easy it was to render such relationships in numerical terms, on who ought to be creating such representations, and on what those figures ultimately said about what was best for Britain's economic future. Yet they were at work, often but not always unintentionally, at creating a medium for arguing about that future. It may well have been true, as Pincus argues, that "there was no shared

[206] Janssen, *General Maxims*, in King, ed. *British Merchant* (1721 ed.), vol. 1, p. 155.
[207] Davenant, *Discourses on the Publick Revenues*, Vol. 1 (1698), p. 31.

vocabulary with which early-18th-century Britons discussed empire and political economy."[208] But if there was no vocabulary, there was increasingly a language of another sort, and it was numerical.

[208] Pincus, "Addison's Empire," p. 101.

– CHAPTER 4 –
DISAGREEING ABOUT THE SOUTH SEA BUBBLE
Bounding Rationality in 1720

> The Frenzy rose so high, that even Mathematical Demonstrations (of which this Subject was always capable) were slighted, and the Authors of them treated as if they had been Quacks or Ballad-Singers.[1]

This was how one anonymous pamphleteer, writing around early October 1720, described a mania of financial speculation that had afflicted Britain earlier that year.[2] That "South Sea Bubble," if not strictly the first crisis of the young London stock market, was certainly the one that first demonstrated that market's capacity for spectacular disaster.[3] The object of that "Frenzy" was a single security, the stock of the South Sea Company, a peculiar corporate hybrid established to refinance sovereign debt and trade slaves. At the height of the Bubble, at midsummer, that Company's Stock touched £1,000 per share, or ten times its par value of £100; by the time this author was writing, the price was around £250, and still had further to fall.[4]

To suggest, as this pamphleteer did, that the 1720 Bubble demonstrated a mass disregard for mathematical demonstration was to assert that contemporaries in 1720 should have been able to know what the South Sea Company's Stock was truly worth. Generations of retrospective observers,

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[1] [Anon.], *Considerations on the Present State of the Nation, as to Publick Credit, Stocks, the Landed and Trading Interests* (London: Printed for A. Dodd… and J. Roberts, 1720), pp. 1-2.

[2] The author does not give a precise date for his calculation, but does explain that he was writing at a time when South Sea Stock traded around £250, suggesting he wrote sometime between the last week in September and mid-October. ([Anon.], *Considerations on the Present State of the Nation* (1720), p. viii.)

[3] Charles Kindleberger's *Manias, Panics, and Crashes* notes three crises that preceded the South Sea Crisis (and the simultaneous Mississippi Crisis in France): a coinage crisis in the Holy Roman Empire (1618-1623); an asset bubble in Dutch East India Company shares, real estate, and tulip bulbs in the Dutch Republic in 1636-7; and the English speculative crisis in the early 1690s in varied assets, including state lotteries and patent "projects," fueled by coinage debasement and the monetary expansion from the newly-founded Bank of England (1694). The most recent major synthesis of the history of financial crises, Reinhardt and Rogoff's 2009 *This Time is Different*, suggests that the history of modern financial crises ought to be taken considerably further back, at least to the 14th-century, because of the significance of external sovereign defaults. See: Charles P. Kindleberger, *Manias, Panics, and Crashes: A History of Financial Crises*, Fourth Edition (New York et al.: John Wiley & Sons, Inc., 2000 [1978]), esp. pp. 223-4; Carmen M. Reinhart and Kenneth S. Rogoff, *This Time is Different: Eight Centuries of Financial Folly* (Princeton, NJ: Princeton University Press, 2009), esp. 8-14, 86-9.

[4] Throughout this and subsequent chapters, the terms "Company," "Stock," "Scheme," "Bubble," and "Crisis," when capitalized, will be used to indicate the versions specifically relating to the South Sea Crisis of 1720. So the capitalized term "Stock" will indicate specifically South Sea Stock, etc.

from eighteenth-century chroniclers of the Bubble to modern economic historians, have held this to be true. Until recently, it has largely been taken for granted that no competent investor in 1720 could have rationally believed that the South Sea Company's mad refinancing Scheme could really have worked as planned, or that the Company's Stock merited the inflated prices it bore in London's Exchange Alley.[5] From the point of view of Britons in early 1720, though, the matter was hardly so obvious. The objective of this chapter is to historicize what it meant to try to calculate financial value in 1720, in order to reevaluate this post-hoc assumption that underlying the alluring South Sea Scheme was a mathematical reality that ought to have been self-evident. There were indeed myriad "Mathematical Demonstrations" offered about the South Sea Stock in 1720, but they did not all tell the same story. Surviving calculations in newspapers, pamphlets, and even government records reveal the rich diversity of ways eighteenth-century Britons attempted to quantify financial value. Through an intensive reconstruction of early-modern valuation techniques—one that does not presume that calculations that appear wrong or antiquated in retrospect were necessarily fraudulent or economically irrational—we can gain a deeper understanding of one financial crisis as an economic, political, and indeed epistemic phenomenon. We can also appreciate why that crisis was, to that point, the most significant moment in the political history of numerical calculation in Britain.

In the past decade, economic historians have revisited the South Sea Bubble in earnest, challenging traditional narratives of the Crisis as a story of mass corruption and extraordinary

[5] For a contemporary example of this attitude, see the eighteenth-century's most authoritative historian of the Bubble, one-time Company employee Adam Anderson. His chronicle of the events of the Bubble is punctuated by reflections on the transparent absurdity of the South Sea Company's scheme and public enthusiasm for the Company's stock. Describing the original refinancing proposal of the Company (and its competitor, the Bank of England), Anderson wrote: "Let any one of but common Understanding consider one Moment how it could be possible for either company to effect what they now proposed, (so as not to be Loser themselves) without *egregiously* deceiving and injuring the Proprietors of these [public] Debts!" (See Adam Anderson, *A Historical and Chronological Deduction of the Origin of Commerce*, Volume II (London: Printed for A. Miller et al., 1764) pp. 285-8, quotation on p. 285.) A more modern example of a similar assumption—that the basic flaws of the Scheme, and the resultant mispricing of the Company's stock, had to have been obvious—can be found in a 2005 article by Richard Dale and collaborators. Those authors contend that the "bulk of the Company's assets" were well-understood to be loans to the government with "known cash flows and terminal values," and therefore could not have been rationally mispriced by contemporaries. (See Richard S. Dale, Johnnie E. V. Johnson, and Leilei Tang, "Financial Markets Can Go Mad: Evidence of Irrational Behavior During the South Sea Bubble," *Economic History Review* 58, no. 2 (May, 2005): 233-71, esp. p. 240.)

popular delusion in a fledgling financial market.[6] Seeking to explain bubbles like the South Sea in terms of the "rational" decisions of contemporary investors, scholars like Larry Neal, Peter Garber, Gary Shea, and Helen Paul have illuminated many overlooked features of early modern financial markets. These scholars have brought our attention to the international flow of financial capital, the peculiarities of "subscription" stock sales, and the captivation of the Atlantic slave trade as a source of imagined riches.[7] Opposing such attempted "rationalizations" of the Bubble, Richard Dale and others have provided their own critical insights into the historically-specific behaviors and sentiments behind this eighteenth-century example of "irrational exuberance."[8]

Scholars on both sides of this rationalist/irrationalist divide have turned to the economic literature of the early eighteenth-century to gain insight into the thought processes of contemporaries. Nonetheless, such explorations of what early-modern analysts actually said about financial value in 1720 have yielded equivocal and, to this point, unsatisfying results. On the one hand, Paul Harrison suggests that surviving calculations generally corroborate a rational interpretation of the Crisis. He deduces that "contrary to popular perceptions, investors in the early eighteenth century, and even during the height of the bubble, used modern valuation techniques based on fundamentals and that were strikingly similar to those of today."[9] Dale, on the other hand,

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[6] The South Sea Bubble was a prominent episode in one of the nineteenth-century's most influential discussions of economic crises, Charles Mackay's *Extraordinary Popular Delusions*, Vol. I (Philadelphia: Lindsay and Blackiston, 1850), pp. 51-90.

[7] Larry Neal, *The Rise of Financial Capitalism: International Capital Markets in the Age of Reason* (Cambridge, UK et al.: Cambridge University Press, 1991), chs. 4-5, esp. pp. 80-8; Peter M. Garber, *Famous First Bubbles: The Fundamentals of Early Manias* (Cambridge, MA: MIT Press, 2000), chs. 16-18; Helen J. Paul, *The South Sea Bubble: An Economic History of its Origins and Consequences* (London and New York: Routledge, 2011), esp. ch. 6 on the slave trade and "Reasons to Invest in the South Sea Company"; Gary S. Shea, "Financial Market Analysis Can Go Mad (in the Search for Irrational Behavior during the South Sea Bubble"), *Economic History Review* 60, no. 4(Nov., 2007): 742-65; Shea, "Understanding Financial Derivatives During the South Sea Bubble: the Case of the South Sea Subscription Shares," *Oxford Economic Papers* 59 (2007): i73-i104.

[8] On this general picture of financial markets, see the influential work of Robert J. Shiller, *Irrational Exuberance*, Second Edition (Princeton and Oxford: Princeton University Press, 2005 [2000]). On applications to the South Sea Crisis, see: Richard Dale, *The First Crash: Lessons from the South Sea Bubble* (Princeton and Oxford: Princeton University Press, 2004); Dale, Johnson, and Tang , "Financial Markets Can Go Mad." The authors present a useful summary of the different economic explanations given in the economic-historical literature (pp. 238-40).

[9] Paul Harrison, "Rational Equity Valuation at the Time of the South Sea Bubble," *History of Political Economy* 33, no. 2 (Summer, 2001): 269-281, quotation on p. 270. Though he is evidently in the "rational bubbles" camp, he is careful to

has argued that, because skillful skeptics in 1720 were able to use modern-seeming valuation techniques to argue that South Sea Stock was overvalued, the fact that the investing public continued to devour the stock is evidence of their collective irrationality. Dale has particularly emphasized the sophisticated, forward-looking calculations of the MP and political economist Archibald Hutcheson, whom Dale calls "the unsung hero of the South Sea Bubble."[10] These two scholars, it would seem, have interpreted contemporary calculations as evidence that the Bubble was rational—and that it was not. Yet a third approach has been offered by Helen Paul, who has countered Dale's irrationalist view by arguing that seemingly prescient computations from the period, especially those by Hutcheson, were themselves politically biased and theoretically flawed.[11] Since naysayers like Hutcheson were not unassailably rational economic thinkers, she argues, the rest of the investing public still could have been.

These economic historians have been limited by their reading of historical financial calculations as testaments to the state of economic *rationality* rather than the state of economic *knowledge*. This has caused scholars to overlook two of the most significant features of such computational reasoning. First, the analytical problems involved were extremely difficult relative to the state of the financial knowledge in 1720. Second, as a result, they were not susceptible to definitive, consensus answers. The questions of financial analysis—modeling, forecasting, valuation—were (and are) not always self-evident matters of rational deliberation, but rather analytical problems that required figuring-out. Innovative financial activities and objects, like the South Sea Company's refinancing scheme and the peculiar hybrid Stock it created, required new

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qualify his claims, noting that "the existence and use of such valuation methods cannot establish that the bubble was rational, only that the economic principles underlying market analysis and valuation were well understood by investors almost three hundred years ago." (p. 270) See also: Harrison, "What Can We Learn for Today from 300-Year-Old Writings about Stock Markets?" *History of Political Economy* 36, no. 4 (Winter, 2004): 667-688, esp. pp. 674-5.

[10] Dale, *First Crash*, esp. pp. viii, 2. Dale claims Hutcheson "may fairly be described as the father of investment analysis."

[11] Helen J. Paul, "Archibald Hutcheson's Reputation as an Economic Thinker: Pamphlets, the National Debt and the South Sea Bubble," *Discussion Papers in Economics and Econometrics* (University of Southhampton), no. 0922 (2009); Paul, *South Sea Bubble*, p. 7. Paul contends that "Hutcheson was not an original economic thinker, and some of his ideas would have been easily criticised by a well-informed contemporary." ("Hutcheson's Reputation," p. 2)

interpretations. Contemporaries had no base of historical experience or data by which to test their solutions to such novel problems, nor did they have well-developed social signifiers of expertise to guide them in choosing between different calculations or calculators. The central argument of this chapter is that observers in 1720, prior to the collapse of the South Sea Stock's price, were faced with multiple, divergent ways of valuing that Stock, none of which constituted a single discernibly correct or orthodox viewpoint. Rather, contemporaries were confronted with a variety of ways of thinking about value that often disagreed but were nonetheless simultaneously *plausible*.

The historian of science Simon Schaffer has argued that greater attention ought to be paid to how plausible claims of knowledge were defined in the past, particularly during the dramatic reordering of knowledge and society that occurred in early Enlightenment Britain.[12] "The study of plausibility," Schaffer writes, "does not imply a social history of what is known, rather a study of the boundaries of what might ever be knowable."[13] Thinking in terms of plausibility and its limits allows us to historicize the calculation of financial value, rather than treating it as a test-case of economic rationality. But what does it mean for rival claims of financial knowledge to have been in *plausible disagreement* in 1720? How do we assess the boundaries of what was possibly true? The goal of this chapter is to do so by reconstructing the internal logic of historical financial valuations, examining the different assumptions, computational choices, and economic sentiments that made possible their divergent conclusions about financial value. On a basic level, simply demonstrating that there *was* such a range of valuations suggests that there was the possibility for genuine disagreement. This chapter seeks to go a step further, to use the numbers themselves to excavate the epistemic uncertainties that made it possible for contemporaries to quantify the same financial phenomena

[12] Simon Schaffer, "A Social History of Plausibility: Country, City and Calculation in Augustan Britain," in Adrian Wilson, ed. *Rethinking Social History: English Society 1570-1920 and Its Interpretation* (Manchester, UK and New York: Manchester University Press, 1993): 128-57. Schaffer writes of the period: "Bubbles, projects, new philosophies and new systems of credit urgently raised the problem of the judgment of matters of fact." (p. 129)
[13] Schaffer, "Social History of Plausibility," p. 129.

differently. Financial economists have begun to explore how investors, constrained in their ability to assimilate all potentially relevant data when calculating value, must engage in a process of "model choice" amongst imperfect alternatives.[14] I hope not only to show that Britons in 1720 built models about South Sea Stock that were in disagreement, but to illuminate why even competent investors would have had a hard time choosing between them.

After a brief summary of the South Sea Scheme and the financial operations that made it such a challenging problem for analysts, I will explore in macroscopic terms the social conditions of knowledge that made it hard for members of the political and investing community to assess the relative quality of analysts' financial computations. Especially critical *dimensions of plausibility* were the difficulty in identifying financial expertise and the unsettledness of many key conceptual and even legal questions about the nature of financial value. The remainder of the chapter will look intensively at the quantitative claims that were made about the South Sea Stock at three different phases during its rise and fall. First, a sketch of several attempts in February-March 1720 to evaluate the Stock prior to the Scheme's implementation will reveal how the inexperience of analysts with the South Sea Company's complicated refinancing maneuvers promoted diverse quantitative conclusions about value. By exploring the critical modeling decisions and heuristic abstractions such analysts had to make in building their models, we can better understand the interpretive uncertainties they faced. Second, two extreme projections, offered as the Stock's price was peaking between April and June, demonstrate how relatively minor differences in the modeling assumptions could translate into radically different numerical conclusions. Such extreme computations, one optimistic and one pessimistic, help demarcate the outer limits of plausibility. Third, I will look at one especially illuminating, pro-Company calculation from fall 1720, produced after the Bubble had begun to deflate. That model took a different approach to valuation from the others discussed, based on the

[14] Harrison Hong, Jeremy C. Stein, and Jialin Yu, "Simple Forecasts and Paradigm Shifts," *The Journal of Finance* 62, no. 3 (Jun., 2007): 1207-42.

present value of future dividends. This analytical strategy combined elements of modern valuation theory with distinctly early-modern ideas about financial information and commercial trust.

Constructing such a historical map of what might have been knowable about financial value in 1720 can help to deepen social-scientific understandings of the bounded nature of economic decision-making. Social scientists working across disciplines have offered powerful explanations for why economic actors fail to live up to the standards suggested by a rational-agent model, exhibiting "bounded rationality" instead.[15] Appreciating the boundaries of rationality necessitates richer *historical* examination of what limited people's ability to say "I know" about economic phenomena in specific historical contexts. Humanistic analysis can thereby deepen our understanding of the epistemic nature of financial crises, complementing exciting recent efforts in the field of financial economics. Scholars like Harrison Hong and Jeremy Stein argue that the fact of disagreement or the "dispersion of opinion" between market actors may be essential to explaining why asset bubbles emerge and persist despite the corrective effects of arbitrage.[16] Such economists have produced a variety of theoretical models focusing on the possible heterogeneity of investor opinion to highlight how certain structural features of modern financial markets, like practical constraints on short-sales, might contribute to the growth of bubbles. They have similarly used assumptions of disagreement to explain empirical phenomena like dramatic price movements in the absence of new public news or

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[15] Concepts of "bounded rationality" were pioneered by Herbert Simon. See, for example, "A Behavioral Model of Rational Choice," *The Quarterly Journal of Economics* 69, no. 1 (Feb., 1955): 99-118. The relevant literature at the intersection of psychology and economics is voluminous, though I have found the following especially helpful: Reinhard Selten, "What is Bounded Rationality?" in *Bounded Rationality: The Adaptive Toolbox,* edited by Gerd Gigerenzer and Reinhard Selten (Cambridge, MA: MIT Press, 2002), pp. 13-36; Daniel Kahneman, "Maps of Bounded Rationality: Psychology for Behavioral Economics," *American Economic Review* 93, no. 5 (Dec., 2003): 1449-75.

[16] For an overview, see Harrison Hong and Jeremy C. Stein, "Disagreement and the Stock Market," *The Journal of Economic Perspectives* 21, no. 2 (Spring, 2007): 109-128. For early investigations into the impact of differences of opinion on asset prices in the 1970s, see: Edward Miller, "Risk, Uncertainty, and Divergence of Opinion," *Journal of Finance* 32, no. 4 (Sep., 1977): 1151-68; J. Michael Harrison and David M. Kreps, "Speculative Investor Behavior in a Stock Market with Heterogeneous Expectations," *Quarterly Journal of Economics* 92 (May, 1978): 323-36. For examples of more recent work, see: Dilip Abreu and Markus K. Brunnermeier, "Bubbles and Crashes," *Econometrica* 71, no. 1 (Jan., 2003): 173-204, esp. pp. 174-5 on "dispersion of opinion"; Harrison Hong and Jeremy C. Stein, "Differences of Opinion, Short-Sales Constraints, and Market Crashes," *The Review of Financial Studies* 16, No. 2 (Summer, 2003): 487-525.

the tendency of large swings in stock prices to be negative rather than positive ("asymmetric volatility").[17]

Economists have cited a variety of factors in explaining the source of economic disagreements, including systemic phenomena, like the information gradients among different investors, and psychological limitations, like the inability of investors to attend to all relevant data or their "overconfidence" in their own judgments.[18] Yet plausible economic disagreement is a complex social phenomenon, one which is more or less possible at different times and in different places. Past economic experience, social structures of expertise, political culture, technologies of communication—these are only a few of the many contingent factors that might dictate how much disagreement might be possible.[19] This chapter begins to explore what a humanistic analysis of disagreement can add to our understanding of financial markets and their breakdown.

I. From South Sea Scheme to South Sea Bubble

The Scheme that spurred London's first financial crisis was the culmination of nearly a decade of political back-and-forth concerning how to unburden Britain from the massive National Debt incurred during a quarter-century of war dating back to 1688. The years leading up to 1720 had seen myriad proposals for tackling the nation's many debts. Their tremendous variety and creativity testifies to how strange and unfamiliar the nation's indebtedness was as an analytical and policy

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[17] Hong and Stein, "Differences of Opinion," pp. 487-9.

[18] David Hirschleifer and Siew Hong Teoh, "Limited Attention, Information Disclosure and Financial Reporting," *Journal of Accounting and Economics* 36, nos. 1-3 (Dec., 2003): 337-86, esp. pp. 341-4 for a review of theories of "limited attention"; Jose A. Scheinkman and Wei Xiong, "Overconfidence and Speculative Bubbles," *Journal of Political Economy* 111, no. 6 (Dec., 2003): 1183-1220; Lin Pen and Wei Xiong, "Investor Attention, Overconfidence and Category Learning," *Journal of Financial Economics* 80, no. 3 (Jun., 2006): 563-602; Shane A. Corwin and Jay F. Coughenour, "Limited Attention and the Allocation of Effort in Securities Trading," *The Journal of Finance* 63, no. 6 (Dec., 2008): 3031-67.

[19] Economists like Malcolm Baker and Jeffrey Wurgler have begun to complement micro-economic or "bottom-up" explanations of the effects of investor sentiment with more "top-down," macroscopic explanations of the various factors that might make certain stocks difficult to value and subject to greater speculation and disagreement. See Malcolm Baker and Jeffrey Wurgler, "Investor Sentiment in the Stock Market," *Journal of Economic Perspectives* 21, no. 2 (Spring, 2007): 129-51, esp. pp. 131-2.

problem. Under the guidance of the Whig party's precocious fiscal guide, Robert Walpole, Parliament had instituted a "Sinking Fund" plan in 1717 that required the government to rigidly repay all redeemable debts as swiftly as possible using any excess revenues. Yet this seemed only the minimum of what was needed. The nation's most frustrating fiscal question was how to deal with long-term, "irredeemable" debts, annuities which carried high interest rates (around 7-9%) and which the government could not pay off without the consent of the holders.[20] The pesky backbencher Archibald Hutcheson wished to augment the Sinking Fund plan with a massive, one-time levy of 10-20% on private property. More adventurous proposals ranged from Humphrey Mackworth's plan for Parliament to float a new "Temporary Species of Money" in paper, to Richard Steele's plan for restructuring the entire debt in ten-part "tontines," to one radical proposal to repay the debts in "equivalent" shares in a series of new, semi-governmental monopolies that were to control effectively all of the nation's trades, natural resources, and overseas possessions.[21]

Those who offered the most promising solution, though, were a core of enterprising Directors of the young South Sea Company. The Company was guided by the ingenious John Blunt, the son of a Baptist shoemaker who had parlayed his acumen as a scrivener and generalist financial broker-dealer into a place as a trusted financial advisor to new Tory administration under Oxford (Robert Harley) in the early 1710s.[22] The South Sea Company had taken form in 1711 as a corporate

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[20] The irredeemables specifically included short-term (expiring 1742), long-term (expiring no earlier than 1792), and single-life annuities. For the public-finance context of the initial South Sea Scheme, see P. G. M. Dickson, *The Financial Revolution in England: A Study in the Development of Public Credit, 1688-1756* (London et al.: Macmillan, 1967), pp. 90-3. His account of the mechanics of public finance in the period remains the standard.

[21] "Tontines," a popular investment vehicle in the eighteenth century, were a kind of group annuity. Members paid money upfront into a collective pool, and then received annuity payments out of the pool for life. As members of the tontine died, their shares were redistributed among surviving members. For Steele's tontine plan and others, see: [Humphrey Mackworth], *A Proposal for Paying Off the Publick Debts by the Appropriated Funds, without Raising Any Taxes upon Land, Malt, or Other Thing for That Purpose*… (London: [n.p.], 1720); Richard Steele, Jr. *A Nation a Family: Being the Sequel of the Crisis of Property: Or, a Plan for the Improvement of the South-Sea Proposal* (London: Printed for W. Chetwood et al., 1720); [Anon.], "An Essay for Discharging the Debts of the Nation, by Equivalents," in *An Essay for Discharging the Debts of the Nation, by Equivalents… And the South-Sea Scheme Consider'd* (London: Printed for J. Noon…, J. Roberts…, and A. Dodd, 1720).

[22] The most comprehensive account of the origins of the South Sea Scheme and the interpersonal politics of the Company is John Carswell, *The South Sea Bubble*, 2nd Edition (Dover, NH: Sutton, 1993 [1960]), esp. pp. 19-106. Carswell

synthesis of Oxford's many policy ambitions. By making an honorable peace with France, Oxford sought to open the door to prosperous overseas trades that, under the control of the South Sea Company, could be mobilized to relieve the nation of its Debt.[23] The Company could also help to relieve the Whiggish Bank of England of its stranglehold on the public's finances. Following a model first attempted in 1697 when the Bank of England "engrafted" £1,000,000 of exchequer bills and bank notes into the Bank's stock (exchanging Bank stock for public debt), the South Sea Company carried out an £11 million debt conversion at its genesis in 1711.[24] This financial operation was supposed to provide the initial capital to finance a massive slave-trading operation with Spanish America, permitted by the *Assiento* ("Contract") which the English government had negotiated with Spain. Indeed, it looked to draw upon the potentially limitless riches of African slave labor as a solution to England's chronic shortage of gold and silver.[25] But, by 1719, diplomatic deterioration with Spain and operational missteps left the Company's trading ambitions largely unrealized. Even more vexing, the South Sea Company (and Britain as a nation) had been surpassed in financial ingenuity by the extraordinary financial system put in place in France by the displaced Scottish wizard John Law.[26]

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is particularly illuminating on Blunt's centrality in the formulation, execution, and direction of the Scheme and the circumstances of his rise to control over the Company. On Blunt's origins, see pp. 16-7.

[23] Carswell, *South Sea Bubble*, p. 35.

[24] Carswell argues that the original idea for the 1711 engraftment was Blunt's. See Carswell, *South Sea Bubble*, pp. 23-6, 34-49.

[25] Since the 16th century, the *Assiento* represented the exclusive right granted by the Spanish government to specific (often foreign) individuals or companies to trade African slaves to the Spanish colonies in the western hemisphere. See: Paul, *South Sea Bubble*, ch. 6; Carl Wennerlind, *Casualties of Credit: The English Financial Revolution, 1620-1720* (Cambridge, MA: Harvard University Press, 2011), ch. 6.

[26] Contemporary observers before and after the South Sea Crisis were well aware of the effect of Law as an object of jealousy and admiration among British corporate and political leaders. One post-Bubble observer reflected on how the image of Law had encouraged the South Sea Company Directors to seek a more active role in political and fiscal management. "The Promotion of Mr. *Lawe* in *France* to the Management of the most important Affairs in that Kingdom, raised such Desires in our Directors at home, to make themselves Sharers in the Government." ([Anon.] *The Nation Preserved; or, The Plot Discovered. Containing an Impartial Account of the Secret Policy of some of the South-Sea Directors* (London: Printed for the Author, 1720 [1721?]), p. 6; *emphasis* in original). On Law's career in general, see Antoin Murphy, *John Law: Economic Theorist and Policy-Maker* (Oxford et al.: Oxford University Press, 1997).

In summer or autumn of 1719, key South Sea Directors began exploring a massive reconfiguration of the nation's debts with government leaders. Late that year, Blunt presented a formal plan to Lord James Stanhope, one of the two leading ministers of the Whig government. The plan promised to absorb ("engraft") effectively all of the National Debt into the Stock of the South Sea Company. The Company would exchange newly-issued shares of Stock for outstanding government debts, including the irredeemables, at to-be-determined prices, paying in addition roughly £3 million to the government for the special right to do so.[27] The government would profit not only from this hefty fee, but also by reducing most of its outstanding debt to a flat 5% interest rate. More importantly, they would finally be able to pay off the stubborn irredeemables. When the proposal was first discussed in the House of Commons on January 21, it failed to gain immediate assent. Some MPs wished to see alternative bids, and in late January the Bank of England acquiesced, proposing their own engraftment scheme. A two-week bidding war ensued. The South Sea Company ultimately proposed to increase their fee from £3 million to approximately £7.5 million, which was enough to earn the support of the Commons on February 2. The bill officially representing the South Sea Company's proposal received royal assent on April 7.

What made the Scheme so appealing for the Company, and ultimately so challenging for outside analysts to model, was the way the planned refinancing maneuvers unlocked the Company's ability to raise additional capital through the sale of new Stock. Legally, the Company was limited as to how much it could increase its capital by dictate of Parliament. By the 1720 scheme, the absorption of government debt allowed the Company to increase their capital one-to-one with the amount of debt it assumed: if the Company assumed the maximum amount of outstanding government debt, roughly £31 million, it would be legally permitted to increase its nominal capital by that same £31 million. If the Company could convince holders of government debt to accept the

[27] The fee was specifically calculated as £1.5 million plus two "years' purchase" on all irredeemables exchanged (approximately £1.5 million more). On the definition and significance of "years' purchase," see Section III below.

Company's Stock at less than one-to-one (namely, for prices over the par price of £100 per share) the Company could absorb the government debt as required without distributing all of the Stock it had the right to issue. This surplus could be sold for cash to new stockholders or paid out as stock dividends.[28] The cash raised could be used to cover the £7.5 million government fee, but also to fund lucrative trades, including a revived trade with Spanish America.

Early critics feared the Scheme was fundamentally infeasible as a means of refinancing the nation's irredeemable Debt. Multiple observers suggested that the irredeemables were so heavily valued by investors that it was "not the Interest of the South-Sea Company to offer the [irredeemable] Annuitants such Terms as may induce them to come in."[29] Those critics figured that the Company wished instead to use the Scheme to gain an effective monopsony on the cheaper and more profitable redeemable debt. The cynical John Trenchard, for example, contended that the Company was unlikely to touch the expensive irredeemables before they had issued all the new stock they could from the £16 million in outstanding redeemable debts.[30] By that point, Trenchard feared, investors might not have sufficient interest or money to buy up so much new South Sea Stock.[31] Trying to sell the newly-minted stock would take a long time, dropping the price and making the irredeemables even more relatively expensive. For "what imaginary Hopes can there be, that their Stock will keep at the advanced Price?"[32]

The events of the spring and early summer soon put the lie to John Trenchard's early fears. The first subscriptions for purchasing new Stock and the first registration of holders of irredeemable

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[28] For example, if the company could convince holders of £15 million in government debts to exchange those debts for Company Stock priced at £300, the Company would only have to give away £5 million in nominal Stock in exchange. But because they absorbed a total of £15 million of government debt, they could increase their total Capital Stock by up to that amount. This effectively created £10 million of new Stock that the Company could sell.

[29] [Anon.], *A Farther Examination and Explanation of the South-Sea Company's Scheme* (London: Printed, and Sold by J. Roberts, 1720), title page.

[30] John Trenchard, *Comparison Between the Proposals of the Bank and South-Sea Company* (London: Printed and Sold by J. Roberts, 1720), pp. 14-5.

[31] Trenchard, *Comparison Between the Proposals* (1720), p. 16.

[32] Trenchard, *Comparison Between the Proposals* (1720), p. 17.

debt wishing to exchange for South Sea Stock began on April 14 and 28, respectively.[33] From the first month of the Scheme, the Company marketed its Stock enthusiastically. On April 14, the Company promised to pay a 10% dividend in additional Stock at midsummer. One week later, on April 21, the Company's directors were authorized by its General Court to begin lending money against Company Stock.[34] By May, the mania was on. According to historian Larry Neal, South Sea Stock sold in the London markets at £342 at the end of April, £595 by the end of May, and £950 by the end of June.[35] The Company's second subscription of new stock for money came on April 29, when £1.5 million of stock was sold at £400. In mid-June, a third subscription was offered, where £5 million of par-value Stock (50,000 shares) was to be subscribed at a price of £1,000 per share; eager investors actually subscribed over £11.2 million.[36] A fourth subscription at the same price followed in August. The redeemables were exchanged in July, and the remaining irredeemables (not subscribed in late April) given a chance to buy-in during early August.[37]

The crash that followed the mania was dramatic and not soon to be forgotten. The Stock's price sagged into the £800s in July and August, but plummeted from £810 at the end of August to £310 by the end of September. It would fall more than £100 more by year's end.

II. Dimensions of Plausibility: Problems of Expertise and the Problem with Value

The Stock's spectacular inflation in the spring and summer seemed to defy logic for a few commentators. Trenchard, after all, had feared that it would take years for the Company to sell off its Stock. The eminent businessman James Milner, writing on April 20, reflected at length on the sudden surge that followed in the price of the South Sea Stock:

[33] Technically, the Company was supposed to only sell new Stock *after* it had absorbed the debts required to increase its capital base, though in practice the Company violated this implicit restriction.
[34] On the Company's use of lending to inflate the value of the Company's stock, see: Carswell, *South Sea Bubble*, pp. 111-3, 120-2; Dickson, *Financial Revolution*, pp. 141-2.
[35] Neal, *Rise of Financial Capitalism*, p. 235.
[36] Dickson, *Financial Revolution*, p. 132.
[37] For a useful calendar of the Company's transactions, see Dickson, *Financial Revolution*, p. 124.

> I could not then foresee the vast Advance of South-Sea Stock; I did indeed think, that by Arts and Stock-Jobbing it might be run up to two Hundred Pound: But three and four Hundred, and Money for the Refusal at five Hundred, nay a Thousand, were Notions I was not capable of…*This I found was a Mystery that Figures were incapable of demonstrating; it's an Arcanum that nothing but the Philosophers Stone can make out, by turning whatever they touch into Gold.*[38]

Milner was an experienced financial observer who was aware of the volatility of speculative ventures; but he was also a staunch supporter of the Bank of England and its competing proposal to refinance the National Debt.[39] His blustery claims of the inexplicability of the early surge in the Company's Stock were probably a bit disingenuous. And they were hardly a majority view, either. As we will see, despite how technically complicated the South Sea Scheme was, there were plenty of Britons who confidently (even overconfidently) asserted their own ability to judge the value of the peculiar Stock. The fact that the valuation of South Sea Stock was a subject of intense disagreement is an essential, and forgotten, part of the story of the South Sea Crisis.[40] What, then, were the general historical conditions that made such disagreement possible, what we might call the *dimensions of plausibility*?

One factor was unequal access to information, compounded by the difficulty in assessing the quality or reliability of data that was available. By the early eighteenth century, the increasingly vibrant circulation of financial data, especially through an emergent financial press, had helped to integrate international markets, increase the prominence of London as a financial center, and educate the broader public about commerce. At the same time, many major informational needs

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[38] James Milner, "A Second Letter, Occasion'd by What Has Past Since, in Relation to the South-Sea Company's Bargain," in *Visit to the South-Sea Company and the Bank: in a Letter to a Friend, Concerning the Late Proposals for the Payment of the Nation's Debts*, Second Edition (London: Printed for J. Roberts… and A. Dodd, 1720), p. 26. (*Emphasis* mine). "Money for refusal" refers to the market for "refusals," contracts allowing the holder to buy the underlying stock for a fixed price at some point in the future (similar to modern "call options.") For more, see Anne Murphy, "Trading Options Before Black-Scholes: A Study of the Market in Late Seventeenth-Century London," *The Economic History Review* 62, no. S1 (Aug., 2009): 8-30.

[39] He had earlier pointed out that many smaller gilt-edged schemes in the past had become "bubbles," and mused that the South Sea directors might be able to profit from the volatility in the South Sea stock to make money trading in puts and refusals. (See Milner, *Letter to a friend* (First Edition), pp. 22-23.) For more on Milner, see Paul, *South Sea Bubble*, pp. 49-50.

[40] Julian Hoppit, "The Myths of the South Sea Bubble," *Transactions of the Royal Historical Society*, Sixth Series, 12 (2002): 141-65, esp. pp. 146-7.

went unfulfilled for British investors.[41] In the case of the South Sea Company, the public confronted numerous informational challenges. Among the most opaque related to the Company's trade with Spanish America, especially the potential windfall that might come from the *Assiento* trade in African slaves. The Company's financial operations throughout 1720 produced challenges as well, as outside investors had very limited insight into the Company's past operations, such as the extent of the money the Company had loaned against its Stock, or its future plans regarding Stock sales or dividends. Technological limitations created further challenges in assessing the Company's financial conditions, as keeping track of how much new Stock was issued across multiple physical record books proved consistently difficult.[42]

The divergence of opinion that emerged regarding the South Sea Stock was not simply the result of informational asymmetries, though. The potential for plausible disagreement went even deeper, as contemporary observers came to very different *quantitative* conclusions about the value of the South Sea Stock on the basis of common, if often difficult-to-interpret, information. As with other commercial numbers, like the import-export figures discussed in Chapter 3, standards of what made for reliable financial data were in the making, and contemporaries fostered a range of sentiments about which numbers to trust and privilege in building their calculations. Contemporary valuation models differed not only in their inputs, but in their very structure, and choosing between them was not easy for many reasons. Eighteenth-century observers might have had different ways to assess the quality of a financial prediction or a statement about financial value: testing its historical

[41] For various perspectives on the importance, and limitations, of financial information in early modern London, see: Lee Krim Davison, "Public Policy in an Age of Economic Expansion: The Search for Commercial Accountability in England, 1690-1750" (Ph.D. Diss., Harvard University, 1990), esp. pp. 98-99, 107-108, 130; Neal, *Rise of Financial Capitalism*, pp. 20-43; Alex Preda, "In the Enchanted Grove: Financial Conversations and the Marketplace in England and France in the 18th Century," *The Journal of Historical Sociology* 14:3 (Sept., 2001): 276-307; Natasha Glaisyer, *The Culture of Commerce in England, 1660-1720* (Woodbridge, UK and Rochester, NY: The Royal History Society/The Boydell Press, 2006), pp. 143-83.
[42] Paul, *South Sea Bubble*, p. 46.

efficacy, evaluating how well it accorded with current theory, using social signifiers to judge the expertise of its creators. In 1720, none of these processes would have yielded definitive results.

To begin, investors contemplating the South Sea Scheme lacked a well-defined body of people, writings, or ideas that could be pointed to as constituting expert financial knowledge.[43] The new world of City finance had plenty of savvy and insightful participants, but few clear ways for broader observers to determine which calculators among them were knowledgeable and trustworthy. As Ann Murphy and others have convincingly argued, the "financial revolution" that began in the late seventeenth century owed much to the growth of practical skills among the varied participants in London's emerging markets.[44] The learning built up among scriveners, goldsmiths, and brokers in the City of London were examples of the urban, artisanal knowledge that Deborah Harkness has argued was critical to the development of scientific culture in early modern London.[45] But this culture had no apparatus to indicate whose claims were credible to those without firsthand knowledge of the workings of Exchange Alley. Financial expertise had no "public face."[46] Historians of early modern science like Steve Shapin, Simon Schaffer, and Adrian Johns have vividly reconstructed how natural philosophers in the seventeenth century constructed new social mechanisms to accredit claims of natural knowledge and the people who made them.[47] Institutions

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[43] On the development of "scientific" financial knowledge and its importance to building cultural confidence in financial markets, see: Alex Preda, *Framing Finance: The Boundaries of Markets and Modern Capital* (Chicago and London: University of Chicago Press, 2009).

[44] As Murphy argues, private learning made it possible for investors to take advantage of the new opportunities provided by growing government demands for capital and advantageous changes in property rights that followed 1688. See: Ann Murphy, *The Origins of English Financial Markets: Investment and Speculation before the South Sea Bubble* (Cambridge, UK et al.: Cambridge University Press, 2009); Ann M. Carlos, Jennifer Key, and Jill L. Dupree, "Learning and the Creation of Stock-Market Institutions: Evidence from the Royal African and Hudson's Bay Companies, 1670-1700," *The Journal of Economic History* 58, no. 2 (June 1998): 318-344.

[45] Deborah E. Harkness, *The Jewel House: Elizabethan London and the Scientific Revolution* (New Haven: Yale University Press, 2007).

[46] Preda, *Framing Finance*, pp. 19-21. The question of how experts were made and distinguished in early modern Europe, particularly in practical occupations of importance to the state, has recently become a major focus of research for historians of science and technology. A useful historiographic overview can be found in Eric Ash's introduction to the 2010 issue of Osiris. See Ash, ed. *Expertise: Practical Knowledge and the Early Modern State*, *Osiris*, Vol. 25 (Chicago: University of Chicago Press, 2010).

[47] Steven Shapin & Simon Schaffer, *Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life* (Princeton, NJ: Princeton University Press, 1985); Shapin, *A Social History of Truth: Civility and Science in Seventeenth-Century England*

like the Royal Society of London helped to publicize and codify key aspects of trade knowledge and to make them part of an accessible body of scientific learning, while also vetting the claims of trade practitioners and separating legitimate knowledge from imposture.[48]

Financiers had no such clubs. Calculating ability and financial skill might come from a variety of sources—from a private sector career in trade or the emergent financial services, from positions in government administration, from related backgrounds in law or the management of landed estates. Educational tools and institutions did exist, including plentiful textbooks on practical mathematics and accounting and even some informal schools to teach those topics.[49] But such mercantile education produced no transparent credentials. There were no consistent professional titles that conveyed financial competence. Pamphlet controversialists sometimes referred to themselves and their combatants by quasi-expert titles like "Accountants" or "Calculators." But they also might simply frame their dispute as an argument between "Gentlemen," or on the other hand dismiss an opponent's calculations by chalking them up to the "dexterity" of an "Artist."[50] Furthermore, it was unclear to some whether a deep familiarity with City finance was even a good or legitimate type of knowledge to have, suggesting as it did an association with the unscrupulous tactics of that most hated profit-seeker, the "stock-jobber." Contemporary writers reflected on how

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(Chicago: University of Chicago Press, 1994); Adrian Johns, *The Nature of the Book: Print and Knowledge in the Making* (Chicago: University of Chicago Press, 1998).

[48] Harkness, *Jewel House*, ch. 6. On the challenges of this process of adjudicating trades, see also Rob Iliffe, "'In The Warehouse': Privacy, Property and Priority in the Early Royal Society," *History of Science* 30, no. 87 (Mar., 1992), pp. 29-68.

[49] On mercantile textbooks and education, see: Mary Poovey, *A History of the Modern Fact: Problems of Knowledge in the Sciences of Wealth and Society* (Chicago: University of Chicago Press, 1998), ch. 2; Glaisyer, *The Culture of Commerce in England*, pp. 100-142; Phyllis Whitman Hunter, "Containing the Marvelous: Instructions to Buyers and Sellers," in *Didactic Literature in England, 1500-1800*, edited by Natasha Glaisyer and Sarah Pennell (Aldershot, UK and Burlington, VT: Ashgate, 2003), pp. 169-185; Harkness, *Jewel House*, ch. 3.

[50] A most illuminating example of the shifting titles and categories assigned to financial specialists is given in an April pamphlet devoted to debunking pro-Company calculations published earlier that month in the *Flying-Post* newspaper. ([Anon.] *Remarks on the Celebrated Calculations of the Value of South-Sea Stock, in the Flying-Post of the 9th of April, 1720* (London: Printed for J. Roberts, 1720).) The critic lashed out at the *Flying-Post* calculator with all of these identifiers, used both directly and sarcastically, calling him at different times a "Gentleman" (p. 1), a "Capital Accountant" (p. 8), a "visionary Artist," (p. 14), a "Calculator" (p. 18), and elsewhere facetiously complimenting the author on the "degree of dexterity" (p. 24) shown in his computations.

farcical it was that honorable people might want to learn from devious financial practitioners whom they had little reason to trust.[51] While some popular didactic essays did exist by 1720, it was still a long time before Thomas Mortimer's 1761 *Every Man His Own Broker* publicly codified a popular theory of financial investment in an attempt to free wealthy non-experts from the need for the expensive and unscrupulous guidance of the City brokers.[52]

When it came to navigating Exchange Alley, deciding which written claims to trust was even more difficult than deciding which individuals to trust. By 1720, the investing public was swamped with published materials telling them what to think about the South Sea Scheme. But the sheer volume and variety of print was as much a challenge as a boon for investors.[53] The pamphlet printing trade in Augustan Britain, after all, thrived on disagreement.[54] From the 1670s, distinct "trade publishers" had emerged to produce cheap, polemical tracts for self-financed authors.[55] The printed controversies over the South Sea Scheme played out almost entirely through the mediating hands of a few of these London trade publishers, most especially the ubiquitous J. Roberts of Warwick Lane, who no doubt recognized the profitability of publishing material on all sides of a controversial issue.[56] Such publication mechanisms provided readers with little guidance on what to

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[51] [Anon.], *Exchange-Alley; or, The Stock-Jobber Turned Gentleman. With the Humours of our Modern Projectors. A Tragicomical Farce* (London: Printed for T. Bickerton, 1720), esp. pp. 16-21.

[52] "Philanthropos" [Thomas Mortimer], *Every Man His Own Broker: Or, A Guide to Exchange Alley* (London: Printed for S. Hooper, 1761). See also: Alex Preda, "The Rise of the Popular Investor: Financial Knowledge and Investing in England and France, 1840-1880," *The Sociological Quarterly* 42:2 (Spring, 2001): 205-232, esp. pp. 211; Paul, *South Sea Bubble*, p. 55.

[53] For one discussion of the role of public media in the propagation of speculative bubbles, see Shiller, *Irrational Exuberance*, ch. 5.

[54] On the history of the pamphlet trade in general, see Joad Raymond, *Pamphlets and Pamphleteering in Early Modern Britain* (Cambridge, UK and New York: Cambridge University Press, 2003).

[55] Critically, these trade publishers generally "expressed no ideological commitment." (Raymond, *Pamphlets and Pamphleteering,* p. 328.)

[56] In 1720, entire skirmishes over specific points of debate were often played out through a single publisher. The antagonistic authors of the *Argument to Shew the Disadvantage to the Public* (pro-Scheme) and the *Examination and Explanation of the South-Sea Company's Scheme* (anti-Scheme) went back and forth at least twice each in the first four months of 1720, all in pamphlets printed and sold by J. Roberts of Warwick-Lane. [Anon.], *Argument to Shew the Disadvantage That Would Accrue to the Publick, From Obliging the South-Sea Company to Fix What Capital Stock They Will Give for the Annuities* (London: Printed for J. Roberts, 1720); [Anon.], *An Examination and Explanation of the South-Sea Company's Scheme, for Taking in the Publick Debts* (London: Printed for J. Roberts, 1720); [Anon.], *A Farther Examination and Explanation of the South-Sea Company's Scheme* (1720); [Anon.] *Remarks upon Several Pamphlets Writ in Opposition to the South-Sea Scheme* (London: Printed for J. Roberts, 1720).

believe.[57] Indeed, publishers benefited from a controversial environment with few rules, in which pamphleteers might resort to extreme and provocative tactics in legitimating their arguments.[58] In this media environment, technical pamphleteers aggressively marketed their computations as revealing the most unassailable kinds of knowledge.[59] It was not uncommon for analysts to package subtle claims of financial analysis as "the plain Fact and naked Truth."[60] In the early eighteenth century, the pressures of the media market even further fueled the "overconfidence" of analysts and investors.

Not only did contemporary Britons lack discernible standards of what qualified as financial expertise among people or publications, they also lacked a body of experience with many of the innovations in public and private finance that they confronted, and even a deep base of consensual ideas about financial valuation. As one economic historian has recently put it, in 1720, "there was nothing that amounted to a theory of finance."[61] Of course, contemporaries in 1720 did not lack for ideas about how to calculate financial value, many of which relied on what for the time were sophisticated computational techniques that resemble key aspects of modern financial valuation.[62]

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[57] For example, financial pamphleteers did not have policing institutions like the Stationers' Company or the Royal Society of London. Adrian Johns has cogently argued that those institutions played a critical function in policing the originality, authenticity, and credibility of scientific publications in early modern England. (Johns, *The Nature of the Book*.)

[58] For well over a century, critics of the cheap press had been denouncing the tendency of pamphleteers and their publishers to exploit the credulity of readers with frivolous or deliberately outrageous claims. (Raymond, *Pamphlets and Pamphleteering*, pp. 5-11.) Indeed, in 1720, the salacious, the libelous, and the apocalyptic all seemed to be welcomed in some degree by the trade publishers, who larded South Sea pamphlets with advertisements for tantalizing works about racy overseas adventures and treason trials. Here again, Roberts was exemplary, flavoring one of Richard Steele's pamphlets with advertisements for a work called *The Jamaica Lady… Containing an Account of her Intrigues, Cheats, Amours in England, Jamaica, and the Royal Navy* and a work on *Tryals for High-Treason, and Other Crimes,* printed in six octavo volumes. See Steele, *A Nation a Family*, pp. [6], 32.

[59] As Schaffer notes: "For Augustan writers, the power of regimes of calculation and measurement to render claims plausible was neither self-evident nor unchallenged." (Schaffer, "Social History of Plausibility," p. 142)

[60] [Anon.], *An Examination and Explanation of the South-Sea Company's Scheme* (1720), pp. 5-6.

[61] Paul, *South Sea Bubble*, p. 7. Antoin E. Murphy has recently made a similar, if overstated, point of the field of political economy more generally. Economic writers in late-seventeenth and eighteenth centuries "did not have the benefit of any settled body of theory, nor did they have access to sizeable libraries of books and articles to help them develop their theories and policies. Instead they started out in the raw quarries of the mind." (Murphy, *The Genesis of Macroeconomics: New Ideas from Sir William Petty to Henry Thornton* (Oxford et al.: Oxford University Press, 2009), p. 6.)

[62] Harrison, "Rational Equity Valuation."

The problem was rather that, among many competing ideas, few had been canonized as consensus principles, and many fundamental points were open to meaningful dispute.

On a most basic level, Britons were collectively undecided about what it even meant to talk about the value of a stock. Disagreements verged on the philosophical. One perspective held that stocks had an "intrinsic" value that inhered only in the most tangible resources of the underlying enterprise.[63] This conservative conception of value had thematic roots in much older economic and ethical notions of "just price." Emphasizing a stock's "intrinsic value" therefore often indicated a profound suspicion that the stock's market price might be largely "imaginary." This was compelling for many in 1720, especially those whose political and religious sentiments encouraged them to look upon paper wealth with anxiety. The classical republican cynic Trenchard, for example, espoused such a conservative view early in 1720 when he expressed his doubt that anyone would buy into the South Sea Scheme. He exclaimed "every Body else sees… That the additional Rise of this Stock above the true Capital, will be only imaginary; that One added to One, by any Rules of Vulgar Arithmetick, will never make Three and a Half."[64] Another moralistic writer put this more precisely later in the year: "*Stock* then I take to design no more than what we esteem to be the real Value, or clear Amount of the Capital Fund belonging to any Company… legally incorporated to trade upon a joint Stock."[65] (Chapter 5 will give further consideration of the complicated history of ideas of "intrinsic value," as seen through the financial thought of Archibald Hutcheson.)

Both Trenchard and the anonymous moralist wanted their audience to believe that a stock's value was strictly delimited by a company's property. But this normative view was far from universal.

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[63] See also Harrison, "Rational Equity Valuation," pp. 271-2. In modern terminology, proponents of this view could be said to espouse a view that value was equivalent to something like "net tangible assets." That particular conceptual phrasing was still a long time in coming, though, because both the ideas of "tangibility" and a clear distinction of a company's "assets," versus "capital" or even "stock," were still future formulations.

[64] John Trenchard, *Letter of Thanks from the Author of the* Comparison between the Proposals of the Bank and South-Sea *&c., to the Author of the* Argument… (London: Printed, and Sold by J. Roberts, 1720), pp. 10-1.

[65] [Anon.], *Letter to a Conscientious Man: Concerning the Use and the Abuse of Riches, and the Right and the Wrong Ways of Acquiring Them* (London: Printed for W. Boreham, 1720), p. 12.

Some Britons found the alternative extreme quite reasonable, namely the idea that the value of a stock was identical with what people were willing to pay for it. Mercantile thinkers like Nicholas Barbon had begun to argue since the late seventeenth-century that "things are just worth so much, as they can be sold for," whether goods or coins or, perhaps, stocks.[66] Yet by 1720 this idea was still frequently lampooned as "Hudibras's Rule," after a mock aphorism from the title character of a 1663 satirical poem of Samuel Butler ("For what is *worth* in anything, But so much money as 't will bring?")[67] But in between the extremes of a just-price notion of value and Hudibras's rule were a range of alternatives, which allowed that a stock's underlying value might come from more than just its net capital and admitted that, while market prices were imperfect, they were not completely fictitious. One early pro-Company pamphleteer expressed such a moderate position in responding to concerns that the Scheme might lead to an unjustified rise in the Company's Stock price that would enrich some at the expense of others. "I don't mean… that the Stock is always intrinsically worth full as much as it sells for," the advocate explained. "For I am not at all afraid to own that Part of the Value is imaginary."[68] Some amount of fiction in the Stock's price was unavoidable, but this was hardly a catastrophe. This author seemed quite comfortable admitting, indeed, that stock value was "not capable of direct Proof either way; for 'twould be ridiculous to endeavour to demonstrate the certain Rise or Fall of Stocks."[69] This pragmatic understanding of financial value was no doubt shared by many of the City's most shrewd (or devious) minds.[70] Contemporaries acknowledged that

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[66] "N.B. M.D." [Nicholas Barbon], *A Discourse of Trade* (London: Printed for Tho. Milbourn for the Author, 1690), p. 20.
[67] See: [Samuel Butler], *Hudibras*: *The Second Part* (London: Printed by T. R. for John Martyn and James Allestry, 1664 [1663]), Canto I, Line 465, p. 34. For references to Hudibras's Rule, see: [Archibald Hutcheson], *An Estimate of the Value of South-Sea Stock. With Some Remarks Relating Thereto* (London: *s.n.*, 1720), p. 10 (text dated Sept. 10, 1720); [Anon.], *The South-Sea Scheme Examin'd: And the Reasonableness Thereof Demonstrated* (London: Printed for J. Roberts, 1720), p. 9.
[68] [Anon.], *Remarks upon Several Pamphlets Writ in Opposition to the South-Sea Scheme* (1720), p. 11.
[69] [Anon.], *Remarks upon Several Pamphlets Writ in Opposition to the South-Sea Scheme* (1720), p. 7.
[70] Despite the well-documented moralistic outrage against the practice of "stock-jobbing," some thoughtful Britons were perfectly comfortable talking about making profits entirely from movements in market prices. For example, the bookdealer and stock-trader "T. Johnson" wrote in late August 1720 to Charles Mackay, a University of Edinburgh History Professor then in London, to encourage Mackay to try his hand in the Dutch markets. "Tho the funds have no great solidity any of 'em," Johnson admitted, "yet there's money to be got in Stock jobbing while it lasts." (T. Johnson to Charles Mack[a]y, 23 August 1720, from the Hague, Laing Manuscripts, EdinUL La. II. 91, f. 30^{v}.)

fortunes might be made by those who felt a stock's "imaginary" value to be out of line, but were willing to ride public enthusiasm.[71]

There were yet other ways to think about what determined the value of a stock that were unconcerned with the question of real value versus market price. Even as many believed that the "Rise and Fall of Stocks" was highly capricious, Britons just as often suggested that the price of a company's stock was subject to objective control, particularly by corporate or political leaders. It was not uncommon for observers to suggest that the South Sea Company's Directors and Parliamentary supporters had a fair deal of power over the Company's Stock price, and not necessarily in a negative way.[72] In late March, a Scottish nobleman, the Duke of Montrose, explained his optimism about the Stock along such lines: "There is this reason indeed to support that belieff that ye Company is not only supported by the Government w^{t} a vue to ye speedy payment of ye Publick debts, which will be one consequence of ye Stocks riseing high, but [also] all the individuals who have ane interest in it wish the stock wrise high."[73] Value could also be understood as much as a legal notion as an economic one. The maximum amount of stock the South Sea Company could issue was legally fixed by Parliament, limited to the amount of government debt the Company absorbed.[74] For some people, value was therefore not a matter to be determined by calculation or in the market. It was a matter of law. In the early months after the Bubble began to deflate, one pamphleteer reflected on this as he lashed out against a pro-Company opponent. "This Author…

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[71] The moralistic author of the *Letter to a Conscientious Man* wrote: "'Tis true indeed, that many of those who deal in this Stock, know well enough the Fallacy of it, and therefore they buy it with no Intention to keep it, but only that, by taking the Advantage of the strong Fascination the People are under at this Time, they may sell it again to Profit…" (p. 20) In a provocative recent article, economic historians Peter Temin and Hans-Joachim Voth have used accounting records to reveal how one savvy financial firm, Hoare's Bank, made considerable profits using sophisticated momentum-trading strategies. See: Peter Temin and Hans-Joachim Voth, "Riding the South Sea Bubble," *American Economic Review* 94, no. 5 (Dec., 2004): 1654-1668.

[72] The bookdealer Johnson, for example, reflected optimistically on the future of the South Sea Stock despite its dip in August 1720, writing that "I doubt not your S. Sea Directors will raise their Stock again higher than before." (Johnson to Mackay, 23 August 1720, Laing MSS, EdinUL La. II. 91, f. 30^{r}.)

[73] James, 1st Duke of Montrose, to Mungo Graham of Guthrie, 25 March 1720, NAS GD220/5/832/20a.

[74] The Parliamentary Bill was in fact entitled "A Bill for Enabling the South Sea Company to Increase their Capital Stock."

pretends to set a *Real Value* upon Stock," the critic smirked, "(tho' I do not know of any such Thing unless it be done by Act of Parliament)."[75] These different visions of the meaning of stock value could promote dramatically different numerical conclusions about what a given stock might be worth.

In addition to these almost ontological disagreements, eighteenth-century investors confronted deep technical quandaries regarding the terminology and mechanics of joint-stock investment. From the creation of the first such English company in 1553, terminological ambiguities plagued joint-stock enterprises.[76] In the earliest joint-stocks, vital terms like "stock" were used simultaneously for multiple different quantities, for example referring at once to the entire property held by a specific enterprise and specifically to the "trading or floating capital" available to purchase goods for resale.[77] Such lexical poverty became an even greater problem as joint-stock companies became an increasing object of private investment and political dispute in the early eighteenth century. New fiscal and commercial imperatives led to new monstrosities of corporate organization, of which the 1711 South Sea Company was among the most confounding.[78] In 1712, one of the Company's chief propagandists, Daniel Defoe, testified to the novel interpretive challenges the Company brought with it, particularly that of understanding how a Company could have one "Stock" that might be used both for trading and public finance:

> There has not been in our Memory an Undertaking of such Consequence, and so generally to be engaged in, nor has there been an Undertaking, about

[75] [Anon.], *South-Sea Scheme Detected, and the Management Thereof Enquir'd Into*, Second Edition (London: Printed for J. Roberts, 1720), p. 14.

[76] In his foundational study, W. R. Scott argues that these confusions dated back to the joint-stock's hybrid origins as a fusion of medieval partnerships with patterns of corporate organization represented in the guild system. W. R. Scott, *The Constitution and Finance of English, Scottish and Irish Joint-Stock Companies to 1720*, Vol. 1, Reprint ed. (Gloucester, MA: P. Smith, 1968 [1910]), ch. 2, esp. p. 15.

[77] Scott, *Constitution and Finance of Joint-Stock Companies*, vol. 1, pp. 59-60. Scott has a wonderful description of the "the ambiguities which arose from the vague use of 'stock'" in the case of a mining enterprise from the 1570s. Scott notes that in that case "the 'stock of the mines' might mean either the metal smelted, ores on hand, tools and provisions or the provisions and cash available for wages and dividend." (pp. 61-62)

[78] For a useful summary of major objections to the genesis of South Sea Company, see the anonymous broadside *Some Queries, Which Being Nicely Answered May Tend Very Much to the Encouragement of the South-Sea Company*… (London?: *s. n.*, 1711).

> which the People, even those who are to be concern'd, have been so uneasie, their Opinions of it so confused, and their Knowledge of the Manner and Circumstances of it so small.[79]

Such quandaries were no less evident eight years later, when the Company undertook its even larger and more complicated refinancing Scheme. Innovation entailed inexperience, and many critical questions regarding new financial operations had never before been put to any definitive test. This was not only true of predictive claims about valuation, for which there was no body of empirical data or historical experience to point to. It was also true in a legal sense. In the young London financial markets, countless open questions about what sorts of financial activities were legally permitted and how certain financial transactions ought to work went unanswered and largely unasked. Market participants operated within zones of regulatory uncertainty, never forced to settle certain procedural or legal points because buoyant markets kept everyone happy. In the aftermath of the South Sea Bubble, many such questions became openly disputed as people tried to litigate their way out of their financial misfortunes.[80] Far from mathematically self-evident, many matters of the definition of financial value had to be determined by the courts.

Such legal uncertainties, indeed, testify to the many epistemic uncertainties that early-eighteenth-century investors faced. Litigious conflicts might migrate into fraught conceptual debates about the nature of financial value. Consider the vicious dispute that played out between two Scottish market-players, Colonel Francis Charteris and James Carmichael, 2nd Earl of Hyndford.[81] In late March 1720, when the South Sea Stock hovered in the low 300s, Charteris agreed to sell

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[79] Daniel Defoe, *An Essay on the South-Sea Trade. With an Enquiry into the Grounds and Reasons of the Present Dislike…* (London: Printed for J. Baker, 1712), p. 5. Defoe confidently asserted his own convoluted way to deal with the problem. "We ought to debate it Two Ways," Defoe wrote of the South Sea Stock. "1. In its separate pre-existent State, as a Debt, and as a Trade respectively. 2. In the new Conjoined Circumstance, as blended together, whereby the Debt and the Trade is call'd, tho' wrong and erroneously, *One South-Sea Stock*." (p. 16)

[80] Gary Shea has vividly reconstructed one set of such disputes. See Shea, "Sir George Caswall vs. The Duke of Portland: Financial Contracts and Litigation in the Wake of the South Sea Bubble," in *The Origins and Development of Financial Markets and Institutions*, ed. Jeremy Atack and Larry Neal (Cambridge, UK et al.: Cambridge University Press, 2009), pp. 121-160.

[81] The dispute is traced in a collection of legal documents held in the Fletcher of Saltoun Papers, NLS MS 17,705, ff. 38-112. The transaction was noteworthy enough at the time to attract the attention of other Scottish aristocrats. See Sir David Dalrymple to Hugh Dalrymple, 29 March 1720, NAS GD110/1254/30.

Hyndford £5,000 par value in South Sea Stock, valued at £315 per share (£100 par), or £15,750 total. Instead of paying for the Stock immediately in cash, Hyndford agreed instead to pay a total of £20,500 a year later. That following March, after the Bubble had burst, Hyndford refused to pay up, claiming that the extra £4,750 Charteris had extracted was effectively an interest payment that violated usury laws.[82] Years of bitter litigation resulted, and behind the petty fighting were serious and subtle questions. The disputants argued in particular over whether the Stock actually had a fixed value at the time of the original deal. If that were the case, as Hyndford argued, the extra £4,750 charged could only be understood as interest. Charteris's side claimed, instead, that the "Stock had no certain Value" at the time of the deal, and the surchage assessed on Hyndford for waiting a year to pay represented the expectation of both buyer and seller that the price of the stock would go up in the intervening year.[83] It is unclear whether the dispute over the potentially-usurious deal was ever settled before Charteris's death in 1729. The bigger questions at issue—about the nature of financial value—were a different matter entirely.

III. Forecasting and Feasibility: February-March 1720

Investors in 1720 confronted many dimensions of uncertainty that made distinguishing an effective and trustworthy financial calculation highly difficult—asymmetries in information, opacities in assessing financial expertise, unfamiliar financial operations and instruments. Disagreements about the assessment of financial value were evident in what contemporaries said about stocks before and

[82] For Hyndford's case, see "Unto the Right Honourable, The Lords of Council and Session. The PETITION of James Earl of Hyndfoord," (9 November 1721), and "The Earl of Hyndford's Case with Colonel Charteris, as it was stated to several English Lawyers; with their Opinions upon it," (1721), Fletcher of Saltoun Papers, NLS MS 17,705, ff. 48-49, 52-54.

[83] As one legal brief put it: "A… Consideration, which absolutely determines this Matter, is, that as Stock had no certain Value, all Mankind clubbed to deceive themselves and each other, into an Opinion, that it was to rise immensely above the Price it then bore… 'Tis very apparent, that both Seller and Purchaser were of this Opinion… If this was then the Case, that both Pursuer and Defender had a stronger Opinion of the Rise of Stock, the Nature of the Bargain betwixt them is easily discovered, and the reason why *an advanced Rate was given payable at a Distant Time*." Charteris's side further argued that the price of the Stock could not be fixed because the deal was agreed to on a Sunday, when the Stock was not actively traded in the public markets. ("Information for *Colonel Francis Charteris of Ampsfield*, against *The Earl of Hyndford*," 11 July 1723, Fletcher of Saltoun Papers, NLS MS 17705, ff. 100-101, on f. 100v.)

during 1720 and in the heated legal fights that began after the Bubble had popped. But in order to see most clearly the dispersion of opinion on a difficult question like the value of the novel South Sea Stock, and to understand the limitations on what could and could not plausibly be said, it is necessary to look intensively at the calculations eighteenth-century observers produced. Surviving calculations delineate a space of plausible valuations that was expansive yet still bounded. Plausible disagreements arose as competing calculators, playing by a loose set of shared rules of financial reasoning, took different positions on open interpretive questions and employed different tools from the arsenal of contemporary computational techniques.

In February and March 1720, while the South Sea Scheme was under public debate but before it was initiated, analysts offered page upon page of dense printed calculations, crafting political arguments about the fiscal efficacy of the Scheme and didactic points about the merits of investing in it.[84] Critically, such pre-Bubble computations had the same basic public information to work from: primarily, the value of the Company's pre-existing capital stock (roughly £11 million), the total value of redeemable and irredeemable public debts to be exchanged in the Scheme (£16 and £15 million, respectively), and the fee the Company would have to pay to the government for the right to carry out the Scheme (£7.5 million, contingent on the outcome of certain debt exchanges). Yet calculators put together these same basic inputs into a startling range of different models. Analysts had to make difficult interpretive decisions without guidance from past financial experience or a body of authoritative knowledge.[85] Was the Company's stock price best thought of as an output of the model, or was it an input, determined by Company or governmental deliberation? How did one lucidly and correctly quantify the multi-stage transactions (debt-for-Stock

[84] These public calculations often carried an avowedly partisan objective, such as explaining why the Bank of England's refinancing plan was superior to the Company's.

[85] Compare Baker and Wurgler, who have argued that, in assessing which stocks are more "speculative," "the crucial characteristic is the difficulty and subjectivity of determining their true values." ("Investor Sentiment in the Stock Market," p. 132.)

exchanges, new Stock sales) that would be needed to effect the Scheme? What was the best way to commensurate the different financial instruments—corporate Stock, redeemable bonds, long-term irredeemable annuities—that were all implicated in the Scheme? What about the value the Company might earn from its trading operations or from the relatively high interest rates the government promised to pay on debts refinanced by the Company?

None of these questions had obvious answers, and different models addressed them in different ways. This section will trace four such representative models. The first two were pessimistic models that came to functionally similar conclusions, and did so by eliding certain interpretive problems in similar ways. Comparing the two models demonstrates the abstractions that contemporaries resorted to in building usable models for understanding the South Sea Scheme. The third model, offered by the MP Archibald Hutcheson, was the most intricate. While it also painted a skeptical picture of the Stock's potential value, it introduced several technical complications that suggested that the Stock might be more valuable than most pessimists thought it could be. The final model, the least legible to modern eyes, presented an optimistic vision of the Stock's value and the feasibility of the Scheme. More importantly, though, it relied on a different computational architecture, capturing the relationships between the Company's Stock and different kinds of public debt using the familiar reasoning of years' purchase.

Modeling the South Sea Scheme was a very difficult problem in contemporary terms. Valuations often relied on odd assumptions or simplifying abstractions, even those that produced retrospectively orthodox conclusions. Consider, for example, two valuations published by different anti-Scheme pamphleteers in February and March (see **Figures 4a-b**).[86] The two calculators both

[86] [Anon.], *Examination and Explanation of the South-Sea Company's Scheme* (1720), esp. pp. 5-7 and [Anon.], *Considerations Occasioned by the Bill for Enabling the South-Sea Company to Increase Their Capital Stock, &c.: with Observations of Mr. Law* [March] (London: Printed, and Sold by J. Roberts, 1720), esp. pp. 25-26. The author of the latter pamphlet had clearly read the *Examination*, because he cites it (among other places on the title page). Though, based on the considerable differences in the way their respective valuation calculations are set up, I do not suspect that the latter author substantially copied the *Examination* calculation, or would have even automatically realized that he was offering an effectively isomorphic

argued that the Scheme implied significant losses to the Company's new proprietors, namely those investors who agreed to take part in the Scheme by exchanging their government debt for Company stock. The authors began their valuations from slightly different conceptual starting-points. The February author chose to reason top-down by starting with the different components that would make up the Company's new stock ownership structure under the Scheme (pre-existing stockholders, various government creditors). His March counterpart, alternatively, began from the point of view of a hypothetical prospective investor holding £100. From these different perspectives, the two calculators pursued a common general approach: they attempted to calculate what the Company's total financial resources (contemporaries did not use the term "assets") would be after the Scheme was carried out, and then divided those resources among the total base of Stockholders that they projected would result from the Scheme's various transactions. Reconstructing the implicit logic of the two arguments and normalizing the assumptions that the two calculators made reveals that they offered a functionally identical numerical conclusion: if the Stock's price were set at £150 for exchanging government debts, the Stock would really be worth only £118¾, a nearly 21% loss to new proprietors. (At a £200 exchange price, the stock value would be £156¼, or a 22% loss).

calculation. Rather, they agreed effectively on major interpretive points, and happened upon similar computations. One potential candidate for the author of the *Examination* was Nathaniel Gould, MP and former Governor of the Bank of England from 1711-1713. A letter from Gould to Robert Walpole dated 18 March 1720 echoed many similar themes from the *Examination*. See: Gould to Walpole, 18 March 1720, CamUL Ch(H) Letters 783.

[Anon.], ***Examination and Explanation of the South-Sea Company's Scheme*** **(London: Printed for J. Roberts, 1720)**

In Units of Millions of £	Exchange Price ***£150***	***£200***
Total Value of Irredeemable and Redeemable Annuities	**£30.0**	£30.0
"Present Capital"	**10.0**	10.0
Total Capital	**£40.0**	£40.0
"Engrafted Stock" Available	**30.0**	30.0
Price	***£150***	*£200*
Amount Raised from Disposal of "Engrafted Stock"	**45.0**	60.0
Amount "Gained Thereby"	**£15.0**	£30.0
One "Moyety [to] pay the Government"	**7.5**	7.5
One "Moyety… to be divided among the Proprietors"	**7.5**	22.5
Proportion to New Proprietors	**5.6**	16.9
"Residue" for the Present Proprietors	**1.9**	5.6
Total Amount Paid by New Proprietors	**45.0**	60.0
Total Return to New Proprietors	**35.6**	46.9
Loss to New Proprietors	**£9.4**	£13.1
Total Value of Capital *(Total Capital + Net Amount Gained by Disposal of New Stock)*	47.5	62.5
Total Capital	40.0	40.0
Implied Value of Stock ***(Total Value of Capital / Total Capital per £100 Share)***	**£118.8**	**£156.3**

Figure 4a. Table showing the first of two parallel reconstructions of pre-Bubble calculations (with **4b**).

[Anon.], ***Considerations Occasioned by the Bill for Enabling the South-Sea Company to Increase Their Capital Stock*** **(London: Printed, and Sold by J. Roberts,**

In Units of £	Exchange Price *£150*	Exchange Price *£200*
Par Amount of Stock Purchased by Individual Investor	£100.0	**£100.0**
Amount Paid	*£150*	***£200***
"Profit Thereby Accruing to the *South-Sea* Company"	£50.0	**£100.0**
Amount of Profit Paid to the Government*	25.0	**25.0**
"To be divided to him and a Proprietor… of Present Capital"	25.0	**75.0**
"To the New Proprietor"	18.8	**56.3**
"To the Present Proprietor"	6.3	**18.8**
"This Person pays… to the Publick and the Old Proprietors"	31.3	**43.8**
Amount "*per Cent*" Paid to Public and Old Proprietors	20.8	**21.9**
Price Paid (per £100) for Stock Purchased	150.0	200.0
"*Per Cent*" Loss on Amount Paid	20.8	21.9
Implied Value of Stock ***(Price Paid net of "per Cent" Loss)***	**£118.8**	**£156.3**

Figure 4b. Table, showing the second of two parallel reconstructions of pre-Bubble calculations. Note that the calculations in **4a** (the *Examinations*) are shown in millions of £, while those in **4b** is shown in whole £. For each of the two calculations, the **bolded** column represents the calculations at the price originally presented (£150 for the *Examinations* and £200 for the *Considerations*), while the other column extrapolates to a different price. (*) Note that the value listed as "Amount of Profit Paid to the Government," derived from the fact that the £7.5 million government fee, out of £30 million in new face-value Stock sold, would cost £25 per share sold.

More interesting than the formal similarity of these two conclusions (which these two analysts would not necessarily have recognized) were the simplifying abstractions that both calculations required to get there. To begin, both authors chose to look at the problem of value in static terms. Their calculations represented snapshots of the Company's financial resources, and took no direct consideration of future incomes like trade profits or the government's ongoing interest payments. Moreover, the congruity between the two models relied on computational hand-waving by both authors regarding the Scheme's flexible financial mechanics. Both authors assumed

that, if the Company gave Stock to holders of government debt at prices over £100, the excess would represent a kind of "profit" to the Company. (For example, if the Company gave Stock priced at £150 in exchange for all the roughly £30 million in outstanding government debts, the Company would create £30 million new Stock but receive back £45 million, creating a £15 million profit.) In both calculations, it was unclear how this "profit" was going to be created, though, and in what form.[87] The payments some new stockholders had to offer were government debts which had a fixed maximum value, the roughly £30 million total. But the "profit" could not come from transmuting existing government debts into more government debts, so new cash had to come in somewhere. Neither calculator precisely specified a mechanism for how this might work, and instead relied on an implicit practical fiction that government annuities and money were fungible.[88] The abstractions that these two calculators used to produce their valuations were not the consequence of a theoretical commitment about the relationship between the Scheme's mechanics and the Stock's value. Rather, employing simplifying heuristics and eliding certain questions, perhaps unintentionally, allowed them to produce legible conclusions.

These first two exemplary models considered the Scheme purely in terms of its financial mechanics: the exchange of Company Stock for existing government debts, the expansion of the Company's base of stockholders, and the resulting sales of new Stock. But this "balance-sheet" approach was not the only way to think about the South Sea Stock. Take, for example, the earliest computation offered by Archibald Hutcheson, the iconoclastic MP for Hastings. Though Hutcheson became one of the most outspoken critics of the South Sea Scheme—and, as we will see in the next chapter, a primary author of the conventional, retrospective understanding of why the Scheme went

[87] The *Examination* describes the operation in vague terms: "Now in case the Company get the engrafted Stock subscribed for, or disposed of at 150 *l.* for every Hundred Pound, then 15,000,000 will be gained thereby." (p.6)
[88] A retrospective critic might offer the following clarification: if the Company wished to exchange Stock at £150 for £30 million of government debt, the Company only had to give away £20 million of Stock; the extra £10 million stock, if sold for cash at £150, would produce the £15 "profit." Another computationally, though not practically, equivalent option was to assume the Company somehow bought up all the government debts in cash at par and then sold all the new stock they could create at the advanced price.

wrong—the earliest numbers he produced were subtle and flexible, capturing sources of potential value in the South Sea Stock that many others ignored. In a detailed pamphlet dated March 31, Hutcheson argued that the value of the South Sea stock was inflated at prices above approximately £150, but he did so through an intricate computation that contemplated a wide range of potential conditions and outcomes for the Scheme.[89]

While he agreed with other skeptical analysts (like those who produced the calculations in **Figures 4a-b**) in suggesting that new investors in the South Sea Company would feel an immediate loss by buying into the Scheme, he admitted that this did not settle the question. Hutcheson's approach was to calculate what the profits from the Company's overseas trade would need to be in order to compensate for the losses he projected new Stock subscribers would experience.[90] Hutcheson calculated the funds to be raised by the sale of new Stock at eight different prices, depending on whether or not the irredeemable debts were engrafted. He then deducted the required payments to the government (£7.5 million) and to the holders of long-term government annuities (approximately £3.3 million above the value at issuance), to determine the value of the dividend to be made to all holders of the Stocks as a result of the sale of the new Stock.[91] He then deducted this dividend from the price paid over par by the new subscribers, further subtracted the gains to be had from the higher interest rate paid by the government, and concluded how much additional profit from trading activities would be needed in aggregate to make up this difference. He deduced what necessary yearly profits would be by using compound interest tables to calculate the equivalent value of a seven-year annuity at 4% interest.

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[89] "A Member of the House of Commons" [Archibald Hutcheson], *Some Calculations Relating to the Proposals Made by the South-Sea Company, and the Bank of England* (London: Printed, and Sold by J. Morphew, 1720).
[90] For a different take on Hutcheson's calculations in this pamphlet, see Dale, *The First Crash*, pp. 82-88.
[91] The £3.3 million, in addition to the amount paid to the government for the right to carry out the refinancing, represented the fact that the Company would have to pay the holders of the long-term annuities 25 years' purchase (25 times the annual annuity payment) in order to redeem them, though the face value of those annuities, which was therefore the amount at which the Company was allowed to increase its capital, was only 20 years' purchase. (Hutcheson, *Some Calculations Relating to the Proposals* (1720), p. 4.)

N° IV. *The Purchase at* 175 l. per Cent

THE Profits of the Additional Stock, at 175 *l. per Cent*. is				*l.* 23,856,000	
But the Money to be paid the Publick, and the Proprietors of the long Terms, is only				10,891,000	
Which leaves a Dividend on the whole Capital of					**12,965,000**
	l.	*s.*	*d.*		
The Advanced Price, as aforesaid, is	75 :	0 :	0		
But the Dividend of 12,965,000 *l*. is, *per Cent*.	29 :	15 :	3	*l.* *s.* *d.*	
Which reduces the Price to				45 : 4 : 9	
But out of this Deduct the present Value of 1*l*. *per Ann.* for Seven Years, which is				6 : 0 : 0	
Then the Price, over and above the Value, is				**39 : 4 : 9**	

Which will require, to make it a Saving Bargain, a Yearly Profit on Trade of ***6l. 10s. 9d.***

	Capital of 28,500,000 *l.*							Capital of 43,558,000 l.						
	1. The advanced Price, or present Loss, of every 100*l*. *South-Sea* Stock Subscribed for.			**2.** The Annual Profits on Trade for Seven Years necessary to make good the said Loss.			**3.** The Amount of the said Annual Profits computed on the whole Capital.	**1.** The advanced Price, or present Loss, of every 100*l*. *South-Sea* Stock Subscribed for.			**2.** The Annual Profits on Trade for Seven Years necessary to make good the said Loss.			**3.** The Amount of the said Annual Profits computed on the whole Capital.
N°.	*l.*	*s.*	*d.*	*l.*	*s.*	*d.*	*l.*	*l.*	*s.*	*d.*	*l.*	*s.*	*d.*	*l.*
1. at *Par* ..	10	7	6	1	14	6	491,625	19	0	4	3	3	4	1,379,336
2. at 125 ..	20	13	8	3	8	11	982,062	25	15	0	4	5	9	1,867,549
3. at 150 ..	30	19	10	5	3	3	1,471,312	32	9	10	5	8	3	2,357,576
4. at 175 ..	41	6	0	6	17	7	1,960,563	39	4	9	6	10	9	2,847,604
5. at 200 ..	51	12	0	8	11	11	2,449,813	45	19	7	7	13	2	3,335,816
6. at 300 ..	92	16	9	15	9	4	4,408,000	72	19	2	12	3	1	5,294,111
7. at 400 ..	134	1	3	22	6	9	6,366,187	99	18	6	16	13	0	7,252,407
8. at 500 ..	175	5	10	29	4	2	8,324,375	126	18	1	21	2	10	9,208,887

Figure 4c-d: Page images from Hutcheson, *Some Calculations Relating to the Proposals Made by the South-Sea Company* (Mar., 1720). The top image (p. 5) shows one example of Hutcheson's basic valuation model, assuming that the Company was to exchange all irredeemable debts and offer new Stock for sale at £200 per share. The bottom image (p. 7) is "An ABSTRACT shewing the Loss to the New Subscribers to the SOUTH-SEA Stock, at the several Prices following." The two panels ("Capital of 28,500,000 *l.*" and "Capital of 43,558,000 *l.*") represent the scenarios in which the Company did not (left) and did (right) choose to absorb the irredeemable debts. (Source: ECCO/ British Library)

Hutcheson's first attempt at valuing the South Sea Stock was distinct from many other pessimistic models. He contemplated many ore possible sources of value for the Company's Stock than did other analysts. For one, he framed his entire model in terms of the Company's hypothetical

trading profits. Even if he had a skeptical view of what those might be, he was unusually generous in even attempting to tie together the Company's immediate financial resources and its potential future income in one calculation. Hutcheson was also unique in arguing that the relatively high 5% interest rate the government had to pay the Company through 1727 was a source of real value, as he assumed that the prevailing interest rates available to investors during that period would not top 4%.[92] The model also had a distinctive computational architecture. Unlike other calculations that argued the Stock was overvalued while leaving the precise mechanics of the Scheme vague (as in **Figures 4a-b** above), Hutcheson contemplated sixteen different scenarios based on choices the Company's leaders could make in carrying out the refinancing (see **Figure 4d**).[93] This thoroughness had a powerful rhetorical effect, as it allowed Hutcheson to argue that high Stock prices were unjustified even when additional sources of value were considered. From a historical point of view, Hutcheson's model demonstrates the wide range of relevant variables that contemporaries might have plausibly taken into consideration in creating, or selecting between, models of financial value.

Not all computations for the unfamiliar mechanics of the financing Scheme produced similar conclusions. One early supporter of the Scheme, the author of the cumbersomely-titled *Argument to Shew the Disadvantage That Would Accrue to the Publick, from Obliging the South-Sea Company to Fix What Capital Stock They Will Give for the Annuities*, conceived of the quantitative mechanics of the proposed debt-for-stock swap in a much different way.[94] The author contended that the Company's refinancing Scheme would be efficacious for the public assuming a price of £175 per share, particularly arguing (against many critics of the Scheme) that the Company and its shareholders

[92] The government was to pay the South Sea Company 5% interest on the consolidated debt balances through 1727. Hutcheson claimed that this additional 1% interest (above base rates) had a value stockholders, equal to a 1% annuity for seven years, or 6 *l. per Cent*.

[93] Specifically, he modeled what would happen if the Company did or did not exchange the irredeemable debts, and the effect of offering new Stock at eight different prices.

[94] [Anon.], *Argument to Shew the Disadvantage That Would Accrue to the Publick, from Obliging the South-Sea Company to Fix What Capital Stock They Will Give for the Annuities* (London: Printed for J. Roberts, 1720).

stood to benefit by exchanging Stock for both the redeemeable *and* irredeemable debts.[95] The calculator's strategy was to show that the Company stood to make at least the same amount of profit, proportionally speaking, by taking in all the debts as by taking in just the redeemables (see **Figure 4e**). The author argued that the Company stood to make a total profit of £7.3 million by exchanging all the redeemable debts for Stock priced at £175, to be divided among the proprietors of £27.5 million in Company Stock. The pamphlet then tried to show that the irredeemables (which would add £13.4 million to the Company's Capital Stock) would offer an attractive level of profit as well (over £4.0 pounds). Because the proportion of profit to new Capital Stock added for the irredeemables (£4.0/£13.4) was actually better than that of the redeemables alone (£7.3/£27.5), the clear conclusion was that the Company would of course live up to its bargain.[96]

[95] Some observers at the time feared that the Company would inherently lose by offering stock for the irredeemable debts because those securities were valued highly in the secondary market. The Company was required under the terms of the Parliamentary Act to pay a fine of about £700,000 if they failed to successfully exchange the irredeemables. The suspicion among critics of the Scheme was that the Company intended to pay that fee in order to simply buy up the more profitable redeemable securities.

[96] As the calculator put it: "Therefore, state the Question thus: If 27,500,000 l. brings an Advantage to the Company of £7,275,458 l. how much ought 13,354,100 l. to bring? Answer, 3,532,988 l. Which Proportion is short of the real Advantage that the Annuities bring," namely £4 million. ([Anon.], *Argument to Shew the Disadvantage* (1720), pp. 6-7.)

[Anon.], *Argument to Shew the Disadvantage That Would Accrue to the Publick, from Obliging the South-Sea Company to Fix What Capital Stock They Will Give for the Annuities* (London: Printed for J. Roberts, 1720).

(£ in millions, except Prices and "years' purchase")

Assumed Stock Price at Exchange	£175	Assumed Stock Price at Exchange	£175
Assuming Redeemables Only Taken In:		**Assuming Irredeemables Taken In:**	
"Principal Sum of Redeemables"	£15.9	Years Purchase Given Per Annuity	30 y.p.
		Value of a £5/year Annuity	£150
"Gain upon… Redeemables" (3/4 of Principal	11.9	Assumed Stock Price at Exchange	175
Less: Amount to be Paid the Government (*)	(4.0)	Gain per Annuity (£)	£25
Less: "Penalty for not taking in the Annuities"	(0.7)		
"Clear Profit to the Company"	**£7.3**	Gain per Annuity (Years Purchase)	5 y.p.
		Plus: Gain from Government Penalty Saved (y.p.)	1 y.p.
"Which… is to be divided among":		Total Gain per Annuity (Years Purchase)	6 y.p.
Proprietors of the Redeemables	£15.9		
Proprietors of "before Subsisting Stock"	11.5	Total Irredeemable Annuities (per Annum)	£0.7
Total Proprietors	**£27.4**	**Total Gain on Irredeemables**	**£4.0**
		"Increase of Capital" by Irredeemables	**£13.4**
Proportion of Profit to Increase in Capital:		Proportion of Profit to Increase in Capital:	
Redeemables = *7.3 / 27.4* =	***0.27***	**Irredeemables** = *4.0/13.4* =	***0.30***

Figure 4e: Table, showing an interpretives summary of calculations from [Anon.], *Argument to Shew the Disadvantage* (1720). (*) Note: The implied fee paid to the government would have been lower had the Company only taken in the redeemable debts.

Beyond its optimistic view of the South Sea Scheme, two features of this difficult calculation are especially noteworthy: its computational mechanics for dealing with the exchange of the irredeemable debts, and its broader reasoning about the relationship between the price of the Stock and the efficacy of the Scheme. First, the *Argument to Shew the Disadvantage* calculated the "Profit" to be made by the Company by taking in the irredeemable annuities using the common contemporary heuristic of "years' purchase." By this technique, the price of a piece of property which offered a regular income stream, such as a tract land or a government annuity, was quoted as a multiple of the yearly income.[97] At market rates in early 1720, irredeemable government annuities were worth 30

[97] For an analogy of "years' purchase" to a price-to-earnings ratio, see Paul Harrison, "Rational Equity Valuation," p. 274.

"years' purchase," meaning that such an annuity which paid £5 per year was worth £150 in cash. The author of the *Argument to Shew the Disadvantage* contended that, if the Company could convince a holder of such a £5/year annuity to exchange that annuity for one share of Company Stock (par value £100) priced at £175, then the extra £25 (£175 – £150) represented a profit to the Company. By retranslating that £25 as 5 "years' purchase" on the original irredeemable annuity and making a series of other subtle adjustments, the author aggregated the entire profit to be earned on all irredeemables, worth £4 million. This technique involved some considerable leaps of arithmetic logic, much like the first two models explored above (**Figures 4a-b**). Given the elliptical nature of the computation, it is difficult for a modern observer even to assess the calculation as "right" or "wrong"—or rational. Yet it reveals much about how contemporaries confronted the complex South Sea Scheme. The author of the *Argument to Shew the Disadvantage* repurposed a familiar heuristic for talking about the value of property, especially real (land) property. By employing the "years' purchase" technique, that calculator not only translated a complicated analytical problem into terms that were likely more legible to some contemporaries (if less so to modern observers), but also may have made some readers more comfortable with the Scheme by implicitly analogizing it to investment in land.

This model of the accretive effect of taking in the irredeemable debts derived from a distinctive vision of the meaning and function of the price of South Sea Stock. The *Argument to Shew the Disadvantage* began with an assumption of the level (£175 per share) at which the Company might set its price for the purpose of effecting the debt-for-Stock Scheme, and argued that at that price the essential transactions involved were beneficial for the major stakeholders involved (South Sea stockholders, redeemable and irredeemable debtholders, the government). It was quite common for analysts assessing the South Sea Scheme to think primarily in terms of its relative fairness rather than absolute or universal value. The analyst then pointed out that "it ought to be observed, that if *South-*

Sea Stock rises above the Price, the advantage in taking in the Annuities, will rise in much greater Proportion than their Advantage upon them now stands," providing summary calculations showing the positive implications of the stock rising to £200 or £300 per share.[98] Though the Stock price was presented formally as an input to this model, the author of the *Argument* hinted at a recursive relationship between the Stock's numerical price (especially in the market) and the value of the Scheme for investors and the nation as a whole. False reports that the Company intended to back out of the full Scheme, he argued, had kept the market price of the Stock artificially low.[99] Once observers realized that the Company was going to go through with the Scheme, and that the Scheme effectively worked better the higher the price went, the Stock price would rise, making the Scheme more effective, reducing the National Debt, further increasing Stock price, and so forth. Because of these powerful and beneficial interactions, it was in no one's interest to try to fix the Company's Stock price ahead of time, as some desired.

In only these four quantitative models produced from February-March 1720, we can begin to see just how many interpretive choices remained open to contemporary analysts, and just how broad the space of plausible computations would have been. Reconstructing the assumptions behind such computational models highlights the difficulty of the interpretive problems evoked by the South Sea Scheme. As we have seen, early computations were often opaque about exactly how the various transactions of the Scheme would work and made various simplifying abstractions in an attempt to produce useful computations. Analysts made different decisions about which factors might be relevant to their models, like the value of trade profits or high government interest payments (Hutcheson) or the potential feedback effects from the success of the Scheme and the reduction of the National Debt (the *Argument*). The selections and heuristics involved in building such analyses suggest deeper sources of uncertainty about the nature of financial value, and even

[98] [Anon.], *Argument to Shew the Disadvantage* (1720), p. 10.
[99] [Anon.], *Argument to Shew the Disadvantage* (1720), pp. 9-10, 14-16.

about what kind of number a stock price was. Though all four calculators made effective claims about the South Sea Stock's value, none of these four models actually yielded a price for South Sea Stock as their final output. In all models, the Company's Stock price was at least in part a dependent variable, something that was to be set in part by Company leadership (or potentially Parliament) for the purposes of carrying out debt exchanges and new Stock sales. In part, this reflected a tendency to think of financial transactions like those involved in the Scheme more in terms of their fairness than their absolute value or profitability. There was no single, consensus way to understand the relationship such assigned Stock prices bore to those prices offered in the marketplace. Such quandaries became even more perplexing as the price investors were willing to offer for the South Sea Stock began to rise to unprecedented heights.

IV. At the Limits of Plausibility? April-June 1720

Disagreements about how to model the unfamiliar mechanics of the South Sea Scheme were not insignificant technical matters. Slight variations between calculations could produce dramatically different conclusions about the present and future value of the South Sea Stock. Two calculations, offered during the period in which the Bubble was inflating, demonstrate the extreme dispersion of opinion that was possible. Unlike the models discussed in Section III, both calculations—one highly optimistic and one highly pessimistic—produced direct values for the South Sea Stock as their outputs. One, offered in early April when the Stock was worth just under £300, suggested it might be worth almost £900; the other, offered in June when the stock was worth over £600, contended that the Stock was in fact worth no more than its par value of £100. Both calculations are susceptible to major, indeed damning, criticisms in retrospect, and did in fact elicit significant challenges from thoughtful contemporaries. Both were offered with evident political agendas. But the way in which the two arguments were presented, and disputed, suggests that both their

producers and critics had reason to think the arguments would be taken by some as credible. These two calculations help, therefore, identify the outer boundaries of what qualified as plausible.

The most notorious public calculation offered in 1720 took up most of the broadsheet *Flying-Post* newspaper for April 7-9, timed just as the Company was about to undertake the first steps of the Scheme.[100] It was certainly offered by a Company supporter, perhaps an actual Director, and contained the most optimistic valuation the stock was ever to receive in print (though not as high as its actual market peak). At a point when the Stock had only just hit £290, the paper suggested that the it might conceivably be worth as much as £880. The calculation was to prompt at least two pointed responses, including one from Archibald Hutcheson. Yet the *Flying-Post*'s computations had a force and clarity that many of the muddled, pre-Bubble pamphlets lacked, and posed a powerful interpretive question that critics could not easily dismiss.

The *Flying-Post* calculations (see **Figure 4f**) began with a careful summary of the South-Sea Company's capital resources, the various government debts available for the Company to redeem, and the interest payments thereon. The author's first central argument was that many critics of the Scheme fundamentally misrepresented how the Company would distribute its profits to its stakeholders in the form of dividends. The author contended that the Company could easily afford to pay dividends at a healthy rate of 9¾%, a claim that critics would claim was misleading even if technically accurate.[101] The second computation the *Flying-Post* calculator offered was even more startling. The author focused on the Company's ability to expand the amount of Stock it was legally permitted to sell by exchanging government debts at less than one-to-one. He argued that, if the Company exchanged Stock for all possible debts at a price of £300, this would only expand the

[100] *Flying-Post*, or, *Post-master*, no. 4428 (7-9 April 1720). Note that a separate version of only this edition of the *Flying-Post* is available in the MOME archive. Accordingly, I have included this text under the "Anonymous Pamphlets" section of the Bibliography, not with other newspapers.

[101] The author's basic point was that the Company only had to pay dividends on the par value of "Capital South-Sea-Stock," not on the value paid-in by new stockholders. Critics pointed out that such nominal dividend rates were irrelevant to investors who bought the Stock at more than par.

"United Capital Stock" to £21.5 million. This would leave roughly £20.7 million of room for the Company to expand their Stock. If this were sold for cash to the public at the same £300 rate, that extra stock would raise £62.0 million in cash. If that sum of cash were used to pay the government fee of £7.5 million, and the remainder were added to the amounts the government owed the Company (£42.2 million), the resulting sum, when divided among the existing stockholders (implicitly, £21.5 million), would be the value of each share of stock.[102] Or, as the calculator put it, this "would make the Intrinsic Value of every hundred Pound in that United Capital South-Sea stock to be 448*l.* 15*s.*"[103]

***Flying-post, or, Post-master*, no. 4428 (April 7-9, 1720)**

	(£ in millions)
"Whole Debt owing to them by the Government"	£42.2
Maximum "United Capital Stock"	42.2
Current "United Capital Stock" after Government Debts Exchanged	21.5
Remaining "Stock to Sell"	£20.7
Stock Price for Selling New Stock	*£300*
Cash from Sale of "Stock to Sell"	62.0
Less: Required Payment to the Government	(7.5)
Plus: Debt "which the Government must pay to the Company"	42.2
Total Value of Capital Resources*	**£96.7**
Current "United Capital Stock"	21.5
"Intrinsic Value" of £100 in "that United Capital"	**£448 15*s*.**

Figure 4f: Table, showing a schematic summary of the calculation in the *Flying-Post*, or*, Post-master,* no. 4428 (April 7-9, 1720). (*) Note: The author does not provide a term for the sum of the Company's cash plus the debt owed the Company by the government. "Capital resources" is used as a placeholder, and is not strictly an actor's category.

The implication was that, if the Company were to sell all available Stock to the public at £300 per share, the Stock would really be worth over £448. Even more provocatively, if the Company were to sell its available Stock at a price of £600 instead, the Stock's "intrinsic value"

[102] Notably, the calculator did not seem to have a specific term for the quantity represented by the sum of the stock sales (less the government fee) plus the amounts owed by the government. The value effectively represented the total value of the Company's assets.
[103] *Flying-post*, or, *Post-master*, April 7-9, 1720, recto.

would soar to over £880 per share. One writer, looking back upon the events of 1720, reflected on this ambitious claim: "The Author pretends to prove in effect, that whatever Price any Person should give for South-Sea Stock, still it would be worth more than he should give."[104] Yet the audacity of the calculation derived from the author's chosen assumptions about the corporate-financial mechanics of the Scheme, questions many of the pre-Bubble critics answered only in the vaguest terms. The *Flying-Post* author (along with Hutcheson) was one of the earliest analysts to carefully model the process by which the Company was going to exchange Stock for debt and then sell the extra Stock they became entitled to create for cash. His key assumption was that the gain from new Stock sales would be divided only among the small base of pre-existing stockholders, and not the new purchasers.

But was this claim *plausible*? At least two contemporaries, Hutcheson and an anonymous pamphleteer, responded with vehement critiques.[105] There would have been little reason for critics to respond with such diligence were it obvious that no one could have read the *Flying-Post* figures and agreed with its conclusions. The fact that critics were unable to tell whether others in the public might find these calculations convincing was part of why observers felt the entire Scheme was so dangerous. As one embittered pamphleteer wrote after the fact: "'Tis hard to determine whether People were misled by these Schemes publish'd in the afore-mention'd Flying-Post, and imagined in the South-Sea there were to found inexhaustible Treasures, and that no Price is too large to be given for the South-Sea Stock."[106] In other words, those highly optimistic calculations were not transparently *implausible*.

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[104] A. B., *Impartial Enquiry into the Value of South-Sea Stock: With Some Thoughts on the Occasion of the Present Decay of Trade and Credit* (London: Printed for J. Roberts, 1720), p. 7.
[105] [Archibald Hutcheson], *Some Seasonable Considerations for Those Who Are Desirous, by Subscription, or Purchase, to Become Proprietors of South-Sea Stock: With Remarks on the Surprizing Method of Valuing South-Sea Stock, Publish'd in the* Flying-Post *of Saturday, April 9, 1720* (London: Printed; and Sold by J. Morphew, 1720); and, [Anon.] *Remarks on the Celebrated Calculations of the Value of South-Sea Stock, in the Flying-Post of the 9th of April, 1720* (London: Printed for J. Roberts, 1720).
[106] A. B., *Impartial Enquiry* (1720), p. 8.

One rebuttal, the anonymous *Remarks on the Celebrated Calculations of the Value of South-Sea Stock, in the* Flying-Post *of the 9th of April, 1720*, revealed especially well the interpretive choices that produced the *Flying-Post*'s extreme valuation, as well as the seriousness with which critics felt such claims had to be taken. That critic pointed out that the *Flying-Post* calculator had implicitly created "three sorts of *South-Sea* Stock of different values."[107] The first type belonged to the holders of the roughly £11 million of original Stock, who "would have to partake of all the good Things, and none of the bad" in the Scheme. The second, a "middle State" consisting of those exchanging government debts for Stock, "partake both of the good and the bad." A third group, consisting of cash purchasers of new Company Stock, were condemned by the *Flying-Post* author simply to "furnish Plunder for the other two."[108] As the critic explained, the *Flying-Post* calculator assumed that any money to be made by the sale of new Stock to the public was to be divided only among the first two groups, which the *Flying-Post* calculator called together "the United Capital Stock, *alias*, the Junto."[109] In other words, the *Flying-Post* could claim that £100 of the "United Capital Stock" might be worth over £448 when it was being sold to the public for £300 because its calculations assumed that those who subscribed to new Stock issues (the third class) paid their £300 entirely to the first two and got nothing in return. In more pejorative—and anachronistic—terms, the critic effectively said that the *Flying-Post* was encouraging investors to buy into the South Sea Company by demonstrating that it made an excellent Ponzi Scheme.[110]

It was an astute criticism, and to a modern eye appears essentially correct. Yet the fact that such a criticism had to be spelled out in such detail suggests that the *Flying-Post* calculator and his critic were engaging in an unsettled dispute about how to analyze the mechanics of joint-stock

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[107] [Anon.], *Remarks on the Celebrated Calculations… in the* Flying-Post*,* pp. 2-3.
[108] [Anon.], *Remarks on the Celebrated Calculations… in the* Flying-Post*,* p. 3.
[109] [Anon.], *Remarks on the Celebrated Calculations… in the* Flying-Post*,* p. 3. The term "Junto" here pejorative partisan echoes. In contemporary politics, the "Junto" referred to a group of especially powerful—and, in some minds, especially corrupt—Whig-party political leaders in the 1690s and early 1700s.
[110] For a modern economic perspective on the role of "naturally occurring Ponzi Processes" and the formation of speculative bubbles, see: Shiller, *Irrational Exuberance*, ch. 4, esp. pp. 74-6; Kindleberger, *Manias, Panics, and Crashes*, ch. 5.

investment. That different groups of stockowners might in fact hold stock of simultaneously different values was probably not inconceivable at the time. The critical *Remarks on the Celebrated Calculations*, after all, did not simply dismiss the *Flying-Post* valuation as a fantasy of arithmetic. That author, instead, chose to argue that the analysis of financial value ought to rest on certain solid, knowable principals and that the *Flying-Post* calculator had simply misapplied them. In criticizing the *Flying-Post*'s treatment of corporate dividends, the critic accused his opponent of "denying or fallaciously evading the main Principle, on which *the whole Science of Stock-Jobbing* is built."[111] As we have seen, it was a considerable exaggeration to suggest that financial analysis constituted a cohesive "science" in 1720. The critic's invocation of such a "Science of Stock-Jobbing" was aspirational, but telling nonetheless. It admitted, or hoped, that both calculators were participating in a shared scientific conversation. It was implicitly to say that his opponent was wrong, perhaps seriously so, but not ridiculous.

Extreme views of the South Sea Stock were not limited to such optimistic boosterism. Even a skeptic like Archibald Hutcheson, who would subsequently be celebrated as the most prescient of prognosticators in 1720, was not immune from venturesome interpretations. As we saw in Section III, Hutcheson's computations in March 1720 had been among the most intricate, and in some ways generous, renderings of the potential value of the South Sea Stock. During the summer mania surrounding the Stock, though, Hutcheson dispensed with such subtlety. On June 11, he drafted a brief broadsheet entitled *An Estimate of the Intrinsick Value of South-Sea Stock*, which he intended to be read by other Parliamentarians on the day of their prorogation.[112] The brief computation was as conservative as the *Flying-Post*'s was favorable. At the point the pamphlet appeared, the Company

[111] Specifically, the principle "That the Benefit of a Dividend (considered as a Motive to the buying or keeping of Stock) is always to be estimated according to the Rate it bears to the Price of the Stock, and the Continuance of that Price, because the Purchaser is supposed to compare that Rate with the Profits he might make of his Money, if otherwise imployed." [Anon.], *Remarks on the Celebrated Calculations… in the* Flying-Post, p. 7. (*Emphasis* mine)

[112] The pamphlet was presumably originally published as [Hutcheson], *An Estimate of the Instrinsick Value of South-Sea Stock* ([London]: *s.n.*, [1720]). It is reprinted in Hutcheson, *A Collection of Calculations and Remarks Relating to the South Sea Scheme & Stock, Which Have Been Already Published* (London: *s.n.*, 1720), pp. 41-42.

had carried out two money subscriptions (selling subscriptions for £3.75 million of par-value Stock for over £12 million cash), exchanged roughly two-thirds of the available irredeemables (valued at over £15 million), and had promised to pay a dividend in stock of 10% at midsummer. The *Estimate's* conclusion: one £100 share of South-Sea Stock was worth exactly £100. The conclusion was one that would have been startling to many readers, and not just because the Stock by that point was soaring past £600 toward nearly £1,000 by the end of June. Months of print had belabored the point that, because the Company had already enticed money subscribers and debtholders to buy-in for prices above £100, South-Sea Stock was at the very least worth more than the par value of £100.

Hutcheson's valuation in this June *Estimate* was not simply an exercise in oblivion or triviality, though. Instead, like the *Flying-Post* calculations, the *Estimate* presented a lucid computation that derived an extreme outcome from nuanced assumptions. The *Estimate* first calculated that the Company had a "Total Capital" of £20.1 million, meaning the total quantity of nominal Stock owned by all the Company's "Proprietors." Hutcheson then reasoned that "Debts due from the Company" totaled £34.6 million, assuming the Company exchanged all possible government debts, against which the Company had £12.4 in expected cash raised from the money subscriptions. The "Remaining Debt" was the total debt minus the cash, or £22.2 million. The maximum value to which the Proprietors were "intitled" could therefore be determined by a simple accounting relationship: that value equaled the total amount of the government debt the Company would hold if it exchanged all possible debts (£42.2 million) minus the "Remaining Debt" the Company owed (£22.2 million), leaving £20 million to be divided among the Proprietors. With a little rounding, the conclusion was that there was £20 million in value to divide among the Proprietors of £20 million in total capital. The stock was therefore worth precisely its face value, or £100 per share.[113]

[113] Hutcheson actually went on to suggest much more vaguely that the Company might be able to "encreas[e] their Capital only to 21 Millions" and therefore be "entirely out of Debt," allowing the £42 million in government debt to be

[Archibald Hutcheson], *An Estimate of the Instrinsick Value of South-Sea Stock* ([London]: s.n., [1720])

	(£ in millions)
The "CAPITAL of the South-Sea Company"	
Irredeemable Debts Subscribed (2/3 of Total)	£3.4
First Two Money Subscriptions	3.7
Original Capital	11.2
Capital before Dividend	18.3
10% Midsummer Dividend	1.8
"Total Capital"	**£20.1**
"Debts due from the Company"	
Bonds and Cash to be Paid for Irredeemables	2.7
"To Purchase the Remaining One Third Part" of the Irredeemables	*7.8*
"To Purchase the Redeemables"	*16.5*
Fee "To be Paid the Publick"	7.6
Total "Debts due from the Company"	**£34.6**
"In Cash, or due to the Company towards the Discharge of this Debt"	
Total Cash or Subscriptions Owed	12.4
"Remaining Debt will be"	**£22.2**
Proprietors "Intitled to" from the Government	42.2
Per £100 share of Capital	*£210*
Less: "Debts due from the Company"	22.2
Per £100 share of Capital	*£110*
"The Remaining Value is" (per £100 share)	**£100**

Figure 4g. Table, summarizing the calculation in [Hutcheson], *Estimate of the Instrinsick Value of South-Sea Stock*. The upper shaded box shows where in the calculation Hutcheson classified outstanding government debts to-be-purchased by the Company as "Debts due from the Company."

This startling outcome resulted from what Hutcheson classified as "Debts due from the Company." These "Debts" included not only the well-known fee owed by the Company to the government for the Scheme (listed as £7.6 million in this *Estimate*), as well as some cash and bond payments the Company had to pay to those who exchanged government debts under the Scheme.[114]

divided among £21 million worth of proprietors. This would justify a stock price up to £200. He offered little explanation for this secondary calculation.

[114] Though the vast majority of the compensation to government debtholders was in Company stock, the Company offered small quantities of cash or bonds as well, mostly when certain government debts did not divide into a whole number of Stock shares.

They also included all of the remaining unsubscribed irredeemable annuities and the redeemable debts. This was the critical move. Hutcheson accounted all of the government debts not yet subscribed as obligations the Company had to pay. He also assumed that the Company would have to pay face-value for those debts, rather than giving stock for them at less than one-for-one.

This was not an impossible scenario. In retrospect, it made sense if the Company decided to try to buy out all of the remaining government debtholders in cash and chose not to sell the additional stock to which those newly-absorbed debts entitled them.[115] But Hutcheson did not clarify that this was what he believed was likely to happen. Rather, by treating the outstanding government debts as if they were the Company's strict obligations, he elided what the Company *ought to do* politically and *had to do* legally and computationally. As Hutcheson continued to publish fuller and more refined valuations of South Sea Stock through the fall, he subtly admitted that his June *Estimate* represented only a most conservative special-case of a broader set of potential valuations.[116] In a way, he established that calculation as his own boundary of what he considered plausible. But at the time that calculation was offered, it relied on a subtle assumption on a disputed point of interpretation, an assumption that was both technically plausible and politically attractive. Calculations like Hutcheson's and the *Flying-Post*'s suggest that the frenzy for the South Sea Stock in the spring and summer of 1720 did more than just inflate the Stock's price. It tested the limits of plausible quantitative belief about what the Stock might really be worth.

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[115] If the Company gave holders of the outstanding government debts Company Stock, this would create new nominal "Capital" and so increase the "Total Capital" held by Company proprietors beyond the £20 million. If the Company instead did nothing and never bought up the remaining debts, the Company would not be entitled to the full £42+ million from the government. It is questionable whether such a strategy would have worked mechanically. First, remaining irredeemable debtholders were under no obligation to accept cash. Second, the Company did not have the cash to repay all of its "debts," as defined in this *Estimate*, and so if the Company chose to pursue a strategy other than exchanging stock for debt, it is unclear how they would have raised the cash to do so.

[116] Hutcheson, *A Collection of Calculations and Remarks Relating to the South-Sea Scheme* (1720), pp. 46-54.

V. Decline, Debt, and Dividends: Fall 1720

The glimpse of possible weakness in the once-surging South Sea Stock did not shut off substantial disagreement about its value, either. This final section will take a close look at a different approach to valuation—one focused primarily on future dividends—that was offered in early fall 1720, in response to the sagging of the South Sea Stock price. By late summer, there were signs that the market was not sustaining the summer's £1,000 prices. The stock had closed August at £810.[117] On August 30, the Company's Court of Directors made a striking resolution: they promised to pay a dividend of 30% at Christmas, and 50% dividends annually for twelve years thereafter. The dividend decision was targeted to offer stockholders a particular incentive to hold the Stock until year's end.[118] The measure, which was officially announced September 8, was insufficient to prevent continued selling, though, and the stock fell to £300 by the beginning of October.

So what did public analysts make of the Stock's value at this pivotal moment? In his benchmark chronicle of the South Sea Bubble, John Carswell notes dismissively: "An unhealthy concentration on the real value of South Sea stock in terms of yields and prospects was to characterize that autumn. Innumerable pamphlets of the most baffling complexity appeared."[119] Amidst these computations of "baffling complexity," though, were sincere, creative ideas about how to calculate financial value that were prompted by the unsettling experience of market panic. One especially noteworthy modeling strategy used the Company's alleged capacity to pay high dividends to set a lower limit for the value of the Stock. This was the strategy of a fifteen-page pamphlet

[117] Larry Neal, *Rise of Financial Capitalism*, p. 235.
[118] See: Dickson, *Financial Revolution,* p. 149; Carswell, *South Sea Bubble*, p. 147. Carswell is, for him, unusually generous in describing how "extraordinary as this announcement was, it was not quite so grotesque as it seems at first sight." Carswell points out that the aim of the measure was to stabilize prices by encouraging stockholders not to sell out. Skilled observers at the time might have quickly realized that the promises were not quite as outlandish as the numbers make them first appear. As was conventional, this dividend was calculated on the nominal quantity of stock held, so that someone who had purchased a £100 share of stock at £500 was to receive in future years 50% only of the £100 par value, or £50/year. This was still a handsome 10% on his investment, but not a total windfall.
[119] Carswell, *South Sea Bubble*, p. 148. Carswell, like many twentieth-century observers of the Crisis, contends that the entire Scheme was deliberately fraudulent, and so computational analyses were unhealthy because they distracted from that underlying criminality

entitled *The South-Sea Scheme Examin'd: And the Reasonableness Thereof Demonstrated.*[120] It was written by the pseudonymous "A Hearty Well-Wisher to Publick Credit," and, while given no specific date, it must have been written and published in the last two weeks of September or first two weeks of October.[121] The pamphlet's main conclusion was that, whatever the going price for the Stock, it still merited a price of at least £400 based on the dividends that could be paid to those who had exchanged government debt for Stock. While the *South Sea Scheme Examin'd* looks forward to modern valuation techniques based on discounting future dividend streams, it simultaneously reveals distinctly early-modern attitudes toward the conceptual relationship between stock (equity) and debt and the credibility of financial information.

The Well-Wisher promised to give an "an impartial and fair Examination into the *South-Sea* Scheme… endeavouring the demonstrate the Reasonableness thereof, after the best Manner which a Person furnish'd only with such Materials as have been published, is enabled to do."[122] After offering a brief summary of the refinancing operations and new stock offerings which the Company had already undertaken, the author turned to the question of the "Valuation of the Respective Funds."[123] The author argued that, based on established market values, the rates at which South Sea Stock had been previously exchanged for government debts were eminently reasonable: the long annuities "never exceeded 25 Years Purchase"; the 9% short annuities and 1710 lottery payouts "sold for about 14 Years Purchase"; and the redeemables "cannot be valued above *Par*, as they were

[120] [Anon.] "A Hearty Well-Wisher to Publick Credit," *The South-Sea Scheme Examin'd: And the Reasonableness Thereof Demonstrated* (London: Printed for J. Roberts, 1720). As noted in the ESTC, this pamphlet has in the past been erroneously attributed to Defoe.
[121] It is relatively easy to date the pamphlet. Because the author suggests that the stock have fallen below £400, the pamphlet must have been written after approximately mid-September, when the stock was still around £500. Because the author does not yet rely on finalized information about the second subscription of government debts (from 14 July and 4 August), the pamphlet must have been written before 15 October, when those amounts were finalized.
[122] [Anon.], *South Sea Scheme Examin'd* (1720), p. 2. I would speculate that he was in fact honest when suggesting that he was not writing in the Company's employ, though it seems highly unlikely that he was not personally interested in the health of the Stock's price.
[123] [Anon.], *South Sea Scheme Examin'd* (1720), p. 6.

liable to be paid off at any time without Notice."[124] More adventurous was his next move. He argued that the various classes of public funds had in fact been paid considerably *more* than these fair market prices, claiming for example that the irredeemable long annuities had received compensation worth up to 36½ years' purchase. Though he omitted the computational details, the point was clear: the package of South Sea Stock, cash, and bonds that the debtholders received for subscribing their annuities was worth more than the market rate for those same annuities.[125] The Well-Wisher deduced that this had major implications for what could be considered a fair price for South Sea Stock: "It will easily be perceived from what is advanced, that the *South-Sea* Stock is valued at 400 *l. per Cent*, which perhaps may be objected to, considering the Price it sells for."[126]

But how did the author use the fact that government debtholders had been effectively overpaid to justify this implied value of £400 per share, which he admitted was his "main Point"?[127] He began his calculation by outlining the concepts of value underlying his computation:

> To judge of the real Value of the Stock, must be by the Dividends, the Company will be able to make upon the Stock, and the Continuance of them: And I hope to make it appear, that the Stock is worth 400*l. per Cent.* by shewing that the Company is able to divide after the Rate of 30 *per Cent.* upon their Stock, for such a Number of Years, as will reimburse every Proprietor his full Principal and Interest for every Share purchased at that Rate.[128]

The author's wished to demonstrate computationally that various classes of stockholders, specifically those who had exchanged government debt, would ultimately make healthy returns on their original investments because of the dividends they would receive. As an example, the Well-Wisher explained

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[124] [Anon.], *South Sea Scheme Examin'd* (1720), pp. 6-7.
[125] For example: Holders of the long irredeemable annuities who exchanged their securities at the first opportunity in May received, for every annuity bearing £100 per annum: £700 in South Sea Stock (valued at £375 at the time), plus £575 in cash and bonds. The holders were also given 10% more Stock as a result of the midsummer dividend, meaning their total holdings were £770 of Stock and £575 of cash equivalents. Valuing that Stock at £375, the cash value of the Stock component was £2,888; with the cash equivalents (£575) this came to £3,463 in total value, or 34.6 times the yearly payment on the annuity. Valuing the Stock at £400, as the author shortly admitted he was doing, produced a Stock value of £3,080, and a total compensation of £3,655, or almost exactly 36½ "years purchase." The various components of compensation offered to government debtholders would have been familiar pieces of information.
[126] [Anon.], *South Sea Scheme Examin'd* (1720), p. 8.
[127] [Anon.], *South Sea Scheme Examin'd* (1720), p. 9.
[128] [Anon.], *South Sea Scheme Examin'd* (1720), p. 10.

why a representative long annuitant who bought into the Scheme as early as possible would in fact make out quite well by their original exchange. The calculation was given in paragraph form:

> As for Instance, every Long Annuitant subscribing 100 *l. per Annum*, upon the first Proposal receives 254*l. per Annum*, which if continued 14 Years, Reimburses a Principal Sum of 2500*l.* with Interest of 5*l. per Cent.* thereon: Which Sum was the just Value or Worth of his Annuity: So that the Subscriber not only receives an annual Sum of 125 *l.* in Lieu of 100*l.* but is a Gainer of 770*l.* Capital Stock, and 575*l.* in Bonds or Money, over and above the 2500 *l.* by him subscribed.[129]

Clarity was not the Well-Wisher's greatest attribute.[130] But it is possible to infer with considerable confidence how this calculation was built. The author began with the premise that the holder of a £100 per annum irredeemable or "long annuity" held the equivalent of a £2,500 "Principal Sum" (based on the 25 years' purchase market price for long annuities). The question then became: how much of a yearly payment would it take to pay down that £2,500 principal over a given period of years (here, fourteen) assuming the holder also expected to earn interest (5%) on whatever balance remained. The answer to this question, as presented, was £254 per year. So, the Well-Wisher suggests, as long as the Company could afford to pay £254 per year to the former annuitant (who now held £770 pounds of Company Stock), that annuitant would at least be repaid full value for the annuity. Not only that, but that annuitant would also earn £125 per year effective interest (at 5%) on his principal value, instead of the £100 per year he had been receiving on the annuity, and would still have, at the end of the fourteen years, his shares of Stock (£770 par value) and the cash equivalents that were paid to him when he first exchanged (£575). The major ellipsis in the computation is the source of the £254 annual payment figure. One possible interpretation is that it represented a 30% dividend on the par value of the holder's stock (£770); but 30% of £770 is the slightly lower figure of £231 per year. Rather, the £254 was almost certainly derived from an

[129] [Anon.], *South Sea Scheme Examin'd* (1720), p. 11.
[130] The difficulty in reading back the calculation stems from a few telling sources: the condensed paragraph format, the equivocation of certain terms (particularly the multiple "annual Sums" of 254, 125, and 100), and the lack of explanation for the sources of certain numbers.

autonomous source. Namely, it was precisely the amount needed simply to pay down a £2,500 principal sum earning 5% in fourteen years according to the strict mathematical operation of compound interest.

Though opaque, the calculation was built out of serious contemporary analytical tools—precisely the kinds of tools William Paterson had been preaching about earlier in the decade. The implicit calculation relied on a subtle piece of technical arithmetic, the debt-sinking calculation, though it would have been legible to some contemporaries with training in accounting or mixed mathematics. It was indeed a variant of the kind of projective, compound-interest mathematics employed in the calculation of the Equivalent (or, as we will see, in Robert Walpole's "Sinking Fund"). It also made for an interesting argumentative gambit. The main point that debtholders who bought into the Scheme were going to get paid back within a reasonable number of years was not easily dismissed. The author took a question of how to value a highly speculative security and turned it into the question of planning debt repayment. It was an approach entirely in keeping with the general argument of his pamphlet, which was that the health of the South Sea Stock was fundamentally a matter of public credit.

In the *South Sea Scheme Examin'd*, we can see both conceptual sympathies with more modern ideas about valuation, and the vestiges of a distinctly early-modern vision of financial capitalism. On the one hand, the method of justifying the value of blocks of Stock by calculating the quantity of debt the attendant dividends could pay down evokes modern methods of valuation using the discounted present value of future dividends.[131] The Well-Wisher's patchwork computation, though, owed more to an early-modern kind of analytical tinkering than to anything like modern theory. For one, his arguments about the different kinds of public debt securities (long irredeemables, short

[131] Harrison argues that analysts in the 1720s did indeed use a method of "discounting future cash flows" in assessing the value of stocks, though his primary citation is a didactic pamphlet from 1726. (Harrison, "Rational Equity Valuation," pp. 272-3.)

irredeemables, redeemables) that were exchanged for Company stock were all discrete from one another, and he never attempted to pull together these various different components of the Scheme into one complete model. Specifically, the author never really verified that the Company could pay back everyone, and not just different groups one at a time. Like several of the calculators in Section III, the Well-Wisher derived his statements about value from a conclusion about fairness, not the other way around. What is more, the major quantitative conclusions about how much the Company could afford to pay annually to various debtholders (like the £254 per year to a holder of a long irredeemable annuity) were determined in order to make the calculation work correctly rather than calculated as an output of the model. The author's main justification for why the Company could pay dividends at anything close to that level was simply that the Company had, in fact, promised to pay 30% dividends annually in future years.

In the end, the entire structure on which the Well-Wisher built his valuation relied on his faith in the Company's own promises. This, perhaps more than any other feature of 1720 valuation calculations, frames the historical strangeness of early-modern ideas about financial value. All calculators in 1720 did not assume that the computation of financial value was a fundamentally critical or skeptical enterprise. In the winter of 1720-1721, after the Bubble had completely popped and Britons angrily began to look for an explanation for what happened, many pointed to the Company's exorbitant and unrealistic dividend promises as a definitive example of the Company's knowing attempts to deceive the public for their own private gain (as will be discussed further in Chapter 5).[132] But, as the Well-Wisher's calculations show us, to assume that such promises were always unbelievable to all competent observers is to presume anachronistically that the Bubble's devastating collapse was inevitable. (Indeed, we will see that the Company's promises of 30% future dividends might not have been so obviously implausible after all. Company representatives in the

[132] *The Reports of the Committee of Secrecy to the Honourable House of Commons, Relating to the late South-Sea Directors, &c. Carefully Corrected* (London: Printed for Cato, 1721), p. 16.

aftermath of the Bubble produced their own computations trying to justify why they believed that such dividend promises were realizable.)[133] Different kinds of financial calculations were made possible by different attitudes of financial trust that existed within the eighteenth century—attitudes still within the bounds of plausibility in a community that had only just begun to experience the wrenching pain of widespread financial panic.

VI. Conclusion: Foreclosing Plausibility

The financial analysts and investors contemplating the Stock of the South Sea Company in 1720 had plenty to disagree about. Untested technical quandaries created great sources of uncertainty in the computation of financial value. How were the proceeds of new Stock sales to be divided amongst new and old investors? Did pending public debts the Company had promised to absorb constitute liabilities to the Company, and if so, how should the impact of those liabilities be calculated? Was the best way to assess the real value of the South Sea Company's stock to evaluate the current state of the Company's resources (in more modern terms, its assets), or to forecast the Company's future ability to pay out dividends? Was the calculation of value a consequence of, or precedent to, the assessment of fairness? By carefully reconstructing contemporary arguments about the value of the South Sea Stock in historicist terms, we can begin to recapture the inherent controversies of economic knowledge that early modern investors, analysts, and politicians faced as they contemplated difficult investment and policy decisions. As we particularly saw in Section IV, disagreements on seemingly narrow technical points could produce radically different conclusions about valuation. At the same time, technical controversies could be implicated in deeper disagreements about the nature of financial value, the responsibilities of public companies, and

[133] "The Scheme or Calculation upon which the Court of Directors of the South Sea Company Grounded the Resolutions of Making the Dividend of Thirty p[er] Cent at Christmas & not less than 50 p[er] Cent p[er] Ann for 12 Years," Treasury Papers, NA T 1/231, ff. 163-4.

about financial trust. The surviving financial calculations of the period do not simply provide evidence to debate historical rationality. Rather, they form the basis of an archaeology of economic understanding and disagreement in a society closely linked to, but deeply different from, our own.

The stories of financial crises have not traditionally been told as stories of disagreement. This chapter has been an attempt at beginning to do so. Telling a story of meaningful and plausible economic disagreement is a strange task. It requires suppressing the urge to evaluate past claims of economic knowledge in terms of modern economic ideas or subsequent economic outcomes. It challenges the notion of a timeless economic rationality. It also requires accepting that analyses of certain economic decisions might appear, in retrospect, to have been wrong or deceitful, but at the time were honest or credible or convincing. Our study of the dispersion of computational opinion before and during one such disaster, the South Sea Bubble, suggests that greater attention ought to be paid to the place of such epistemic instability in the development of financial bubbles. This investigation of financial computations in 1720 complements and gives further credence to the recent work of financial economists like Hong and Stein, who have emphasized the importance of disagreement in breakdowns of market efficiency. In doing so, the findings of this chapter suggest the critical role that the history of knowledge ought to play in our understanding of markets.[134] Financial crises, perhaps, are less the result of mass delusion than of mass disagreement or confident confusion. They are crises of understanding in which the problems of knowledge produced by economic changes and innovations grow faster than the ability of an economic community to agree upon what is going on.

The capacity for plausible disagreement amidst the rise and fall of the South Sea Stock not only suggests further reconsideration of how we think about financial bubbles in the abstract. It also

[134] Hong, Stein, and Yu have recently begun to make an effort in the other direction with their studies of model selection and "paradigm shifts" in the decision-making processes of investors. Their analysis borrows from Kuhn. (Hong, Stein, and Yu, "Simple Forecasts and Paradigm Shifts.")

brings into question the historical processes which have shaped our dominant conceptions of what bubbles are and how they work. Let us return, for example, to the quotation with which we opened this chapter, taken from one of the most immediate histories of the South Sea Crisis. "Even Mathematical Demonstrations… were slighted," our anonymous pamphleteer reflected. Foreshadowing centuries of subsequent analyses, he described the 1720 Crisis as a mass deviation from mathematical logic. Financial valuation, after all, was a "Subject… *always* capable" of effective computational analysis.[135] As familiar as this sentiment has become to our understanding of financial markets, in the context of 1720 this seems like a decidedly peculiar claim to make. First of all, as we have come to see, there were plenty of mathematical demonstrations offered about the South Sea Stock, but they did not all say the same thing. What is more, the author made this claim in the immediate aftermath of the most devastating financial collapse that anyone had ever experienced, which had vividly demonstrated that speculative mania could cause an entire nation to do completely unpredictable and unreasonable things. The author's assertion seems almost counter-intuitive. The failures of the South Sea Scheme were not the result of the inherent unintelligibility or irrationality of financial markets, he suggested; they were the result of the public ignoring a profound mathematical regularity that should have been evident the entire time. For this author at least, financial crisis seemed to affirm the rationality of financial markets. The exception had proved the rule, or at least the existence of rules.

In the months immediately after the collapse of the South Sea Bubble, a standard story coalesced explaining mathematically what had happened. There grew the idea that there was a single "Mathematical Demonstration" that could have explained the Stock's true value. In a sense, the Bubble itself, and especially the political need to explain it, acted as an epistemic filter that separated out one computational image of value from a universe of once-plausible alternatives. In the

[135] *Emphasis* mine.

following chapter, we will reconstruct that dynamic filtering process, hoping to add historical perspective to economists' questions about "investor learning" and the processes of "revisionism" by which investors assimilate past experience into new economic models.[136] In part, this was an empirical process, whereby the facts of the Stock's collapse served to confirm one past model of its value and deny many others. But it was just as much a political process. The orthodox model of the South Sea Stock that came to be cited in the autopsies of the Bubble was prized not only for its apparent predictive success, but its capacity as a benchmark against which to evaluate the ethical failings that people believed ultimately caused the Bubble. Financial knowledge and financial ethics were co-produced amidst financial crisis.[137] That new financial knowledge—in part ratified by empirics, in part by ethics—had considerable impact on the future development of financial capitalism in the eighteenth century and beyond. The idea that a financial object like a share in a joint-stock company ought to have, at a most fundamental level, a value that was definitively calculable did more than just help explain what happened when financial markets stopped working. It simultaneously affirmed that there were inherent aspects of the emerging financial markets that were susceptible to solid understanding.[138] A financial crisis served as the foundation for building a new kind of consensus about financial value, and a new confidence in the intelligibility of finance itself.

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[136] Shiller, *Irrational Exuberance,* ch. 11; Hong, Stein, and Yu, "Simple Forecasts and Paradigm Shifts," esp. p. 1210.
[137] Sheila Jasanoff, "The Idiom of Co-Production," in *States of Knowledge: The Co-Production of Science and Social Order*, ed. Sheila Jasanoff (Abingdon, UK and New York: Routledge, 2004), pp. 1-12.
[138] I disagree with sociologist Alex Preda's recent argument that, prior to the 19th century, Europeans by and large believed that financial phenomena like the movements of stock prices were effectively incalculable and, his words, "radically unknowable." (Preda, *Framing Finance*, p. 86.)

– CHAPTER 5 –

ARCHIBALD HUTCHESON'S INTRINSICK VALUES

Secrecy, Certainty, and Financial Responsibility amidst the South Sea Crisis

When the anonymous author of the *Considerations on the Present State of the Nation* wrote, in the wake of the crash of the South Sea Bubble, that "that even Mathematical Demonstrations (of which this subject was always capable) were slighted, and the Authors of them treated as if they had been Quacks or Ballad-Singers," he likely had one specific author in his mind.[1] This was Archibald Hutcheson, the MP and fiscal policy critic who was the most active, influential, and—to many minds then and now—accurate analyst of the South Sea Scheme. It was Hutcheson, more than anyone else, who was responsible for promoting the idea that the value of South Sea Stock was something "always capable" of mathematical proof. This chapter reconstructs what Hutcheson's calculations of the "real and intrinsic value" of South Sea Company stock meant to him in his own time, and explains how his numbers, among a universe of once-plausible alternatives, came to be understood by many as the best way to understand financial value. At the very heart of Hutcheson's understanding of financial value was a distinct vision of financial ethics. In 1720, computational techniques Hutcheson had developed earlier in his career as instruments of political interrogation and criticism were repurposed as methods of normative judgment. In the aftermath of the Stock's crash, his calculations were judged analytically *right* in large part because of their success in demonstrating the ethical *wrongs* that brought about the Bubble.

The influence of Hutcheson and his calculations was evident both in the honors he earned in his own time and in the stories that have been told about the Bubble for centuries. In the months and years that followed the 1720 crash, fellow Britons invoked Hutcheson as the embodiment of prudent financial foresight, crediting him with having "constantly opposed, in Parliament and in

[1] [Anon.], *Considerations on the Present State of the Nation, as to Publick Credit, Stocks, the Landed and Trading Interests* (London: Printed for J. Roberts… and A. Dodd…, 1720), pp. 1-2.

Print, the *Fatal South Sea Scheme*, and Early foretold the Ruinous Consequences thereof."[2] Commentators angered by what had transpired in 1720, like polemicist Eustace Budgell, celebrated Hutcheson's computational public service. "Your several Calculations of the Value of *South-Sea* Stock have shewn you to be an *honest Man*, and a good *Accomptant*," Budgell wrote in a post-Bubble pamphlet dedicated to Hutcheson. "I wish, for the Sake of my Country, I could say half as much of some other people."[3] One poet-pamphleteer published an epistle to Hutcheson in 1722, which pondered how much better off the nation might have been if Hutcheson's fiscal plans had been adopted: "Full happy shou'd we've been, nor e'er disdain'd, / If Your Elaborate Schemes had once obtain'd."[4] Such applause was not limited to the press. In that same year, Hutcheson earned re-election to the Commons, both for his existing seat in the remote seaside borough of Hastings, but also for a new seat in Westminster, one of Britain's most populous and prominent constituencies. Campaigning on his fiscal policy record and his prescience about the South Sea Scheme, he won nearly 4,000 votes.[5] In the process, he defeated none other than William Lowndes, widely-respected for over twenty-five years as Parliament's go-to man on fiscal administration.[6]

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[2] Hutcheson was quite skilled at promoting his own prescient views, and citing the South Sea debacle as testament to his prudence. See Archibald Hutcheson, *A Collection of Advertisements, Letters and Papers, and Some Other Facts, Relating to the Last Elections at Westminster and Hasting* (London: Printed for T. Payne, 1722), p. 5.

[3] Note that Budgell did not name Hutcheson directly, but instead referred to him as the "Author of the Several Calculations." There is no question the attribution is to Hutcheson, whose pamphlets were regularly entitled "Some Calculations," "Collection of Calculations and Remarks," etc. See: Eustace Budgell, *Case of the Annuitants and Proprietors of the Redeemable Debts: In a Letter to the Author of the Several Calculations on South-Sea Stock* (London: Printed for J. Roberts, 1720), p. 3.

[4] [Anon.], *An Epistle to Archibald Hutcheson, Esq.* (London: Printed for T. Payne, 1722) p. 4. For one interpretation of this pamphlet, see Helen Paul, "Archibald Hutcheson's Reputation as an Economic Thinker: Pamphlets, the National Debt and the South Sea Bubble," *Discussion Papers in Economics and Econometrics* (University of Southampton), no. 0922 (2009), p. 9.

[5] Hutcheson led the polls with 3,952 votes, while his running-mate John Cotton earned 3,782; their opponents, Thomas Crosse and William Lowndes, drew less than 2,200. It was a highly contentious election, complete with accusations that Hutcheson and Crosse tampered with the results by riling up the London crowds. See: "The Humble Peticon of Sr Thomas Cross Bart. and William Lowndes Esqr.," MS draft, c. March 1722, Lowndes Papers, NA T 48/20, no foliation, as well as subsequent versions of the petition in NA T 48/20; [Archibald Hutcheson], *The Case of Archibald Hutcheson and John Cotton, Esquires, Members Return'd for the City of Westminster. In Answer to the Petition Against Them by William Lowndes, Esquire* ([London]: *s.n.,* [1722]), copy in NA T 48/20, esp. pp. 3.

[6] The election was later voided in December 1722, on charges of election-tampering, following the petitions of Lowndes, Crosse, and the government Whigs. The salient point about Hutcheson's electoral popularity nonetheless stands.

Even more enduring has been Hutcheson's influence on nearly three centuries of narratives about the Bubble. Some chroniclers have very explicitly celebrated Hutcheson's role. In 1764, one-time Company employee Adam Anderson recalled how, at the height of the mid-June frenzy, "some began to have their Eyes opened by the judicious Calculations of *Archibald Hutcheson*, Esquire, and others."[7] In 2004, business historian Richard Dale likewise turned to Hutcheson as the "unsung hero" of the South Sea Bubble and the veritable "father of investment analysis," citing his many pamphlets as guides to the flaws of the South Sea Scheme and evidence that eighteenth-century investors had access to modern valuation techniques.[8] Hutcheson's influence is further evident, if less overt, in the accounts developed in the centuries between Anderson and Dale. In his Victorian fable *Memoirs of Extraordinary Popular Delusions*, Charles Mackay passed on many of Hutcheson's core ideas (if not his name) without even knowing it, repeating a variety of Hutchesonian tropes but attributing them, probably mistakenly, to Sir Robert Walpole.[9] The twentieth-century accounts of W. R. Scott, John Carswell and P. G. M. Dickson make only passing reference to Hutcheson but repeat major aspects of his interpretation, including critical technical conclusions.[10] In her recent work, historian Helen Paul has argued that Hutcheson's ideas have so biased much of the historiography

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[7] Adam Anderson, *An Historical and Chronological Deduction of the Origin of Commerce*…, Volume 2 (London: Printed for A. Miller et al., 1764) p. 288.

[8] Richard Dale, *The First Crash: Lessons from the South Sea Bubble* (Princeton and Oxford: Princeton University Press, 2004) pp. viii, 2.

[9] Mackay credited Robert Walpole, not Hutcheson, as "almost the only statesman in the House who spoke out boldly against" the South Sea Scheme. Yet in following Walpole's late eighteenth-century biographer William Coxe, Mackay seems to have given Sir Robert far too much credit, as Walpole only spoke out against the Bubble after Hutcheson and others had already provided robust analyses of their own. Many of the prophetic warnings that Mackay attributes to Walpole read like a précis of Hutcheson's own themes. See: Charles Mackay, *Memoirs of Extraordinary Popular Delusions*, Vol. 1 (London: Richard Bentley, 1841), pp. 80-1; J. H. Plumb, *Sir Robert Walpole, Volume I: The Making of a Statesman*, Reprint Ed. (London: Allen Lane The Penguin Press, 1972 [1956]), pp. 302-4.

[10] Paul in particular argues that Hutcheson's "ideas have been used by Scott and Dickson, and through their works have become more influential." Carswell, in one moment, literally borrows Hutcheson's own symbolic reasoning from one of his autumn pamphlets, in which Hutcheson "point[ed] to the many unknowns which prevented any satisfactory value being assigned" to South Sea Stock at that point. See: Helen Paul, *The South Sea Bubble: An Economic History of its Origins and Consequences* (London & New York: Routledge, 2011), p. 76. For illuminating references to Hutcheson and examples of Hutchesonian reasoning, see: W. R. Scott, *The Constitution and Finance of English, Scottish and Irish Joint-Stock Companies to 1720*, Vol. I, Reprint ed. (Gloucester, MA: P. Smith, 1968 [1910]), p. 437; John Carswell, *The South Sea Bubble*, 2nd Edition (Dover, NH: Sutton, 1993 [1960]), pp. 105, 179; P. G. M. Dickson, *The Financial Revolution in England: A Study in the Development of Public Credit, 1688-1756* (London et al.: Macmillan, 1967), p. 136.

that a balanced economic history of the Bubble requires debunking the myth of him as a "financial savant."[11]

Hutcheson was of course not the only critic of the South Sea Scheme, nor the only person to warn against its future dangers, nor the only skilled financial calculator of his day. But his way of calculating financial value became disproportionately important in orthodox analyses of the Bubble. His political positioning allowed him literally to write his way of thinking into semi-official Parliamentary reports explaining the Crisis. It is necessary to appreciate Hutcheson's influence not to assign historical credit to him, but rather to recognize how his political ideals and moral assumptions became embedded, even hidden, within ideas about financial value that would long outlast his own historical moment. Hutcheson's computational analyses of the South Sea Scheme grew out of pre-existing political fears about national indebtedness, the corrupt intentions of "designing ministers," and the uncertainties wrought by state and corporate secrecy. Drawing upon a tradition of interrogative political arithmetic pioneered by Charles Davenant, Hutcheson built computations that framed what the political public *did not know* in order to pressure political insiders into revealing privileged information. This political objective was embodied in Hutcheson's most distinctive style of calculation, the multivariate arithmetical *model*, which repeated a single computational procedure multiple times, assuming different quantities for key, unknown parameters.

Hutcheson's concerns about the power and danger of inside information helped inspire a particular understanding of the nature of *value*, particularly the "intrinsic value" of financial objects. Britons at the turn of the eighteenth century were engaged in a sustained debate about economic value, energized by bitter policy disputes about the health of the nation's currency. Hutcheson borrowed from a long, even ancient, tradition of citing the naturalistic "intrinsic value" of objects in assessing what made for fair commercial transactions. Yet, like many of his peers, he found new

[11] Paul, *South Sea Bubble,* pp. 75-7; Paul, "Archibald Hutcheson's Reputation."

meanings and uses for the concept in a changing financial economy. In particular, he interpreted value in terms of the politics of knowledge, fearing that the "intrinsic value" of paper financial instruments or even currencies was a kind of political secret. He worried about the ability of insiders to obscure the intrinsic value of commercial objects, engineering market prices that violated that inherent worth. It was a process he witnessed firsthand in the currency manipulations of John Law in France in 1718.

In early 1720, when Hutcheson first reflected on the pending refinancing project pitched by the South Sea Company, he reacted to it not as an investor or even political economist, but as a particular kind of political arithmetician. A close reading of his earliest South Sea calculations reveals the nature of Hutcheson's self-appointed mandate. His first publication on the South Sea Scheme expressed a central fear that the Scheme relied too heavily on uncertain information left in the hands of untrustworthy individuals. As in his earlier pamphlets on National Debt policy, he built a computational model that emphasized the particular dimensions of uncertainty that most troubled him. Hutcheson's arithmetic created a mechanical linkage between certain aspects of the Scheme, particularly the Company's potential trading profits, and the real value of its Stock, showing how certain aspects of the Scheme which were under the secret discretion of Company insiders posed automatic and instantaneous threats to the public at large. Over the course of 1720, the content and objectives of his calculations subtly shifted, as the price of South Sea Stock began to soar, then teeter, and then fall. Throughout the mania, the South Sea Company's Directors never provided the certain knowledge of their Stock's value Hutcheson demanded. In turn, Hutcheson increasingly worried about the inability of public investors to assess the propriety of the Scheme, due not only to lack of information but to lack of skill. A September pamphlet, written just as the South Sea Stock price began to tumble precipitously, reprinted previous Company announcements of its own Stock price and castigated Company leaders for basing their own valuations in the free-wheeling

sentiments of Exchange Alley. In the winter of 1720-1721, after the Stock's price bottomed out, Hutcheson offered new, retrospective computations of what the Stock's value *had been* at various points during 1720, citing these post-hoc valuations as evidence that the Company's Directors had betrayed the public trust by selling their stock above its intrinsic value. Appointed a member of the Parliamentary committee charged with examining the Crisis, Hutcheson wrote his calculations into the autopsy reports produced by Parliamentary investigators. "Mathematical demonstrations" of the Company's value became a kind of demonstrative proof of the Company's guilt.

Hutcheson's retrospective valuations were not the only evidence that came to light to prove the criminal wrongdoing of the Company's Directors. Parliamentary investigators unearthed evidence of rampant bribery, record tampering, and witness intimidation. Such visible criminality not only complemented, but in fact strengthened Hutcheson's analytical claims about the Company's betrayal of its "intrinsic value." Yet the fact that the Company was wrong in an ethical sense did not, indeed, mean that the Company was automatically wrong or intentionally dishonest about the value of its own Stock. The final section of this chapter will attempt to take a look inside the Company's own reasoning about value, reconstructing one manuscript calculation from January 1721, in which Company representatives attempted to explain and justify its seemingly outlandish dividend promises after the fact. This partial view from the inside provides some preliminary insight into the disorder that existed in the design, execution, and management of the era's most complex financial instrument.[12] Further, exploring the alternative, and potentially plausible, visions of value that existed within the Company helps highlight one of the most critical legacies of Hutcheson's financial epistemology—namely, the idea that the Company's most powerful managers could not have been meaningfully conflicted or honestly wrong about their own Stock value. Indeed, it helps us think

[12] This phenomenon has analogues in the complex derivative securities of modern finance, as captured in Vincent Antonin Lépinay, *Codes of Finance: Engineering Derivatives in a Global Bank* (Princeton, NJ and Oxford, UK: Princeton University Press, 2011.

about how it came to be that people, in 1720 and beyond, came to believe that the real or "intrinsic" value of financial instruments was a single, knowable, *calculable* quantity.

I. Archibald Hutcheson and the Quest for "Exact Estimates," 1713-19

For Archibald Hutcheson, financial valuation was only one facet of a broader project in political arithmetic. His assiduous efforts to calculate the value of South Sea Stock in early 1720 continued a six-year project of economic criticism that dated at least to his entry into Parliament in 1713. Even more, they carried on a tradition of critical computation forged in the 1690s and codified in the writings of Charles Davenant. Hutcheson shared Davenant's concerns about Parliamentary ignorance, fiscal waste, and ministerial corruption, and energetically carried on his method of using numerical computation to combat informational disorder and ministerial secrecy. Yet Hutcheson also fostered practical-epistemological values that differed from those of his forerunner. Both arithmeticians recognized that informational asymmetries meant outsiders had to make the most of whatever limited data they could acquire. But if Davenant embraced the necessity of making probable political knowledge in the face of inherent uncertainties, Hutcheson envisioned his calculations as imperfect, stop-gap measures necessary only until a better political arrangement could be found. The distinctive flavor of Hutcheson's political arithmetic was evident in his most notable computational innovation—what might be termed the multivariate arithmetical *model*, usually presented in tabular form. Ultimately, Hutcheson longed for a world in which the computational "estimates" he provided were irrelevant because institutions of public trust already made their "exact" knowledge available to the public.

In 1719, Hutcheson summarized what he considered to be his most salient political positions: "To save with the utmost care the Publick Money; To encourage our Trade; To clear off the Debts of the Nation, with all possible Expedition, and to unite the Minds of an unhappily

divided people."[13] While Hutcheson may have presented himself as a champion of non-partisan, almost platitudinous political ideals, his political identity was hardly uncontroversial or easy to pin down. Historians have termed him "a well-meaning oddity": "variously described as a Whig or a Tory, but who seemed comfortable with neither party"; friends to many Jacobites but perhaps not one himself; rather "Country"-minded but unmatched in his study of London finance.[14] Hutcheson's party loyalties were somewhat ambiguous, particularly early in his political career. The patronage of the Tory Duke of Ormond no doubt played a key role in his election as MP for Hastings in 1713. At around the same time he earned sufficient favor with the Hanoverian Court and its Whig supporters, who controlled Parliament after 1714, to earn a spot on the Board of Trade.[15] Once in Parliament, he espoused several comparatively non-partisan agendas, notably his encouragement of domestic woolen manufacturing and the trade in African slaves. Yet he quickly spoke out against major legislation from both parties. On the one hand, he staunchly opposed the 1714 Schism Act, a Tory bill requiring that all schoolmasters and tutors be licensed by the Church of England.[16] On the other, his continued loyalty to the accused Jacobite Ormond, who was impeached by Parliament in 1715, quickly contributed to a rift with Whig leaders.[17] In that same year, he vigorously opposed Whig

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[13] Archibald Hutcheson, *Mr. Hutcheson's Answer to Mr. Crookshanks's* Seasonable Remarks (London: *s.n.*, 1719) ["To the Reader," p. ii].

[14] Linda Colley, *In Defiance of Oligarchy: The Tory Party 1714-1760* (Cambridge et al.: Cambridge University Press, 1982) p. 99; A. A. Hanham, "Hutcheson, Archibald," in Eveline Cruickshanks, Stuart Handley, and D.W. Hayton, eds. *The History of Parliament: The House of Commons 1690-1715,* Vol. IV, (Cambridge, UK: Cambridge University Press, for the History of Parliament Trust, 2002) p. 449-450.

[15] Geoffrey Holmes has marked him as an "independent whimsical," more Whiggish than many Tory "whimsicals." See: Holmes, *British Politics in the Age of Anne* (London et al./New York: Macmillan/St. Martin's, 1967), p. 283; Hanham, "Hutcheson," p. 451.

[16] Hanham, "Hutcheson," p. 451.

[17] Accusations of Jacobitism followed Hutcheson throughout his political career, though similar charges were leveled against many Tory politicians throughout the period. Some historians, notably Eveline Cruickshanks and Howard Erskine-Hill, have suggested that Hutcheson played an active role in efforts to restore the Stuart monarchy through the 1710s and 1720s, though such arguments are not conclusive. See: Eveline Cruickshanks and Howard Erskine-Hill, *The Atterbury Plot* (Houndmills, UK and New York: Palgrave Macmillan, 2004), esp. 89-90 (regarding the Westminster election of 1722), and pp. 126, 136 for suggestive evidence.

efforts to repeal the 1694 Triennial Act, which required new Parliamentary elections every three years.[18] He consequently resigned from the Whig-dominated Board of Trade in 1716.[19]

After 1716, Hutcheson became more identifiably Tory, though this may have had more to do with his distaste for the particular Whigs who were in power than to a consistent commitment to Tory principles, especially not religious conformity. Arguably, Hutcheson's greatest political loyalty was to the principle of opposition, to an almost obsessive distrust of those entrusted with governmental power. It echoed the interrogative, skeptical attitudes espoused by Robert Harley and the Commissioners of Public Accounts in the 1690s.[20] Like those "Country" critics, many of Hutcheson's core commitments echoed the "classical republicanism" of the First Earl of Shaftesbury and his "Old Whig" followers, such as his fear of the consolidation of power by "designing Ministers" and the need for frequent parliaments.[21]

Hutcheson's most consistent and outspoken cause was his deep opposition to the National Debt, which he called a "Gangrene of Twenty five Years Continuance."[22] Since the 1690s, Davenant and others had worried about the emergence of permanent national indebtedness, contending that chronic interest payments and the resulting high taxation threatened to destabilize England's uniquely balanced social order, impoverishing the landed gentry and transferring power to a "class of

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[18] The Whigs ultimately succeeded in replacing the Triennial Act with a "Septennial Act," requiring new elections only every seven years. The Septennial Act stood in place until its repeal in 2011. For Hutcheson's views on the matter, see [Hutcheson], *A Speech Made in the House of Commons, on Tuesday the 24th of April 1716. At the Second Reading of the Bill for Enlarging the Time for Continuance of Parliaments, &c.* (London: Printed for T. Baker and T. Warner, 1716).

[19] Hutcheson would later cite his quick resignation from the Board of Trade as a sign of his political independence. See: Hutcheson, *Collection of Advertisements* (1722), pp. 5-6; [Anon.] *A Letter of Advice to Archibald Hutcheson, Esq; Occasion'd by His Pretended Letters to the Earl of Sunderland* (London: Printed for A. Moore, 1722), p. 17.

[20] Hutcheson, like Davenant, began his career in governmental service, and would later earn an elevated position in the state's commercial administration; unlike Davenant, though, Hutcheson quickly abandoned his lofty position of power when he quit the Board of Trade in 1716. This may have had to do with the £40,000 dowry Hutcheson received upon his marriage to the daughter of a wealthy West Indian merchant in summer 1715.

[21] Hutcheson's opposition to the repeal of the Triennial Act, for example, borrowed "images culled directly from various Shaftesburian pamphlets of the 1670s." (Colley, *In Defiance of Oligarchy*, p. 92, 98-100, quotation on p. 98.) See also J. G. A. Pocock, "The Varieties of Whiggism from Exclusion to Reform," in J. G. A. Pocock, *Virtue, Commerce, and History: Essays on Political Thought and History, Chiefly in the Eighteenth Century* (Cambridge, UK and New York: Cambridge University Press, 1985), p. 232.

[22] [Archibald Hutcheson], *A Proposal for the Payment of the Publick Debts, and an Account of Some Things Mentioned in Parliament on that Occasion* ([London]: *s.n.*, 1714/1715), p. 18. The pamphlet is dated "January 14, 1714," which is presumably an Old Style date.

professional creditors."[23] Hutcheson enthusiastically picked up this line of argument. He invoked a familiar agrarian idiom in his first published pamphlet of 1715, when he lamented that all standard Parliamentary taxes had been "Mortgaged and Sold for ever, or for long Terms of Years."[24] This "Mortgaging," he contended, required the continued imposition of burdensome special taxes on malt and particularly landed property, and forced excessive Customs taxation, which proved "great Obstructions to Trade, the Channel of the Nation's Wealth."[25] Hutcheson in turn designed his own decisive schemes to conquer the National Debt. He presented an ambitious plan in 1715 for swift repayment that involved the conversion of the 1713 land tax into a perpetual but redeemable charge on land rents, a 10% one-time levy on all property (a literal "decimation"), an apparel tax, a decrease in the national interest rate, and a rigid schedule for debt retirement.[26]

Hutcheson's 1715 *Proposal for the Payment of the Publick Debts* contained only a single numerical table (see **Figure 5a**). But that small array of numbers was noteworthy in its own right, especially for its distinctive computational structure. It described the results of an intricate calculation showing how long it would take to repay the National Debt by use of a "sinking" mechanism, a procedure for repaying debt that used the exponential effects of compound interest to pay down debt at an ever-increasing rate. The chart showed the number of years it would take to retire a debt of £45 million given five different initial annual payments (£100,000 to £1.5 million) and four different interest rates (3-6%).[27]

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[23] J. G. A. Pocock, *The Machiavellian Moment: Florentine Political Thought and the Atlantic Republican Tradition* (Princeton: Princeton University Press, 1975), ch. 13, quotation on p. 439.
[24] Hutcheson, *Proposal for the Payment of the Publick Debts*, (1715), p. 17.
[25] Hutcheson, *Proposal for the Payment of the Publick Debts*, (1715), pp. 17, 20. Hutcheson's sympathies aligned in many ways with Steve Pincus's description of Tory political economy in the period. See: Steve Pincus, "Addison's Empire: Whig Conceptions of Empire in the Early 18th Century," *Parliamentary History* 31, no. 1 (Feb., 2012): 99-117, pp. 102-105.
[26] Hutcheson, *Proposal for the Payment of the Publick Debts*, (1715), pp. 15-16. Specifically, Hutcheson proposed that the current land-tax be converted into a perpetual duty on landowners, who would then have the option to "redeem" the charge at 22 years' purchase (in other words, pay off their land tax forever by paying a one-time tax of 22 x their annual land tax rate).
[27] More specifically, the table specified five different values for the size of the annual payment to be made on the debt *over and above* what was already being paid for interest.

The Annual Sum to pay off 45 Mill.	The Number of Years according to the Rates of Interest			
	6 p. C.	**5 p. C.**	**4 p. C.**	**3 p. C.**
A Million and half	18	19	21	22
A Million	23	25	27	29
Half a Million	32	35	39	45
250,000 *l.*	43	48	54	63
100,000 *l.*	58	65	76	91

Figure 5a. The only numerical table in Hutcheson's 1715 *A Proposal for the Payment of the Publick Debts* (p. 21).

This lonely table of numbers was potentially misleading, suggesting perhaps that the British nation would be able to get out of debt faster if the interest rate on the debt they were paying was higher: for example, paying £1 million on the debt a year, it would take 29 years to pay off the full debt if the interest rate were 3%, versus only 23 years at 6%.[28] Hutcheson, though, was a staunch advocate of reducing national interest rates to save public resources, and the purpose of the table was to show that a reduction in interest rates would both save money annually and not excessively *increase* the amount of time it took to retire the debt. Most noteworthy, though, was the computation's technical structure. It was a first example of what would become Hutcheson's distinctive computational style—the multivariate, tabular *model*. His table represented the consolidated results of what were actually a series of distinct computations repeated on different sets of parameters, in this case the annual payment size and the interest rate on the debt. Each of the twenty different entries in the table were the outcome of a distinct computation, and the table itself represented a range of possible outcomes under unknown conditions. This was a computational style—and a strategy for dealing with uncertainty—to which Hutcheson would turn again.

[28] This was the consequence of the compound interest effect: the higher the interest rate on the debt, the more interest was saved each year when part of the debt was paid down, and this extra saved interest was used to pay down more debt the next year. Hutcheson's table did not clearly explain that, at higher rates of interest, the government would have needed a higher level of income in the first place to service the interest. This odd computation ought not, though to be taken as some testament to Hutcheson's relative lack of financial understanding, as one scholar has argued (Paul, "Archibald Hutcheson's Reputation," pp. 11-13).

Hutcheson's first printed table served more as a mathematical exposition of a technical financial process, rather than as vehicle for new information. Indeed, the table itself contained no actual data, aside from the general estimate of the National Debt at £45 million (and that number would later get him in trouble).[29] Hutcheson acknowledged that what he offered was only a starting point. "In Order to the forming any Scheme," Hutcheson explained, "'tis absolutely necessary to have an exact State of the entire Debt of the Nation, and of the clear yearly Income of the Revenues appropriated to the Payment of the same."[30] When Hutcheson revisited the National Debt in 1717, he had found better data to work with, thanks to a new Treasury report offered to Parliament in March.[31] With this information, Hutcheson developed a more extensive picture of the Debt's past and future. His *Computations Relating to the Publick Debts* included a massive table of twenty-four rows by ten columns, showing ten different features of the National Debt at that point, including original sums, amounts repaid, current interest, and the impact of changes in interest rate.[32] He described eight different kinds of redeemable debt plus two different groups of annuities, and for the annuities (with terms of 32 and 99 years), Hutcheson offered not just one but three different "valuations," for example valuing certain outstanding 99-year annuities at 17, 17½, and 19 years' purchase. It was yet another example of his computational modeling, using multiple parallel calculations to show the impact of an unknown parameter (in this case, annuity valuation) while remaining agnostic about its precise value. To make an anachronistic parallel, he was prefiguring the modern "spreadsheet"—though doing so without any of the conveniences of modern computing technology.

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[29] This was the "45" that got him in trouble with John Crookshanks in 1718. See Introduction, p. 1.
[30] Hutcheson, *Proposal for the Payment of the Publick Debts* (1715), pp. 19-20.
[31] Hutcheson acknowledged that positive strides had been made with regards to the management and the eventual repayment of the Debt, thanks to the efforts of one "Honourable Person," presumably Chancellor of the Exchequer Robert Walpole, who had recently proposed to institute the kind of debt-sinking scheme Hutcheson discussed in 1715. See: [Archibald Hutcheson], *Computations Relating to the Publick Debts, Taken from the Abstract Deliver'd into Parliament the 14th of March, 1716* (London: Printed for H. Clements, 1717), p. 5.
[32] Hutcheson, *Computations Relating to the Publick Debts* (1717), unpaginated, after p. 4.

Hutcheson's 1717 pamphlet synthesized everything that *was* known about the National Debt in order to frame how much was ultimately *unknown* about it. Following the table was a lengthy exposition of what additional fiscal data would be needed to put together a meaningful plan to deal with the Debt.[33] Echoing Davenant, Hutcheson explained that there were in fact many "considerable advantages which will accrue from this Information," including assessing the efficacy of past policies.[34] But given the incomplete data he had to work with, he hoped nonetheless that his figures might "incite those who know a great deal more, to rectify not only my Errors in Calculations, but in my way of reasoning on the same."[35] For Hutcheson, this was more than feigned humility. Behind his dizzying array of figures was a conviction that there were indeed people who had to know much more than he did. After providing detailed "Estimates" of what various tax revenues could be expected to produce, he explained that it was likely that those estimates would "fall short or exceed" actual outcomes, and that such variances would alter the future trajectory of the National Debt. But, Hutcheson explained, whether he was exactly right or not was a secondary point, because the matter would "easily be seen when the exact Estimates are given into Parliament."[36] Such "exact estimates" would not only help save Britain from permanent indebtedness, but from the whims of a "Designing Ministry" as well.[37]

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[33] Hutcheson, *Computations Relating to the Publick Debts* (1717), p. 5. Compare Charles Davenant, *Discourses on the Publick Revenues, and on the Trade of England*, vol. 1 (London: Printed for J. Knapton, 1698), p. 164.

[34] He pointed out, for example, that Parliament had no idea whether one recent change in tax policy, the "Doubling and Trebling the Duties on Soap, Candles, and other Things," would actually result in two-to-three times as much revenue from those specific taxes, as many seemed to assume. In an argument very reminiscent of Davenant's 1695 *Essay upon Ways and Means*, Hutcheson pointed out that a true account of the produce of those increased taxes would allow Parliament to assess whether that had truly been a "prudent Method of Taxation." See: Hutcheson, *Computations Relating to the Publick Debts* (1717), p. 5.

[35] Hutcheson, *Computations Relating to the Publick Debts* (1717), p. 3.

[36] Note that Hutcheson was actually quite hazy on the epistemological problem of predicting the past from the future. He seemed, for example, to be quite comfortable with the notion that an accurate depiction of the recent, historical produce of key taxes would be more than sufficient to make judgments about their future performance. See: Hutcheson, *Computations Relating to the Publick Debts* (1717), "An ESTIMATE of the Yearly Savings to the Publick by the Reduction of Interest," unpaginated, between pp.4-5.

[37] Hutcheson, *Computations Relating to the Publick Debts* (1717), p. 5.

The matter of getting the government to reveal its privileged information became a cause it its own right for Hutcheson. In 1717-18, he set his sights on military expenditures. It was an inviting target, particularly because of frequent episodes of embezzlement (real or purported) among military administrators since 1688, and because of long-standing Country fears about "standing armies," especially evident in the military expenditure debates following the 1697 Peace of Ryswick.[38] Amidst ongoing debates in the Commons, Hutcheson published two pamphlets on the issue.[39] He offered accounts detailing dubious expenses, from the costs of peacetime recruitment to the improper allocation of officers' personal expenses, and constructed tabular analyses showing the costs of ill-considered "half-pay" pension policies and the size of the military forces in 1718 versus 1715.[40] Yet a primary target was informational inadequacy itself, and he specifically highlighted aspects of his computations that were—by necessity—hypothetical.[41] He pinned the responsibility for such numerical uncertainties on insiders within military administration. "When this matter is fully explain'd to the House, by the proper Officer," he wrote, "it will be then seen whether there be, or be not, any Prejudice to *Britain* therein."[42] He also suggested in a subsequent pamphlet that, at each new session, Parliament appoint "particular Committees… to examine strictly into every Part of the Administration of our Money Affairs," effectively calling for the resuscitation and expansion of the Parliamentary Commission of Public Accounts, which had been dissolved in 1713.[43] "For this,"

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[38] There was episode in 1711-12 during which Tory leaders claimed that tens of millions of pounds were had gone missing from certain naval accounts, under the watch of Robert Walpole, then Treasurer of the Navy and Secretary at War. On this episode, see Chapter 6, section I. For a creative take on the politics and culture of "standing armies," see Hannah Smith, "Politics, Patriotism, and Gender: The Standing Army Debate on the English Stage, circa 1689–1720," *Journal of British Studies* 50, no. 1 (Jan., 2011): 48-75.

[39] [Archibald Hutcheson], *Abstracts of the Number and Yearly Pay of the Landforces, of Horse, Foot and Dragoons in Great Britain, for the Year 1718*… (London: *s.n.*, 1718); and, [Archibald Hutcheson], *Some Further Remarks Relating to Half-Pay*… ([London]: *s. n.*, [1718]).

[40] Hutcheson, *Abstracts of the Number and Yearly Pay of the Landforces*, pp. 1-7, and tables on pp. [iv]-[v], 8-10, 15.

[41] Hutcheson, *Abstracts of the Number and Yearly Pay of the Landforces*, pp. 13-14.

[42] Hutcheson, *Abstracts of the Number and Yearly Pay of the Landforces*, p. 14. For further comments directed at such "proper Officers," see also: Hutcheson, *Some Further Remarks Relating to Half-Pay* (1718), p. 3.

[43] Some earlier commentators had called for a similar, or even more radical, expansion of the power of the Commission of Public Accounts. See, for example: [William Paterson?], *England's Great Concern. In the Perpetual Settlement of a Commission of Accounts*… (London: Printed for D. Brown, and Sold by J. Nutt, 1702). The attribution to Paterson is questionable.

Hutcheson suggested, "would probably make Officers of all Kinds much more careful than of late Years they have been in their Demands on the Publick, in the Accounts and Estimates which are respectively brought in by them."[44]

Hutcheson's self-appointed role as analyst of public accounts was seemingly a begrudging one. Or at least that is how he represented himself. In his notorious 1718 pamphlet on the *Present State of the Publick Debts and Funds* (which would spark the controversy with John Crookshanks, where our story began), Hutcheson aired his frustration that the interpretive accounts he was forced to produce from the outside were not already compiled by the "proper Officers" within the government.[45] He had already spoken out on such matters some fifteen times, he explained, and he worried that such computational demands were weighing upon his "sickly Constitution." In a perfect political world, a gentleman like Hutcheson would not have to carry this computational load. He drove this point home, following a calculation of the "Medium" annual produce of various taxes critical to servicing the National Debt. "The several Accompants for the respective Duties, or some proper Officer for the whole," he complained, "should have taken this trouble upon them, and not left it upon the Gentlemen of the House of Commons."[46] A "Private Person," after all, could never produce sufficiently certain, "Authentick" political knowledge.[47] Hutcheson proposed an alternative. "If the Accounts of the several Duties were all directed to be closed at *Michaelmas* or *Christmas*… it would give a more clear and easy view of the Annual Nett Produce," he explained. "And if this be laid before the Parliament every Year, they will from time to time be informed with certainty, and not need rely on the conjecture of a *Medium* calculated in any manner."[48]

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[44] Hutcheson, *Some Further Remarks Relating to Half-Pay* (1718), p. 3.
[45] Archibald Hutcheson, *Some Calculations and Remarks Relating to the Present State of the Publick Debts and Funds* (London: *s.n.*, 1718).
[46] Hutcheson, *Present State of the Public Debts and Funds* (1718), p. 14. *Emphasis* in original.
[47] Hutcheson, *Present State of the Public Debts and Funds* (1718), p. 14. *Emphasis* in original.
[48] Hutcheson, *Present State of the Public Debts and Funds* (1718), p. 14. *Emphasis* in original.

Fiscal politics and computational epistemology were once again deeply entangled. For Hutcheson, the very kind of conjectural calculation he was doing—probabilistic "Mediums," estimations, models across multiple uncertain variables—was an epistemological symptom of a deep political disease. Conjecture and estimation were not what the nation needed. *Certainty* was. What bothered Hutcheson most was the fact that such certainty was conceptually attainable; the mechanics of his computations showed that to be the case. It simply went unrealized out of the laziness, incompetence, or deliberate secrecy of government agents. Here Hutcheson diverged from his key computational predecessor. Charles Davenant had acknowledged that some level of informational disorder and chronic deception was inherent to political life; Hutcheson craved certainty, and resolutely believed it was there if the proper agents would simply let it be known.[49]

II. Valuing the Intrinsick

Hutcheson's computational analyses of the South Sea Scheme in 1720 married his commitment to the necessity of certain political knowledge to a particular conception of economic value. That vision held that valuable objects, from goods to money to stocks, carried a "real" or "intrinsick value" based on their inherent qualities and distinct from the worth assigned them by desirous people. Distinguishing between intrinsic values and market prices was a longstanding—indeed ancient—way of reasoning about commerce, and the language of "intrinsic value" bore with it traditional assumptions about what made commercial transactions *just*. In the century before 1720, the language of "intrinsic value" retained a vital place in economic and ethical discourse, but was also tested, repurposed, and at times directly disputed. Two early eighteenth-century invocations of intrinsic

[49] Hutcheson's distinctive epistemological attitude was almost old-fashioned—not only when compared to Davenant—in its preference for certain over probable knowledge. It was even more so when contrasted to the many economic commentators on public finance and especially public credit, particularly among Whigs, who since the late seventeenth century had "employed probabilistic epistemologies in designing institutions that would safeguard trust in credit." See: Carl Wennerlind, *Casualties of Credit: The English Financial Revolution, 1620-1720* (Cambridge, MA: Harvard University Press, 2011), quotation on p. 85, as well as ch. 3 (on the "Epistemology of Credit") and pp. 169-189.

value likely influenced Hutcheson. One model could be found in Tory financial polemics. Another came from his own individual experience, especially a trip he took to France late in the year 1718.

"Intrinsic value" had played a central but elusive role in economic and ethical analysis since Plato and Aristotle. Those classical philosophers, and centuries of followers, explored the distinction between the (superior) "intrinsic" value of things or actions that were good in themselves, and the "instrumental" value of things or actions that were useful merely as a means to an end.[50] Among medieval Christian thinkers, the notion that goods held an "intrinsic value" based on the materials and labor that went into them became one important factor in the complex moral calculus of "just price."[51] While medieval thinkers had developed their own detailed conceptual models for understanding how marketplace dynamics might produce fair judgments of value, early modern economic observers confronted new challenges, as trade became increasingly global and European nations entered into new forms of commercial integration and competition with one another.[52]

For policymakers and mercantile theorists in early seventeenth-century England, the troubling state of English money and the deteriorated "exchange" of English coins in relation to their foreign counterparts brought a new immediacy to the abstract question of value and its

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[50] The place of "intrinsic value" in the history of ethical and philosophical thought is obviously a much broader topic. For an introduction, see Michael J. Zimmerman, "Intrinsic vs. Extrinsic Value," *The Stanford Encyclopedia of Philosophy* (Winter 2010 Edition), ed. Edward N. Zalta. <http://plato.stanford.edu/archives/win2010/ entries/value-intrinsic-extrinsic/>. Accessed 7 March 2012. The question of "intrinsic value" has continued to trouble modern ethical philosophers. See, as examples: Fred Feldman, "Hyperventilating about Intrinsic Value," *The Journal of Ethics* 2, no. 4 (1998): 339-354; M. Bernstein, "Intrinsic Value," *Philosophical Studies* 102, no. 3 (Feb., 2001): 329-343.

[51] On "just price" in the medieval period, and particularly the ways medieval thinkers understood the relationship between just price and market price, see: Raymond de Roover, "The Concept of Just Price: Theory and Economic Policy," *The Journal of Economic History* 18, no. 4 (Dec., 1958): 418-434, as well as the subsequent discussions by J. A. Raftis and David Herlihy (pp. 435-438); John W. Baldwin, "The Medieval Theories of the Just Price: Romanists, Canonists, and Theologians in the Twelfth and Thirteenth Centuries," *Transactions of the American Philosophical Society*, New Series 49, no. 4 (1959); Joel Kaye, *Economy and Nature in the Fourteenth Century: Money, Market Exchange, and the Emergence of Scientific Thought* (Cambridge, UK et al.: Cambridge University Press, 2000), esp. pp. 87-101.

[52] Kaye in particular argues that medieval commentators, motivated by a pervasive concern with the concept of the "common good," extended and revised Aristotelian ideas of market exchange, developing the idea that fair economic value was determined not by individual need but by a collective process of "common valuation." See: Kaye, *Economy and Nature*, esp. pp. 152-158.

determinants.[53] In his 1623 *Circle of Commerce*, for example, Edward Misselden began to parse the uneasy relationship between the intrinsic value of the precious metals in coins and the actual prices or exchange rates at which they changed hands. Misselden noted that there were in fact two different kinds of exchange, "*Natural* or *Politique*." "A *Natural Exchange* is when mony is exchanged *Value* for *Value*, according to the *Intrinsique* or inward fineness, or true value thereof," he explained, whereas "The *Politique Exchange*, is when mony is exchanged value for value, according to the *extrinsique* or outward valuation."[54] Misselden and fellow mercantile theorist Thomas Mun argued that measuring intrinsic values was practically challenging and campaigned against attempts to fix "extrinsic" exchange rates at their intrinsic pars through monarchical intervention.[55] Even though they argued against using royal power to make sure "intrinsic" equalled "extrinsic," Misselden, Mun, and many other seventeenth-century thinkers still clung tightly to the belief that intrinsic value did exist, and looked to the concept as a means of reconciling new economic challenges to well-held philosophies of natural and social order.[56] As Andrea Finkelstein writes of Thomas Mun, "intrinsic (or objective) value was the cement holding the finite universe together."[57]

The concept of intrinsic value came under more searching reflection in the later seventeenth century, though. Some commercial theorists, like Nicholas Barbon, had none of the qualms of Misselden and Mun, and dispensed with intrinsic value altogether. Barbon contended that the value of commodities derived from their usefulness to the people who consumed them, not from intrinsic

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[53] Andrea Finkelstein, *Harmony and the Balance: An Intellectual History of Seventeenth-Century English Economic Thought* (Ann Arbor: University of Michigan Press, 2000) pp. 3, 66, 85-8; Mary Poovey, *A History of the Modern Fact: Problems of Knowledge in the Sciences of Wealth and Society* (Chicago and London: University of Chicago Press, 1998), pp. 69-74.
[54] Edward Misselden, *The Circle of Commerce. Or The Ballance of Trade, in Defence of Free Trade* (London: Printed for Iohn Dawson, for Nicholas Bourne, 1623) pp. 97-8.
[55] Misselden and Mun's opponent, Gerard de Malynes, advocated fixing exchange rates at intrinsic pars. On the difficulty of measuring the intrinsic value of coins, see Misselden, *Circle of Commerce* (1623), p. 97.
[56] This is a central argument of Andrea Finkelstein in *Harmony and the Balance*. Her general contention is that the innovative "economic concepts" developed by seventeenth-century English political economists "were intended to 'save' their writers' visions of a moral or essential universe, not to construct our vision of the observed regularities of an existential one." See Finkelstein, *Harmony and the Balance*, quotations on pp. 1-2.
[57] Finkelstein writes of Misselden that he would ultimately prove deeply "anxious… that the foreign exchange reflect that intrinsic value (and not its relative purchasing power)." Finkelstein, *Harmony and the Balance*, pp. 66, 88.

properties.[58] In his 1690 *Discourse on Trade*, Barbon asserted outright that "things are just worth so much, as they can be sold for."[59] Yet such a provocative celebration of the logic of the marketplace found many critics.[60] Money once again proved a major test case, as the coinage crisis of the mid-1690s prompted an unprecedented number of publications on questions of value. When it came to the vexing question of the nation's coinage, many in the period "cherished the principle of intrinsic value as the polestar within a vast, crowded vista of possibilities," writes Deborah Valenze.[61] Most prominent was John Locke, who insisted that any plan to remedy England's money acknowledge that the value of money came from the intrinsic value of the precious metals it contained.[62] Merchant theorists like Barbon, John Cary, and James Hodges took issue with Locke's stubborn attachment to intrinsic metal value as the determinant of money's value. As Hodges put it, "silver, considered as Money, hath, speaking properly, no real intrinsick value at all."[63]

When it came to the specific question of recoining England's silver currency in the 1690s, Locke's arguments carried the day. But more broadly, the intense seventeenth-century debates on trade and coinage gave the concept of intrinsic value a critical place in Britons' collective political-

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[58] Barbon in turn hailed the importance of domestic consumption as a driver of national wealth, rejecting a key the balance-of-trade logic Mun and Misselden had helped codify. On Barbon, see: Elgin Williams, "Nicholas Barbon: An Early Economic Realist," *Southern Economic Journal* 11, no. 1 (Jul., 1944): 45-55, esp. pp. 50-51; Marian Bowley, "Some Seventeenth Century Contributions to the Theory of Value," *Economica* 30, no. 118 (May, 1963): 122-139, esp. pp. 127-130; Joyce Oldham Appleby, "Ideology and Theory: The Tension between Economic and Political Liberalism in Seventeenth-Century England," *American Historical Review* 81, no. 3 (Jun., 1976): 499-515, esp. pp. 508-9; Finkelstein, *Harmony and the Balance*, ch. 13; Paul Slack, "The Politics of Consumption and England's Happiness in the Later Seventeenth Century," *English Historical Review* 122, no. 497 (Jun., 2007): 609-631, esp. 614-8.

[59] "N.B. M.D." [Nicholas Barbon], *A Discourse of Trade* (London: Printed for Tho. Milbourn for the Author, 1690), p. 20.

[60] An interesting example of a thorough rejection of such market logic is discussed in David Hawkes, "Thomas Traherne: A Critique of Political Economy," *Huntington Library Quarterly* 62, no. 3/4 (1999): 369-388.

[61] Deborah Valenze, *The Social Life of Money in the English Past* (Cambridge, UK et al.: Cambridge University Press, 2006), pp. 39-44, quotation on p. 39.

[62] See especially Joyce Appleby, "Locke, Liberalism and the Natural Law of Money," *Past & Present* 71 (May, 1976): 43-69, esp. 49-52. Locke acknowledged that the value placed upon silver itself was in some sense the consequence of social agreement, but did not accept that the relative prices placed on such precious metals ought to be subject to artificial manipulation. Hence, Locke advocated a heavily deflationary policy whereby coins were recast such that the weight of silver they contained actually reflected the value stamped on the coins. William Lowndes, in particular, proposed an alternate, inflationary policy whereby coins were to be reminted with less metal in the same face value (i.e. 1 "new" shilling would properly have roughly 80% of the silver of 1 "old" shilling).

[63] James Hodges, *The Present State of England as to Coin and Publick Charges*… (London: Printed for Andr. Bell, 1697), p. 142, quoted in Appleby, "Locke, Liberalism, and the Natural Law of Money," p. 50.

economic lexicon. The term continued to carry many of its traditional connotations of commercial justice and social order. Valenze argues that "intrinsic value accorded with aristocratic notions of inherent worth and the preservation of hierarchy, while a more fungible notion of money belonged to the meretricious world of 'Change Alley and financial schemes."[64] Yet such a dichotomy was never so neat. As paper financial instruments became increasingly central to the public's finances, the world of aristocratic hierarchy and "the meretricious world of 'Change Alley" became more and more entangled. Intrinsic value came to take on new significations, which were not necessarily conservative. If the problem of intrinsic versus extrinsic value was difficult when it came to coins, stocks proved another matter entirely. The potentially troublesome nature of the pricing of stocks was evident in 1681, for instance, amidst debates over whether the East India Company (EIC) ought to be allowed continued monopoly privileges on Asian trade. A pamphleteer lobbying for the EIC as "Philopatris" (possibly Josiah Child) argued that anyone could share in the profits of the company's exclusive rights by buying into the Company's joint-stock. Yet, EIC critics were quick to point out that "then they must pay 280*l.* for 100*l.*" In other words, many seemed confused at the idea that they would have to pay so much, £280, for a share in the EIC's stock worth only £100 on its face. Philopatris tried to explain away this confusion. "The *intrinsic value* is worth so much; which is as true as 2 and 2 makes 4," he stated, but further admitted that such a fact "is not so soon demonstrated to their [the critics'] apprehensions."[65] The author invoked the morally-recognizable language of intrinsic value not only to instruct readers why investment in EIC stock might be profitable, but also to justify the company's joint-stock structure and monopolistic status.[66]

[64] Valenze, *Social Life of Money*, p. 42.
[65] "Philopatris" [Josiah Child], *A Treatise Wherein is Demonstrated I. That the East-India Trade is the Most National of All Foreign Trades…* (London: Printed by J. R. for the Honourable the *East-India* Company, 1681), p. 11.
[66] One of the pamphlet's most important arguments was "That the Trade of the *East-Indies* cannot be carried on to National advantage, in any other way than by a General Joynt-Stock." (See *Treatise* (1681), title page.)

Intrinsic value was not just a stale concept invoked by conservative aristocrats. It could just as well be appropriated to explain, legitimate, or critique the novel dealings of Exchange Alley. As stocks became more actively traded and widely owned, and their prices became more significant markers of the nation's commercial well-being, Britons explored a variety of ways of thinking about the intrinsic value of stocks. Carl Wennerlind has reconstructed two such positions, represented by Whig and Tory pamphleteers in 1710.[67] On the one hand, Wennerlind explains, Whig pamphleteers like Benjamin Hoadly argued that financial paper, particularly the stocks and bonds that supported the finances of the government, could constitute substantive property. Writing in the wake of the dismissal of Whig finance minister Lord Godolphin, Hoadly contended that the partisan scheming of the Tory party had threatened to undermine the nation's credit, upon which the value of public stocks was based. As Wennerlind puts it: "In Hoadly's mind, even though financial wealth was grounded in immaterial and abstract future-oriented notions—like trust, confidence, and opinion—it nevertheless carried the same legitimacy as the most real and concrete forms of property."[68]

Hoadly and the Whigs contended that the detrimental effects of the Tories' political machinations were manifest in falling prices of key public securities, like Bank of England stock. Tory propagandists took issue with Hoadly's implication that market prices were effective metrics of underlying financial value and even the political health of the nation.[69] Simon Clement, a Tory pamphleteer writing in the employ of Robert Harley, prefigured many aspects of Hutcheson's subsequent picture of financial value. Clement had apparently first contemplated abstract questions of value amidst the recoinage debates the 1690s. He espoused a moderate view on the coinage question, holding that the value of coins were inherently anchored by the precious metals they contained, but acknowledging that the value of coins and bullion could vary in different

[67] Wennerlind, *Casualties of Credit*, pp. 172-189.
[68] Wennerlind, *Casualties of Credit*, p. 175.
[69] Wennerlind, *Casualties of Credit*, p. 176.

circumstances.[70] As he put it, though there might be "Occasions by which Bullion and Exchanges do ordinarily come to Rise and Fall," nonetheless "these Alterations… cannot be great."[71] Minor, circumstantial variations might give rise to modest profit opportunities for traders.[72] But, Clement explained, while "some Men have skill to manage that kind of business to a competent Advantage, yet there can be no such Miracles wrought by it."[73]

In 1710, Clement extended this model of arbitrage (not a term he would have used) to stocks. In two pamphlets, *Faults on Both Sides* and a follow-up *Vindication of the Faults on Both Sides*, Clement attacked Hoadly's claims that the falling price of key securities indicated deteriorating public credit or political instability. Like occasional alterations in exchange rates, a momentary fall in stock prices was, in Wennerlind's words, "an inconsequential adjustment in the public's imagination or opinion."[74] Clement drew a clear distinction between what constituted a stock's "real Worth" and what merely reflected the caprice of stock-jobbers. "As to the falling of Stocks," he wrote, "there's nothing strange nor unreasonable in it, they were run up to an imaginary Value much above their real Worth."[75] Stocks, like coins, had a knowable intrinsic value that could guide investment decisions: "People ought never to value them by the Rates they may go at in Exchange-Alley, but to inform themselves truly of the certain Sum that has been paid into the Stock, and of the Dividend that is constantly made, together with the probable Success of the Management, and then they may

[70] See "A Merchant" [Simon Clement], *A Discourse of the General Notions of Money, Trade, & Exchanges, As They Stand in Relation to Each Other. Attempted by Way of Aphorism…* (London: *s.n.*, 1695), esp. pp. 3-12.
[71] Clement, *Discourse* (1695), p. 10.
[72] Clement offered a way around a conceptual problem that troubled thinkers like Locke, namely how to explain the fact that clever tradesmen could profit by trading and smuggling money and bullion if monetary value and bullion weight were one and the same.
[73] Clement, *Discourse* (1695), p. 17.
[74] Wennerlind, *Casualties of Credit*, p. 177.
[75] [Simon Clement], *A Vindication of the Faults on Both Sides… With a Dissertation on the Nature and Use of Money and Paper-Credit in Trade, and the True Value of Joint-Stocks* (London: Printed and Sold by the Booksellers of London and Westminster, 1710), p. 15.

make a rational Judgment when to lay out and when to keep their Money."[76] Though he provided little technical guidance on how to compute intrinsic value, Clement did suggest that such a value was capable of "evident Demonstration." Further, he contended that the intrinsic value of stocks, like those of coins, were fundamental properties resistant to deliberate control or political manipulation, minor fluctuations in extrinsic price notwithstanding. Meaningful wealth was not really lost or made in the tricking trade of the stock-jobbers, no more than in smuggling money.

Yet weathering the ups-and-downs of financial value, even in the case of currencies, did not seem as easy to everyone as it did to Clement. Indeed, Hutcheson's personal experience with the tumult of foreign exchange helps to explain how he came to develop an understanding of intrinsic value that differed in critical ways from Clement's. In late fall 1718, amidst his pamphlet-war with John Crookshanks, Hutcheson went to France. There he connected with English and French diplomatic officials, including the British ambassador to the French Court Lord Stair, and reported his observations to State officials in England.[77] He was particularly attentive to the worrisome state of the exchange between British and French currencies in Paris.[78] British merchants in France were gravely concerned that those exchanges rates had become artificially out of line, such that merchants bearing bills of exchange denominated in British pounds were getting far less than fair value when

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[76] Clement, *Vindication* (1710), p. 16. He concluded that those who bought overvalued stocks did not merit public sympathy. "For the Loss which the Dealers in this Tricking Trade have lately suffered," wrote Clement of the stock-jobbers, "it ought not to bear any more regard than we had for such who formerly bought Guineas at Thirty Shillings."

[77] Hutcheson to [Stair?], 16 Nov./5 Nov. 1718, Paris, NA SP 78/162, f. 322-3; Hutcheson to [Craggs?], 21 Nov./10 Nov. 1718, NA SP 78/162, f. 334; Hutcheson to "Labbe' Dubois," Copy, 21 March 1719/[10 March 1718/9], NA SP 78/163, ff. 228-9. Interestingly, John Dalrymple, the 2nd Earl of Stair, was the older brother of Sir David Dalrymple, the Scottish Whig who was critical in soliciting the services of John Crookshanks to write a rebuttal to Hutcheson's 1718 *Present State*. Party-political circumstances in Britain may have explained some of these unexpected political linkages, as the major schism that racked the Whig party shook up established political alliances and gave rise to a variety of different cross-party interactions.

[78] One contemporary commentator on the currency and exchange problems was none other than Simon Clement. See: "An Impartial Hand," [Simon Clement], *Remarks upon a Late Ingenious Pamphlet, Entituled,* A Short But Thorough Search into What May Be the Real Cause of the Present Scarcity of Our Silver Coin… (London: Printed for S. Baker, 1718). Therein, Clement developed a more sophisticated taxonomy of three different notions of coinage value: "natural" or intrinsic (based on weight and fineness of metal contained), "computative" (based on use in accounting), and "denominative" (based on official names or labels assigned to specific coins). (See pp. 10-12) Clement's pamphlet was a response to [David Clayton], *A Short But Thorough Search into What May Be the Real Cause of the Present Scarcity of Our Silver Coin* (London: Printed for the Author, and Sold by James Roberts, 1717).

they cashed their bills in for French *livres*. In a November 1718 letter, probably to Stair, Hutcheson forwarded a manuscript by "An Eminent Merchant," which spelled out these fears.[79] The author explained that, based on the weight and fineness of metal contained in each coin, one French *crown* (equal to 6 French *livres*) was "at least 1/5 lighter and by consequence 1/5 of Intrinsick Value less" than a comparable English *crown* (equal to 5 English *shillings*).[80] This implied that a French *crown* (6 *livres*) ought to buy 4 English *shillings*, or 3,000 French *livres* ought to buy 100 English *pounds*.[81] But, he continued, the current exchange rates given to English merchants paying not in coins or bullion but, as most had to, in bills of exchange or other credit instruments did not reflect this "Par," or ratio of intrinsic values. As he explained: "Exchange being now at about 32 pence English for a French Crown… the bearers of Bills or Credit receive only 2250 livres for their £100. Ster. so they are bubled out of ¼ of the Intrinsick Value of their Money."[82]

This was hardly a blip or modest "alteration" in exchange rates. As the "Eminent Merchant" put it, "This loss is like goods thrown into ye Sea, for no body gains it."[83] But what could explain this radical and sustained imbalance? Some contemporaries were cognizant that a substantial deficit in the balance of trade between two nations might have implications on exchange rates, pushing down the relative value of the money of the country in deficit—which after 1713 many in the country believed to be Britain, including Hutcheson himself.[84] But trade imbalances also did not seem to be enough to account for the dire situation in 1718. One alternate explanation was offered in a second

[79] "Some Memorandums Relating to Exchange, by an Eminent Merchant," contained in Hutcheson to [Stair?], 16 Nov./5. Nov. 1718, NA SP 78/162, ff. 324-5.
[80] "Some Memorandums Relating to Exchange," NA SP 78/162, f. 324^{r}.
[81] At 20 English *shillings* to 1 English *pound*, a total of 100 English *pounds* was equivalent to 2,000 English *shillings*. At a ratio of 4 English *shillings* to 6 French *livres*, this meant that 100 English *pounds* equaled 2,000 English *shillings* equaled 3,000 French *livres*.
[82] "Some Memorandums Relating to Exchange," NA SP 78/162, f. 324^{r}.
[83] "Some Memorandums Relating to Exchange," NA SP 78/162, f. 324^{r}. In response, The "Eminent Merchant" proposed an elaborate plan of setting up official English factors in major French ports, funded with Bank of England specie, to offer English merchants fair terms of exchange.
[84] Hutcheson wrote in 1718: "It is too well known, and a sad Truth it is, that the Balance of Trade has been for some time past considerably against us; that our silver coin is grown very scarce; and that it is impossible that our Gold can stay at home, till an advantageous turn is given to our trade." (*Present State of the Public Debts and Funds* (1718), p. 16). On trade balances, see Chapter 3.

manuscript treatise which Hutcheson forwarded along to his diplomatic superiors, most likely by Hutcheson himself.[85] It brought Hutcheson's distinctive political ideals to bear on the "Mischief to Britain from the present Course of the Exchange with France."[86] He wrote:

> It seems extraordinary, that the Effigies or Stamp of any Prince on a piece of Silver or Gold should raise it in Commerce or Exchange, with other Nations, above *the real Intrinsick Value thereof*, since by such a Stamp it is not made a Security from the Prince or State for the payment or delivering of a larger piece either of Silver or Gold, and therefore can be nowise resembled to Bank Bills, Goldsmith's Notes or Exchequer Tallys; It is but very lately that France has found out this Expedient, & such an extravagant advantage can never be produced merely by the Ballance of Trade in their Favour, but by some other artfull Managements and the Negligence of the Nation they have to do with.[87]

Macroscopic commercial forces like an unfavorable balance of trade could not produce the kind of "extravagant advantage" that currently reigned between French and British currencies. But, Hutcheson worried, the "artfull Management" of currencies by skilled *political* agents might in fact be able to do so. Hutcheson was pretty clear who the culprit was in the French case. "It is very probable," he explained, "that the very ingenious Gentleman who is now the sole Director of the Bank of Paris, may have a greater Command of Money & Credit than any 20, perhaps a greater Number of the richest Merchants of Europe, & thereby & his great Capacity has been able to doe these Wonders for France."[88] The Director of the Bank of Paris was the devastatingly clever Scottish exile John Law, whose innovations in public finance were quickly becoming the envy of British financial projectors, including those behind the South Sea Company.[89]

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[85] Archibald Hutcheson, "Some Hints Relating to the Public Debts and Expense" and "Some Hints Relating to Trade and Coin," NA SP 78/162, ff. 340-4, 344-50, enclosed in Stair to Craggs, 22 Nov./[11 Nov.] 1718, NA SP 78/162, ff. 335-6. This appears to be a scribal copy of a manuscript inclosed by Hutcheson in a letter to Stair, not in Hutcheson's hand (see NA SP 78/162 ff. 326-330). See NA SP 78/162, f. 335^{r-v} for Stair's attribution of the manuscript to Hutcheson. Stair wrote to Cragg: "Sent you a memoriall of Hutchinson's in wch you will find several things wch I believe maybe of use." There may be an outside chance that the manuscript was not originally written by Hutcheson, and was simply being passed on by him, but Stair seemed to believe the work was Hutcheson's.

[86] Hutcheson, "Some Hints Relating to Trade and Coin," NA SP 78/162, f. 346^{r}.

[87] Hutcheson, "Some Hints Relating to Trade and Coin," NA SP 78/162, f. 346^{r-v}. *Emphasis* mine.

[88] Hutcheson, "Some Hints Relating to Trade and Coin," NA SP 78/162, f. 346^{v}.

[89] The historiography offers some evocative and potentially inaccurate depictions of Hutcheson's business in France, and his potential relationship with John Law. The Earl of Stair, a Scot, had personal connections to John Law, and John

Hutcheson's 1718 "Some Hints Relating to the Trade and Coin" seems to have been his first direct discussion of "Intrinsick Value" as a concept. Law's manipulations of French currency provided Hutcheson with a frightening model for the mechanics of intrinsic value. This was not, as Simon Clement had described, an instance of small, ephemeral "alterations" in the "imaginary" market prices of financial objects. This was a deliberate effort by a powerful person to create and sustain a divergence between "intrinsic" and "imaginary" values, whereby honest traders were "bubled out of ¼ of the Intrinsick Value of their Money." A loss of merely 25% would come to seem like a rather modest loss in the next bubble Hutcheson would try to explain.

III. The Mystery of the South Sea Company

When Archibald Hutcheson began to contemplate the intrinsic value of South Sea Company Stock in 1720, he did so not with the shrewd, self-interested gaze of a potential investor, but with a distinctly politicized eye. As evident in his early writings on the South Sea Scheme, from March and April, Hutcheson's political objectives became embedded in his financial mathematics. He used calculations to build linkages between fiscal policies and distant social and political outcomes. Further, by plausibly showing the dangers that lurked behind covert Schemes like the South Sea Company's, Hutcheson sought to compel the Company's leadership and political supporters to

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Carswell points out that Stair was critical in reporting back to key political and financial figures in London about the "need to do something to compete with" Law. Carswell suggests that, on his trip to France, Hutcheson was among a large group of English people who "flocked to Paris to speculate" in Law's enterprises. Carswell's evidence is somewhat unclear, though, and he does not point out that Hutcheson may have been vital in explaining Law's financial power to Stair. One interesting—and intensely ironic—possibility is that Hutcheson's critical comments to Stair about Law's financial machinations may have in fact fueled interest in creating a Law-like scheme in Britain. (Carswell, *South Sea Bubble*, pp. 78-9). Cruickshanks and Erskine-Hill have argued that while in France, Law was masterminding a scheme for the restoration of the Stuart monarchy in Britain, and suggestively pick up Carswell's evidence to suggest that both Law and Hutcheson were complicit in Jacobite scheming. They stretch the limits of Carswell's claim, though, and offer no other evidence of a Hutcheson-Law connection (*Atterbury Plot*, ch. 1, esp. p. 40). Indeed, there is at least some evidence that a potential Law-Hutcheson connection was never in fact made. A reference in the papers of the Earl of Sunderland states: a "Mr Mackdonnagh Prior of Flaux Usez in Languedoc… gave Mr Hutcheson the favour of his Company in his Tour of Provence, who finding him a very ingenious good man recommended him earnestly to Mr Law, then in great power, who promised faithfully to provide well for him nigh Parish; but the Embarrassment of his own affairs happening soon after, this pour Trifle Slipt out of his Mind." ("A Memorandum relating to Prior Mackdonnagh," [after 1720?], Bleinheim Papers, BL Add. MS 61,547, f. 206.)

reveal greater data about their plots. The computational architecture of Hutcheson's analyses, particularly in his March pamphlet, was targeted to this objective. As in his earlier pamphlets on the National Debt, he built multivariate models that repeated the same calculation over multiple different uncertain parameters, meticulously showing what was *known* in order to highlight what was *unknown*—or, in this case, could only be known by the South Sea Company itself.

Hutcheson's first contribution to the debate over the Scheme came around March 1720, shortly after the South Sea Company and Bank of England finished wrestling for the privilege of buying up most of the National Debt. His dense, thirteen-page pamphlet explored the "the loss to the new subscribers" in the South Sea Stock and compared it to the hypothetical fate of similar subscribers under the Bank of England proposal.[90] He soon added a "Preface," dated March 31, 1720, in which he expounded on his attitudes toward the Scheme and the objectives of his calculations.[91] Hutcheson assured readers that he was not against aggressive attempts to combat the nation's indebtedness, and admitted that he had initially preferred the refinancing plan of the South Sea Company to that of the Bank of England (though both were less desirable than a true National Bank). At least two factors likely motivated this preference. First, his observations of Law's artificial manipulations of money and exchange in France had made him wary of giving too much power and discretion to those who controlled the nation's money. As he wrote, he found "a great Capital less dangerous in the *South-Sea Company*, than in the *Bank*; who have a Power very like that of Coining

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[90] [Archibald Hutcheson], *Some Calculations Relating to the Proposals Made by the South-Sea Company, and the Bank of England, to the House of Commons; Shewing the Loss to the New Subscribers…* (London: Printed, and Sold by J. Morphew, 1720). Dated March 31, 1720.

[91] Hutcheson, *Some Calculations Relating to the Proposals*, Reprint ed., "Preface," in Hutcheson, *A Collection of Calculations and Remarks,* p. 7. The original edition of Hutcheson's March pamphlet does not contain this Preface, which appears to have been added later in the month prior to a reprinting. The second Reprint Edition, with the Preface, was included in a later compilation of several of Hutcheson's South Sea Pamphlets, entitled *A Collection of Calculations and Remarks Relating to the South Sea Scheme & Stock, Which Have Been Already Published*, (London: *s.n.*, 1720), pp. 6-21. The Preface, as contained in the later *Collection of Calculations and Remarks,* is explicitly dated March 31, 1720. While none of the major online archives contains the stand-alone Reprint Edition (with the Preface), the English Short Title Catalogue does include a citation for that edition (though I have not yet been able to view the only edition listed, located at the University of Chicago Library). This is all to say that, while the Preface appears to have been written slightly after the original *Some Calculations Relating to the Proposals*, there is no reason to believe it was not written, as stated, in March 1720.

Money."[92] A second factor may have been the South Sea Company's political heritage. It had, after all, been created by Harley and the Tories in 1711, intended as a check to the growing power of the Whiggish Bank of England. In its original formulation, the South Sea Company had been built around principles Hutcheson would have supported, promising the swift redemption of the nation's debt based on a solid commercial premise—the African slave trade.

By the time he wrote, though, Hutcheson had become extremely wary of the looming South Sea behemoth. He was no doubt concerned about the Company's notable entanglement with the Whig faction that controlled the Commons, indicated by the deep involvement of Chancellor of the Exchequer John Aislabie in ushering the Company's bill through Parliament. A primary objective of his March pamphlet was therefore to frame the sheer scale of the Scheme and put into numerical context the tremendous amount of financial—and political—power being entrusted to one cohort of individuals. "To risque, at once, the Liberties of *Britain*, by making the Path to Arbitrary Power plain and easy, is a Measure which I never can come into," Hutcheson wrote. "For so great a Company, under the Influence of an ill-designing Ministry… may load the Nation with heavier chains, than the Debts we are endeavouring to Discharge."[93] The responsibility for preventing this upheaval lay with Parliamant, Hutcheson explained, however enthusiastic for the scheme the broader public might be. "Is it not the Duty of a *British Senate*, to take all necessary Precautions, to prevent the Ruin of many Thousands of Families?" he asked.[94]

The numbers Hutcheson provided to complement this Country rhetoric sought to fulfill a distinct political mandate:

> The Offers made by the *South-Sea Company*, and the *Bank*… gave me reason to imagine, That they had the Prospect of Raising these great Sums, on a

[92] Hutcheson, *Some Calculations Relating to the Proposals*, Reprint ed., "Preface" (Mar., 1720), in Hutcheson, *Collection of Calculations and Remarks*, p. 7.
[93] Hutcheson, *Some Calculations Relating to the Proposals,* Reprint Ed., "Preface" (Mar., 1720), in Hutcheson, *Collection of Calculations and Remarks,* p. 7.
[94] Hutcheson, *Some Calculations Relating to the Proposals,* Reprint Ed., "Preface" (Mar., 1720), in Hutcheson, *Collection of Calculations and Remarks,* p. 8.

> solid Foundation of the real Value of their Stocks… And the Pamphlets which were afterwards wrote, and what I have heard, either within or without doors, having been generally designed in Favour of one or the other of the said Two Companies, have been far from setting the Matter, to me, in any clear Light; and it was this which put me upon the making the following CALCULATIONS.[95]

Even the typography indicated the gravity of Hutcheson's computational task. His "CALCULATIONS" aimed to make sense of a complex and shadowy transaction that promised to redistribute political power as much as money. The outlines of Hutcheson's main March calculation have been described in Chapter 4, yet it is worth rereading his analysis in light of the distinctly political objectives it was intended to achieve. As mentioned, Hutcheson did not set out in his March pamphlet to calculate a single value for South Sea Company stock, nor specifically to predict the future course of the Stock's price.[96] Rather, he treated price as an input to his computations, whose immediate output was an determination of what the Company's trading profits needed to be—and whose ultimate output was an assessment of the Scheme's impact on the "Liberties of *Britain*." He built a multivariate model (recall **Figure 4d**) that included sixteen parallel assessments of the South Sea Stock under different choices for two key uncertainties: whether or not the Company would follow through and buy the irredeemable annuities (in addition the redeemable debts); and what price the Company set for its stock (£100 or "Par," £125, £150, £175, £200, £300, £400, or £500). For each of these sixteen (2 x 8) different scenarios, he carried out the same effective computation, shown for one specific example—assuming the irredeemables *would* be taken in, and assuming a price of £175—in **Figure 5b** below:

[95] Hutcheson, *Some Calculations Relating to the Proposals,* Reprint Ed., "Preface" (Mar., 1720), in Hutcheson, *Collection of Calculations and Remarks,* pp. 7-8.
[96] Notably, Hutcheson's first pamphlet did not include the word "intrinsic." He did, though, speak of the stock's "real value."

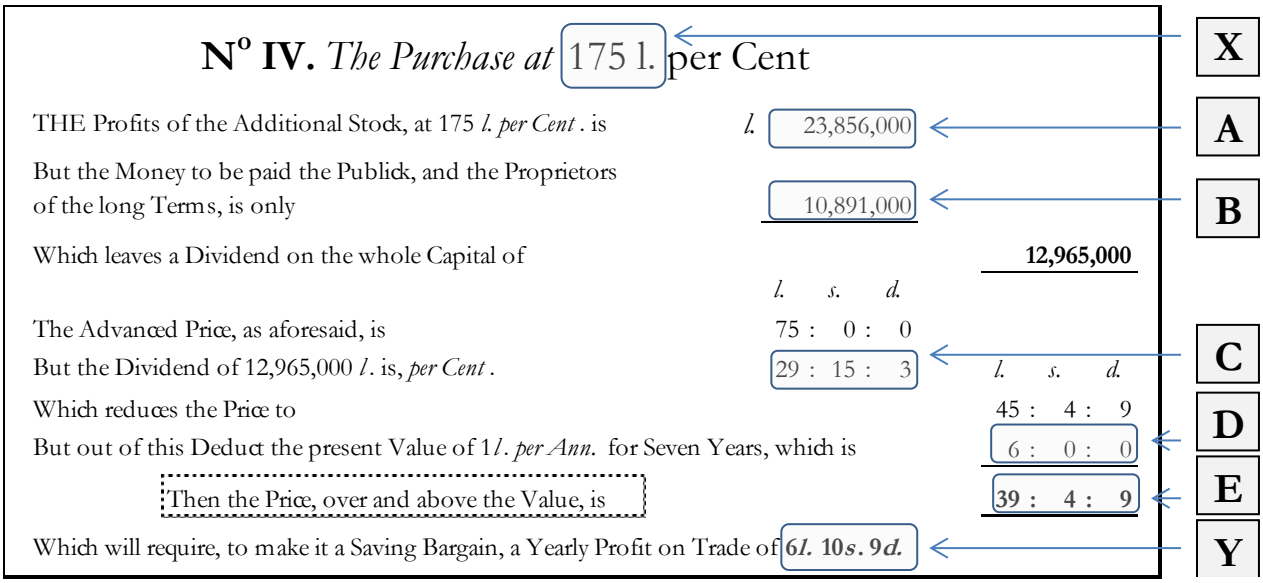

Figure 5b: Table, showing one example of the primary valuation calculation in Hutcheson, *Some Calculations Relating to the Proposals*, Reprint ed., (March 1720) in Hutcheson, *A Collection of Calculations and Remarks*, p. 13 (p. 5 in the original edition). The calculation shown represented the 12th of 16 valuation's Hutcheson carried out, assuming that the Company priced its Stock at £175 and chose to buy up the irredeemable (as well as redeemable) annuities.

Hutcheson began his calculation by calculating the difference between two critical values. First, there was what he called "The Profits of the Additional Stock," which represented the amount of extra money raised by selling new company stock above par. In the example case, the Company was entitled to sell "New additional Capital" of £31,808,000, assuming they took in the redeemables. At a price of £175 *per Cent.*, the sale of all of that new stock would raise a profit of 75 *per Cent*, or £23,856,000 total (**A**). It should be noted that even at this early stage in the computation, Hutcheson had made some critical interpretive choices: he presented the price of the Stock as something uncertain to outsiders but within Company control; he defined any amount of money raised by the sale of Stock above *par* as a "Profit." From the value of the "Profits on the Additional Stock," he then deducted a cost, described as "the Money to be paid the Publick, and the Proprietors of the long Terms." This was actually quite a complicated number, which collapsed two very different quantities. The first—the "Money to be paid the Publick"—was straightforward, representing the well-known fee the Company had agreed to pay Parliament (about £7.5 million). The second

payment—to "the Proprietors of the long Terms"—was a much trickier matter. The long-term irredeemable annuities, the main target of the refinancing Scheme in the first place, did not carry an official face value because the government never had the option to repurchase them. Instead, these annuities were denominated by the *annual* amount the government paid the holder. Prior to the Scheme, the government had to pay a total of roughly £667,500 *annually* to the holders of these long-term irredeemables. But, those annuities needed to be assigned some nominal value for the purposes of determining how much new Stock the Company could issue by virtue of buying them up. According to the terms struck with Parliament, this nominal valuation was set at 20 years' purchase, meaning if the Company absorbed all of the irredeemables, they would earn the right to issue about £13.4 million (20 × £667,500) in new stock. Hutcheson argued that the Company would have to pay considerably more than this to actually buy the annuities, because annuity owners would not accept 20 years' purchase for their annuities, which sold for much more in private markets.[97]

Hence, he calculated an extra five years' purchase on the total volume of irredeemables, equal to an extra £3.34 million, which he treated as an additional surcharge the Company would have to pay. Adding that figure to the government fee produced the second line of Hutcheson's calculation, a total of £10,891,000 (**B**). This computation embedded a variety of assumptions, about both the Company's decisions (it required assuming that the Company planned to buy up the irredeemables in stock valued at *par*, or cash) and about the effective market value of annuities. At the time Hutcheson was writing, there were reasons to contest both of these assumptions. More interesting than their correctness, though, was what those embedded suppositions suggested about

[97] As one author put it, it was "generally agreed that the long Annuities will not be taken in, unless the Company give the Proprietors 25 Years Purchase; which is rather less than the Price currant." ([Anon.], *A Farther Examination and Explanation of the South-Sea Company's Scheme* (1720), p. 7). The question of whether the Company could feasibly buy up the irredeemables, given the high prices they would have to pay for them, was a major point of debate in February and March 1720. For exemplary contrasting views on the question, see: *Argument to Shew the Disadvantage That Would Accrue to the Publick, from Obliging the South-Sea Company to Fix What Capital Stock They Will Give for the Annuities* (London: Printed for J. Roberts, 1720); and [Anon.], *A Farther Examination*, esp. "Postscript," pp. 25-39. Note that the Company ended up actually offering, nominally, 32-36 years' purchase for those long irredeemables, though much of this was in Company Stock at high prices. For a summary of the exchange terms, see Dickson, *Financial Revolution*, p. 135.

Hutcheson's broader computational agenda. He was not trying to hide assumptions that made the Company's plan look worse simply for rhetorical effect; in fact, certain of his arguments were quite favorable to the Company and its Stock price, including his assumptions about annuity valuation. Rather, the hiddenness of these assumptions was indicative of the kind of calculation he was trying to create. The South Sea Scheme had myriad variable and uncertain factors behind it. In order to analyze it, and keep the computations manageable, he had to effectively fix several of those variable—like the entire problem of what it would take to buy out the irredeemable annuities. In the number **B**, Hutcheson turned a complicated market story into a rigid accounting quantity.

This allowed Hutcheson to isolate specific parameters and highlight that those quantities in particular were unknown—especially the price the Company gave to its own Stock. The calculation in turn gave the impression that those critical variable inputs, like Stock price, were connected to the outputs by way of almost mechanical linkages, represented by the numerical armature of accounting. Hutcheson proceeded to explain these connections. The difference between the "Profits" the Company was to raise by selling new Stock (**A**) and the effective fees the Company incurred (**B**), represented the "Dividend on the Whole Capital" that would result from the transaction. Hutcheson rendered this part of the Scheme like a simple, one-time commercial venture; the profits less the costs represented an immediate dividend to be divided among stockholders, equal to £12,965,000.

At this point in the calculation, Hutcheson shifted perspectives. Instead of reasoning about the total dividend produced by the Scheme, he turned to the question of how the Scheme impacted one individual purchaser of South Sea Stock. The remainder of the computation, therefore, was denominated not in aggregate monetary terms, but rather in pounds per £100 share. Hutcheson began by stating the "Advanced Price" paid for the Stock, namely the amount over *par* (£75 in this case). From this, he deducted the portion of the "Dividend" that each purchaser would be entitled to, on a "*per Cent.*" basis, dividing the total Dividend (£12,965,000) by the "whole encreased Capital"

of the South Sea Company once all of the refinancing transactions took place, which he calculated earlier in the pamphlet to be £43,558,000.[98] This represented a dividend of £29. 15*s.* 3*p.* (**C**), which Hutcheson suggested would be effectively paid back to purchasers of new Stock to compensate them for overpaying for the Stock in the first place. This dividend had the outcome of "reducing the Price" that new purchasers paid, from £75 to about £45.5*s.* Hutcheson also noted, quite generously, that the new purchasers also stood to receive an additional benefit from the relatively high interest rate (5%) that the government promised to pay on its obligations to the Company over the next seven years.[99] Assuming that general interest rates would remain at 4%—not necessarily a simple or obvious assumption—Hutcheson concluded this was worth an extra £1 per year per £100 share, which according to the mathematics of compound interest had a "present Value" of £6 (**D**). Deducting this £6 from the price of the Stock, Hutcheson determined the vital quantity (**E**). "Then the *Price*, over and above the *Value*," he wrote, was £39. 9*s.* 4*d.*

The model created a rigid, arithmetical mechanism for determining the divergence between the *price* which investors were being asked to pay for new Stock—by the Company itself—and the Stock's *value*. Hutcheson acknowledged, though, that he did not necessarily include all of the sources of the Stock's value. He deliberately left out the Company's potential trading profits, a matter on which he had almost no information as an outsider. The final step of his calculation was to translate the difference between the Stock's "price" and "value" from a single lump sum into a series of

[98] The "whole encreased Capital" broke down as: the "Present Capital" (£11,750,000); the Long Irredeemables (£13,355,000); the Short Irredeemables (£1,703,000); the Redeemables (£16,750,000).

[99] There were several reasons Hutcheson's assumptions about interest rates could have been disputed. For one, it is not even entirely clear what Hutcheson meant when he spoke of "the Interest being stated at 4 *l. per Cent. per Ann.*" (Hutcheson, *Some Calculations*, First Ed. (March 1720), p. 2). Mostly likely he was referring to the stated interest rate the government was paying on short-term, redeemable debts at the time. But, as scholars like Kenneth J. Weiller and Philip Mirowski have explored, there were a variety of different things one could point to as representing contemporary "interest rates," and it is hardly clear whether the specific figure of 4% Hutcheson selected would have been understood to represent the return common investors could expect on saved money. The history of interest rates in the period, and particularly contemporary understandings of what they were and how they worked, is a topic deserving of greater attention. For an introduction, see Kenneth J. Weiller and Philip Mirowski, "Rates of Interest in 18th Century England," *Explorations in Economic History* 27, no. 1 (January, 1990): 1-28; Dickson, *Financial Revolution*, ch. 19.

annual payments.[100] He argued, again using the mathematics of compound interest, that in order for the Company to make up the £39. 9*s.* 4*d.* that it had effectively overcharged for its stock, it would need to make an annual profit of £6. 10*s.* 9*d.* from its trading activities (**Y**).

Hutcheson's March 1720 calculation is a rich historical text. Two critical features are especially worthy of attention. The first is the overall structure of the computation. Hutcheson decided to build not one single calculation of the value of South Sea Stock (or even two or three different scenarios), but to systematically repeat the same calculations for sixteen different scenarios. This was arguably the most novel and innovative aspect of Hutcheson's analysis, and one that set him apart from the alternative computations of his peers. Hutcheson's modeling approach was a clever, almost radical, method for dealing with informational uncertainty. He isolated specific uncertain elements and, within some vague boundaries, allowed them to remain uncertain, reasoning about the impacts of those elements *as if* they were known with certainty. Yet Hutcheson's strategy for dealing with the uncertain revealed a political motivation. He did not, after all, treat every uncertain parameter as an unknown. He readily offered estimates for some variables, like the markup that would have to be paid to the irredeemable holders. He specifically *chose* the unknowns he did—Stock price, the choice about the irredeemables—because they were parameters which Hutcheson believed the Company itself controlled.

One of the effects of Hutcheson's modeling strategy was therefore to suggest that unknown elements in the calculation, like the price of the Stock transactions, were not inherently unstable or unknowable, but simply unknown at the moment by the public. A second key effect of his modeling was to suggest that those parts of the calculation which were *not* singled out as unknowns were as good as certain. Hutcheson's calculation, presented as a present-time commercial account, reduced

[100] Hutcheson, it should be noted, was highly skilled in the kind of compound-interest or "ready money" calculations that were advocated so strenuously by William Paterson and proved so important to the calculation of the Equivalent, as discussed in Chapter 2.

all of the Company's different resources and obligations into commensurable numerical terms. It also translated the future into the present. Hutcheson produced a fixed, frozen image of the Stock's "value" which treated a variety of future transactions—the different debt exchanges, the sale of new stock, the allocation of the hypothetical "dividend" from sales of stock to the various stock owners—as already completed, more or less simultaneously. Using the mathematics of compound interest to shift quickly between future incomes and "present value," Hutcheson effaced many of the uncertainties that were likely to emerge over time, like what might happen to future prevailing interest rates. His computation created the impression that once the inputs of the computation—the given stock price (**X**) and the choice of taking in the irredeemables or not—were selected, the final outputs of the model (**Y**) were essentially forced, the consequence of an almost instantaneous causal and indeed ethical chain that could be rendered in demonstrative mathematical terms. His arithmetic created a model of the kind of reasoning he believed had to have been within the capacity of the Company itself.

Building this mathematical-ethical bridge was the central objective of Hutcheson's calculation. As he explained, "If the Computations I have made, be right, it is then evident, That the Gains of the *South-Sea Company*, in Trade, must be immensely Great, to make Good to the New Subscribers, at any high Rates, the Principal Money advanced by them."[101] Hutcheson was, like many, skeptical of the Company's trading prospects, and admitted to believing that "there is no real Foundation for the present, much less for the further expected, high Price of *South-Sea Stock*."[102] (He was not, it must be noted, economically or morally skeptical about the Company's purported line of business, the trade in African slave labor). But his elaborate model did far more than just argue that

[101] Hutcheson, *Some Calculations Relating to the Proposals,* Reprint Ed., "Preface" (Mar., 1720), in Hutcheson, *A Collection of Calculations and Remarks,* p. 8.
[102] Hutcheson, *Some Calculations Relating to the Proposals,* Reprint Ed., "Preface" (Mar., 1720), in Hutcheson, *A Collection of Calculations and Remarks,* p. 8.

the Company's stock was overvalued. It translated into numerical terms what he saw to be a highly dangerous political arrangement:

> Is it not, therefore, reasonable, That the *South-Sea* Company should Explain, from whence their Advantages are to arise, which may be a solid Foundation for the Value of their Stock; and that the *Bill*, now depending in the *House of Commons*, may stop till then; that Thousands and Thousands of unwary People may not be Undone[?][103]

The progress of the Scheme in spring 1720 prompted an increasingly pointed tone from Hutcheson. He became especially irked by the fact that, while the Company failed to produce honest information about its value, Company supporters promoted the Stock through misleading computations based on publicly-available information. Notably, one Company advocate produced a calculation in the April 9 issue of *Flying-Post* newspaper, which "demonstrate[d] this extraordinary Paradox, *viz.* That the higher the Price is which is given for *South-Sea* Stock, the greater Benefit will the Purchaser have thereby; And that at 300 *l. per Cent.* it is intrinsically Worth 448 *l.* and at 600 *l.* is Worth 880 *l.*"[104] The *Flying-Post* computations (for which see **Figure 4f**) galvanized Hutcheson's anger about the Scheme, giving him a new computational cause—not just overcoming the Company's passive secrecy, but educating the ingenuous masses.

Hutcheson responded to the *Flying-Post* with a creative computational challenge. In a pamphlet of April 21, Hutcheson argued that the "ingenious Computer" had made the error of dividing the immediate profits from the sale of new Company Stock among too small a group of proprietors, including only the original holders of the Stock plus those who had redeemed government debt for Stock.[105] The *Flying-Post* calculator effectively suggested that new purchasers of South Sea Stock would get nothing back in return. Hutcheson strategically mimicked certain

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[103] Hutcheson, *Some Calculations Relating to the Proposals,* Reprint Ed., "Preface" (Mar., 1720), in Hutcheson, *A Collection of Calculations and Remarks,* p. 16.
[104] The technical details of this computation have been discussed in Chapter 4. See: Hutcheson, *Some Seasonable Considerations for Those, who are Desirous, By Subscription, or Purchase, to Become Proprietors of South-Sea Stock* (London: *s.n.*, 1720), p. [2]. Dated April 21, 1720.
[105] Hutcheson, *Some Seasonable Consideration* (Apr., 1720), p. 3.

calculations made in the *Flying-Post* and then carried them to their logical extreme, arguing for example that he could use similar logic to show South Sea Stock priced at £300 was worth not just £448, but over £862.[106] By co-opting the *Flying-Post* calculations, Hutcheson sought to show his own superior computational command while discrediting his combatant's figures and revealing how such reasoning was itself ethically dubious. (It was a move of which the *Mercator* would have been proud.) In turn, he cast the *Flying-Post*'s figures as evidence for why the Company's leadership had to provide the public with better information. "This, I presume, will be evident to every Body," Hutcheson declared, "that no judgment can be form'd of the real Value of *South-Sea* Stock, from any Dividends which the Company may propose to make, without a clear Proof, that they are able to do it."[107] Hutcheson was convinced that "those who have the Honour to serve in the Administration or Direction of the *South-Sea* Company" would promptly do the responsible thing and "disown the aforesaid, and all such Sort of *Calculations*" like those of the *Flying-Post*. Instead, he hoped they would, "in a plain and easy Method, State the instrinsick Value of their Stock." Hutcheson felt that in the meantime, by educating Britons directly of the pernicious mechanics of the South Sea Scheme, he might help the "unweary People, unskilled in Figures" protect themselves. This was his goal—to "explain to them the Mystery which the Advocates for the *South-Sea* Company, with so much Art, endeavour to conceal."[108]

IV. Facts Notorious to the Whole Nation: Criminal Evidence, Mathematical Proof

Hutcheson's computations in spring 1720 were intended to model possible outcomes of an indeterminate transaction, demonstrating its potential dangers and framing just how uncertain the

[106] Specifically, he showed that, if one were to divide the profits of new stock sales (at a price of £300) solely among the original proprietors (holding approximately £11.2 million of capital), and neither the government creditors nor the new subscribers, Hutcheson could justify the value of the stock to be over £862. (*Some Seasonable Considerations* (Apr., 1720), p. 5.)

[107] Hutcheson, *Some Seasonable Considerations* (Apr., 1720), p. 5.

[108] Hutcheson, *Some Seasonable Considerations* (Apr., 1720), p. 3.

public was about it. His calculations foregrounded the Scheme's external uncertainty, but were ultimately grounded in the belief that the situation was quite certain on the inside. The rise and fall of stocks was not naturally stochastic, but a reflection of how much information the public did not have, the vestige of an inadequate political arrangement. In the summer and fall, as the Bubble began to crest and eventually to fall, Hutcheson became increasingly frustrated with all that remained unknown about the Scheme. His computations became increasingly normative, seeking not only to manage the prevailing uncertainty but to judge it.[109] On September 10, 1720, as the South Sea Stock price was teetering on the brink of total collapse, Hutcheson began his newest calculations by reflecting on his approach to valuation. "In the following, and all the other Valuations which I have made of this Stock," he wrote, "I consider only the Debt due to the Company from the Publick, and the Money gained by Subscriptions, having as to these some Light to guide me; but as to the Profits which have arisen, or may arise, from their Home and Foreign Trade, I am intirely in the Dark, and do not, therefore, pretend to make any Guess about it."[110] For Hutcheson, the bifurcation between such "Light" and "Dark" spaces of the South Sea Scheme was at the heart of the project's danger.

He explained that the South Sea Scheme had been kept afloat because new investors, overpaying for the Stock, had effectively given "great Presents" to previous buyers, who themselves had often overpaid.[111] "It passeth my Imagination to conceive," he wrote, "how Justice can be done to those, who have already, or shall hereafter purchase at high Prices."[112] Hutcheson was quite forgiving of those who had sought profits trading South Sea Stock in Exchange Alley. As he put it, "there is certainly a very great Difference between the Transactions of particular Persons in the buying and selling of this Stock, and the Conduct of the Directors of this Company, who are in the

[109] We have already discussed one of those computations in Chapter 4, namely the rather extreme, polemical computation Hutcheson offered to Parliament and published in a broadside entitled *An Estimate of the Intrinsick Value of South-Sea Stock* in mid-June.
[110] [Archibald Hutcheson], *An Estimate of the Value of South-Sea Stock. With Some Remarks Relating Thereto* (London: *s.n.*, 1720), p. [5]. The text is dated Sept. 10, 1720.
[111] Hutcheson, *Estimate of the Value* (Sep.,1720), p. 8.
[112] Hutcheson, *Estimate of the Value* (Sep., 1720), p. 9.

Secret of this Mystery, and who knew, or ought to have known, the real and intrinsick Value of this Stock."[113] He went on to contend that the Company's Directors were obliged, "in Justice and in Conscience" to show "That the Stock is worth the highest Prices at which they have sold." Especially troubling was that the Company's Directors had misrepresented their own intentions to inform the public: "I was in great hopes… to have seen a full and authentick State of the Value of the Stock of this Company; by which the fluctuating Price thereof might have been settled, and People might have been at some Certainty."[114]

The Company's greatest injustice, perhaps, was failing to provide the people the promised *certainty* they so desperately needed. Hutcheson filled the next half-page of the pamphlet with direct transcriptions from four official announcements in the *Daily Courant* newspaper (May 19, August 13, August 31, September 9). These sparse clippings included announcements of major decisions by the Company's Directors and, as far as Hutcheson could tell, represented the Company's only meager efforts to testify to their value. The first three excerpts simply reported the Stock's recent trading prices. "Had this Account of the Value of *South-Sea* Stock been published by the meanest Broker of the *Alley of Iniquity*, there might have been some apology made for him," Hutcheson wrote in frustration. "But what can be said of for so lame a History of the value of this Stock, from those who are in the Direction and Management thereof? For it amounts to no more than this; That on *Monday* the 23 of *May*, 1720. People thought fit to give 357 *l. per Cent.* for this Stock, and, therefore, it was worth so much."[115] This, as Hutcheson explained in big letters, was simply to rely on the "Authority of Hudibras"—"What's the Worth of any Thing, / But as much Money as 'twill bring?"[116] In Hutcheson's mind, for the Company to buy into Hudibras's logic was already to betray the responsibilities entrusted to them by Parliament and the public at large. For contrast, he

[113] Hutcheson, *Estimate of the Value* (Sep., 1720), p. 9.
[114] Hutcheson, *Estimate of the Value* (Sep., 1720), p. 9.
[115] Hutcheson, *Estimate of the Value* (Sep., 1720), p. 10.
[116] Hutcheson, *Estimate of the Value* (Sep., 1720), p. 10.

provided the Company's leadership a recipe for the certain knowledge they should have provided: "Surely, they ought to have set forth, The Money due them from the Publick; The Money gained at those Respective Times by Subscriptions; and, The Profits made by their Home and Foreign Commerce; and to have likewise set forth, The Debts due from them; and, Than on the Balance of their Books, their Stock was then worth such a certain Sum."[117] The Company had access to certain answers that the public did not, and it was their ethical responsibility to share it in a thorough and accurate calculation "By this they would have dealt candidly and uprightly with all Mankind," he argued, "and would thereby have given such a Proof of the real and intrinsick value of their Stock, as was only fit for them to give."[118] Valuing complicated stocks was not an impossible or even probabilistic problem. Intrinsic value was capable of proof, the highest form of mathematical certainty. But, for unfortunate political reasons, access to such proof lay only with the Company's Directors. The *intrinsick*, for Hutcheson, was the privileged sphere of the insider.

Hutcheson's reproaches did not go unheard. After the price of South Sea Stock had plunged from £800-1,000 in summer to under £200 in December, he finally got the opportunity to demand the kind of insider information he longed for. That winter, Hutcheson was appointed a member of the Commons' (aptly-named) "Committee of Secrecy" responsible for investigating the South Sea Scheme. His vision of the Company's responsibility for its own value became a powerful guide for the Committee's efforts.[119] Parliamentary investigators demanded a massive volume of information from the Company, including its account books, records of all of its transactions (including covert actions like the lending of money on stock security), subscriber lists, and accounts of the Directors'

[117] Hutcheson, *Estimate of the Value* (Sep., 1720), p. 10.
[118] Hutcheson, *Estimate of the Value* (Sep., 1720), p. 10.
[119] The Committee was primarily composed of an "anti-ministerial and non-political" collection of MPs, though most of whom were Whigs by political affiliation. On the composition and early activities of the of the Committee, see: Carswell, *South Sea Bubble*, pp. 219-225, quotation on p. 220.

deliberations.[120] Critically, the investigators demanded to see not just data, but also clear evidence of the Company's reasoning about its own Stock value. Two instances were of particular interest to the Parliamentary investigators. The Company's Court of Directors reported in their minutes of December 30 that they received the following requests:

> That the Directors of the South Sea Comp[a]. do lay before this House the Calculations & Inducements on which they took in the 3[d] and 4th. money Subscriptions at 1000 p[er] Cent, and also the Scheme or Calculation or other Inducements upon which they grounded the Resolution of making a dividend of 30[£]. p[er] Cent at Christmas, and of not less than £50 p[er] Cent p[er] ann for Twelve Years after.[121]

These two moments of apparent misrepresentation—the £1,000 pricing of the summer subscriptions and the 30%/50% dividend policy—prompted special scorn from the British public and their representatives. The MP Sir James Lowther, for example, reported in a letter that the Commons had become fixated on the question of how the Company had understood its own value: "The House is preparing to examine into the ill practices of the South Sea Directors, and have for that purpose ordered them to lay before the House their reasons for resolving to make dividends of fifty per cent., and for promoting subscriptions at 1000, it being evident that those proceedings have brought on this calamity and misery upon the nation."[122]

The Company's Directors would in fact attempt some justification for these valuations (on which more to come in Section V), but these seemed to have done little in the near term to convince Hutcheson or anyone else of the Company's good intentions. At the same time the members of the Committee of Secrecy were hard at work uncovering what they considered to be evidence of deliberately fraudulent and deceptive behavior on the part of the Company. Through skillful exercises in a kind of forensic accounting, Hutcheson and his colleagues unearthed a frightening

[120] See: Minutes of the Court of Directors of the South Sea Company, entries for 13 December 1720 - 30 December 1720, Vol. 6, BL Add. MS 25,499, ff. 83[v] - 103[r].
[121] Minutes of the Court of Directors of the SSC, entry for 30 December 1720, Vol. 6, BL Add. MSS 25,499, f. 103[r].
[122] Sir James Lowther to [Henry Howard, 4th Earl of Carlisle], 29 December 1720, in HMC Carlisle, p. 26. For another report on the matter, see C[avers] Douglas to [John Clerk], n.d. (c. 29 December 1720), Clerk Papers, NAS GD18/5319/11, f. 1[v].

amount of graft and fraud. In the Committee's First Report, they explained how the ledgers of Company cashier Robert Knight revealed that the Company had given Stock incentives to a great number of prominent politicians in exchange for their support of the Scheme.[123] Particularly egregious were two large payments totaling £250,000 to Charles Stanhope, a Treasury Secretary and cousin of Whig chief minister Lord James Stanhope, concealed in Knight's ledgers through a serious of fictitious transactions under the clever name *Stangape*.[124] Later reports elaborated in shocking detail how the Company used intermediary brokers to conceal the ultimate target of stock bribes and how Company employees (specifically, a clerk Christopher Clayton) had systematically ripped pages from critical ledgers and violently intimidated fellow employees to protect Company secrets.[125]

This evidence of wrongdoing confirmed Hutcheson's worst fears about the ethical dangers of the South Sea Scheme. The role of key Whig politicians like Aislabie and the Stanhopes in corrupting the legacy of the formerly Tory South Sea Company no doubt fueled his ire even further. Critically, the visible criminality of the affair did not render Hutcheson's computations irrelevant. It empowered them. The revelation that the Company was in so many ways a vehicle for fraud became a new piece of data with which Hutcheson could refine his own numerical models. Hutcheson's earliest calculations in 1720—and indeed, many of the public-financial calculations he constructed before 1720—were proofs of computational possibility, which showed what the "proper Officers" should be able to know by demonstrating the necessary calculations and applying them to a range of values for key inputs. After the South Sea Bubble had popped, Hutcheson's calculations became retrospective efforts to prove what the Company's leaders *must* have known. In early 1721, Hutcheson published a scathing pamphlet impugning the leadership of the South Sea Company,

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[123] House of Commons*, The Reports of the Committee of Secrecy to the Honourable House of Commons, Relating to the Late South-Sea Directors, &c. Carefully Corrected.* (London: Printed for Cato, 1721), p. 15. In particular, the Company had given key politicians the opportunity to buy Stock from the Company at below-market values at future dates, locking in the profits of a rise in Stock prices. Effectively, this would be the equivalent of giving away modern stock "options."
[124] See *Reports of the Committee of Secrecy* (1721), p. 11; Carswell, *South Sea Bubble*, pp. 93-4, 97, etc.
[125] *Reports of the Committee of Secrecy* (1721), p. 50 (second series; pagination is repeated in text) and pp. 72-3.

entitled *A Computation of the Value of South-Sea Stock, on the Foot of the Scheme as it Now Subsists, Made from the Facts as They Are Stated by the Directors of the South-Sea Company*.[126] In the Preface, he looked back on his earlier computational efforts:

> I Have in and since the Month of *March* last, published several Computations relating to the *South-Sea* Scheme, and the Execution thereof; and altho' at the respective times I wrote, I was not perfectly informed of the Facts, yet I now perceive my several Computations, tho' not exact, came sufficiently near the Truth, to serve all the Ends of the necessary Information and Caution I thereby proposed.[127]

Hutcheson was happy to admit earlier computations were "not exact" because he had never before been "perfectly informed of the Facts." That had always been his message. Now, in the aftermath of the Bubble, the veil of secrecy that had shrouded the Company had been lifted, and so:

> I have given my-self the Trouble to make the following Computations from the Facts as they are stated by the Directors of the *South-Sea* Company… that I might conclude my writing on this subject with exact Calculations, and which, in what I have formerly published, were, and could only be, nearly guessed at.[128]

The aftermath of the bursting of the South Sea Bubble was cathartic for Hutcheson—not only because his fears had been vindicated, but because it finally gave him to opportunity to develop the kind of "exact calculations" he had always sought. Instead of having to make elaborate models that contemplated many different scenarios, he could now make a single calculation, an exact determination of the Stock's intrinsic value. His analyses transformed from a tool for interrogation to a tool of judgment, a way to prove the Company's worst crime—selling the public a stock whose price they knew, with certainty, could not be justified by its intrinsic value. For example, Hutcheson argued that, at the point in April when the Directors of the Company had taken in the first two money subscriptions (valued at £300 and £400, respectively), and had taken the first exchange of

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[126] Archibald Hutcheson, *A Computation of the Value of South-Sea Stock, on the Foot of the Scheme as it Now Subsists, Made from the Facts as They Are Stated by the Directors of the South-Sea Company…* (London: *s.n.*, 1720/1721). Dated 6 February 1720/1721.
[127] Hutcheson, *Computation of the Value of South-Sea Stock, on the Foot of the Scheme as It Now Subsists* (Feb., 1721), p. 3.
[128] Hutcheson, *Computation of the Value of South-Sea Stock, on the Foot of the Scheme as It Now Subsists* (Feb., 1721), p. 3.

annuities (for stock valued at £375), the "Value of 100*l.* Stock" was "not ¼ above 120*l.*"[129] The calculation Hutcheson offered to explain this retrospective valuation was efficient and conservative (**Figure 5c**), built around a basic mercantile accounting relationship that held that an enterprise's total stock was worth the "Net Value of Capital" (the enterprise's productive resources less its obligations).

	(£ in millions)
Company's Stock Issued:	
Original Stock	£12.9
New Stock Exchanged for Government Debt	3.6
New Stock Sold for Cash	4.1
Total Company Stock	**£20.6**
Company's "Capital"	
Total Government Debt	£21.2
Total Cash	12.8
Total Company "Capital"	£34.0
Fee to Government and Other Obligations	9.2
"Net Value of Capital" *(Capital - Obligations)*	24.7
Implied Stock Price *(Net Capital Value per £100 Share)*	**£120**

Figure 5c: Summary of the retrospective valuation of South Sea Stock offered in Hutcheson, *Computation of the Value of South-Sea Stock, on the Foot of the Scheme as It Now Subsists* (Feb., 1721), pp. 15-16, and reproduced in the *Reports of the Committee on Secrecy* (1721), p. 16. The critical conclusion was that the Company had sold stock to the public at £300-400 when it was only worth £120 based on its "intrinsic value."

This retrospective "Net Value of Capital" computation bore some obvious and important similarities to the computations he had offered in March, at the first implementation of the Scheme. It began from the main premise that the Company's value was based primarily in the clear and accountable financial resources it controlled, namely the government debt it held and the cash it raised (or could raise) through the sale of Company Stock. Yet his *post facto* computation showed several key differences.[130] Most critically, his retrospective computation left out critical sources of

[129] Hutcheson, *Computation of the Value of South-Sea Stock, on the Foot of the Scheme as It Now Subsists* (Feb., 1721), p. 16.
[130] Hutcheson's language and subtle aspects of his computational approach had changed. Whereas in March, for example, he had spoken of the "profits" of the Company's stock sales in terms of a "Dividend" to be paid on the

potential value that Hutcheson had given the Company credit for in March: the Company's potential trading profits, which had always been unknown, and the value to the Company's stockholders of the relatively high (5%) interest rate that the government promised to pay to the Company (which Hutcheson had calculated to be worth £6 per £100 share in March). Hutcheson's post-Bubble computations appear somewhat atrophied in comparison to the sensitivity and complexity of his pre-Bubble computations. But Hutcheson would not have understood this flattening of complexity from March 1720 to February 1721 as intellectually inconsistent. His post-Bubble computations were rather a realization of the kind of computation to which his pre-Bubble computations aspired. As Hutcheson saw it, the Company's secretive "*Facts*" confirmed the worst of all scenarios he had contemplated: the Company was a fraud from the outset, and hence never had any realistic prospects for trading profits.[131] That unknown variable was—and always had been—worth zero.

Hutcheson's retrospective "Proof of the real and intrinsick value of their Stock" became proof of the guilt of the Company's Directors. Contemporaries acknowledged the key role such computations played in the indictment of the Company directors. In one anonymous pamphlet revealing various "secret policies" of the South-Sea Directors, the author went out of the way to explain in the pamphlet's introductory dedication that his intention was *not* to "to calculate your Stock, and show how much you may have unlawfully cheated the Nation of." That mathematical case, it seemed, had already been conclusively made.[132] Indeed, it became a formal part of the legal case leveled against them by Parliament. Hutcheson inscribed his mathematical analysis of the

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Company's collected "Capital," in retrospect he spoke of the Company's "Net Value of Capital" as divided among the Company's proprietors. The changing ambiguity of terms like "capital" and "stock" is evident even within the changing language Hutcheson himself used, and those linguistic shifts suggest how the experience of the Bubble itself may have contributed to the consolidation of a financial lexicon.

[131] The question of the £6 per £100 he had credited the Stock for the government interest bonus is more tricky. Arguably, if he were being rigidly consistent, Hutcheson should have credited the Company with that value in his retrospective valuation. But Hutcheson may well have explained that even that £6 was something the Company's Directors would have known was worthless, because they would have known that the Company could never have survived the seven years necessary to realize that value.

[132] [Anon.] *The Nation Preserved; or, The Plot Discovered. Containing an Impartial Account of the Secret Policy of some of the South-Sea Directors* (London: Printed for the Author, 1720 [1721?]), pp. 4-5.

Scheme into the official reports issued by the Committee of Secrecy, between the evidence of the payments to Stanhope and other politicians and a second-hand report about the outlaw Company cashier Robert Knight.[133] Hutcheson's calculations helped isolate what particular actions the Company's leaders had taken "to raise the *Nominal Value* of South-Sea Stock, to that extravagant Rate to which it was afterwards advanced above the real and intrinsick Value thereof."[134] For one, his analyses showed that the whole Scheme would have actually worked, and the public relieved of its irredeemable debt burden, had the Company simply fixed a fair price for its Stock. Had the Company been happy with some modest markup from the beginning—say around £125-175 per share, around where the South Sea Stock traded on the London market before the Scheme went into effect—they could have appropriately encouraged government creditors to exchange their holdings, covered the fees promised the Government, and made a just profit for the South Sea shareholders without risking the mania that ensued.[135] As Hutcheson put it: "The money stipulated for the Publick might have been raised, with a considerable Gain to the Proprietors of the Old Capital, without carrying the Stock higher than 150 *l. per Cent.*"[136]

Hutcheson's figures showed that the Company's Directors instead pursued a series of systematic deceptions about their own Stock's value: the initial decision to price the first money subscriptions and exchanges at £300 and greater, the increasing price of their subsequent subscriptions (up to £1,000), and their lavish dividend promises.[137] The Company's September 8 announcement to pay a 30% dividend at Christmas and 50% annually for twelve years thereafter was shown to have been grossly fraudulent. The calculations were so clear, Hutcheson suggested, that no one on the inside reasonably could have thought that the Company could support such dividends.

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[133] Hutcheson's computational analyses can be found in *Reports of the Committee of Secrecy* (1721), pp. 16-21.
[134] *Reports of the Committee of Secrecy* (1721), p. 15.
[135] In fact, when the Bank of England proposed its competing version of the scheme in early 1720, they proposed to fix the price of stock for exchange purposes at £170 principal debt for one £100 share of stock.
[136] Hutcheson, *Computation of the Value of South-Sea Stock, on the Foot of the Scheme as It Now Subsists* (Feb., 1721), p. 13; *Reports of the Committee of Secrecy* (1721), pp. 15-16.
[137] *The Reports of the Committee of Secrecy* (1721), pp. 16-18.

"Your Committee observe that it appears to them very extraordinary, that the Directors on the 8th Day of September, (when the said high Dividend was declared in a General Court) should have had no foresight of the Turn, which so soon after… happened in their Affairs."[138] After all, "the Directors of the South-Sea Company cannot possibly be supposed to have been ignorant" of the Company's dire state at the time.[139]

In Hutcheson's retrospective reconstruction, mathematical evidence proved the Company's ethical failings. The feasibility of the scheme at a much lower stock price, the Director's deliberate mis-pricing of the Stock, the fraudulent dividend promises—these were not speculative claims or disputable interpretations. As Hutcheson said: "These *Facts* are now Notorious to the whole Nation, and have been long so to my self, and many others; and what possible Apology can be then offered for those who have either acted in, or contributed towards the Support of the Execution of this Scheme in a Manner so grossly fraudulent?"[140] The particular ethical transgressions of the Company were *facts* not only in the common modern sense of distinct quanta of true knowledge, but *facts* in the older, legalistic sense of things proven *to have been done*.[141] For Hutcheson, these facts proved not just the individual immorality of the Directors, but the broader political decay (mostly the fault of the Whigs) that had permitted such untrustworthy characters such unspeakable power.

V. The View from the Inside

One effect of Hutcheson's mathematical demonstrations was generally to exculpate the mass of public investors, even the professional jobbers, for their role in the Crisis. The Bubble could not be

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[138] *The Reports of the Committee of Secrecy* (1721), p. 16.
[139] Hutcheson, *A Computation of the Value of South-Sea Stock, on the Foot of the Scheme as It Now Subsists* (Feb. 1720/1), p. 4.
[140] Hutcheson, *Computation of the Value of South-Sea Stock, on the Foot of the Scheme as It Now Subsists* (Feb. 1720/1), p. 4. *Emphasis mine*.
[141] Barbara Shapiro writes that it took time for "fact," originally a term from the courtroom lexicon, to take on its more modern meaning: "'Fact' in this context did not necessarily refer to an established truth but often to an issue of truth. Indeed, one of the great changes that occurred over the course of two centuries in some cultural arenas was the transformation of 'fact' from something that had to be sufficiently proved by appropriate evidence to be considered worthy of belief to something for which appropriate verification had already taken place." See: *A Culture of Fact: England, 1550-1720* (Ithaca, NY and London: Cornell University Press, 2000), p. 31.

blamed on collective avarice or folly, because most of the people who bought Stock or exchanged government annuities for it simply could not have had enough information or even skill to honestly judge real value. Even those of otherwise unassailable morality and intelligence, Hutcheson explained, made this mistake: "Our Reverend Clergy, the best and most valuable in the World, the Judges and Sages of the Law, the greatest Peers and Commoners, have not been Proof against the Delusion."[142] Here, Hutcheson deviated critically from a forerunner like Simon Clement, who held that assessing financial intrinsic value was well within the capacities of the public investors, and thus it was they who bore responsibility for their losses. There was, of course, one group who Hutcheson did not allow to claim ignorance—the leadership of the Company itself. For all his awareness of the complications that most Britons encountered in valuing South Stock, Hutcheson was no financial relativist. Intrinsic value was a definite quantity, and the Company itself had to know what it was. Hutcheson gave very little consideration to the fact that the Company's leaders might have been wrong through simple carelessness, let alone that they might not have had complete information themselves or might have honestly disagreed (within themselves or with Hutcheson) about how to calculate intrinsic value. But how accurate was Hutcheson's picture? In what sense did the Directors of the South Sea Company *knowingly* deceive the public about the Stock's intrinsic value?

Hutcheson's central accusation that the Company's leaders must have understood the deceits they were perpetrating has been at the heart of nearly all major histories of the Scheme since the eighteenth century. In 1764, former Company employee Adam Anderson described the Company's Directors as a "Junto" who played upon the enthusiasm in Exchange Alley as justification of the high prices their Stock commanded. Anderson claimed that the Directors, "as sworn Trustees for the Proprietors, ought to have either stopped the unreasonable Rise of Stock, or else have disqualified themselves, and by a public Declaration to the World have testified their absolute

[142] Archibald Hutcheson, *Some Computations Related to the Proposed Transferring of Eighteen Millions of the Fund of the South Sea Company, to the Bank, and East-India Company* (London: *s.n.,* 1720[1721]). p. 3. Dated 7 January 1720/1.

Disapprobation thereof."[143] John Carswell's definitive 1960 history of the Bubble essentially recounts the entire episode as a calculated fraud, largely concocted by the tireless crook John Blunt. Carswell and Dickson both contend that only some of the Company's Directors and management may have actually had any insight or say into the Company's secretive policies, but neither challenge the idea that there existed a central group of decision-makers who understood the limits of the Stock's real value and lied about it anyway.[144]

Yet the available evidence on how the Company's Directors reasoned about their own decisions about value is rather more equivocal. The greatest insight comes from the seemingly egregious 30%/50% annual dividend promises made in late August. Contemporary observers, including some with close connections to the Company, certainly did not find the August dividend decisions automatically implausible or ethically suspicious at the moment they were made. Some in the City looked upon the decision as a shrewd and perhaps overdue effort to aid shareholders, as the banker Robert Mann reported to Robert Walpole. "I find the Town is well pleas'd with the South's Resolution as to their twelve years dividend," Mann wrote. "The Directors show themselves wth the Ally which indeed they had not done for some time."[145] The manuscript minutes of the Court of Directors provide only sparse records of the collective decision-making of the Court as a whole at such key moments. An entry for August 30 explains the dividend resolutions similarly, noting "That it is the opinion of this Court that a dividend of £30 p[er] Cent on the Capital Stock of this Company… be made to the Proprietors at Christmas next," and noting that that decision was "Resolved, N.C.," or *nemine contradicente* (nobody contradicting).[146] The matter of dividend policy did prompt some further reflection, as the Court of Directors approved an official statement to be made

[143] Anderson includes a vignette about one Company Director who explained to a patron at Garraway's Coffee House that the Company planned to offer their third subscription at a price of £1,000 because "Truly Gentlemen seem to strive to talk us into some such Price, whether we will or no!" See: Anderson, *Origin of Commerce*, Vol. 2 (1764), p. 286.
[144] Carswell, *South Sea Bubble*, p. 149; Dickson, *Financial Revolution*, p. 99.
[145] See: Robert Mann to Robert Walpole, 1 September 1720, CamUL Ch(H) Letters 832, f. [1]^{r}.
[146] Minutes of the Court of Directors of the SSC, Vol. 6, entry for 30 August 1720, BL Add. MS 25,499, f. 45^{r}.

to the "General Court," or general meeting Company Stock owners. The Directors approved a statement that emphasized "the very Great Profits already made, and remaining to be made to the Company," as well as "the many advantages they have reason to belive will (for the Interest of the Publick, as well as of the Company) be given to them" in the future.[147]

The sparse entries in the Company minutes permit various readings. They might suggest that the Company's Directors did have almost unanimous confidence in the valuations they were proclaiming, or alternately might hint that many of the Directors had simply become uncritical or powerless yes-men for Blunt's cabal. At least one retrospective report, key to Dickson's account of the Bubble, strongly denied that there had been generic enthusiasm among the Directors for August's lavish dividend promises. The 1726 *Secret History of the South-Sea Scheme*, published under the name of freethinker John Toland but perhaps the work of a former Company Director, recounted the "voting a Dividend of no less than 50 *l.* per Cent.":

> The very words are childish and ridiculous. It cannot be believed that any one of the Directors thought it a judicious action: but the gaming part of the town being very fond of such a large Dividend for a number of years, the Court of Directors imprudently came into it, merely out of compliance, and to keep up the Stock, till more solid answers could be taken. It must be owned without any subterfuge or evasion, that this was a great inadvertency and error of judgment in so many men: *for the calculations laid before them, to induce them to come into the resolution were as absurd as the declaration itself*. Those Inducements have been afterwards laid before the Parliament, and therefore need not be inserted here.[148]

Two points in the account stand out. First, the author claimed that the Directors chose the dividend policy in part out of a kind of uncertainty, to keep investor enthusiasm up "till more solid answers could be taken." It is not entirely clear what answers the Directors were looking for, but the elliptical phrase nonetheless complicates the Hutchesonian image of the Company as all-knowing about its

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[147] Minutes of the Court of Directors of the SSC, Vol. 6, entry for 8 September 1720, BL Add. MS 25,499, ff. 47^{v}-48^{r}. "Belive" is spelled thus in the manuscript text.

[148] "The Secret History of the South Sea Scheme," in *A Collection of Several Pieces of Mr. John Toland, Now First Publish'd from His Original Manuscripts*…, Vol. 1 (London: Printed for J. Peele, 1726), pp. 404-74, quotation on pp. 437-8. *Emphasis* mine.

own affairs. Second, the author suggested that the Directors at-large were indeed presented with calculations justifying the dividend policies, but they were evidently "absurd." It was only out of an error in judgment or "inadvertency" that the Directors approved the plan, rather than honest belief in what the numbers said.

What were these calculations that the *Secret History* discussed? I have failed to find the supposedly original calculations that Company management may have presented to the Directors in late August, and it is unclear whether they are recoverable, if they existed in the first place. What are available, as the *Secret History* suggests, are the "Inducements" and calculations which were later delivered to Parliament in response to demands from MPs (no doubt Hutcheson in particular). On January 3, the Court of Directors had in fact "went into a Comittee of the Whole Court to consider of Preparing an answer to the Order of the Honble House of Comõns of the 29th. December, Requiring an Account of … the Scheme or Calculation relating to the Dividends."[149] After this off-the-record discussion, the Directors appear to have instructed a Company employee, a Mr. Webster, to compile such calculations, which he presented before the Directors on January 11.[150] Copies made their way to Parliament, along with other requested evidence, and eventually came to rest amongst the Treasury Papers. A copy remains among an uncatalogued packet of papers described by the editor of the 1889 *Calendar of Treasury Papers* as simply "numerous papers, most of them arising out of two acts of parliament" relating to the South Sea Company.[151] While the author of the *Secret History* suggested that these "calculations" and "inducements" were common knowledge, this document appears not to have been seriously considered (if at all) in any of the modern

[149] Minutes of the Court of Directors of the SSC, Vol. 6, Entry for 3 January 1720/1, BL Add. MS 25,499, ff. 108^{r-v}.
[150]The Minutes for January 11 read: "Mr Webster laid before the Court a Calculation on which they proposed a dividend of 30 p[er] Cent at Christmas, and not less than 50 p[er] Cent for Twelve Years after, which was also read, and ordered to be Transcribed fair against the morning, all but the Last Three Lines, beginning at [which dividend]." (Minutes of the Court of Directors of the South Sea Company, No. 6, Entry for 11 January 1720/1, BL Add. MS 25,499, f. 119^{v}.
[151] "The Scheme or Calculation upon which the Court of Directors of the South Sea Company Grounded the Resolutions of Making the Dividend of Thirty p[er]Cent at Christmas & not less than 50 p[er]Cent p[er] Ann for 12 Years," Treasury Papers, NA T 1/231, ff. 163-4; Redington, ed., *CTP, Vol. 6: 1720-1728*, p. 30.

historiography of the Bubble. Judging by the state of the creases in the massive pages, it seems unlikely that the computations contained therein have seen much attention of any kind.

What is perhaps most striking about the Webster's calculation is how plausible it probably was, or at least would have been in the summer of 1720, whatever the protests of the *Secret History*. Webster's computation was not that different from, for example, many of Hutcheson's, requiring only modest variations in a few assumptions to produce a radically more optimistic result. (Webster's calculation is, arguably, the most salient piece of evidence for the argument advanced in Chapter 4—that contemporaries had a range of plausible ways to calculate the value of South Sea Stock in 1720.) The calculation is presented and discussed in detail in **Appendix 3**, but it is worth pointing out a couple of general features. Like many other computations, Webster began with a general account of the Company's current Stock structure, computing how much Stock the Company had left to issue under the stipulations of the original Parliamentary Act. Assuming that all of the holders of outstanding public debts decided eventually to buy into the Scheme—at a price of £1,000 per share—Webster concluded that as of late August, the Company still had some £14.9 million left in unsold Stock that could have been offered to the public. Assuming that this was all sold to the public, again at the price of £1,000, the Company would have been able to raise some £149 million in additional cash. Added to money previously raised from Stock sales, and deducting various debts (including the £7.5 million fee owed to the government), Webster concluded that the Company had effective "Money" available totaling £187.9 million. Webster's next computation was one that Hutcheson would have understood well; he calculated how much, assuming 4% compound interest, this quantity of money could be expected to pay out annually over twelve years. He calculated: "Now as 9£. 7.8½ Imployed at 4 p[er]Cent p[er] Annum Compound Interest will produce an Annuity of 20 shillings p[er] Annum for 12 Years, so 187,854,519.4 being employed at that Rate will

produce ye Ann^l^. Summ of 20,016,464.9."[152] Adding in roughly £2.1 million that could be expected to be paid by the government on their debt, plus a very modest £400,000 for the "advantages expected upon Trade yearly," he concluded that the Company was in a position to pay out £22.5 million a year in dividends. That amount came to just over 50% of the Company's £43.4 million in nominal Stock outstanding. The conclusion—that the Company could pay 50% annual dividends—followed from there.

Two major assumptions made this calculation "work": first, that the Company could indeed expect to get all of the remaining debtholders on board and then sell the maximum amount of Stock to the public at a price of £1,000; and, second, that the Company could somehow earn 4% interest on all of that money and gradually pay it out to its stockholders like an annuity (indeed, like a reverse sinking-fund). The first assumption was definitely optimistic, but not unreasonable. The Company had, after all, sold large portions of that Stock to the public at £1,000. The second was also quite sound in a mathematical sense, though an astute contemporary analyst might have asked some important questions about the practical feasibility of such a scheme. (Where was the £150 million going to come from to pay for all of that new Stock, particularly given Britain's chronic, or at least perceived, scarcity of money? How was the Company going to generate the 4% interest it assumed it could earn, especially given the fact the Company was not allowed to use the money for overt banking activities due to the Bank of England's monopoly? What about the relative timing of the various transactions, and the fact that the Company did not have anything close to £180-200 million in money on hand? Was there any problem with the fact that the plan assumed the Company would pay out all of its cash over twelve years, leaving it with a balance of zero at that point?) But the basic mathematical logic that drove Webster's calculation was that of compound interest. It was largely the same logic, indeed, that drove the calculation of the Equivalent in 1706, the perceived feasibility of

[152] "The Scheme or Calculation upon which the Court of Directors of the South Sea Company Grounded the Resolutions of Making the Dividend…," NA T 1/231, f. 164^r^.

Hutcheson's plans to repay the National Debt in 1715, Walpole's Sinking Fund in 1716, and indeed much of Hutcheson's own analysis of South Sea Stock in March 1720.

As one historian puts it, "to the Augustan mind, compound interest possessed an almost magical lustre, beckoning to a future of limitless wealth."[153] But the attraction of compound interest was not bred purely of folly or avarice. Exponential calculations offered a way to bring the uncertainty of the economic future under the control of the economic present. (This would not, of course, the last financial-mathematical invention to make that promise).[154] It was also a tool whose power and limitations had not yet really been tested. And like contemporary machines that promised to make perpetual motion a reality, the machine of compound interest could mean different things to different audiences.[155] What was a salvific instrument to conquer National Debt for Hutcheson was a creative invention for managing future corporate profits for others.

So what can be learned from this retrospective calculation about what the Company's own leaders might have *known* about the Company's dividend potential or Stock value in summer 1720? Was Webster's January 1721 calculation purely a hindsight attempt at justification, or was it fair representation of the logic employed by Company leadership in coming to the August dividend policy? The answer seems to fall in between these extremes. The calculation provided to Parliament included a "Memorandum" explaining that it was not an exact rendering of the Company's original computations, writing that Company Treasurer "M^{r}. Knight acquainted the Court that the Paper upon which the Calculation was made is Lost or Mislaid, But he and M^{r}. Webster declare this"—the

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153 Geoffrey Wilson Clark, *Betting on Lives: The Culture of Life Insurance in England, 1695-1775* (Manchester and New York: Manchester University Press, 1999), p. 89.

154 Two modern examples would be the Black-Scholes-Merton model for pricing time-dependent derivative securities like stock options and the securitization of pools of high-risk, contingent assets like subprime mortgages. For discussions, see: Donald Mackenzie, *An Engine Not a Camera: How Financial Models Shape Markets* (Cambridge, MA: MIT Press, 2006), ch. 5; Mackenzie, "The Credit Crisis as a Problem in the Sociology of Knowledge," *American Journal of Sociology* 116, no. 6 (May, 2011): 1778-1841; Joshua Coval, Jakub Jurek, and Erik Stafford, "The Economics of Structured Finance," *The Journal of Economic Perspectives* 23, no. 1 (Winter, 2009): 3-25.

155 Simon Schaffer, "The Show that Never Ends: Perpetual Motion in the Early Eighteenth Century," *The British Journal for the History of Science* 28, no. 2 (Jun., 1995): 157-189

January 1721 analysis—"was made agreeable to the same."[156] This brings into doubt whether there ever existed such an original paper, as does the fact that the Court of Directors apparently had to scramble to answer Parliament's demand for such a paper in the first place. At the same time, the calculations themselves indicate that there may have been conscious mathematical intent behind the Company's seemingly outrageous dividend policy. In particular, the Company's choice of exactly *twelve* years as the time horizon for the 50% dividends seems like it may have been a deliberate choice based on computation. According to the assumptions and computational strategy provided in Webster's paper, the Company would not have been able to extend the proposed 50% dividends for a thirteenth-year. The Company did not cite a specific reason for choosing the twelve-year horizon, and there does not appear to have been an obvious, unstated reason for the selection.[157] In other words, the specific promise of twelve years of 50% dividends—as opposed to eleven or thirteen—was likely a derivation of mathematical analysis.

It is hardly certain, of course, that anyone within this Company deduced the twelve-year horizon for precise computational reasons. Nor can we say, if they did, they did so out of honest belief that the dividend plan would "work," rather than out of a desire to create something that was, shall we say, mathematically plausible. What is perhaps clearest about the "Company's" collective understanding of its Stock value and dividend potential is that there was no single answer. In speaking of the evident absurdity of the calculations that the Company's managers presented to the Directors, the author of the *Secret History* did protest far too much. Some Directors may indeed have thought the calculations were absurd; yet others potentially found them convincing, and the largest

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[156] "The Scheme or Calculation upon which the Court of Directors of the South Sea Company Grounded the Resolutions of Making the Dividend…," NA T 1/231, f. 164r.

[157] One plausible explanation for the twelve-year horizon, for example, might have been that the terms of the Parliamentary act originally approving the South Sea Scheme allowed for major changes to the arrangement between government and Company after twelve years, but this does not appear to have been the case. The major change in the terms between government and Company came after 1727 (a seven-year horizon), when the government's effective interest paid to the Company decreased to a flat 4%. Note that the pro-Company *South-Sea Scheme Examin'd*, which had tried to justify the Company's value based on its dividends using similar compound interest logic, had adopted a fourteen-year horizon (see Chapter 4, section V).

group probably found them too confusing to follow. In a recent ethnographic study of the invention of a new derivative security (the "CGP") at a major French investment bank in 2000-2001, sociologist of finance Vincent Lépinay has shown in vivid detail how many differences—in expertise, agenda, language—divided the various actors involved in the development and sale of one financial object.[158] Coordinating across these complex "topographies" was highly difficult and highly complex. As Lépinay puts it, the story of the invention of the CGP is "a story of highly localized practices and competing idioms struggling to live up to the blueprint of a global financial product."[159] In a similar way, the South Sea Stock was built out of the often uncoordinated actions of a variety of different actors: not just the schemers like Blunt, but the Directors who affirmed the policies, the clerks who carried out the calculations, the politicians who promised the Scheme support, and more. Different participants carried different notions of what "value" really was. In the retrospective computations composed by Webster we see, in a sense, the Company collectively trying to "live up to the blueprint" of what a single, coordinated financial object ought to look like—the blueprint that Hutcheson and the Parliamentary investigators had drawn up.

This analysis is not intended to exculpate any of the Company's Directors, many of whom were undoubtedly crooked. Rather, it encourages us to contemplate whether some people very close to the center of Company power might have honestly believed that the Company's Stock really was worth £1,000, and out of more than just gullibility or greedy wishful thinking. Even more, looking at the South Sea Company's own computations forces us to consider why these alternative computational perspectives have never really been considered. Perhaps the most interesting thing about Webster's computation on the late-summer dividends, buried in a miscellaneous packet of papers in the National Archives, is how completely untouched it seems to have been. Most people interested in the South Sea Crisis seem never to have looked at that calculation seriously at all. (The

[158] Lépinay, *Codes of Finance.*
[159] Lépinay, *Codes of Finance*, p. 9.

editor of the *Catalogue of Treasury Papers*, for example, did not.) It is a vivid metaphor for how easily alternative expressions of economic reasoning, once plausible in their own day, can become forgotten over time.

Even more, the specific story of Webster's calculation suggests one way such forgetting can happen.[160] Most of the MPs (outside of Hutcheson) who might have looked at the computation in passing would not have felt capable of making much sense of what it said. But that did not matter much. Most of the angry Parliamentary investigators already knew that what was contained in those papers was *wrong*. Wrong, that is, in a moral sense. And thus, wrong in a mathematical or economic or logical sense as well. But perhaps we ought to consider that those calculations were not quite *as* wrong as the Company's rampant bribery of political officials or doctoring of official ledgers. Or at least wrong in a very different kind of way.

VI. Conclusion: the Ethics and Epistemology of Financial Value

The bursting of the South Sea Bubble affirmed Archibald Hutcheson's understanding of financial value, both in mathematical-economic sense and a moral-political one. But that vindication was no simple or passive process; Hutcheson actively created a retrospective image of the Crisis as an event explicable through his calculations. For one, the collapse of the Stock's value and the massive losses suffered by many unwitting investors ratified many of Hutcheson's central analytical claims about the technical risks of the Scheme and the intrinsic value of South Sea Stock. It demonstrated that the Company's market price was largely imaginary, unsupported by the Company's accountable financial resources. It also revealed that the Scheme was at its core a machine for redistributing wealth from new generations of South Sea investors to older ones. Yet the enduring impact of Hutcheson's

[160] It appears that the specific copy of the calculation in the Treasury Papers, like other papers filed by the Company with Parliamentary investigators, got sent along to William Lowndes, trusty Treasury Secretary, for review. See Treasury Papers, NA T 1/231, f. 164^{v}, as well as, e.g., ff. 176^{r}.

interpretation of the Bubble, both in his own time and for centuries beyond, cannot be explained purely by these empirical successes.[161] In order to understand the success of the Hutchesonian interpretation, it is necessary to appreciate its resounding success in political and moral terms. Hutcheson's financial mathematics up to the beginning of the South Sea Scheme in early 1720 were largely cautionary tools aimed at framing the dangers of political and economic secrecy. Viewed in terms of these intentions, the catastrophic results of the South Sea Scheme signaled an unqualified analytical success for Hutcheson. What truly confirmed his predictions was not just the empirical fact of the collapse of the South Sea Stock, but the incredible revelations of deliberate criminal malfeasance behind the Scheme. The bribery, the record-tampering, the cover-up—these were arguably more important evidence in confirming Hutcheson's foresight than was the collapse of the Stock itself.[162]

Yet the success of Hutcheson's political-moral prediction about the dangers of the South Sea Scheme did seem to confirm that his mathematical perspective on the nature of financial value was itself correct. Methods of calculation that had been developed as forms of interrogation became normative evidence themselves, inserted in between reports of doctored ledgers and the testimony of Company employees. Behind this transformation was a kind of logical sleight-of-hand, or at least logical recursion. In retrospect, Hutcheson's computed values for South Sea Stock were offered as evidence of the Company's unethical behavior. But, it was the external evidence of the Company's corruption that made it possible to select those specific valuations from the many others that had

[161] In her analysis of the 1720 Crisis as a "rational bubble," Helen Paul writes in no uncertain terms that "Hutcheson did not predict the South Sea Bubble." (*South Sea Bubble*, p. 77). Instead she argues that Hutcheson's criticisms of the South Sea Scheme had "more to do with his fears of its success than its failure," and therefore should not be taken as evidence that contemporaries could have known better than to invest in the Company had they heeded his advice. Paul overstates the point, but she is certainly right that it does not make sense to look at Hutcheson's analysis of the South Sea Scheme as an instance of purely rational financial foresight, nor as a demonstration of the kind of reasoning of which other eighteenth-century investors ought to have been capable.

[162] Hutcheson in fact criticized others for making too much of the fall of stock prices, mocking those who claimed that "the fall of South-Sea Stock from 1000l. to under 200l." represented "the loss of Publick Credit, and a Ruin to the Nation." (*Some Computations Relating to the Proposed Transferring* (Jan., 1720/1), p. 3.)

been offered. Hutcheson's computational analyses worked as well as they did in large part because he and many of his peers already *knew* the Company was a fraud all along.

Hutcheson's interpretation did not, of course, completely silence alternatives, and he was not without his critics. Different contemporary observers of the Crisis tended to distribute blame differently than Hutcheson did, and some even offered very different models for thinking about the ethics and epistemology of financial value.[163] The alternatives notwithstanding, the core elements of Hutcheson's picture have endured as central parts of how the South Sea Bubble has been understood for centuries: the idea that South Sea Stock always did have a single and knowable "intrinsic value"; that many in the Company had to have known it; that they defrauded the public by selling new Stock and promising dividends that violated that basic mathematical truth. The range of possible ways to tell the story of the value of South Sea Stock during the Crisis of 1720 has only gotten smaller with time. With a canonical retelling in each of the subsequent centuries—Adam Anderson in the mid-eighteenth century, Charles Mackay in the mid-nineteenth, John Carswell in the mid-twentieth—the basic hold of Hutcheson's story became tighter even as his own name became more obscure. Indeed, the decoupling of Hutcheson's interpretation of the Bubble from Hutcheson himself is emblematic of a broader process, whereby over centuries the growing hold of certain economic orthodoxies has made it difficult to appreciate the peculiar ideas, ethics, and calculations that shaped financial understanding in a past historical time. Only in the twenty-first century have new digital archives and new topical concerns about past bubbles brought Hutcheson's name back to the fore—and encouraged us to think about the historical strangeness of his ideas about financial value, rationality, and responsibility.

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[163] While it is beyond the scope of this chapter to explore them in detail, two particularly interesting alternatives can be found in: [Anon.]*The History of the Rise and Fall of South-Sea Stock, with a Method Humbly Proposed for the Relief of the Sufferers of All Sorts, in a Letter to a Friend* (London: Printed for the Author, by J. Tonkey, and Sold by J. Robert, n.d. [1721?]), p. 15; "Timothy Telltruth" [Anon.], *Matter of Fact; or, The Arraignment and Tryal of the D—RS of the S—S—Company, with The Pleadings of the Counsel on Both Sides* (London: Printed for John Appelbee… W. Boreham… and A. Dodd, 1720), p. 14, 37-9.

The Hutchesonian vision, indeed, had ramifications that transcended his own career or the specific event of the South Sea Bubble.[164] Two such impacts are worth pondering in closing, one which speaks to the broad theme of this dissertation and one which speaks more to a longer history of financial epistemology. First, the central role of mathematical analysis in discussions of the South Sea Bubble marked a climactic moment in the political career of calculation in the half-century after 1688. The South Sea Bubble probably did more than any other single event to convince Britons that computation had to be a necessary part of political discourse and an expected capacity of anyone entrusted with political power. On April 4, 1721, the Hutcheson wrote in the preface to one of his seemingly endless pamphlets on the Bubble: "This is the last Time I shall appear in Print on this Subject, or, perhaps, on any other; for it is with Satisfaction that I observe, That the late reigning Madness is well-nigh cured; That Men have again recovered their Senses, and begin to *reason* and *compute*."[165] Hutcheson was wrong about being done publishing on such matters. But he was right about one thing—people had begun to "reason and compute," or more specifically to think that the two were one and the same.

Britons of course had computed about financial matters before 1720. Yet one of the vital legacies of the Crisis—and Hutcheson's interpretation of it—was that it gave members of the British public glaring evidence that computing was something that ought to be done, not only by individual investors but especially by those corporate leaders and political representatives in whom public trust had been placed. Larry Stewart, by comparison, has explored how the "frantic bustle of the Financial Revolution," and particularly the threat of commercial catastrophe borne in projects like the South Sea Scheme, created new public demand for experimental philosophers who could teach the

[164] There were ways in which Hutcheson's vision did not triumph, specifically when it came to the punishments meted out to the Company's Directors. Thanks largely to the political protection or "screening" of Sir Robert Walpole, who assumed primary command of government affairs shortly after the Bubble's collapse, many of the Directors received relatively light sentences. This was not without popular opposition. Walpole, the "Screen," and the aftermath of the Bubble are considered in greater detail in Chapter 6.

[165] Archibald Hutcheson, *Some Further Computations Relating to South-Sea Stock. With a Proposal to Be Made Therefrom, to Be Laid Before the House of Commons*… (London: *s.n.*, 1721), p. 4. Dated 4 April 1721.

denizens of the coffee houses what to believe about the natural world.[166] While the crises of 1720 may have cause some Britons to momentarily doubt the honesty of calculation—"mathematics, in some minds, had gone mad"—it had the far greater effect of heightening desire for more powerful, more accurate, more legible calculations.[167] Bad numbers begat good ones, in financial matters foremost of all. In this sense, the failure of the South Sea Scheme marked the crowning success of a tradition of critical, external political arithmetic that dated to Charles Davenant. New expectations about what Davenant once called the "Computing Faculty" of ministers, and the impact that the South Sea Bubble had on them, would become especially evident in the ministerial career of Sir Robert Walpole, the topic of our next and final chapter.[168]

Second, Hutcheson's interpretation of the South Sea Crisis was an essential, early moment in the development of modern ideas about financial value. It helped established a vital epistemological and ethical model for managing the uncertainties of new forms of financial wealth. Financial agents were expected—indeed assumed—to understand the value of what they sold, and any major misalignment of a stock's price with its value fell upon them. This ethical vision bore along with it a clear set of epistemological commitments. Hutcheson believed that financial "intrinsic value" was something that was knowable with absolute certainty, so much so that the retrospective calculation of such values could be invoked as a kind of legal evidence.

In his recent *Framing Finance,* Alex Preda has offered a sociological explanation of how finance became, over time, defined and bounded as a socially and morally legitimate activity. Preda contends that it was not until the late nineteenth century and the rise of "Chartist" analysis (the graphical analysis of stock price movements) that finance came to be seen as a legitimate object of

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[166] Larry Stewart, "Others Centre of Calculation, or, Where the Royal Society Didn't Count: Commerce, Coffee-Houses and Natural Philosophy in Early Modern London," *The British Journal for the History of Science* 32, no. 3 (Jun., 1999): 133-153, quotation on p. 152; Stewart, *The Rise of Public Science: Rhetoric, Technology, and Natural Philosophy in Newtonian Britain, 1660-1750* (Cambridge, UK and New York: Cambridge University Press, 1992).
[167] Stewart, "Other Centres of Calculation," p. 153.
[168] Charles Davenant, *Discourses on the Publick Revenues, and on the Trade of England,* Vol. 1 (London: Printed for J. Knapton, 1698), p. 6.

expert knowledge and therefore deserving of social approbation. By contrast, he argues that eighteenth-century observers generally believed that financial values were "radically unknowable," outside the realm of calculation.[169] Yet, we have seen that, before the collapse of the South Sea Bubble, plenty of eighteenth-century observers felt confident in their valuation skills, some going so far as to suggest that stock-jobbing already had its own "science." Despite the trauma it caused, the South Sea Bubble did not destroy this confidence. The experience of the Bubble, and the work of Hutcheson in particular, offered instead a conservative but potentially certain vision of "intrinsic" financial value based on the net worth of a company's most solid capital resources. In turn, it helped entrench a bifurcated understanding of financial value as containing an unpredictable "imaginary" part and a knowable real one.[170] Oddly, the South Sea Crisis may have given contemporaries even *more* reason to believe in the calculability of financial value.

[169] Alex Preda, *Framing Finance: The Boundaries of Markets and Modern Capitalism (*Chicago and London: University of Chicago Press, 2009), p. 86.

[170] The Chartists' science of value in the nineteenth and twentieth century may be said to have been an attempt to create a science of that aspect of financial value which had long been relegated to the *imaginary*.

– CHAPTER 6 –
FUTURES OF CALCULATION
The Politics of Arithmetic in the Age of Walpole

In his provocative arithmetical polemics of the 1690s, Charles Davenant returned often to one particularly incisive style of critical calculation. The strategy was simple, but demanded analytical skill and computational creativity: Consider a particular tax. Using whatever external information might be assembled, compute a reasoned estimate of what that tax ought to yield. Compare that calculated expectation to the best recent data on what that tax actually produced. Derive a suitable political conclusion. The most inventive calculation in his 1695 *Essay upon Wayes and Means*, the work which made his name, followed this recipe. His concern there was "poll money," a war-time direct tax required of individuals, based on social status and occupation.[1] Davenant stitched together a rough demographic picture of the English population, using indirect data like hearth tax returns and the number of land tax commissioners as proxies for the size of different social groups. From this patchwork census, he determined that the poll tax was under-producing by over £200,000 per year. In his more extensive *Discourses on the Publick Revenues*, Davenant developed even more elaborate analyses of a wide range of poorly performing taxes.[2] That computational procedure embodied Davenant's use of political arithmetic as a tool of critique. Calculation made it possible to compare the political situation as it was, to the political situation as it ought to be, to measure the distance between ideal and reality.

As we have seen in the preceding chapters, other prominent quantitative polemicists like William Paterson and Archibald Hutcheson offered creative variations on this computational theme, figuring out how to use external numerical reference points to assess the efficacy of government tax

[1] [Charles Davenant], *An Essay upon Wayes and Means of Supplying the War* (London: Printed for J. Tonson, 1695), pp. 54-55. See also Chapter 1, Section IV.
[2] Charles Davenant, *Discourses on the Publick Revenues, and on the Trade of England…*, Vol. 1 (London: Printed for J. Knapton, 1698), Discourse III, "On the Management of the King's Revenues," esp. pp. 101-102.

policies and procedures, past and future.[3] But perhaps the archetypal example of Davenant's method for analyzing tax policy can be seen in the early 1730s, in the form of a short treatise exploring Customs taxation, in the papers of Robert Walpole.[4] It applied the Davenantian formula with expert care to the Customs taxes on the burgeoning Maryland and Virginia tobacco trade (**Figure 6a**). The anonymous author—possibly Walpole but more likely one of the many calculators in his employ—began by stating that 63,687 hogsheads of tobacco were imported to Britain per year, based on a seven-year average or "medium." He assumed 720 pounds per hogshead, based on a survey of twelve ships each from Virginia and Maryland, made an adjustment for damaged tobacco, and estimated what fraction of total imported tobacco was not re-exported, and therefore was subject to Customs (he estimated one-third).[5] That implied roughly 15.1 million pounds consumed in Britain annually, which at the Customs rate of 4¾*d.* per pound, implied annual revenue of over £299,000. Yet net revenues had averaged only £160,000 per year in the past seven years. Even admitting several favorable adjustments, this represented a massive shortfall of over £120,000 per year.

[3] See Chapter 2, Section II and Chapter 5, Section I.
[4] Untitled manuscript calculations relating to Customs duties on Maryland and Virginia tobacco, [c. 1733?], CamUL Ch(H) 43/11/2.
[5] Goods re-exported were entitled to a "drawback" or refund of Customs paid when the goods were re-shipped out of Britain. "As people differ concerning the Quantity of Tobacco used for home consumption," the calculator explained, he intended to use the "Lowest Estimate" available, namely that only one-third of tobacco was consumed at home.

Quantity	Value		Unit
"Tobacco... brought into Britain from Virginia and Maryland," annually (7-year average)	63,687		Hhds.
Weight of tobacco, per hogshead (based on an average sample of 12 ships)	720		lbs.
Total weight of tobacco imported, annually	45,834,640	(*)	lbs.
"From which... being deducted for damage Tobacco cut off before weighed"	(481,301)		lbs.
"Nett" weight of tobacco imported, annually	45,353,339		lbs.
Fraction of "Tobacco used for home consumption," based on the "Lowest Estimate"	1/3		
Quantity of Tobacco used for home consumption	15,117,780		lbs.
Rate of impost on tobacco, "dear of all deduction"	4 3/4		d.
Imposts on Maryland and Virginia tobacco "should produce annualy"	**£299,206**		£
"The nett money paid into the Exchequer… upon the Impost of Tobacco" (7-year average)	160,625		£
Customs paid in Scotland, estimated	4,000		£
Paid out of impost on tobacco, for charge of management	8,000		£
"Nett produce" of imposts on tobacco	**£172,625**		£
"Which is less than it ought to produce upon the foregoing Estimate"	126,581		£
Less: "The price of the Insurance upon the Quantity ship'd may amount"	(6,000)		£
"Sum... lost by different frauds committed in the Collection of this Revenue"	**£120,581**		£

Figure 6a: Table, showing a calculation comparing expected and actual produce of Customs taxation on Maryland and Virginia tobacco, adapted from CamUL Ch(H) Papers 43/11/2. (*) Note: The calculation of total tobacco imported annually (lbs.) is irregular, as 63,687 times 720 equals 45,8**5**4,640, not 45,834,640. This is likely a computational or transcription error.

The author had deftly followed Davenant's procedure, using external data—in this case, volume of tobacco imported, by weight—as the foundation for a reasoned calculation of what tax revenues ought to be.[6] For the calculator, it was quite clear where this shortfall came from. It was "lost by different frauds committed in the Collection of this Revenue." He listed various tricks: taking a refund or "drawback" for more tobacco than actually re-exported, exporting tobacco and then sneaking it back into Britain, surreptitious "pilfering," bond defaults, and more. Though the manuscript calculation is brief, its agenda is clear—to demonstrate the considerable flaws in current

[6] I know of no similar analyses showing that particular taxes met or *exceeded* expectations. This apparent absence likely stemmed from multiple factors. For one, tax collection likely was "inefficient," in the sense that receipts rarely came close to their potential due to evasion, corruption, and administrative challenges. More importantly, the prominence of such "underperformance" arguments is indicative that innovations in computational analysis were driven by the desire to critique governmental practice, not praise it. Patrick O'Brien points out: "almost everywhere in ancien regime Europe the traditional machinery in place for the assessment and collection of taxes was perceived at the time (and has been represented by historians since) as corrupt, oppressive, and above all inefficient—in the sense that the gap between net revenues received and taxes assessed… became and remained unacceptably wide." (Patrick K. O'Brien, "Fiscal Exceptionalism: Great Britain and Its European Rivals from Civil War to Triumph at Trafalgar and Waterloo," Working Paper no. 65/01, Department of Economic History, London School of Economics and Political Science (Oct., 2001), p. 22.)

methods of Customs taxation and suggest that a change needed to be made. But whereas Davenant's many printed calculations in the 1690s were aimed at critiquing government policy from the outside, this analysis of tobacco Customs was part of Walpole's own, governmental effort to overhaul tax policies, instituting major new domestic Excise taxes on the consumption of tobacco and wine.[7] A key justification for Walpole's "Excise Scheme" was that the current methods for taxing wine and especially colonial tobacco were irreparably broken.[8]

The analysis of tobacco Customs provides an especially crisp example of how the practice of political calculation, and especially computational critisicm, was internalized within executive government in the age of Walpole. Davenant had written in 1698 that "the Abilities of any Minister have always consisted chiefly in this Computing Faculty."[9] It was Walpole, perhaps more than any other politician or minister in the half-century after 1688, who most completely embodied Davenant's hopeful dictum.[10] This final chapter seeks to explore Walpole's "Computing Faculty" by examining two key episodes: the restructuring of the South Sea Company in the aftermath of the 1720 crash, and the continued fate of the "Sinking Fund," a fiscal invention for managing the National Debt first implemented by Walpole. I argue that the centrality of calculation in Walpole's government, both in private and public, testifies to how deeply embedded, even commonplace, computational logic had become to the practice of political reasoning in eighteenth-century Britain. This is not to say that Walpole was the first minister to embrace calculation as a valued tool of governance, nor that he was a financial "genius," nor that he ushered in more methodical, efficient,

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[7] The standard study is Paul Langford, *The Excise Crisis: Society and Politics in the Age of Walpole* (Oxford: Clarendon Press, 1975).

[8] As Langford notes, there is some debate as to whether the problem of Customs fraud was really the immediate impetus for Walpole's Excise policy, or rather one of many reasons cited for a policy that had broad motivations. (See *Excise Crisis,* pp. 26-31.) Walpole's papers concern many texts concerning Customs frauds (especially CamUL Ch(H) Papers 41, esp. 41/17; 43/11/6).

[9] Davenant, *Discourses on the Publick Revenues*, Vol. 1 (1698), p. 6.

[10] It is perhaps ironic that the 1690s vision of political arithmetic formulated by Davenant—the Tory, the frustrated outsider, the public critic—were most clearly realized by Walpole—the Whig, the inside dealer, the master patron. But such ironies—between outside and inside, criticism and legitimation—are central to the story of calculation in British political life in the eighteenth century.

or accountable procedures in public administration.[11] This is, instead, an argument about what Walpole tells us about the practices and patterns of political cognition in eighteenth-century Britain. It is about *how* Walpole and his contemporaries thought, not *how well*. The extensive and varied numerical archive that remains in Walpole's vast papers, particularly in manuscript, leaves no doubt that his was a government—and a political culture more broadly—in which decisions were *calculated*.

The arithmetization of British politics by the age of Walpole was evident on multiple dimensions: cultural, social, and epistemic. First, it was a phenomenon of political culture in- and out-of-doors. In private decision-making, Walpole and his advisors thought *through* calculation. Walpole's papers are dense with creative and speculative computational models, often in-progress, developed to analyze current and future policies. At the same time, Walpole and company were highly attuned to the consequences of numerical claims in public spaces of political deliberation, especially Parliament and the press. Walpole had himself been the victim of a bitter computational attack early in his career, courtesy of Harley and the Tories, and he remained highly attuned to the importance of controlling public numerical discourse on key issues. He and his supporters not only crafted their own calculations for circulation, but also anticipated quantitative counter-arguments and diligently reconstructed and critiqued the computational efforts of opponents, from familiar foes like Hutcheson to new ones like William Pulteney. Second, Walpole's "Computing Faculty" was as much a social phenomenon as a cultural one. Davenant, for example, had argued that political arithmetic was not just a method of quantitative analysis, but a method for the social organization of political knowledge. "A great Statesmen," he wrote in the *Discourses*, formed his judgments only after

[11] Many of Walpole's predecessors and competitors were of course competent calculators and knowledgeable about trade and revenue: Danby, Montagu, Godolphin, Harley. Furthermore, administrative historians like Henry Roseveare have argued that standards of professionalism and accountability declined under Walpole's supremacy, as the first minister relied heavily upon the allocation of administrative places in managing political relationships. (Roseveare, *The Treasury, 1660-1780: The Foundations of Control* (London/New York: George Allen & Unwin/ Barnes and Noble Books, 1973), pp. 58-60).

"consulting all sort of Men" and "by summing the Difficulties on either Side."[12] Though a very competent calculator himself, Walpole's computing faculty derived largely from his ability to mobilize and synthesize the computational energies of others. These ranged from key City figures like Nathaniel Gould, to his personal financial advisor Robert Jacombe, to a more anonymous collection of minor clerical officials, accountants, and hack writers.[13] Walpole indeed commanded a network of men-on-the-make who sought professional advancement through their computational services to the Prime Minister.[14] Men like John Crookshanks.[15]

Third, and most critically, the numbers that populated Walpolean political deliberation and communication revealed emergent changes in political epistemology. Particularly remarkable was a subtle transformation in the shape of political time. The era of Walpole saw the political *future* come nearer at hand, as technologies of calculation made it possible—and necessary—to reason in new ways about political outcomes that had not yet occurred. To borrow an (admittedly clunky) sociological term, the tools of economic calculation "appresented" the future in British political life—that is, they brought the "distant 'near' to participants, rendering it interactionally or response-

[12] Davenant, *Discourses upon the Publick Revenues,* vol. 1 (1698), pp. 13-14.

[13] For examples of letters with Gould, see: Nathaniel Gould to Robert Walpole, 18 April 1720, Ch(H) Letters 783; Gould to Walpole, 12 April 1733, Ch(H) Letters 1967. For Jacombe, see the discussion in Section II below.

[14] As Davenant had once written of political-economic calculation: "There is in this Art a Sphere for lower Capacities to move in, who can presume no further than to find out and prepare Materials, to be made use of by abler Hands." In the context of the *Discourses*, Davenant counted himself among these men of "lower Capacities." (Davenant, *Discourses upon the Publick Revenues,* Vol. 1 (1698), p. 25.)

[15] Crookshanks became a computational advisor to Walpole during the 1710s while holding a place as controller-general of the Customs. Following a major falling-out between Walpole and the Whig leadership under Sunderland and Stanhope, Crookshanks was driven out of government, under the pretense of irregularities in Customs accounting. After his ouster, Crookshanks continued to communicate regularly with Walpole on matters like the accounting of imports and exports of tobacco (October 1721), Customs on tobacco and wine (July 1724), "Errors in the Printed accompts of the National Debt" (February 1727), and the anticipation of the Sinking Fund (April 1727). Crookshanks also offered commentaries on critical pamphlets and drafted polemical materials for Walpole relating to conflicts over National Debt in 1727. In return for his services, Crookshanks appears to have earned a diplomatic position in Spain in the early 1730s. For details, see: "The Case and Petition of John Crookshanks," enclosed in John Crookshanks to Robert Walpole, 28 March 1727, Ch(H) Letters 1415; Jacob M. Price, "Glasgow, the Tobacco Trade, and the Scottish Customs," *The Scottish Historical Review* 63, no. 175, Part 1 (Apr., 1984): 1-36, esp. pp. 8-12; CamUL Ch(H) Letters 923, 1140, 1405, 1417, 1944, 1948; CamUL Ch(H) Papers 73/10-10a. Crookshanks may also have been the author of two manuscripts from the 1730s on plans to refinance government annuities (BL Add. MS 74,066, item nos. 18/10-11).

present."[16] Two particular mathematical tools proved essential. First, the multivariate model, so key to Hutcheson's computational polemics, became central to how Walpole and his calculating confidants thought through the future consequences of political decisions. Second, exponential mathematics proved a powerful technology for projecting present power into future glory, and vice versa, as evident in the celebration of Walpole's Sinking Fund as a means of conquering the National Debt. The conquests over the deep political future that occupied the Walpolean era, particularly around the Sinking Fund, provide some of the strongest evidence of the authority attained by quantitative reasoning in the decades since 1688.

The conquests over the financial future that followed 1720 were also illustrative of a broader epistemic transition in the eighteenth century—the emergence of predictive or "forward-looking" reasoning across many cognitive activities. In a 1976 article surveying the history of science, education, law, and commerce in England, Edward Jennings argues that there occurred a distinct cultural "transition, between 1600 and 1800, from an attitude that individual and social destiny is beyond human control to an attitude that the future can be predicted and affected by human behaviour."[17] Yet this was no smooth transition, as Jan Golinski and Will Slauter have recently shown.[18] In areas from weather forecasting to wartime news-reporting, Britons in the early eighteenth century began to acknowledge clear benefits in "speculating" about what was likely to occur in future time. Yet, as Golinski notes of climate observers, those who aspired to understand future weather by analyzing empirical patterns confronted skeptics who claimed such predictions were no better than astrological divination. Slauter notes that political writers in the early 1700s felt

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[16] Karin Knorr Cetina and Urs Bruegger, "Inhabiting Technology: The Global Lifeform of Financial Markets," *Current Sociology* 50, no. 3 (May, 2002): 389-405, on p. 392. The authors' example is the way in which the technology of computer screens "appresents" the space of currency markets for traders.

[17] Edward M. Jennings, "The Consequences of Prediction," *Studies on Voltaire and the Eighteenth Century* 153 (1976): 1131-1150, on p. 1131.

[18] Jan Golinski, *British Weather and the Climate of Enlightenment* (Chicago and London: University of Chicago Press, 2007), esp. ch. 3; Will Slauter, "Forward-Looking Statements: News and Speculation in the Age of the American Revolution," *Journal of Modern History* 81, no. 4 (Dec., 2009): 759-792.

similar tensions.[19] Daniel Defoe, for example, lamented that even though "the Calculation of Probabilities may give a Man an insight farther into an Affair, and its Consequences, than every one may think possible," yet "when what was rationally deduc'd comes to pass, the Man is taken for a Conjurer."[20] Yet eventually this skepticism yielded, and I suggest that financial politics may have been vital to this shift.[21] In the aftermath of the South Sea Bubble, public finance became one area in which it was impossible to dispute the value of reasoned prognostication, even about the very distant future. After 1720, for example, Archibald Hutcheson had actively promoted his own former political foresight as an example of his service to his nation. So indeed did Robert Walpole, who also argued that the nation would have avoided the perils of the South Sea under his forward-looking leadership. Walpole took predictive politics even one step further, using mathematical calculation to claim credit for national triumphs, like the extinguishment of the National Debt, that had not yet occurred, and would not for decades to come.

I. Walpole's Missing Millions and the Culture of Computational Combat

Elected MP in 1701, Walpole rose to political prominence through a series of technically-demanding positions of administrative trust, appointed a member of the Council of the Lord High Admiral in 1705 and Secretary at War in 1708.[22] In 1710-11, he enjoyed a brief spell as Treasurer of the Navy, where he became the target of one of the most violent numerical attacks of the age. Shortly after a

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[19] Slauter, "Forward-Looking Statements," pp. 778-80. For an example of the most extreme enthusiasm for political prediction, see the Tory John Asgill, who wrote in a 1713 pamphlet entitled *Dr. D—nant's Prophecy* that he thought "nothing would do more Service" for his country "than to give them some *Predictions*, that so being warn'd of their Danger, they may prevent it." ([Asgill], *Dr. D—nant's Prophecys* (London: Printed for A. Baldwin, 1713), p. 3.)

[20] Daniel Defoe, *Review of the Affairs in France*, 9 December 1704, quoted in Slauter, "Forward-Looking Statements," p. 779. Hutcheson himself was accused of being "Conjurer" at points in his career. See: [Anon.], *A Letter of Advice to Archibald Hutcheson, Esq; Occasion'd by His Pretended Letters to the Earl of Sunderland* (London: Printed for A. Moore, 1722), p. 17

[21] Slauter also emphasizes the importance of financial motivations in the increased interest in "forward-looking statements" (see pp. 770-7), though I examine both an earlier time period (the 1720s-30s rather than the 1760s-1770s) and a different kind of financial prediction (the public-political rather than private-speculative).

[22] The standard, two-volume biography of Walpole is J. H. Plumb, *Sir Robert Walpole, Volume I: The Making of a Statesman* (London: Cresset Press, 1956); Plumb, *Sir Robert Walpole, Volume II: The King's Minister* (London: Cresset Press, 1960).

landslide Tory victory in the general elections of autumn 1710, the new Tory ministry under the leadership of Robert Harley began an aggressive interrogation of administrative and accounting practices under previous Whig officeholders. The attacks came complete with scathing pamphlets, courtesy of Daniel Defoe, explaining the Tories' heroic "Search After the Great Plunderers of the Nation."[23] Harley's hounds particularly assailed those Whig agents responsible for managing various "imprest" funds for the Navy. (The "imprest" system was a method of fiscal management and accounting akin to a petty-cash system, though on a much larger scale, whereby a rough quantity of money was advanced upfront to cover expenses, and then the total funds used were summed up after the fact.) In April 1711, the Auditor of the Imprest Edmund Harley (Robert's brother) presented a report to the Commons from a committee specifically composed to investigate "how far the several Imprest Accomptants had passed their respective Accompts."[24] The report of Auditor Harley and the committee suggested that a total of more than £35 million, which had been granted by Parliament before Christmas 1710 under the imprest system, had not been accounted for by the appropriate officials, an accusation which hit particularly hard at Walpole as Treasurer of the Navy.[25] It was a shocking, if admittedly misleading, figure, and it caused a modest public stir. "In many parts of the Country," Walpole observed in one defensive pamphlet on the matter, "our People were taught to think they had been plunder'd of Thirty five Millions."[26] (This was not, of course, to say that Walpole had not himself been involved in some fiscal chicanery, but £35 million was an unrealistic amount to embezzle.)

The affair of the disappearing millions gave Walpole a firsthand lesson in political-numerical combat, thanks to one of the very best in Robert Harley. Walpole and fellow Whig propagandist

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[23] [Daniel Defoe], *The Re-Representation: or, A Modest Search After the Great Plunderers of the Nation* (London: *s.n.*, 1711).
[24] See: *The Report from the Committee Appointed to Enquire How Far the Several Imprest Accountants Have Passed Their Respective Accounts*… (London: Printed for Samuel Keble… and Henry Clements, 1711).
[25] On Walpole's involvement with the "missing millions" affair, see Plumb, *Walpole, Vol. I: Making of a Statesman*, pp. 169-182.
[26] [Robert Walpole and Arthur Maynwaring], *A State of the Five and Thirty Millions Mention'd in the Report of a Committee of the House of Commons* ([London?]: s.n., [1711?]), p. 1.

Arthur Maynwaring published detailed technical writings on the complicated imprest system, trying to explain why so much money was appropriated for naval use by "computation" after-the-fact rather than "estimate" before-the fact, and why £35 million not-yet-accounted-for did not mean that £35 million had been stolen.[27] These instructive polemics only went so far, though. J. H. Plumb contends that "there can be little doubt that the accusation of the ministry obtained a wider currency" than did the well-reasoned but convoluted rebuttals of Walpole and his defenders.[28] In the "missing millions" affair, Walpole saw both how much political leverage could be gained by citing provocative numerical evidence and controlling numerical discourse. He also saw how difficult it became to make a politically compelling argument (or personal defense) reactively rather than proactively, particularly the more convoluted the calculations became.

Walpole may also have come to learn that, no matter what its sources, numerical uncertainty came with a political cost. One of the main arguments that Walpole and Maynwaring tried to marshal in defending the missing millions was that large quantities of money appropriated for naval use more or less *had* to go unaccounted for, because naval affairs were so riddled with unknowns—shipwrecks, naval battles, weather, delays, costs of stores and victuals—that the only way to do business was to entrust administrators with large amounts of money and then settle up at the end. "By the nature of these Services it appears impossible, at first sight, to fix and ascertain the exact Expence upon any Head except that of Wages," they tried to explain in one pamphlet. "For how can it be foreseen that the Loss or Damage of Ships by Storms, or by the Enemy, shall be just so much

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[27] See: [Arthur Maynwaring and Robert Walpole], *A Letter to a Friend Concerning the Public Debts, Particularly That of the Navy* ([London?]: *s.n.*, 1711), esp. p. 1. Also: Walpole and Maynwaring, *State of the Five and Thirty Millions*; [Robert Walpole? with Arthur Maynwaring], *An Estimate of the Debt of Her Majesty's Navy on the Heads Hereafter Mention'd, as It Stood on the 30th of September Last*… ([London]: *s.n.*, [1712]). On attributions, see: Henry L. Snyder, "Daniel Defoe, Arthur Maynwaring, Robert Walpole, and Abel Boyer: Some Considerations of Authorship," *Huntington Library Quarterly* 33, no. 2 (Feb., 1970): 133-153.

[28] Plumb contends that, in his writings on the matter, "Walpole demonstrated forcibly the misrepresentation of the Committee who had used the technical delays of accountancy to try and create an atmosphere of colossal corruption." But he also notes that Walpole's arguments were at times too self-justificatory and awkward. (Plumb, *Walpole, Vol. I: Making of a Statesman*, pp. 172-3).

in one Year, and no more…? This last Article of Expence can never be fix'd, unless it were in the power of Parliament to set the Price upon all Naval Stores."[29] Naval administrators needed to account for their expenditures many months after they were incurred, "because the Charge and Expence is suppos'd to be uncertain."[30] Walpole in particular argued that the administrative complications of "the present Times," characterized by massive quantities of money being moved well beyond Britain's own borders, meant it was impossible to follow older standards of Exchequer procedure to the letter all of the time.[31]

Such appeals to the necessity of uncertainty would hardly have been reassuring to members of a political community racked, at that very moment, by partisan conflict and widespread distrust. And indeed they did not save Walpole from Tory ire. Many Tories looked eagerly for any way to take down important Whig figures, and in 1712 Walpole found himself doing a six-month bid in the Tower of London on charges of corruption.[32] The affair did little, though, to hinder Walpole's political career, serving rather to turn him into a kind of "whig martyr," who was regularly visited by key party personnel during his incarceration.[33] Walpole's administrative skills and his political sacrifices were not forgotten when the Whig party returned to power in 1714. Walpole became First Lord of the Treasury and Chancellor of the Exchequer in 1715, and it was in that position that he engineered the introduction of the Sinking Fund to the government's finances, a strict series of fiscal procedures intended to capitalize on the power of compound interest to reduce the National Debt—on which more below. A rift with Whig leaders forced Walpole into opposition in 1717. But, as many in the core of the Whig ministry found themselves implicated in the disaster of the South Sea Bubble, Walpole found himself in an opportune position. In 1721, Walpole seized the forefront

[29] Maynwaring and Walpole, *Letter to a Friend* (1711), p. 1.
[30] Maynwaring and Walpole, *Letter to a Friend* (1711), p. 1.
[31] Walpole and Maynwaring, *A State of the Five and Thirty Millions* (1711), p. 2.
[32] Plumb, *Walpole, Vol. I: Making of a Statesman*, pp. 178-182.
[33] Plumb, *Walpole, Vol. I: Making of a Statesman*, p. 182.

of ministerial power, rising to ultimate preeminence thanks, perhaps, to his efforts to pick up the pieces of the government's finances and the Whig party in the aftermath of the South Sea Crisis. It is to Walpole's involvement with the restructuring of the South Sea Company that we now turn, as a window into Walpole's own computing faculties.

II. Walpole's Computing Faculties: Restructuring the South Sea Company

The problem of what to do with the South Sea Company was a consuming and multi-faceted political issue from the fall of 1720 through the summer of 1721. Firstly, as we have already seen, there was the matter of making sense of what went wrong and who was to blame for it, over which Hutcheson and his angry colleagues on the Committee of Secrecy took the lead. Fury against the Company Directors was widespread, but there were many borderline cases, particularly among the more peripheral Directors and those in the government who supported or profited from the Scheme in indirect ways.[34] Walpole led the calls for moderation in the treatment of such figures, earning himself a somewhat unsavory reputation among anti-government critics as "Screenmaster-General" for his role in screening key Whig politicians from Bubble-related retribution.[35] Secondly, there were the thorny questions about what to do for and about the many private investors who had become entangled in the Scheme. Would those who had subscribed money for new Stock at exorbitant summer prices, but not yet paid up fully, be legally required to make all of their promised

[34] The enterprising Levant merchant, Whig political economist, and South Sea Director Theodore Janssen wrote to Walpole in May 1721 with an appeal to help spare him the harsh estate-seizures that many wished to be meted out to the Directors. Since "all the mismanagm[t] in the South Sea Co. is owing to 6 or 7" of the Directors only, Janssen explained, he did not even profit of the undertaking, as he made clear by an account of his estate as of December 1719. Janssen's account showed that his estate had decreased by over £52,000 between December 1719 and March 1721. See: Theodore Janssen to Robert Walpole, 24 May 1721, with enclosed "Particular of S[r]. Theodore Janssen's Real and Personal Estate on the first of December 1719," CamUL Ch(H) Letters 887.

[35] Helen Paul lauds Walpole for his role in preventing what she sees as a damaging over-regulation of the stock market in the aftermath of the Bubble. On this, and the "screen" more generally, see: Helen J. Paul, "Limiting the Witch-Hunt: Recovering from the South Sea Bubble" (paper presented at "The Sub-Prime Crisis and How It Changed the Past," Past, Present & Policy 4th International Conference, Geneva February 3-4, 2011), online at <http://www.cepr.org/meets/wkcn/1/1730/papers/PaulFinal.pdf>; John Carswell, *The South Sea Bubble*, 2nd ed. (Dover, NH: Sutton, 1993 [1960]), chs. 13-14.

subscription payments? Would investors who had subscribed for cash or government annuities at £1,000 prices be given any retrospective discount on such unjustifiable valuations? Such questions were both politically and morally fraught, involving the compensation of some private individuals at the expense of others, among whom none were culpable for the calamity.

Lastly, something did have to be done with the ongoing finances of the South Sea Company, and with the nation's commerce at large. Though modern scholars have argued that the impact of the Bubble on Britain's broader economic health was short-lived and relatively benign, contemporaries were deeply concerned about the threats the Crisis posed for the nation's commerce and public credit.[36] As one contemporary pamphleteer put it, one of the worst "Evils" perpetrated by the collapse of South Sea Stock, "which affects the Nation in general, is the Decay and Loss of private Credit."[37] In the moment there was plenty to fuel this fear, like the decision by the Bank of England on September 29 to temporarily stop discounting bills of exchange, closing off a major source of everyday commercial credit and making it difficult for Londoners to get their hands on specie.[38] The perceived crunch in private credit was further exacerbated by "the complex network of sums due from and to the South Sea Company," including the numerous loans the Company had made to its own stockholders and the vast quantity of bonds the Company had itself issued, both of

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[36] On the macroscopic and long-term influences of the Bubble on the British economy, or lack thereof, see: Julian Hoppit, "Myths of the South Sea Bubble," *Transactions of the Royal Historical Society*, Sixth Series, 12 (2002): 141-165, esp. pp. 150-158; Ron Harris, "The Bubble Act: Its Passage and Its Effects on Business Organization," *The Journal of Economic History* 54, no. 3 (Sep., 1994): 610-627. Larry Neal makes the slightly different argument, that a crunch in the availability of credit in England was not so much a consequence of the Bubble, but in fact a cause of its inflation. He suggests that lack of credit due to lending reductions and outflows of capital to the Low Countries in June 1720 gave the South Sea Company undue control over lending in Britain, which it exploited to attract further investment in its Stock. See: Neal, *Rise of Financial Capitalism: International Capital Markets in the Age of Reason* (Cambridge, UK and New York: Cambridge University Press, 1990), pp. 101-111.

[37] [Anon.], *Considerations on the Present State of the Nation, as to Publick Credit, Stocks, the Landed and Trading Interests*…(London: Printed for J. Roberts ... and A. Dodd ..., 1720), p. 3.

[38] The Bank of England also made a 25% call on loans issued by the Bank against the security of South Sea Stock, and on October 6 suspended any further loans on stock. Several of Walpole's interlocutors commented on the Bank's decisions. See: Minutes of the Court of Directors, Vol. H: July 10th 1718 to June 22nd 1721, Bank G4/11, p. 179; Lord Godolphin to Robert Walpole, [4?] Oct 1720, CamUL Ch(H) Letters 847; Robert Jacombe to Robert Walpole, 13 Oct. 1720, CamUL Ch(H) Letters 852.

which were of dubious recovery value.[39] Such credit seizures fed into chronic anxieties about the nation's scarcity of money. As early as August 1720, observers like Robert Jacombe had become concerned that the poor state of Britain's foreign exchange with the Dutch was sapping the country of specie, forcing Britons to sell stocks for cash and threatening stock prices.[40] It seemed like the Bubble may have made Britain's money problems even worse, as foreign profiteers had taken even more money out of the country through well-timed speculations on South Sea Stock. The artificial inflation of the South Sea Stock price had not just moved wealth around from some Britons to others, it seemed, but had opened the door for even more monetary wealth to leave Britain and flow to its enemies.

In the wake of the Crash, commentators and politicians, including Walpole himself, worried about how it might be possible to resuscitate public credit without jeopardizing the country's monetary health even further.[41] There were difficult trade-offs everywhere. Compensating investors who bought in late at the highest prices hurt earlier investors. Seeking to bolster the price of the Stock helped those left holding the stock but potentially threatened—once again—Britain's commerce and credit more broadly. As once commentator, perhaps Walpole himself, put it:

> An attempt to raise the Stock to a Higher value than it can be supported at, would only involve a new set of persons in the misfortunes that others at present labour under, & expose the Publick to the great Loss that will be sustaind by Foreigners selling out at high prices, and exposing our Gold & Silver.[42]

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[39] P. G. M. Dickson, *The Financial Revolution in England: A Study in the Development of Public Credit, 1688-1756* (London et al./New York: Macmillan/St. Martin's Press, 1967), pp. 160-1.

[40] Robert Jacombe to Robert Walpole, 4 August 1720, CamUL Ch (H) Letters 792.

[41] One contemporary commentator explained the frustrating situation in a manuscript to Walpole: "We are under a Necessity of endeavouring to retrieve our lost Credit, without it, We cannot Subsist, and such is our unhappy Condition, that by raising it, We are too liable to be drained by our Neighbours and our Enemies of the little Specie they (*sic* for "we"?) have left." See: Henry Vander Esch (Eich?), "Remarks on the South Sea Scheme," [1720], Walpole Papers, BL Add. MS 74,066, item no. 15, p. 5.

[42] [Sir Robert Walpole?], "Some Thoughts & Considerations Concerning the Present Posture of the South Sea Stock Humbly Laid Before His Majesty," [1720], MS [Copy?], Walpole Papers, BL Add. MS 74,066, item no. 7, ff. 1^{r-v}. The British Library catalogue entry explains the questionable authorship as such: "in Sir Robert's hand?; Coxe refers to an original draft by Sir Robert, in his hand; this seems not to be a first draft, but the hand resembles Sir Robert's; addressed to George I; annotated by Coxe; apparently printed."

Beginning in September 1720, business leaders, politicians, and pundits entertained a variety of therapies for the ailing South Sea Company and its stockholders. In September, the South Sea Company proactively sought to prop up its sagging Stock price and appease evermore angry investors by retrospectively amending the prices on Company Stock that had been offered to money subscribers and annuity-holders in the summer, effectively dropping the lofty £1,000 share price down to £400. Around the same time, political leaders led by Walpole began to contemplate more aggressive measures, like the "Bank Contract," a two-part bail-out to be executed by the Bank of England, under consideration from September to November.[43] Under the plan, the Bank would first agree to "circulate" or effectively guarantee £3 million in South Sea Company bonds, raising a new public subscription to get the money to do so. Second, the Bank would agree to transfer to the South Sea Company £3.775 million in government debts it held, receiving in exchange over £15 million in South Sea Stock.[44] The Bank quickly soured on the idea, though, and the plan died in mid-November. Thereafter, a new and even more involved work of financial engineering, heavily supported by Walpole, came to dominate discussion.[45] This "Ingraftment Scheme," first discussed by Walpole's personal banker and informal economic policy advisor Robert Jacombe in October, involved distributing £9 million of South Sea Stock (roughly a quarter of the Company's capital) to each of the Bank of England and the East India Company, in exchange for a comparable amount of Stock in those two great companies.[46]

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[43] For details, see: Dickson, *Financial Revolution*, pp. 162-7.
[44] There is extensive documentation on this plan and the negotiations surrounding it in Walpole's papers. See in particular CamUL Ch(H) Papers 88/20-24 and 8/25/1-8.
[45] The plan is first mentioned in Robert Jacombe to Robert Walpole, 11 October 1720, CamUL Ch(H) Letters 851. Jacombe therein mentioned: "a thought of mine that twould be best for the Interest of the Nation if instead of adding more to the company their Capital were divided amongst the Three Great Bodys the Bank ye S. Sea & india Companys thereby making them neare equall but upon separate Interests as Checks on one another & consequently less powerfull & less dangerous to ye State." Like the Bank Contract, there is extensive information on the Ingraftment proposal in Walpole's papers. See for example: CamUL Ch(H) Papers 88/25/10, 88/35/1-2, 88/104/1, 88/107.
[46] For further details, see Dickson, *Financial Revolution*, pp. 170-1.

The discussions over that proposed plan were lengthy and often ill-tempered. The Bank and EIC did eventually agree to take part in the plan and a Parliamentary Bill permitting it was approved in March 1721, but neither Company proved willing to execute the transactions, and the Ingraftment Scheme withered and died. Between May and July 1721, a Committee of the Whole House of Commons hashed out a more modest reconstruction plan, which would receive royal assent in August. The bill excused the Company of most of the £7 million-plus fees it had promised to pay the government upon agreeing to the Scheme in early 1720, but cancelled £2 million of the Company's underlying capital (long-term debts owed by the government to the Company). Subscribers who had yet to pay up their full subscriptions were forgiven their outstanding payments, and given Company Stock at £300-400 for what they had already paid, depending on their time of subscription. Remaining outstanding Stock was then to be distributed proportionally to all remaining Company Stockholders.[47]

The disruption of the South Sea Bubble was unquestionably pivotal to Walpole's rise to political preeminence. Yet historians have disputed Walpole's level of economic and financial acumen and the importance it played in his political achievements, particularly as it pertained to the aftermath of the Bubble. From his earliest biographers to twentieth-century historians of finance, many have held that Walpole was—or at least was perceived to be—one of his time's great financial minds, who helped raise British commerce from the ashes of 1720 through his substantial computational gifts. One late-eighteenth-century depiction described how Walpole introduced "System into the buisness of the State" and "recovered the administration of the Financies of the Country out of confusion; and rescued them from corrupt & ruinous management."[48] Walpole's first comprehensive biographer, William Coxe, reported that: "It was said of him that he was endowed

[47] Dickson, *Financial Revolution*, pp. 175-6.
[48] Thomas Pownell, "Character of Walpole," originally October 1783, Horace Walpole Papers, BL Add. MS 35,335, ff. 69-81, quotation on f. 76r. Note that "buisness" and "Financies" are both spelled thus in the original text.

with a genius for calculation; and that the method which he adopted in settling accounts, was a mystery understood only by himself."[49] The early-twentieth-century financial historian, W. R. Scott, specifically listed Walpole as one of two people "who were held to be the financial experts of the time" in the early eighteenth century, along with Hutcheson.[50] P. G. M. Dickson gives substantial praise to Walpole for many of the positive economic achievements of Britain's "financial revolution," crediting him in particular with being the primary architect of the nation's recovery from the South Sea Crisis, whose policies "applied the harsh cautery of common sense to the soaring dreams and megalomaniac expectations of the South Sea year."[51] Though he admits that Walpole's economic ambitions were only partially achieved, Dickson credits Walpole with having "created a general atmosphere of financial confidence, which encourages substantial market investment by institutions, government departments and rich individuals."[52] By contrast, Walpole's preeminent modern biographer J. H. Plumb has sought to dispel the historical notion that Walpole was a financial genius, and that such genius helped launch him to political preeminence.[53] Plumb points to Walpole's failures to recognize the dangers of the South Sea Scheme early on, his own questionable investment decisions during 1720, and his lack of originality in the financial correctives he proposed after the Crash as evidence of his lack of great financial understanding.

There are elements of truth to both of these judgments. Yet overall, the concern with judging Walpole's individual insights and decisions has distracted scholars on both sides from more deeply interrogating the nature of Walpole's political reasoning—the question of *how* he thought, not

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[49] William Coxe, *Memoirs of the Life and Administration of Sir Robert Walpole, Earl of Orford*, Vol. 1 (London: Printed for T. Cadell, Jun. and W. Davies, 1798), p. 2. Coxe did actually attempt to moderate these images of Walpole somewhat, noting that "the events of his early life will shew that the natural talents of Walpole, were rather solid than brilliant, and that his acquirements were the fruit of considerable industry." (p. 2)

[50] W. R. Scott, *The Constitution and Finance of English, Scottish and Irish Joint-Stock Companies to 1720. Volume I: The General Development of the Joint-Stock System to 1720*, Reprint edition (Gloucester, MA: Peter Smith, 1968 [Cambridge: Cambridge University Press, 1912]), p. 437.

[51] Dickson, *Financial Revolution*, p. 176.

[52] Dickson, *Financial Revolution*, p. 210.

[53] Plumb, *Walpole, Vol. I: Making of a Statesman*, ch. 8, esp. pp. 293-4, 304, 309-316.

how well—particularly on matters of fiscal policy. Walpole was, without question, a very competent financial calculator. But even more critically, he was someone who early in his career became well-acquainted with the vital role financial calculations could play as a weapon in the public political contests of the day. He was an especially shrewd reader and critic of financial calculations, and cultivated an extensive network of largely unofficial financial advisors who provided him with policy ideas, commentary, and targeted calculations. He did not receive this advice passively. He actively questioned the analyses that were provided to him and commissioned specific computations he felt were needed. There was of course nothing new about leading ministers receiving advice on technical matters. Yet Walpole's remarkable use of financial calculation, and particularly computational *models*, as a tool for policy and politicking was conditioned by far-reaching patterns of political cognition characteristic of the eighteenth century.

Throughout 1720, Walpole was kept well-informed of the matters on Exchange Alley, thanks largely to the diligence of his banker Jacombe, who looked after Walpole's own extensive financial investments. Walpole was well-apprised of the technical dimensions of the Crisis, including the day-to-day movements of financial indicators, not only South Sea Stock but also other key stocks, like that of the Bank of England, and more obscure metrics like the discounts on South Sea bonds.[54] In the tumult of the fall of 1720, many concerned Britons looked to Walpole (who spent much of the period in Norfolk) for guidance, enough so that contemporary newspapers reported on how Walpole was contemplating a variety of financial remedies that had been proposed to him.[55]

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[54] Walpole's letters from September – December 1720 are filled with references to market movements. (The correspondence for that period is contained in CamUL Ch(H) Letters 830-868). For an illustrative example, see Jacombe to Walpole, 1 October 1720, Ch(H) Letter 846, in which Jacombe reported that a sudden turn of optimism about South Sea Stock had lifted the price from 200 to 300, and reduced the discount on South Sea bonds from 25-25% to 5%. One careful chart among Walpole's papers tracked the price of South Sea Stock every day from the beginning of August to the end of November. ("Price of South Sea Stock from 2^{d}. August to 30th. November 1720," CamUL Ch(H) Papers 88/27.) Note that the chart was written out with each week on a different row, and each of five column representing one day of the week. Graphical representations of stock-price movements were unknown at the time.

[55] Plumb argues that Walpole's earliest efforts to save the South Sea Company through an infusion of capital from the Bank of England came to nothing, and that Walpole then deftly left London for Norfolk in late summer 1720 as a way

Walpole digested a wide range of proposals about what to do about the South Sea calamity. Some of these were ambitious and imaginative financial projects of the sort that were regularly pitched to leading ministers in the era. Typical was "A Proposal for Reducing five Millions of the South Sea Capital into Annuities at 6 pounds, 6 pounds 10 shillings, or 7 pounds p[er] Cent p[er] Annum for life by way of a Lottery at 100 pounds p[er] Ticket. And 11 Millions in 4 p[er] Cent Transferable Annuities."[56] Some of these proposals, though, may have shaped Walpole's thinking, quite substantially, on the South Sea Crisis and beyond. A correspondent named Thomas Houghton, for example, wrote to Walpole in December with a proposal to revive the South Sea Company by empowering it to build warehouses in which British merchants could store imported goods, particularly those intended for re-export.[57] The South Sea Company could thus help the government rationalize Customs collection, taking a cut for themselves—a plan that prefigured Walpole's later policy of using government "bonded warehouses" to save merchants from the messy process of claiming "drawbacks" on goods re-exported.[58]

Some of these proposals no doubt were sent to Walpole unsolicited, as for example when Henry Vander Esch wrote to Walpole on October 20, 1720, enclosing a commentary on the "General Calamity" and asking that Walpole "pardon this temerity of breaking in upon your Retirement with so poor a Performance."[59] Yet Walpole looked upon the work of some financial commentators with very serious attention. Walpole's papers contain one illuminating manuscript page of his own working notes with regard to the Jacombe-Walpole Ingraftment Scheme, which

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to give the impression of having more power over the situation than he really did. See: Plumb, *Walpole, Vol. I: Making of a Statesman*, pp. 321-4; Dickson, *Financial Revolution*, p. 159, n. 7.

[56] CamUL Ch(H) Papers 88/99.

[57] Tho. Houghton to Robert Walpole, 24 December 1720, CamUL Ch(H) Letters 868.

[58] Langford, *Excise Scheme*, pp. 31-2.

[59] Vander Esch began by lauding Walpole: "You have a just Claim to whatever can be Offered in Aid of the Publick Credit… on Acc^{t}. of your extraordinary Abilities in judging and forming whatever tends to the Publick Good." Vander Esch's proposal involved converting all of the South Sea Stock into generous, fixed-term annuities, with different terms for original South Sea Stockholders, money subscribers, and those who subscribed redeemable and irredeemable debts. The text of Vander Esch's proposal appears to be in the Walpole papers in the British Library. See: Henry Vander Esch to Robert Walpole, 20 October 1720, CamUL Ch(H) Letters 855; Henry Vander Esch, "Remarks on the South Sea Scheme," 1720, Walpole Papers, BL Add. MS 74,066, item no. 15.

includes bullet-point summaries of the work of three different financial commentators—"Mill[r]," "Sloper," and, notably, "Hutch."[60] The telegraphic summary of the piece by "Mill[e]r" is illustrative, if very hard to make sense of:

> Mischeifs from sale by Subscription. No Loans upon Stock.
> 2[ms]. Redeemables not subscrib'd.
> raise Stock Forreigners
> 18[ms]. given away. last to course of Laws.[61]

Walpole's engagement with the financial commentaries of others was not limited to such common-placing. He directly critiqued some of the computational analyses that came into his hands, including at least one paper by Archibald Hutcheson.[62] Walpole's papers include a manuscript copy of "A State of South Sea Stock," attributed to Hutcheson, which discussed how certain new proposals for restructuring the South Sea Company, including a retrospective reduction in purchase prices for the Stock and the proposed Ingraftment, would impact beleaguered holders of Company Stock. Hutcheson was concerned that the proposals under discussion led to unfair outcomes, compensating certain investors at the expense of others. He noted, for example, that "according to the New Scheme, the first money Subscribers at 300 are in a worse Condition than any of the Subscribers at 400."[63] In Walpole's manuscript copy, Hutcheson's text was only transcribed on the verso of each page, leaving the facing side free for extensive comments. Walpole's marginalia reveal a remarkable technical command over Hutcheson's figures, and a particular interest in figuring out

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[60] "Sloper" referred certainly to William Sloper, at the time MP for Great Bedwyn and outspoken critic of the South Sea Company and of stock-jobbers, and a member of the Secret Committee appointed to investigate the South Sea Company Directors. See: [Robert Walpole], Untitled Notes on Ingraftment Scheme, [1720 or 1721], CamUL Ch(H) Papers 88/34a.

[61] CamUL Ch(H) Papers 88/34a, recto. It is unclear to me which pamphlet Walpole was summarizing.

[62] Archibald Hutcheson, "A State of the South Sea Stock…" MS copy, with Comments by [Robert Walpole], [late 1720 or early 1721], CamUL Ch(H) Papers 88/118. Much of this material was later printed in Hutcheson, *Some Computations Relating to the Proposed Transferring of Eighteenth Millions of the Fund of the South Sea Company, to the Bank, and East-India Company* (London: *s.n.*, 1720/1).

[63] Hutcheson, "State of the South Sea Stock," MS copy with R. W. Comments, [1720-21?], CamUL Ch(H) Papers 88/118, f. [1][v]. The papers in the Ch(H) collection are generally not individually foliated, but I have indicated the implied folio numbers where it might be helpful for the reader.

what assumptions lay behind them.[64] For instance, the latter claimed in his "State" that, after certain of the proposed restructuring operations were carried out, the value of £100 South Sea Stock would be worth a mere £114. 14*s*. 2*d*. Walpole pointed out in the margin that: "These Computations are made upon two suppositions 1. that the praemium be paid to the Government 2. that in the present Capital the Subscriptions be Completed. both these suppositions are left out by the new s[c]heme."[65]

Discerning the impact of such buried assumptions was critical for Walpole given that both factors—whether the £7.5 million "praemium" was paid and whether all of the money subscriptions were required to be paid up—were largely under Parliamentary control. Other assumptions behind Hutcheson's numbers were less controllable, but Walpole was still interested in interrogating them, as questioning such presuppositions provided Walpole with insight into Hutcheson's political agenda, and how to combat it. One marginal comment astutely noted that Hutcheson's figures disregarded many potential benefits to South Sea Stockholders that were not easily quantifiable: "Besides in these Computations Mr H makes no allowance for any advantages in trade etc. in the South Sea, nor any advantage from the Bank nor the East India Company. All these several omission will bring the value of £275 present Stock much higher than his imaginary £559.5.10."[66] For Walpole, analyzing Hutcheson was perhaps no less important than analyzing the state of South Sea Stock. At the end of the pamphlet, indeed, Walpole's comments drifted a bit from critical engagement to outright snark. Referring to a closing computation Hutcheson made about how £100 of former South Sea Stock would be reallocated between the South Sea Company, Bank, and EIC

[64] It would not be the last time Walpole and Hutcheson butted heads. Another example of a commentary on Hutcheson in the Walpole papers, though not in Walpole's hand, can be found in "Mr. Hutchinson's Views in his Writings," [1722?], CamUL Ch(H) Papers 75/22. It appears to concern Hutcheson's views on the repeal of the Septennial Act.
[65] Hutcheson, "State of the South Sea Stock," MS with R.W. Comments, [1720-21?], CamUL Ch(H) Papers 88/118, f. [3]r.
[66] Hutcheson, "State of the South Sea Stock," MS with R.W. Comments, [1720-21?], CamUL Ch(H) Papers 88/118, f. [3]r.

under the proposed Ingraftment Scheme, Walpole noted: "The distribution of the 3 stocks might have been made by any body of much less capacity and business than Mr. H."[67]

Walpole's textual dialogue with Hutcheson went even deeper than reverse-engineering the assumptions behind the calculations. He also used the text as a jumping-off point for conjectural computations of his own. At one point in the text, Walpole remarked that "Mr. H Computation of the value of 275 pound… is right," and proceeded to explain that the difference between Hutcheson's computations and the calculations on the "New S[c]heme" that Walpole and his advisors seem to have been using internally. The difference, he explained, arose from the internal calculations "not reckoning the second payment of the 2^{d}. subscription pay^{d}."[68] Walpole proceeded to note what the implied valuations would be based on different assumptions about these payments on the second subscription:[69]

> if both payments are made the Value is £145.08^{decimals}
> if only one payment is made the Value is £146.009.

These kinds of *if-then* calculations were not limited to the margins of other people's pamphlets. They were indicative of a major pattern in Walpole's financial and political reasoning. Calculating *what might be* provided Walpole a way to reason about the efficacy of decisions, to justify policies, and to render the unknown political future into present terms.

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[67] Hutcheson, "State of the South Sea Stock," MS with R.W. Comments, [1720-21?], CamUL Ch(H) Papers 88/118, f. [4]^{r}.
[68] Hutcheson, "State of the South Sea Stock," MS with R.W. Comments, [1720-21?], CamUL Ch(H) Papers 88/118, f. [3]^{r}.
[69] Hutcheson, "State of the South Sea Stock," MS with R.W. Comments, [1720-21?], CamUL Ch(H) Papers 88/118, f. [3]^{r}. Note that decimal arithmetic was still somewhat unusual for reasoning upon monetary matters, compared to calculating in terms of shillings and pence, and so calculators would sometimes indicate that they were using decimal figures, for example by a superscript notation.

III. Sundry States: Modeling Political Futures

Throughout his engagement with the South Sea Scheme and its aftermath, Walpole's political reasoning was guided by financial *models*. As Mary Morgan, Margaret Morison, and others have discussed, models serve a critical and autonomous *mediating* function in the making of knowledge. Models mediate between the empirical world and theories about it, giving form to the chaos of observation while also rendering the implications of abstract theories into intuitive, usable form.[70] Models, I suggest, also help to mediate between past and future, using former outcomes as the foundation for making plausible statements about what is yet to come. Chapter 5 discussed how a kind of computational modeling became a targeted political tool for Archibald Hutcheson, who frequently repeated a single arithmetical procedure multiple times, across a variety of different assumptions about key unknown—or secret—variables. For Hutcheson, modeling was a means of managing uncertainties, particularly those caused by not having complete information or not being privy to key decisions. It also carried a political message—to calculate a range of plausible outcomes was to highlight how much the public did not know. Robert Walpole assimilated these strategies of computational reasoning even more actively into political decision-making.[71] If Hutcheson used computational models to make sense of the uncertainties of policies that were outside his control, Walpole read and created them to deal with the unknown futures of policies he helped create.

Reorganizing the South Sea Company after its collapse was, as discussed, a complicated political-economic problem with multiple variables and many different, often competing, metrics of success. Even without considering major feats of financial engineering, like the Ingraftment project, decisions had to be made about whether to amend retrospective prices offered to various investors,

[70] See Mary S. Morgan and Margaret Morrison, "Models as Mediating Instruments" in *Models as Mediators: Perspectives on Natural and Social Science*, eds. Morgan and Morison, (Cambridge, UK and New York.: Cambridge University Press, 1999), pp. 10-37.

[71] There can be found other, earlier examples of administrators and economic policymakers thinking through the outcomes of multiple policy scenarios. See, for example, W[illiam] L[owndes], "Comparison Effects of a New Bank Contract," Lowndes Papers, NA T48/6. Nonetheless, I have not seen evidence of the pervasiveness of such models and the level of computational detail evident in Walpole's papers elsewhere.

about whether to require subscribers to pay all of their promised funds for Company Stock, about whether to require the Company to pay fees it still had outstanding to the government, and so forth. And these were only the variables under a degree of political control. Others, like whether substantial sums could be recovered from the estates of the disgraced Directors or whether the many loans extended by the Company would ever be repaid, were far more chaotic. There were many different people and institutions with a stake in what happened to the Company—original shareholders who still held Stock, those who bought into the Scheme early at lower prices or those who bought in late at higher ones, those who gave government debts for Stock, those who resold Stock in the secondary markets, not to mention the government itself and the other companies, like the Bank of England and East India Company, who might become implicated in any restructuring Scheme. Each stakeholder had a different agenda, and the matter of finding some kind of fair solution that was broadly agreeable to such diverse and contentious interests could seem at times like a political puzzle with no possible solution.

Financial mathematics provided one vital tool for reasoning through this mess of entangled variables and conflicting interests. In May 1721, Walpole received a manuscript calculation from one Samuel Hyde which was exemplary. (This was not Walpole's first communication with this particular computational advisor).[72] Hyde's dense three-page manuscript explored the impact of the government forgiving or "remitting" the outstanding fees the Company owed to the Government for taking on the Scheme in the first place, which totaled over £7.1 million by his calculation. At issue was the question of who among the Company's different classes of stockholders would benefit from the forgiveness of the £7.1 million, and in particular whether it was fair to let any of that benefit accrue to the Company's original (pre-1720) stockholders, who had engineered the Scheme

[72] "A Computation of the Present Value of South Sea Stock of the Old Capitall in Particular," enclosed in Samuel Hyde to Robert Walpole, 2 May 1721, Ch(H) Letters 884. Hyde's brief covering letter stated: "The Honour you did me in peruseing the Papers Imboldens me to offer the Inclosed to your Consideration."

in the first place and may well have profited from it considerably. Hyde began by calculating the "present value" of South Sea Stock, assuming an expected recovery of almost £6.1 million from the Director's estates, with a series of adjustments for "stock pawned" or used as security for loans. While the sources of his assumptions are difficult to follow, it is clear that Hyde calculated the basic value of one share of South Sea Stock to be just over £127, assuming the Company was still on the hook for the £7.1 million to the government.[73] From this base valuation, he proceed to explore the impact of the government's "remitting" the fee, particularly on "Proprietors of Old Stock," namely those who owned South Sea Stock before 1720. Holders of this "Old Stock," he calculated, accounted for £10,358,411 of the Company's total capital stock.

Hyde laid out three scenarios or "suppositions." Under the first supposition, he calculated how the proprietors of Old Stock would have fared assuming the £7.1 million owed to the government was still demanded. If South Sea Stock were worth £127 per share, the £10.36 million in (face-value) shares owned by the Old Stock proprietors was worth £13.17 million. Given that the original South Sea proprietors had only paid £9.42 million to the nation (back when the South Sea Company was first founded in 1711), the holders of Old Stock had still made a tidy profit of £3.75 million even *after* the Bubble had burst. As Hyde put it: "It is therefore conceived that the Proprietors of Old Stock as such cannot plead for the Charity of the Legislature as to ye 7.134.976 but whatever the Legislature are pleased to remit will be equally divided among the New Subscribers."[74] For comparison sake, though, Hyde laid out a second "supposition" showing how much the owners of Old Stock would profit if they were allowed to share in the spoils of the government's £7.1 million refund. Assuming the refund was equally distributed among all owners, including the Old proprietors, the value of South Sea Stock increased to £151, and the holders of Old Stock saw their total profits increase from £3.75 million to £6.24 million.

[73] Several of the assumptions Hyde was working with were attributed to "Mr. Hutcheson."
[74] Hyde, "A Computation of the Present Value of South Sea Stock," in CamUL Ch(H) Letters 884, f. [1]^{r}.

Hyde's "3[d]. Supposition" was more peculiar, and more telling of the problems he was trying to work out. That scenario read: [75]

Supposing One Half of the Proprietors of Old Stock to be no Losers & valueing the same att £127.10148[Dec] pC[t] is	}	£6.582.846
The other Half to be loser valued att 151.113109[Dec] pC[t] is…		7.836.458
10.358.411 will then be Value…		£14.309.204
The Originall Value paid the Nation was but…		9.416.738
So that these Proprietors of Old Stock gain…		£4.892.406

Figure 6b. The speculative calculation in Samuel Hyde's "3[d]. Supposition," in Hyde, "A Computation of the Present Value of South Sea Stock," in CamUL Ch(H) Letters 884, f. [1][v].

Hyde was wrestling with how to compensate, by way of the government's £7.1 million remittance, only those "losers" who had been harmed by the South Sea Scheme, without further lining the pockets of the Company's original stockholders ("no losers"). But, for any number of reasons, it was hardly obvious that all of those people who held "Old Stock" as of May 1721 were winners by the Scheme. Holders of "Old Stock" might have bought it in the secondary market at inflated prices themselves, or might have invested further in "New Stock." Hyde's third "supposition" dealt with these unknowns by assuming that exactly half of those people left holding "Old Stock" in May 1721 had not lost (and likely gained) by the events of 1720, and that the other half had lost by it. Hyde did not delve into the complexities of how it would be possible to distinguish "losers" from gainers, or the logistical challenges of compensating some stockholders and not others. Rather, he used his financial calculations as a way to test the fairness and political feasibility of major political decisions, before those decisions were made, and without perfect information.

Hyde's three-scenario model was a rather rough exercise, and its many ellipses make it somewhat difficult for a modern reader to follow. Far more elegant was a manuscript paper entitled

[75] Note that, as was common, the dot or period mark "." was used in the place of the comma "," to separate digits (after the thousands place, after the millions place, etc.). The same mark was also used, as in more modern notation, as the "decimal point." Note again the use of the "Dec" superscript to indicate that Hyde was calculating in decimals, not shillings and pence.

"A View of the Value of 100 Pounds Capitall in Sundry States of South Sea Stock," which can similarly be dated to spring or early summer 1721, and was probably produced slightly earlier than Hyde's calculations.[76] The manuscript showed the output of effectively dozens of repeated calculations assessing the hypothetical value of South Sea Company stock at several conceptual points in the near past and in the near future. While the precise valuation procedure was not specified, the sundry "values" assigned to South Sea Stock appear to have followed the conservative valuation techniques that were invoked by Hutcheson and others in the aftermath of the Bubble.[77] The top half of the left-hand page dealt primarily with a series of past hypotheticals, showing what the value of South Sea Stock ought to have at various moments during the fervor of 1720, under various different conditions. Some of the differing assumptions reflected alternative decisions the Company might have made, like choosing not to carry out certain financing transactions or setting different pricing or terms for them, while others reflected circumstances outside the Company's control, such as whether or not subscribers for new sales of Stock would have paid up all of their subscription fees. The first line, for example, offered the pessimistic view that that the Stock would have been worth only £58. 19*s*.10*d*. (per £100 share), "if no subscription had been taken by the Company."[78] The most optimistic valuation suggested that if the Company had managed to exchange Stock for all of the possible outstanding government debts at favorable terms, and had

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[76] "A View of the Value of 100 Pounds Capitall in Sundry States of South Sea Stock," [1721], CamUL Ch(H) Papers 88/94a. The paper seems almost certainly to have been written before the terms set down in the 1721 Act "to restore the Publick Credit" were finalized, so before the end of July 1721. Similarly, several factors make it easy to date after about March 1721: it seems certainly to have come after the failure of the more dramatic restructuring schemes, like the three-company Ingraftment plan; it came after major information was made available on the South Sea Company's outstanding liabilities, which were first reported in detail on February 13; and the paper considers the potential recoveries from the confiscated estates of South Sea Directors, agreed to in April.

[77] That is, they held that the value of the Company's Stock was determined entirely by the size of the Company's most solid financial assets, particularly cash and money owed to the Company by the government, divided by the size of the stock held by shareholders.

[78] While it is not clear what precise figures the calculator was using, it is easy to see roughly where this calculation came from. To illustrate, assume that the total amount of South Sea Stock outstanding before the 1720 Scheme was £11.2 million (based on £11.2 million owed to the Company by the government), the fee for the Scheme cost £4.5 million, and no value was given to the Stock for anything other than the money already owed the Company by the government (£11.2 million). Then the value of the Stock would be calculated at: (£11.2 – 4.5) / £11.2 = £59. 16*s*.5*d*., which is very close to the value of £58. 19*s*.10*d*. calculated in the "Sundry States."

sold all the new Stock that entitled them to at £1,000 per share, the Stock would have been worth £542. 10*s*. Together, these sequential valuations provided a conjectural history of the *value* of South Sea Stock during the Bubble, disjoint from the history of the Stock's *price*.

				Payment to the Publick		
				Remitted	*in Stock at 400*	*In money*
100[l]. Capit[l.] Stock	If 1st Subscrib'd Ann[s] made Stock at 375; Money p[d] on 1st Subscription at 300, and the Money p[d] on 3 Last at 400 p Cent.	Comp[a]. have Lent 11558778:11:0 upon Stock &c. and owe 5361182:0:0.	2[d]. Subscrbd Ann[ties] and Redeemables at **400** p Cent.	**152: 8: 2¼**	**139: 3: 5**	**113: 15: 5½**
			2[d]. Subscrbd Ann[ties] and Redeemables at **300** p Cent.	**136: 18: 7**	**130: 17: 1**	**105: 10: 1½**
		Comp[a]. are Rep[d]. money Lent and owe 5361182:0:0.	2[d]. Subscrbd Ann[ties] and Redeemables at **400** p Cent.	**174: 2: 1**	**165: 8: 1**	**144: 19: 7**
			2[d]. Subscrbd Ann[ties] and Redeemables at **300** p Cent.	**163: 2: 4**	**155: 9: 8¼**	**135: 16: 8**
		Comp[a]. owe 5361182 have Lent 11558778... and Recover... 10,000,000 of late Directors et al.	2[d]. Subscrbd Ann[ties] and Redeemables at **400** p Cent.	**199: 6: 0**	**183: 18: 7½**	**161: 5: 3**
			2[d]. Subscrbd Ann[ties] and Redeemables at **300** p Cent.	**180: 1: 11**	**171: 5: 7**	**149: 10: 1**
		Comp[a]. owe 5361182 Rep[d]. money lent and Recover of late Direct[rs] et al 10,000,000	2[d]. Subscrbd Ann[ties] and Redeemables at **400** p Cent.	**214: 18: 5½**	**204: 4: 5**	**185: 15: 11**
			2[d]. Subscrbd Ann[ties] and Redeemables at **300** p Cent.	**201: 7: 3**	**191: 18: 10**	**174: 1: 6**

Figure 6c. Table, adapted from of a portion of "A View of the Value of 100 Pounds Capitall in Sundry States of South Sea Stock," Ch(H) Papers 88/94a.

The right hand side of the "Sundry States" was even more remarkable. The calculator's gaze shifted from past to future. The elaborate calculation was part-table and part-decision-tree, showing

the hypothetical future value of South Sea Stock in 24 different states of the world. Along the vertical axis of the table, the calculator laid out eight different scenarios, arising from three different binary unknowns. The first unknown concerned whether or not the Company could expect to recover any money from the estates of the recently disgraced former Directors. The calculator considered two scenarios: option 1, that the Company would get nothing from the Directors' estates, or option 2, that they would generate £10,000,000. The second unknown was whether the Company would recoup any of the nearly £11.6 million they had loaned out in the previous year.[79] The third unknown was more technical and subject to deliberate choice, concerning how to retrospectively revise the prices offered to people who had invested in South Sea Stock in 1720. In this case, the calculator contemplated whether those people who had exchanged government annuities for Company Stock in the months of July and August, at prices up to £1,000 per share, ought to have those exchange prices dropped just to £400 (option 1), or all the way down to £300 (option 2). On the horizontal axis, the calculator also considered the effect of one further decision, given three possible outcomes. This concerned the still-outstanding fees (between £7-7.5 million) the Company had agreed to pay the government for the right to carry out the Scheme in the first place. Parliament conceivably had a few different options about what to do with that outstanding fee: they could allow it to be completely cancelled or "remitted" (option 1), require that the Company repay it in Stock, in this case priced at £400 (option 2), or, most harshly, require that the Company repay it in cash (option 3).

[79] During the course of 1720, the South Sea Company loaned large quantities of money to owners of Company Stock, against the security of Stock or, even more problematically, against unpaid or partially paid subscriptions for Stock, or "scrip." Both contemporaries and historians have been widely critical of the irresponsibility, if not outright criminality, of this practice. For example, one commentator, probably Robert Jacombe, wrote in a discussion of the errors made by the South Sea Company that: one "mistake was that they parted with their Cash in loans but this must be termed rather a Roguery than a Mistake." See: [Robert Jacombe?], Untitled Calculation and Comments Regarding the South Sea Scheme, [late 1720?], CamUL Ch(H) 88/123/1, f. [2]^{r}. Carswell is particularly critical of the Company's practice, which he credits to John Blunt, of issuing large quantities of loans to potential investors in advance of stock subscriptions, or, as he calls it, "first flooding, then mopping up." (Carswell, *South Sea Bubble,* p. 129.)

All-tolled, the four different unknowns, three with two outcomes and one with three outcomes, produced twenty-four different possible scenarios (2 x 2 x 2 x 3), as arrayed in an eight-by-three grid. Each of the 24 numbers in the grid represented the value of South Sea Stock under one particular set of choices. The possible valuations ranged from £105. 10*s*. 1½*d*. in the least favorable scenario (the Company recovered none of the money it lent out and nothing from the Directors' estates, reduced the annuity-exchange prices all the way to £300, and had to pay the government its fee in cash), to £214. 18*s*. 5 ½*d*. in the most favorable case (when all the assumptions were reversed). In between lay a range of intermediate alternatives. For example, the value in the second column and fifth row from the top represented the value of South Sea Stock if the Company was repaid none of the £11.2 million it had lent, recovered £10 million from the estates of the late Directors, reduced the prices on the July-August annuity exchanges to £400 (but not all the way to £300), and was required to repay the government fees in Stock valued at £400 (but not in cash). In this case, the calculator determined the Stock would be worth £183 18*s*. 7½*d*. By navigating through the different entries on the chart, a reader could assess the incremental value of the change in certain assumptions. It showed that, holding the other three assumptions the same (debts unrecovered, £10 million from the Directors' estates, £400 retrospective price), choosing to cancel the government fee instead of requiring its payment in Stock raised the Stock's value from just under £184 to £199. 16*s*. Showing how shifts in specific variables changed the ultimate Stock value was conceivably very useful, given that two of the unknowns—the revised annuity prices and the fate of the government fee—were active decisions that had to be made by Parliament, under Walpole's guidance.[80]

Like Hutcheson's computational models, the 1721 "Sundry States" translated a variety of unknown factors into a single, appreciable metric—in this case the price of South Sea Stock. Modeling was a tool for managing uncertainty. But for Walpole and his network of calculators,

[80] For speculative calculations related to the South Sea restructuring, see BL Add. MS 74,066, item no. 16.

political uncertainty was of a very different sort that it was for Hutcheson. If Hutcheson modeled uncertain political outcomes in order to demonstrate that such uncertainty existed, Walpole and his allies modeled different political futures in order that they might better control them. The question of the restructuring of the South Sea Company was not, of course, the last issue on which such modeling would be necessary. Walpole and his computational advisors, for example, drafted many, technically demanding computations attempting to understand the impact of a 1737 proposal by the MP John Barnard to reduce interest rates on public debts to 3%.[81] Yet calculating the future was not merely useful for shaping policies. It was also useful for managing political conflicts, for shaping opinions, for building authority. As evident in the history of Walpole's Sinking Fund, calculation became a tool not just for assessing the future, but for making it.

IV. Exponential Aspirations: Walpole's Sinking Fund

To contract a debt is to acknowledge the future. But such futures are not always entered with all that much thought. Much of the unprecedented National Debt amassed by England and later Britain in the quarter-century after 1688 was borrowed in a desultory fashion—£800,000 here, £1 million there—often on terms that, with only a little bit of reflection, proved very unfavorable to the nation. As we saw in Chapter 2, William Paterson warned King William III in 1701 of the considerable costs of "dear, and bad Bargains, High Interests of Money, Discompts, Premiums, and other Extortions."[82] From the 1690s forward, the British government was never at a loss for ideas and projects about how to borrow more money, through new kinds of loans or stock subscriptions or lotteries. What proved more problematic was how to actually pay that money off, a question which

[81] On analyses of the 1737 interest-reduction scheme, see, for example: BL Add. MS 74,066, item nos. 18/5, 18/10-13, 18/15, 22. One commentator, Thomas Martin, fretted that: "I have seen the sense of ye House if Sr Jno B. wild scheme takes place by an Immediate reduction I am perswaded it will bring a 2^{d} South Sea year." (BL Add. MS 74,066, item no. 18/5).

[82] William Paterson, "Letter to King William III," unpublished MS, November-December 1701, BL Add. MS 88,618 B, f. 3^{r}.

was always on the horizon but became particularly prominent in times of peace (1697-1702 and after 1713). Various incentives which made it easier to raise money in the first place—high interest rates, discounts, irredeemable terms—made them harder to unwind in the aftermath. The South Sea Scheme was one such projects designed to make the National Debt more payable. But it was not the only one, nor was it the longest lasting. Another such project was the "Sinking Fund," an (only relatively) more sober mechanism put in place by Walpole, which began before and ended long after the tumults of 1720. Exploring the history of the Sinking Fund provides a valuable window into the developing financial politics of the Walpole era, and demonstrates how numerical argumentation created new—*future*—spaces for discursive political conquest.

From the 1690s onward, there were myriad reasons for Britons to be concerned about the repayment of the National Debt, and not just when or whether it would happen, but how. Planning for the repayment of the public's debts might help to save long-term interest costs and bolster public credit and the trading value of public debt instruments, not to mention offering political reassurance that the Debt would not become an interminable burden. With an eye toward these different goals, economic commentators and calculators explored different ways to plan and structure how debts were repaid. As with many aspects of contemporary financial mathematics, there was no one obvious way to project the repayment of debts, and calculators presented a variety of plausible computational plans. One interesting early example, probably from the mid-1690s, was outlined by "Wm. Van Laitz" in a manuscript entitled "A Proposal to Ease the Subject, and to Restore the Credit of the Nation," which survived in the papers of the enterprising Whig financial policy-maker Charles Montagu (Lord Halifax).[83] Van Laitz explained the vital importance of making

[83] Wm. Van Laitz (*sp?*), "A Proposal to Ease the Subject, and to Restore the Credit of the Nation; So That Within 6 Months Bank Bills and Tallies Will Be as Currant as Ever They Were, the Deficiency of all Parliamentary Funds Made Good, and the Want of Mony Supplyd…" [1690s?], Charles Montagu Papers on the Bank of England, 1682-96, NLS Adv. MS 31.1.7, f. 44. The mention of "Bank Bills" suggests this was drafted after 1693. The spelling of "Van Laitz" is somewhat unclear in the manuscript. It is reasonable to suspect he may have been Dutch.

the future repayment of government debts transparent and credible, with specific reference to certain common short-term government financing instruments ("tallies" and "bank bills.") "It is impossible to Restore the paper Credit of the Nation," he explained, "except we can make it plainly appear that a bill which promises to pay 10 pound is Really worth the Value 10 pound or more, and that one Subject is willing to take it from the other in Trade for Debts Due."[84] In order to help make government credit instruments "currant," Van Laitz proposed taking one half ("one moyety") of outstanding tallies and guaranteeing that they be repaid according to a strict ten-year schedule. Instead of paying then-standard interest rates of 8% on the tallies, the government ought to promise to pay 10% interest for the first five years and 5% interest for the last five.

	Years	Principal (£)	paid from principal (£)	Interest £	*s*	*d*
At 10 p Cent	1	50	5	5		
Do	2	45	5	4	10	
Do	3	40	5	4		
Do	4	35	5	3	10	
Do	5	30	5	3		
At 5 p Cent	6	25	5	1	5	
Do	7	20	5	1		
Do	8	15	5		15	
Do	9	10	5		10	
Do	10	5	5		5	
			£50	**£23**	**15**	

Figure 6d: Wm. Van Laitz's schedule for repaying government tallies, adapted from Van Laitz, "A Proposal to Ease the Subject," NLS Adv. MS 31.1.7, f. 44.

According to Van Laitz's schedule, the public would end up paying £73. 15*s*., including interest, on £50 principal worth of tallies. This was compared to the £90 that would be spent in total if the government chose instead to just maintain the current 8% interest rate for ten years, and then repaid the £50 at the end of the ten years. Van Laitz concluded that not only would the scheme help

[84] Van Laitz, "A Proposal to Ease the Subject," NLS Adv. MS 31.1.7, f. 44r.

improve public credit and the trading value of tallies, but the £16. 5*s.* saved every ten years on every £50 of tallies would amount to £325,000 saved per £1 million debt outstanding.

Van Laitz's scheme showed how diligent repayment of debt saved interest in the long run. The concept of the "Sinking Fund" took this idea even further. Like many of the creations of financial mathematics, a Sinking Fund was an intuitively simple idea with possibly counterintuitive consequences. It worked like this: in order to pay off a certain outstanding debt, the debtor (for example, Parliament) would dedicate a certain initial amount of revenue, like the annual proceeds of specific tax, to a "fund" for repaying the debt's principal.[85] Because principal was repaid, the interest in the following year would be lower, and that amount of interest saved would also be contributed to the Fund. Each successive year, the principal repayment would increase exponentially. The Sinking Fund, therefore, harnessed the power of compound interest to decrease debt.

The basic logic of exponential growth and/or decay that empowered the Sinking Fund was one that was seen in many other places in the financial policies and projects of the era. Paterson and Gregory used advanced compound-interest mathematics in calculating the Equivalent. Critics of the Equivalent, like William Black, in turn used growth-at-interest calculations in reverse to show how quickly that loan would be paid back by the Scots. Archibald Hutcheson used compound-interest calculations in March 1720 in showing why the value of the South Sea Stock probably was not worth very much, while six months later South Sea Company advocates would use compound-interest mathematics to justify how it was they could in fact pay 50% annual dividends for twelve years. The exponential (and, inversely, logarithmic) mathematics of compound interest was by no means obscure in early-eighteenth-century Britain, but nor were the consequences of exponential thinking uniformly or universally understood. Compound-interest calculations jostled with alternative ways of

[85] One primary recognized function of sinking funds in modern finance is as a demonstration of credibility and responsibility of the debtors. For a modern take, see: Richard Sylla and Jack W. Wilson, "Sinking Funds as Credible Commitments: Two Centuries of US National-Debt Experience," *Japan and the World Economy* 11, no. 2 (Apr., 1999): 199-222.

thinking about financial value over time, like the pervasive years' purchase conventions or computations based on simple, rather than compound, interest. Well into the eighteenth-century, the exponential mathematics of finance produced provocative, inventive, and even counter-intuitive conclusions that inspired both fancy and doubt. The story of the Sinking Fund saw a bit of both. The Sinking Fund concept had been used as a formal public finance mechanism at least as early as the mid-17th century by Johan de Witt in Holland.[86] In England, the idea of using the exponential power of compound interest to repay debt was touched upon in indirect or off-hand ways before being seized upon more deliberately as an inventive tool of public financial policy in the 1710s. The idea was implicitly floated in English publications as early as 1700, when an anonymous author (perhaps) Paterson, penned a brief *Letter to a Member of the Late Parliament, Concerning the Debts of the Nation*.[87] The author presented one computation which projected the amounts that could be paid annually on the principal of the National Debt over the subsequent six years. Most interesting was the fact that these payments grew larger every year, and at an increasing rate. (The payment in the second year was just under £65,000 greater than that in the first, but the payment in the sixth year was over £85,000 greater than that in the fifth). In effect, the author demonstrated numerically the effect of a Sinking Fund, but neither used that name nor described the mechanism in detail.[88]

[86] Johan De Witt (1625-1672) was Grand Pensionary of Holland (a preeminent administrator in the Dutch Republic) from 1653 until his death, and was known for several contributions to finance and mathematics, especially concerning early theories of probability. On the history of the Sinking Fund idea, including its application in Britain, see: N. A. Brisco, *The Economic Policy of Robert Walpole* ([New York]: Columbia University, 1907), pp. 39-40; E. L. Hargreaves, *The National Debt* (London: Edward Arnold & Co., 1930), ch. 2.

[87] *A Letter to a Member of the Late Parliament, Concerning the Debts of the Nation* (*s.l.*: *s.n.*, 1700), p. 1. A second edition of the pamphlet, with minor additions and revisions, was published in 1701 with the imprinted "London: Printed for Edward Poole."

[88] *A Letter to a Member of the Late Parliament* (1700), p. 4.

A Computation of what may be paid off from the principal Debt in Six Years, according to the Proportion of Payment, betwixt the 19*th*. of *Dec.* 1699, and the 20*th*. of Dec. 1700, at 7*s*. 2*d*. *per C.* which was the nearest Interest then paid off as *per Acc*^{t}. of the Payments.

	l.	*s*.	*d*.	
The First Year	912,512	0	0	
Second	977,300	7	0	
Third	1,046,688	13	6	
Fourth	1,121,003	11	0	
Fifth	1,200,694	16	6	(*)
Sixth	1,285,944	2	6	
	6,544,143	**10**	**0**	

Figure 6e: Table of debt repayment from *A Letter to a Member of the Late Parliament, Concerning the Debts of the Nation* (1700), p. 4. (*) Note: the "Fifth" year figure—1,200,694—appears to be irregular, in that following the pattern of compounding repayment established in years 1-4, the figure should be 1,200,*5*94. This minor error was carried through the calculation, resulting in an error for the "Sixth" Year (presumably 1,285,837) and the Total as well (presumably 6,543,936).

The author of the 1700 *Letter* implicitly brought the tools of compound interest, which would have been familiar in various forms to financially knowledgeable Britons at the time, to the problem of repaying the National Debt. (In the 1730s, indeed, the Opposition MP and economic polemicist William Pulteney pointed to the author of the *Letter* as the true original author of the English Sinking Fund, largely to take that honor away from his foe Walpole.)[89] Yet the *Letter* only looked six years into the future, and did little to explicate the more spectacular powers of compound interest as a tool to be harnessed by the public. The first person to do that was, perhaps, Archibald Hutcheson, whose 1715 *Proposal for the Payment of the Publick Debts* included far-reaching mathematical projections of the amount of time it would take for the "sinking" of the National Debt.[90] As we saw in Chapter 5, one of Hutcheson's first characteristic speculative models was a 5 x 4 chart showing the number of years it would take to sink a debt of £45 million pounds assuming different initial

[89] William Pulteney, *Some Considerations on the National Debts, The Sinking Fund, and the State of Publick Credit: In a Letter to a Friend in the Country* (London: Printed for R. Franklin, 1729), pp. 67-8.
[90] [Archibald Hutcheson], [Archibald Hutcheson], *A Proposal for the Payment of the Publick Debts, and an Account of Some Things Mentioned in Parliament on that Occasion* ([London]: *s.n.*, 1714/5), p. 21.

annual payments and different interest rates (**Figure 5a**). That chart had the odd potential implication, perhaps, that the nation would be able to get out of debt faster the higher the interest rates it was paying.

The realization of the Sinking Fund as a tool of public finance was not Hutcheson's doing, though. But Hutcheson was quite willing, at the time, to laud the "Honourable Person" who put the mechanism into effect.[91] That person was Walpole. His Sinking Fun was part of a much larger parcel of fiscal reform objectives in 1716-1717, including the reduction of the nation's "floating" debt, an overall lowering of interest, and the consolidation of several tangled sources of government revenue into a few specific "Funds."[92] Indeed, the more immediate concern was the reconfiguration of the mess of outstanding public debts into more flexible terms with lower interest rates. Walpole, with the help of the ever-reliable William Lowndes and other computational assistants, carefully analyzed how much money would be saved to the public by refinancing all outstanding debts to interest rates no higher than 5%.[93] Estimates suggested that the total savings to the public could equal £527,000, £600,000, or even £690,000 annually, just on the debts that were redeemable. More complicated was whether it might be possible to get holders of long, irredeemable annuities to exchange them for new securities at lower interest rates, and a lot of detailed attention was given to the question of what kind of compensation (in the form of new annuities) would have to be given to get holders of irredeemable annuity-holders to take such a switch.[94] (The solution of exchanging those pesky

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[91] [Archibald Hutcheson], *Computations Relating to the Publick Debts, Taken from the Abstract Deliver'd into Parliament the 14th of March, 1716…(*London, *s.n.* 1717), p. 5.

[92] On Walpole's 1717 financial reforms and the introduction of the Sinking Fund, see: Brisco, *Economic Policy of Robert Walpole*, pp. 35-41; J. H. Plumb, *Sir Robert Walpole, Vol. I: The Making of a Statesman*, p. 247; Dickson, *Financial Revolution*, pp. 82-87. In addition to an "Aggregate" Fund that had consolidated certain revenue streams in 1715, the acts of 1717 created a "General" fund as well as "South-Sea" and "Bank" funds intended for the payment of debts owed to those two institutions.

[93] [Robert Walpole], "M^r. Lowndes Savings, by Reductions of Redeemable Fonds to 5£. p^r. C^t.," [c. 1716?], Ch(H) Papers 49/1a/5; Untitled Notes in Robert Walpole's Hand, on Interest Savings, Ch(H) Papers 49/1a/9; Ch(H) Papers 49/1a/16, f. [1]v; "A Computation of the Savings by Reducing such Debts as Carry 6£ p[er] C^t or upwards to 5£ p[er] C^t," Ch(H) Papers 49/4.

[94] Walpole and his advisors considered offering holders of redeemable annuities a variety of different compensation packages. For example, holders of long-term (70-years plus) annuities might have been offered a lower up-front

irredeemable for shares in a joint-stock company, all the rage by 1720, was not yet on the table). Walpole contended that, the lower the interest rate the irredeemable annuity-holders would agree to, the greater the interest savings, estimating at one point that a reduction to 5% would save another £170,000, while a reduction to 4% would contribute £250,000.[95]

It was hardly a foregone conclusion that this was feasible, but if such an interest-rate reduction could be effected, though, the benefits could be tremendous: "The Savings of all Fonds after ye reduction [were] to be strictly applied towards the discharge of ye National Debt."[96] The power of such a Sinking Fund was quite potent, as Walpole himself scrawled:

> 250,000^£^. p^r^ Annum, wch added to ye Savings upon ye redeemable Fonds makes a Fond of above 700,000^£^ p^r^. Annum to be strictly applied towards reducing ye National Debt, & it is to be observ'd that a Fond of 700.000^£^ p^r^. Annum, will by compound interest reckon'd at 4^£^. p^r^.C^t^. & annually only, pay off the present Debt of ye nation in less than 30 years, if computed quarterly, wch will be practiced in this case the work will be done in a much less time.[97]

While Walpole's Sinking Fund was yet one of many comparatively sober fiscal reforms he hoped to carry out, it nonetheless exhibited some of the confident enthusiasm about the power of compound interest advocated more aggressively by Paterson and Hutcheson. Historians have perhaps failed to recognize the degree to which Walpole's Sinking Fund was indeed a product of both intensive computational analysis and mathematical optimism. Biographer J. H. Plumb claims of the Sinking Fund that "by this device Walpole showed great originality," but notes also that "it bears the mark

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valuation for their money, but a higher ongoing interest rate (16-17 years purchase, and 5% ongoing interest), or a higher up-front valuation and a lower long-term interest rate (18-18.5 years purchase, and 4% ongoing interest). A great deal of computational analysis went into this question, including which of these various options was superior for the government. See: "State of the Present Value of the Several Annuitys Computed," [1716?], Ch(H) Papers 49/1a/13; Ch(H) Papers 49/1a/16, various folios (note that 49/1a/16 contains no foliation, and is quite disorganized).

[95] [Walpole], Ch(H) Papers 49/1a/16, f. [3]^r-v^. (Foliation is estimated).

[96] Ch(H) Papers 49/1a/10, recto.

[97] [Walpole], Ch(H) Papers 49/1a/16, f. [3]^v^. (Foliation is estimated). The particular emphasis on the benefits of quarterly compound interest over annual compound interest is highly reminiscent of William Paterson, and gives some circumstantial evidence that he may indeed have contributed to Walpole's thinking. Compare: "Lewis Medway" [William Paterson], *An Inquiry into the Reasonableness and Consequences of an Union With Scotland* (London: Printed and Sold by Ben. Bragg, 1706), p. 110.

of so much of Walpole's administrative work, for it was simple, practical and sound."[98] In an earlier scholar's estimation, Walpole did not even conceive of his Sinking Fund plan in terms of the accumulation of compound interest.[99] Evidence from Walpole's papers suggest that Walpole's Sinking Fund may have been conceived in a more adventurous spirit than these scholars have indicated. Walpole's Sinking Fund was itself a kind of creative, largely untested financial *project*, which—like Paterson's Equivalent or even Hutcheson's proposals for repaying the National Debt—required asking British representatives and citizens to put their political faith in the numbers. The fact that it came to be seen as a comparatively sober exercise in fiscal responsibility, and an emblem of Walpole's fiscal genius, was itself a political construction.

V. "Freer and Happier Every Year": The Sinking Fund and Political Futurity

Soon after its introduction in 1717, the Sinking Fund went somewhat overlooked, as contemporaries turned their attention to the seemingly more inventive, and ultimately more infamous, South Sea Scheme. Yet the principle of the Sinking Fund remained in place as a government policy through the 1720s, and in the aftermath of the South Sea Bubble, the Walpole and his Whig supporters recast the Sinking Fund as a reminder of the world that might-have-been had Walpole never lost control of Britain's finances. From 1721 to 1724, Walpole had managed to bring some kind of resolution to the South Sea Affair, to neutralize key political rivals like Lord Carteret and appease the often unruly political interests of the City of London, and to institute new tax policies (particularly an Excise on tea, chocolate, and coconuts) amenable to a broad range of constituents in city and country.[100] But

[98] Plumb, *Sir Robert Walpole, Vol. I: Making of a Statesman*, p. 247
[99] Brisco, *Economic Policy of Robert Walpole,* p. 40
[100] See Plumb, *Sir Robert Walpole, Vol. II: The King's Minister*, ch. 2-3, esp. pp. 72-6, 107 on tax reform and City politics. Plumb notes, for example, that: "The Parliamentary sessions of 1723 and 1724 were conducted with an ease that was unprecedented. Never in the memory of any politician had there been less debate or more alacrity in the passage of necessary bills of supply." (p. 76)

soon thereafter new political demands and new political forces emerged, which brought Walpole's Sinking Fund even greater attention—and power.

A key turning point came in the spring of 1725, when Walpole asked the Commons to assume responsibility for debts incurred on the Civil List, the dedicated revenues given annually for the use of the Crown. In early April, Walpole's one-time political ally William Pulteney made heated speeches in the Commons, accusing Walpole and his government of waste, incompetence, and corruption in fiscal administration, and, in classic style, demanding to see comprehensive figures on pensions and secret service payments made by the Crown.[101] Walpole soon ejected Pulteney from positions of executive responsibility, and the latter joined with other disaffected political figures like Lord Bolingbroke to form the core of a new "patriot" opposition to Walpole, which skillfully and wittily voiced their discontent in pamphlet polemics and the brilliantly biting *Craftsman* newspaper.[102] At this new height of controversy, the political significance of the Sinking Fund was transformed. As Patriot opponents disputed the honesty, efficacy, and ingenuity of Walpole's fiscal invention, pro-Walpole commentators extended the futuristic reach of the Sinking Fund and explicated its theoretical and mathematical underpinnings. Further, nearly a decade out from the Fund's founding, it became possible to measure its efficacy in the past, and attempts to do so provoked heated controversy. As such debates about the past became increasingly intractable, Whig advocates of the Fund made even more ambitious claims about the Fund's future power.

A wave of new attention to the Sinking Fund was marked by the 1726 *Essay on the Public Debts of the Kingdom* by MP Nathaniel Gould, a former Bank of England Governor, opponent of the

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[101] As Plumb notes, Pulteney "accused Walpole of providing false figures, insisted that money was filched form the Sinking Fund, that the Bank was allowed to make money out of the civil list debts, that the financial arrangements were thorough incompetent, that money was squandered on pensions, bounties and gratuities, that Walpole was feathering his own nest handsomely." (Plumb, *Sir Robert Walpole, Vol. II: The King's Minister*, p. 123.)

[102] On Pulteney and the opposition, see Christine Gerrard, *The Patriot Opposition to Walpole: Politics, Poetry, and National Myth, 1725-1742* (Oxford: Clarendon Press, 1994). Henry Roseveare includes Pulteney among a collection of critical MPs who kept alive, faintly, an ethos of public accountability Roseveare claims was lost early in the eighteenth-century. (Roseveare, *Treasury: Foundations*, p. 59.)

South Sea Scheme, and ally of the Walpolean Whigs.[103] The avowed objective of Gould's *Essay* was a common one in British financial politics: to demonstrate that Britain's National Debt had moved in a positive direction from the past (in this case, 1717) to the present, and thereby to demonstrate the probity of current financial policymakers.[104] In particular, Gould wished to dispel a "general Suspicion of the Inefficacy" of the Sinking Fund (no doubt a reference to the barbs being leveled by Pulteney and his fellow members of the Opposition).[105] Gould published calculations showing a £2.1 million net decrease in the National Debt over the preceding decade. Gould did not just account for the past, though. He generated a projection of the future power of the Sinking Fund, showing that a roughly £50 million annual debt would be repaid by 1756, assuming 4% interest. Critically, he argued that this calculation was effectively correct even if certain key pieces of information, such as the yearly tax revenues, were merely estimates. Gould echoed the epistemological arguments that Davenant and even Hutcheson had long invoked in justifying their exercises in computational criticism, but in the name of promoting government policy:

> There are a great many Particulars which you will see… I must want the Knowledge of, in order to make this Supposition with any great Exactness. But however unprovided I am with for an Inquiry of this kind, it may be yet worth while to proceed in describing the Proportions in which any determined yearly Sum (though by mistake) supposed to be the present yearly Produce at a Medium of the Sinking Fund, will increase, when apply'd to the Payment of the Publick Debts; as those Proportions will be the same with those in which any other Sum, with more Truth or Probability supposed to be produced one Year with another by the Sinking Fund, will increase when apply'd to the same Purpose.[106]

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[103] See Nathaniel Gould, *An Essay on the Publick Debts of this Kingdom…* (London: Printed for J. Peele, 1726). Gould was MP for New Shoreham from 1701-08 and 1710-1727. He had been active in debates on international trade in the late 1710s and had corresponded with Walpole early in 1720 about certain dangers relating to the South Sea Scheme, and the relative superiority of the Bank of England's refinancing proposal. (Indeed, I think it is quite likely he was the author of one or more anti-South Sea Scheme pamphlets in early 1720, as discussed in Ch. 4, Section II, note 86). After the South Sea crash, he had advocated harsh reparations for the South Sea Company's officials following the 1720 Bubble.
[104] See Ch(H) Papers 49/13, 18/1-5, esp. 49/18/2 for Walpole's own marginal comments on one "Account of such Nationall Debts incurr'd before 25 Decembr 1716 as have been since discharged."
[105] Gould, *Essay on the Publick Debts* (1726), pp. 6-7.
[106] Gould, *Essay on the Publick Debts* (1726), p. 11.

Gould's argument was that the mathematical principles behind the Sinking Fund worked more or less regardless of whether the empirical specifics that went into the calculation were known with any precision. In order to drive this argument home, Gould turned to yet another strategy of computational rhetoric which had been invoked in the writings of Paterson and Davenant's *Mercator*—didactic instruction. Gould laid out the mathematical rules by which the Sinking Fund operated, as if to teach readers that, by mobilizing the "common Rules for calculating the Increase of Principal Sums continued at Compound interest," one could easily project the progress of a Fund at many different interest rates and payment levels. Critically, he explained that it was a very simple matter to figure out when a certain principal balance would be entirely repaid, by simply figuring out when the size of the Sinking Fund yearly payment would have increased by the amount of annual interest on the initial principal balance.[107] Showing command over computational method had the dual effect of representing the efficacy of the Sinking Fund itself, and asserting the computational authority of the pamphlet's author (and by extension, the author of the Sinking Fund itself). Gould's most aggressive claim was that the Sinking Fund's enchanted powers still held even if it necessitated borrowing new money to make the required payments.[108] Gould even presented a hypothetical calculation showing that, if the nation were to take on £15 million in new debt each year for over a century, the Sinking Fund would assure that the entire balance was repaid within 105 years.

Gould soon became the victim of a bitter partisan attack from opposition leader William Pulteney, whose 1727 *State of the National Debt* accused Gould of pandering to Walpole and trying to deceive the public.[109] As Plumb notes, "Pulteney had an excellent head for figures and loved using it," though that skill was one far more readily applied to finding faults in financial policies than

[107] Gould, *Essay on the Publick Debts* (1726), pp. 22-3.
[108] See Gould, *Essay*, pp. 37-40. For Hargreaves' take on Gould, see *The National Debt*, pp. 41-44.
[109] William Pulteney, *A State of the National Debt, As It Stood December the 24th, 1716. With the Payments Made towards the Discharge of It out of the Sinking Fund, &c. Compared with the Debt at Michaelmas, 1725* (London: Printed for R. Francklin, 1727).

finding merits.[110] In this sense, of course, he was very much an heir to the vibrant tradition of computational criticism fostered by Davenant (in his early writings) and Hutcheson. In his 1727 text, Pulteney attempted to show by a "debtor and creditor" accounting scheme that the National Debt had actually increased by over £2 million since 1717.[111] He called upon numerical precision as a defense against the sophistic generality that he felt usually marked discussions of the nation's finances. "Facts and Figures are the most stubborn Evidences," Pulteney appealed.[112] Gould had exploited the power of compound interest embodied in the Sinking Fund to deceive readers, a deceit nowhere more evident than in his ridiculous calculation showing a Sinking Fund could repay a £1.5 billion debt in 105 years. The "Arguments for the Preservation of the Sinking Fund have a very odd Appearance in one," Pulteney wrote, "the whole Intent of whose Writing seems to be, to pervert the great and good Ends proposed by it, to the most pernicious Purposes… viz. An Encouragement and Foundation of a Succession of endless Debts and Taxes."[113]

Despite his appeal to the plain intelligibility of numbers, much of Pulteney's argument came down to subtle critiques of interpretations Gould had made about past financial events. Most critically, Pulteney harangued Gould for not counting as "new debt" a nominal increase in principal that resulted from the government's exchanging certain "irredeemable" annuities for lower interest, redeemable debts with higher nominal values in 1720.[114] Whether this increase in the face-value of the government's debt counted as new debt assumed in 1720 was hardly an obvious question.

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[110] Plumb, *Sir Robert Walpole, Vol. II: The King's Minister*, p. 122.

[111] By using the idiom of double-entry bookkeeping, Pulteney was arguably attempting to capitalize on the rhetorical authority of that style of calculation. Pulteney wrote: "The Manner of drawing up Accounts, by way of Debtor and Creditor, being, I believe,most plain and intelligible, I have therefore stated the Accounts this way." (*State of the National Debt*, p. 5). On the rhetorical function of double-entry bookkeeping, see: Mary Poovey, *A History of the Modern Fact: Problems of Knowledge in the Sciences of Wealth and Society* (Chicago and London: University of Chicago Press, 1998), ch. 2.

[112] Pulteney, *State of the National Debt* (1727), pp.14-5. Pulteney claimed that Gould had translated the usual sophistry applied to financial matters into numerical terms, a kind of counterproductive move in Pulteney's view. "For if it was possible to believe, that any… could have a Desire that the National Debts should be thought of in the Light which this Author would put them; was not the only Way of doing this, to leave them, as before, to be talked of in general words?" (p. 14)

[113] Pulteney, *State of the National Debt* (1727), p. 29.

[114] For Gould's argument, see *Essay on the Publick Debts* (1726), pp. 25-27. For Pulteney's retort, see *State of the National Debt* (1727), pp. 18-19.

Indeed, it was a question that required political consensus, rather than analytical precision, to answer. Pulteney's attempt to capitalize on the stubborn, evidentiary quality of "Facts and Figures" rang a bit hollow when placed beside such interpretive quandaries, as pro-Walpole calculators quickly pointed out in manuscript and print. One manuscript commentator, for example, offered a brief exposition of the "many gross mistakes and impositions" within Pulteney's *State of the National Debt*, citing double-counted payments and inconsistent annuity valuations as indication of the "disingenuity, or ignorance of the Author."[115] Gould published his own *Defense of an Essay on the Publick Debts of the Kingdom* in 1727.[116] Gould slyly presented a series of calculations that showed just how much he and Pulteney actually agreed upon. Gould said he was willing to condescend to analyzing Pulteney's calculations on their own terms, but could do so only "as far as such a Task is practicable, in examining Accounts made up of Assertions and States, which are neither true nor false, and where, I being to perceive, my greatest Difficulty will be to find his Meaning."[117] Pulteney's formal method of calculating (in the debtor-creditor form) and his inflexibility in interpreting numbers became, to the Walpolean calculators, a sign that he cared about (to mix metaphors) the letter of the mathematical law and not its spirit. Honest political calculation, it seemed, meant recognizing when certain numerical assertions simply were "neither true nor false."

In a particularly memorable barb, Gould lamented Pulteney's state of confusion: "What a Misfortune is it, to understand Arithmetick with no better luck in the Application of it."[118] Gould's numerical *modeling* about what the Sinking Fund *could* do clashed violently with Pulteney's interrogative skepticism about what a Sinking Fund—in the hands of Walpole's ministry—actually *had done*. Of course Pulteney's method of historical accounting, as we have seen, had become a

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[115] [Anon.], Untitled comments on Pulteney's *State of the National Debt*, [c. 1727], CamUL Ch(H) Papers 49/14, recto.
[116] Gould, Nathaniel. *A Defence of* An Essay on the Publick Debts of this Kingdom*, &c. In Answer to a Pamphlet, Entitled,* A State of the National Debt*, &c. By the Author of the Essay*. (London: Printed for J. Peele, 1727).
[117] Gould, *Defense of* An Essay (1727), p. 13.
[118] Gould, *Defense of* An Essay (1727), p. 51.

mainstay of partisan controversy since the beginning of the century. Gould's strategy of eschewing formal accuracy in favor of far-reaching mathematical projections, and actively criticizing his opponent's interpretive rigidity, marks the success of a new kind of computational idiom nurtured by Walpole and his computational associates in the 1720s.

In the late 1720s, the Sinking Fund became transmuted into a symbol of financial orthodoxy and of Walpole's personal genius.[119] Walpole himself, for example, resolutely defended his own ingenuity in having invented the Sinking Fund. "To obviate an objection, wch. I am sensible will be made by some, tho not at all to the present purpose," Walpole wrote in one manuscript paper, perhaps a draft for a speech, "I do admit, there had been Sinking Funds before this time." But, he explained, the fact that there had been sinking fund-like arrangements with regard to the repayment of certain sets of Exchequer bills and annuities prior to 1716 did not mean that Sinking Funds were common practice. "This does not at all attest my assertion, that *A Sinking Fund*, made & establish'd wth regard *to the National Debt* in general, was first projected & form'd in y^{e}. year 1716. & till that time unthought of, unheard of."[120]

The talismanic status of the Sinking Fund soon gained a kind of official sanction. Shortly after the death of King George I in 1727, the House of Commons, firmly under the control of Walpole, presented their *Humble Representation of the House of Commons to the King* to George II, containing a purportedly consensus view of the state of the nation's finances.[121] The Sinking Fund earned a starring role. In fact, the authors claimed that "had this Method… been further pursued and without Interruption, the Dangerous and Mischievous part of the late *South-Sea Scheme* might

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[119] Odd proof of the Sinking Fund's emerging iconic place in public discourse can be seen in the anonymous publication of a 1727 pamphlet entitled *Great Britain's Speediest Sinking Fund is a Powerful Maritime War, Rightly Manag'd, and Especially in the West Indies* (London: Printed for J. Roberts, 1727). Written at a height of Anglo-Spanish tensions, the hawkish piece argued that the best way to defray England's debt was to send a massive naval force to demolish the Spanish in the West Indies.

[120] [Robert Walpole], "An intire Paragraph" concerning the Sinking Fund, [1727 or later?], Ch(H) Papers 49/1a/14.

[121] House of Commons, *The Humble Representation of the House of Commons to the King, with His Majesty's Most Gracious Answer Thereunto* (London: Printed for R. Knaplock et al., 1728).

have been avoided."[122] The *Representation* further claimed to settle the historical matter of how much the nation's Debt had changed in the previous decade, asserting a £2.7 million decrease. Yet the authors did not shy away from some aggressive, futuristic mathematics of their own. They argued that the £800,000 that had been added to the annual Sinking Fund since 1717, if treated like a perpetual annuity valued at 25 years purchase, "Makes a real Profit to the Publick Amounting to Twenty Millions."[123] If Walpole and his followers sought to stabilize the meaning of the Sinking Fund's *past*, they did so while making aggressive claims about its future.

Indeed, Walpolean propagandists came to project the power of the Sinking Fund deeper and deeper into Britain's future. An especially intriguing example of the creation of a mythos around Walpole's Sinking Fund came in a 1728 pamphlet carefully entitled *Remarks on the R—p—n of the H— of C—ns to the K—g; and His M—y's A—s—r. Address'd to All True Britons*.[124] The anonymous author began by arguing that the Commons' *Representation* settled the matter of the efficacy of the ministry's policies in reducing the National Debt, and that recent efforts to claim otherwise (as in *The Craftsman*) were intended to foment unrest in the minds of the people. The author then described the ministry's current policies in hyperbolic terms: "The Sinking Fund is deservedly a darling Project, glorious for the Contriver, and happy for his country; on which all our other National Happiness chiefly depends."[125] The author then turned to the future, but not just the future of the Sinking Fund; he rather sought to project the whole of British financial history in an effort to demonstrate the merit of the ministry. "Permit me, for once," the author wrote, "to personate a future Historian, who, in the advanced Ages of Time, some three hundred Years hence… he'll be obliged to give the World the honest, candid Account following."[126] The ventriloquized future-

[122] House of Commons, *Humble Representation* (1728), p. 142.
[123] House of Commons, *Humble Representation* (1728), p. 143.
[124] [Anon.], *Remarks on the R—p—n of the H— of C—ns to the K—g; and His M—y's A—s—r. Address'd to All True Britons.* (London: Printed for A. Moore, [1728]).
[125] *Remarks on the R—p—n* (1728), p. 14.
[126] *Remarks on the R—p—n* (1728), p. 17.

historian of 2028 described how Walpole, "one of the greatest Men that ever *Britain* bred," had met the financial challenges of the early Georgian period.[127] He "found Means to discharge the [nation's debts] with Honour, and put them into such an annual Course of Payment, that they have been all paid off above two Centuries ago."[128] Walpole's (future) retirement was described as a moment of great joy for the Prime Minister, "having had the satisfaction to see his Country grow freer and happier every Year by the Sinking Fund, the Establishment of which was wholly owing to himself."[129] The Sinking Fund had become the armature upon which an entire history of administrative success could be built—into the future.

VI. Conclusion: "Figures, Which They Thought Could Not Lie"

The Sinking Fund, though, was not simply a mathematical phenomenon, and the future it projected was one that had to be *made* by political actions. In particular, political leaders and representatives had to protect the Fund and make payments into it according to the rules specified. Yet those rules, despite any rhetoric that might have surrounded Walpole's great invention, were not inviolable, and the good faith of its ministers, including the Prime Minister, was required to see its power realized. In fact, Walpole's faith proved not to be good for long. Beginning in 1727, Walpole rerouted around £100,000 per year designated for the Sinking Fund to increase the Civil List granted to the new King George II, despite vehement criticisms that such an action was a sacriligious encroachment on the Fund. In 1729 he raised a new debt of £1.25 million, with the interest to be paid out of the Sinking Fund. In 1730, he rerouted Sinking Fund monies to pay the interest on a debt to the East India Company, abolishing the salt taxes that had earlier supported that interest. Two years later, he reintroduced the salt taxes, but did so in order to reduce taxes on land, not restore the Sinking Fund.

[127] *Remarks on the R—p—n* (1728), pp. 19-20.
[128] *Remarks on the R—p—n* (1728), p. 25.
[129] *Remarks on the R—p—n* (1728), p. 31.

Reducing the taxes on land was a main agenda behind Walpole's disastrous "Excise Scheme" of 1733, a plan to shift the government's revenue sources from land taxes to taxes on domestic consumption that blew up in his political face in 1733-1734.[130] But opposition to Walpole's tax policy did not save the Sinking Fund. In 1733, he diverted £500,000 from the Fund to cover expenses; in 1734, the number was £1.2 million; by 1735, the fund was mortgaged.

So a mere seven years after Walpole's advocates were predicting three-hundred years of national prosperity on the back of the Sinking Fund's unstoppable power, the Fund was almost entirely dead, killed, as it were, by its own parent. The relentless Pulteney of course did not miss the opportunity to lament this fact, and to point out just how little foresight the grand predictions of Walpole's supporters had really shown. Among other things, Pulteney pointed out how the commitment to a long-standing principal debt, even one neutralized by a Sinking Fund, promoted a massive growth in civil bureaucracy and its attendant corruption. "But our Predecessors either thought that the publick Debts would have been paid off in a short Course of Years… by the Improvements of the Sinking Fund, with the inviolate Application of it to the Purpose," Pulteney fretted. "Or, from a Want of due Foresight into the Consequences, which attend the long Continuance of such an annual, settled Revenue, They did not use those necessary Precautions, relating to it, which the Importance of the Case required."[131] As a result, the Sinking Fund withered into an "accidental Appendix only to the Office of the Treasury."[132]

Walpole and his supporters grasped for ways to defend their tampering with the Sinking Fund. One way was to claim that the supposed inviolability of the Sinking Fund was itself a kind of political fiction, trumped up by a "motley tribe" of conniving political opponents bent on

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[130] Brisco, *Economic Policy of Robert Walpole*, pp. 62-6; Langford, *Excise Scheme*, pp. 31-6.
[131] William Pulteney, *An Enquiry into the Conduct of Our Domestick Affairs, from the Year 1721, to the Present Time.* (London: Printed by H. Haines, 1734), p. 14. Pulteney would continue to write on the appropriation of the Sinking Fund, publishing, for example, his *Case of the Sinking Fund, and the Right of the Publick Creditors to it Considered at Large* (London: Printed for H. Haines, 1735) in the following year.
[132] Pulteney, *Enquiry into the Conduct of Our Domestic Affairs* (1734), p. 14.

convincing the people that "most of our Laws have been of late calculated for enlarging the Prerogative of the Crown and retrenching the Liberty of the Subject."[133] In his own published response, Walpole denied that the Sinking Fund represented any kind of long-term "Contract betwixt the Publick, and the Creditors of the Publick," preferring instead a highly contingent view of the Fund's obligations, stating that it might legally be repurposed "when the Exigency of the Publick makes it necessary."[134] Other writers sought to subtly clarify or redefine what the Sinking Fund was intended to do, arguing for example that the Sinking Fund might rightfully be used toward any end that ultimately had the long-run effect of reducing national indebtedness, including paying current expenses that might otherwise necessitate raising expensive new loans.[135] Yet another interesting kind of justification for the appropriation of the Sinking Fund, cited by Walpole himself, was simply the fact that no one, including public creditors, really seemed to be complaining all that much about such a technical reallocation of funds.[136]

However many plausible justifications might be cited for the alienation of the Sinking Fund, though, there is no question that it placed Walpole and his supporters in a strange position. They found themselves facing a quandary of futurity, left to explain their way out of a future they themselves had calculated. The very tool Walpole created for conquering the political future—the Sinking Fund—ultimately shackled his own ministerial power. This quandary had a very specific, constitutional dimension, as a profound question arose in the 1730s as to whether one Parliament might bind a future one, as the Sinking Fund required. At the same time, the political quandary of the Sinking Fund had a more diffuse, epistemic character. In arguing for the potency of compound

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[133] [Anon.], "An Essay on the Sinking Fund: Wherein the Nature Thereof is Fully Explained; And the Right of the Publick to that Fund Asserted and Maintained," MS Copy, Ch(H) Papers 73/36, pp. 2-3. Also printed (London: Printed for J. Peele, 1736).
[134] Robert Walpole, *Some Considerations Concerning the Publick Funds, the Publick Revenues, and the Annual Supplies, Granted by Parliament. Occasion'd by a Late Pamphlet, Intitled*, An Enquiry into the Conduct of our Domestick Affairs (London: Printed for J. Roberts, [1735]) pp. 8-9.
[135] For example, [Anon.], Untitled manuscript on the "Sinking Fund," [early 1730s?], BL Add. MS 74,066, item no. 16b.
[136] Walpole, *Some Considerations Concerning the Publick Funds,* (1735), p. 9.

interest to control the future of the National Debt, Walpole and his supporters had in some ways agreed to make themselves accountable to that logic, to be answerable for the success of their own predictions. The defiant logic of immediacy and contingency which Walpole invoked in destroying the Sinking Fund sat quite uncomfortably next to the language of exponential predictability that had been used to create and glorify the Sinking Fund years earlier. Walpole had used calculation to try to conquer the future, but he found that the very computational rules he had set up to do so made it harder to control the present.

In the three-and-a-half decades from 1700 to the mid-1730s, the Sinking Fund had gone from an implicit computational oddity or trick of mercantile know-how, to part of a grandiose scheme of public financial reconstruction, to real policy, to symbol of Walpole's genius and Britain's future prosperity, to dead vestige of Whig supremacy. With it, perhaps, can be traced the history of economic calculation, and futuristic projection, in British political life more broadly. Of course, the story of the Sinking Fund can only be taken so far. Walpole did manage to effectively expropriate the entire Sinking Fund. The force of mathematical rules and critical calculations did not, ultimately, win over the force of political patronage and parliamentary majorities. The story of the Sinking Fund rather speaks to the gradual authority that computational logic had come to garner in British political culture. We began with a discussion of how, in the 1690s, Charles Davenant had to struggle to convince readers that any amount of numerical estimation, let alone speculation or prediction, might form the basis of a credible political argument. By the 1720s, on the other hand, the forward-looking computational projections associated with Walpole's Sinking Fund became a foundation not only for a battery of fiscal policies, but also for the construction of a mythic persona for Walpole himself, one which looked some three hundred years into the future. The very totemic status attained by the Sinking Fund is one of the greatest pieces of evidence for the mounting political authority of calculation in the eighteenth century.

That political authority, though, was one fraught with ambivalences and ironies. What had emerged by the time of Walpole was not so much a pervasive "trust in numbers" in British political life, nor certainly a truly calculating, technocratic approach to governance. Rather, Walpole, his allies, and his opponents found themselves in a kind of persistent political numbers game, in which it was more or less expected that political policies would be justified by recourse to calculations, and it was similarly expected that such justifications would be subjected to unforgiving computational scrutiny by opposing calculators. It was not a very good game by most standards. Competitors tried to set their own rules and so often found themselves playing by different ones. Contests were often very unsporting, and it was rarely clear who, if anyone, ever won. But political leaders and their opponents found it was a game they had to play, because it was too costly not to, because to cede the numerical ground was to give up far too much.

It was Walpole himself who offered perhaps the most insightful reflection on the state of computational politics in the mid-1730s. In his 1735 pamphlet response to Pulteney, Walpole explained what brought him to publish his own thoughts on the National Debt:

> I have learn'd that the Poison has spread itself through the Nation, and that honest and very well-meaning Persons, when they saw a Representation of Facts so call'd, cloath'd in the Dress and Appearance of *Calculations and Figures, which they thought could not lie,* have been stagger'd, and silent upon a Subject that they could not answer.[137]

One might wonder what Walpole's long-time computational associate John Crookshanks would have said in response to this sentiment. Walpole was not saying, as Crookshanks had in 1718, that "Truth and Numbers are always the same." The key point for Walpole was that many "honest and very well-meaning Persons," throughout the political nation, had somehow come to think—to assume—that "Calculations and Figures" simply "could not lie." Who knows how many Britons really were quite so gullible, so willing to believe the complicated numerical claims that were thrust

[137] Walpole, *Some Considerations Concerning the Publick Funds* (1735), p. 7. *Emphasis* mine.

upon them and which they could not, probably, quite understand. What was more important, indeed, is the perception that such numerical faith existed. That avowed fear, that the public was too easily deceived, especially by calculation, had been a concern of Davenant's, of Hutcheson's, of Pulteney's. Its effect was not to discredit calculation as a tool of political argumentation, but to make it more threatening and more potent, and to drive political calculators to push ever further for calculations that were more convincing, more explicable, more believable. Walpole knew numbers could lie, and that was all the more reason not to stop calculating.

– Conclusion –
Accounts Are Amazing Things

Our story began in 1691, as anxious Parliamentary Accounts Commissioners, struggling desperately to piece together a passable picture of the nation's finances, wondered whether vital secrets of the public's money had gone lost forever with the death of one man, William Jephson. Towards our story's end, we came across the author of the 1728 *Remarks on the R—p—n of the H— of C—*ns, speculating about all the political wonders that could be expected come the year 2028, thanks to the enduring fiscal triumphs of a different man, Robert Walpole. We have come, it would seem, from confusion to clairvoyance, from the fear of the unknowable to the thrill of the foreseeable. It is perhaps too contrived to set the mysteries of Jephson's Secret Service accounts next to the mysterious powers of Walpole's Sinking Fund as definitive examples of the state of political-economic understanding in their respective moments. Yet such a contrived comparison is very much in keeping with the spirit and standards of argumentation fostered by the historical actors that have been our focus, the economic calculators of post-1688 Britain: the comparison is illuminating if not completely fair or intellectually rigorous. The dramatic differences in technical sophistication, political familiarity, and epistemological ambition between the debates over Jephson's mysteries and Walpole's demonstrate the fundamental elevation of *calculation* in the culture and cognition of British politics in the half-century after the Glorious Revolution.

There are multiple trajectories along which to explore this emergent numerical pattern of political thinking, whether by tracking the people, practices, or possibilities of calculation. First, this dissertation has chronicled the development of a new coterie of actors on Britain's political and intellectual stage. These were the public calculators, the men of (mostly) modest, if not non-existent, historical reputation who have populated the preceding pages. These public calculators did not yet have clear credentials or obvious indicators of their expertise, nor even an obvious name—"political

arithmetic"? "accounts"? "matters of Trade & Revenue"? "the science of stock-jobbing"?—for what it was they collectively knew about. They hailed from many different backgrounds: Charles Davenant came up through the Excise; John Crookshanks was an accountant for a trading company in Italy; Archibald Hutcheson was a lawyer and colonial administrator; David Gregory was an academic mathematician. They shared very different experiences in political life, from the frustrations and insecurities of the career place-seekers like Crookshanks, to the remarkable longevity achieved by William Lowndes, to the unprecedented power of Robert Walpole. And these are just the characters that are easily identifiable. Arguably as essential to our story as the influential calculators like Davenant and Hutcheson and Walpole was the more hazy class of figurers who never attained any prominence. And not just our touchstone Crookshanks. The computational political culture that arose in Britain was sustained by many characters even more obscure than him—from the two English members, named Taylor and Townsend, of the Committee of Six who calculated the Equivalent in 1706, to people like Samuel Hyde and Thomas Houghton who comprised Walpole's extensive network of political calculators, to the anonymous authors of so many dense, numerical pamphlets whose names will likely never be known.

Despite all of these differences, this cohort of calculators did share a remarkable set of intellectual skills and political concerns that effectively constituted a distinct field of economic knowledge, even if it is hard to put a name on that field (or many of those who made it). This domain included their common objects of attention, the public's money and all the many difficult phenomena associated with it—taxation, foreign trade, state administration, money, debt, stocks, and so forth. Collectively, the new community of public calculators transformed the intricacies of Britain's "Trade & Revenue" from a clandestine subject, jealously guarded by the likes of Sir Robert Howard yet little analyzed, to an object of open and intensive intellectual concern. Contemporaries in the early 1700s began to remark on how the tangled mass of questions surrounding the public

funds had become so complicated that they necessitated a new kind of political actor, purely to understand what was going on. As one anonymous pamphleteer put it in 1720:

> The very large Debt the Nation contracted for the Expences of a long and tedious War, having given Rise to sundry and diversity of Projects for raising the necessary Supplies, 'twas almost become *matter of Study for Life*, to be Master of the different Denominations of the kinds of the Publick Debts, together with the Funds established for the Discharge of the same.[1]

While they did not "Study for Life" in precisely the same way that other learned professions of their day did (or as economists do now), a core of such "Masters" of accounts did come into being in the early eighteenth century. They shared clear technical skills, like adept command over tables of compound interest, the ability swiftly to carry out lengthy arithmetic calculations with limited errors, and the knowledge to parse the complicated accounts of government debts or corporate capital holdings. Yet they also included a variety of other less obvious gifts more specific to their distinct political moment and their peculiar role within it. These gifts, I argue, distinguished them from the larger set of merchant bookkeepers, scriveners, government clerks, and other numerate individuals who found calculation a useful skill for getting by in private life. These *public* calculators had to think very creatively about how to build coherent numerical arguments out of incomplete data, cleverly using estimations, interpolations, and proxy variables to fill in the information they so often wanted but could not get. At the same time, they had to think deeply about how to make their own arguments clear and credible to a broader audience, probably far less numerate than they were. Finally, such calculators also had to think about how their arguments would hold up under the scrutiny of partisan opponents, and, alternately, how they might use computations to pick apart and discredit those opponents' claims. All of these political-economic calculators were driven, sometimes entirely, by the demands of public and partisan politics, by the need to make effective arguments, not enduring theories or iconic texts.

[1] [Anon.], *A Letter to the Right Honourable the Earl of Sunderland, with an Account of the Causes of the Present Diminution of Publick Credit* (London: Printed for J. Roberts, 1720), p. 3. *Emphasis* mine.

One of the most remarkable features of the computational economic knowledge that developed in the half-century after 1688 is how poorly it has seemed to fit within standard definitions of knowledge, whether in their time or ours. The demanding computational skills developed by men like John Crookshanks had no obvious name and fit no comfortable place in existing institutions of learning, be it the universities or the Royal Society. That kind of computational work had an ambiguous relationship to more coherent intellectual domains like "mathematics," as was particularly evident in some of the pamphlet contests over the Union Treaty in Scotland in 1706, when writers like William Black and James Donaldson seemed not to know whether they wanted to be "Mathnmatitians." There was not yet even a sufficiently robust tradition of "political economy" to appeal to as an identity—and it is not even clear if that would have been a viable title for much of what the public calculators did. Furthermore, modern historians of economic thought have not, by and large, seen fit to include the activities of the early-eighteenth-century in longer narratives of the development of political economy or economics.[2] Synthetic histories of economic thought regularly glance by a few purportedly serious late seventeenth-century English thinkers—Petty, Locke, North, perhaps Davenant—before picking up the story in France with the Physiocrats (often by way of John Law), only returning to Britain for the triumphs of the Scottish Enlightenment.[3] Some historians have noted that "economic thought in England developed briskly in the first half of the eighteenth century, and there are a large number of writers whose contributions are of interest," though only a tiny selection of those "large number" are ever discussed.[4] No major history of economic thought has paid any attention to Archibald Hutcheson,

[2] For more, see Julian Hoppit, "The Contours and Contexts of British Economic Literature, 1660-1760," *The Historical Journal* 49, no. 1 (Mar., 2006): 79-110.
[3] Exemplary of this pattern would be Guy Routh, *The Origins of Economic Ideas* (London et al.: Macmillan, 1975), esp. ch. 2, entitled "The Preposterous Origins." A less egregious example can be found in Terence Hutchison, *Before Adam Smith: The Emergence of Political Economy, 1662-1776* (Oxford and New York: Basil Blackwell, 1988), esp. chs. 5, 7-9.
[4] Eric Roll, *A History of Economic Thought*, 3rd edition (Englewood Cliffs, NJ: Prentice-Hall, 1956), p. 112.

even though, if Walpole's papers are any indication, few other economic thinkers merited greater attention from contemporary British politicians in the 1710s-20s.

There are many reasons for this lack of scholarly attention to the era's quantitative economic thinking. Much of the neglect comes down to form. The serious and inventive economic thinking of the 1688-1738 period was topical, momentary, indeed ephemeral—not the sort of material that easily registers on the scales of intellectual history. This was not an age of economic great books.[5] Nor was it obviously an era that produced big ideas, or at least easily-packaged ones.[6] And, perhaps most damning of all in the eyes of many retrospective observers, the age was one in which basically no economic thinker, no matter how sophisticated or well-meaning, could claim to be truly free of "interest," whether personal or political. It is all too easy to undercut or toss aside much of the economic knowledge made in the era because of the seemingly base goals behind it: Davenant was an East India Company shill and a Tory sycophant; Paterson was trying to use the Anglo-Scottish Equivalent to get back all the money he lost at Darien; Crookshanks was just an office-seeker; Walpole was Walpole. Impure motivations may not produce pure or internally consistent or timeless ideas, but they do produce ideas. Even more importantly, they produce arguments, and tools for trying to win them. The primary outputs of the conflicts of political-economic calculation in the era were new *practices* of economic thinking. Taking a more ethically-neutral stance with regard to the

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[5] Many of the most canonically important "big books" from the fifty years are from the 1690s: Dudley North's *Discourses upon Trade* (1691), John Cary's *Essay on the State of England* (1695), Davenant's *Discourses on the Publick Revenues* (1698). The heavily influential 1721 edition of *The British Merchant*, edited by Charles King, was kind of the exception that proved the rule; even though it eventually became a kind of "text-book of mercantilist economics," it was born as a collection of targeted polemics. (G. N. Clark, *Guide to English Commercial Statistics,* 1696-1782 (London: Office of the Royal Historical Society, 1938), p. 18). Sophus Reinert offers a very intriguing discussion of how Cary's 1695 *Essay* became a pivotal part of the political-economic canon in nations that were not Britain. See: Reinert, *Translating Empire: Emulation and the Origins of Political Economy* (Cambridge, MA: Harvard University Press, 2011).

[6] Steve Pincus has begun to make the provocative case that it is to precisely this period that we ought to date the emergence of at least one major political-economic innovation—a systematic theory of economic growth based on labor, as developed in the writings of Whig economic thinkers like Henry Martin. He also admits that the novelty of this idea has largely gone overlooked in the history of economic thinking. See: Pincus, *1688: The First Modern Revolution* (New Haven and London: Yale University Press, 2009), ch. 12; Pincus, "Addison's Empire: Whig Conceptions of Empire in the Early 18th Century," *Parliamentary History* 31, no. 1 (Feb., 2012): 99-117; Pincus, "Rethinking Mercantilism: Political Economy, the British Empire, and the Atlantic World in the Seventeenth and Eighteenth Centuries," *The William and Mary Quarterly* 69, no. 1 (Jan., 2012): 3-34.

"interests" of past thinkers may help historians of economic thinking appreciate a profound lesson from the recent historiography of the natural sciences—that the day-to-day processes that make knowledge are just as important, if not more so, than their products.

Practices, indeed, are the second trajectory along which it is possible to trace the development of economic calculation in the decades that followed 1688. Public calculators developed and refined essential techniques of quantitative estimation, modeling, and projection. First, computational estimates became increasingly pervasive, intricate, and credible in British political life. Recall that, in the very first debates over the Revolutionary "financial settlement" in 1689, MP William Garway had worried that it might not even be possible to make sound estimations of annual revenues based on historical figures: "We cannot say the Revenue will stand to 1000, or 10,000l., there being several variations of the Customs in several Years."[7] In the decades that followed, calculators inside and outside of Parliament not only became increasingly comfortable with using averages, samples, and extrapolations as guides to policy, but also increasingly creative in how to build those estimates. The preceding chapters have recaptured several instances of the burgeoning art of economic estimation: Davenant called upon the number of land tax commissioners to estimate the size of the English gentry in 1695; Paterson extrapolated from Edinburgh figures for annual poor relief costs to calculates the cost for the whole of Scotland; an anonymous calculator in Walpole's network estimated annual tobacco Customs using import volumes and sample data from selected Maryland and Virginia ships in the early 1730s. Under the pressure of partisan scrutiny, competing calculators also developed acuity for the biases inherent in such estimating processes, as was especially evident in the sustained and intensive debates over how to adjust available Customs data to generate a fair appraisal of the Anglo-French balance of trade in 1713-1714.

[7] Anchitell Grey, ed. *The Debates in the House of Commons, From the Year 1667 to the Year 1694*, Vol. 9 (London: Printed for D. Henry and R. Cave, and J. Emonson, 1763), pp. 177-8.

Such proto-econometric techniques sought to hone in on reasonable, usable numerical solutions to messy problems, where clear and reliable information was often limited. Another vital computational innovation—modeling—sought not to distill a single, probable answer for such uncertain economic questions, but rather to represent and bound a range of possible outcomes. Such quantitative models no doubt drew some inspiration from the various calculated numerical arrays common at the time, like tables of compound interest or logarithms. Generically speaking, " Tables" were of course among the most pervasive and important tools for organizing knowledge across many intellectual spheres in the "classical" episteme.[8] Yet the multivariate, tabular models developed by Hutcheson and others were more than just tables. Hutcheson filled his numerical tables by developing a single computational procedure and then repeating it serially across a range of different, unknown inputs. He developed tabular models to explore the effects of interest rates, annual payment sizes, and market prices for annuities on the course of the National Debt in the 1710s. Even more powerfully, he used the same computational strategies to assess the "intrinsick value" of South Sea Stock in 1720, producing multiple, parallel computations to demonstrate how many unknown—indeed, secret—factors lay behind that real value. Hutcheson used computational models to frame political uncertainty and to highlight informational asymmetries. Hutcheson's models were the consummate outsider's tool. Yet they also became a vital instrument in the political cognition of Robert Walpole, who diligently read, critiqued, and repurposed Hutcheson's polemical computations. The Prime Minister and his calculating associates used similar modeling tactics to envision the likely outcomes of pending policy decisions, like those involving the restructuring of the South Sea Company. They also used them to anticipate and stave off the computational criticisms of their opponents, to control not just policy but political discourse.

[8] Michel Foucault, *The Order of Things: An Archaeology of the Human Sciences*, English Ed. (London and New York: Routledge, 2002 [1966]), ch. 3, esp. pp. 69-70, 79-82; Andrea Rusnock, *Vital Accounts: Quantifying Health and Population in Eighteenth-Century England and France* (Cambridge, UK and New York: Cambridge University Press, 2002), pp. 1-14, 16-24

Many of the estimates and models built by contemporary public calculators looked to bridge different moments in political time, to compare past to present and extrapolate from present to future. The question of how reliable the past was as a guide to the future was one of the era's constant epistemological puzzles. Yet across the half-century after 1688, mathematical promoters and political-economic analysts built an increasingly powerful and ambitious battery of computational projections. The 1706 "Equivalent" was a "Great Project" of diplomacy and political-economic reform built upon a great mathematical projection. Paterson, Gregory, and the Committee of Six estimated a complicated menu of new Scottish tax burdens, projected them decades into the future, and used compound interest or "ready money" calculations to collapse those unfolding payments into a single, present value. The exponential mathematics of compound interest, which had been explained in pedagogical texts since the early seventeenth century, was invoked in increasingly creative and ambitious ways in the financial and political-economic computations of the day. Hutcheson drew upon them to model a variety of different future time horizons for the National Debt and to translate the uncertainties of the South Sea Company's commercial future into statements about its present Stock price. The anonymous author of the 1720 *South-Sea Scheme Examin'd* used compound interest projections to build an inventive, if overly credulous, valuation of South Sea Stock on the basis of future dividends promised by the Company. That Company's own representatives, in turn, used the same techniques to justify to Parliamentary investigators the seemingly outrageous dividend promises they made in summer 1720. In the age of Walpole, the mathematics of compound interest took on even greater public, political powers, as writers like Nathaniel Gould used exponential projections of the virtues of the Sinking Fund to fashion identities for Walpole and the Whigs as saviors of Britain's finances—and its liberties.

Probable estimations, multivariate models, exponential projections—these were the arsenal of computational tools by which public calculators built a new kind of quantitative political-

economic practice. These demanding computational techniques no doubt remained a recondite form of knowledge to the majority of Britain's political nation. But it seems likely that the pressures of political controversy helped to disseminate some of these computational habits to a broader audience, and thereby to shape broader patterns of economic reasoning in these early days of financial capitalism. The debates over the Anglo-Scottish Union and the Equivalent gave William Paterson a wide audience for his more abstract, didactic proclamations about the power of compound interest and the financial value of time. Though many contemporaries, particularly in Scotland, resisted Paterson's imperious mathematical preaching in 1706, the comparatively obscure lessons he tried to teach in that year continued to infuse British political life over the following decades. A particularly remarkable piece of evidence was offered by Thomas Watkins, who in 1717 published a pamphlet entitled *A Table of Redemption. Shewing at One View in What Time Any Debt from Three to Six per Cent. May Be Discharged.*[9] Watkins was a Fellow of the Royal Society of London who had two years earlier published a highly sophisticated, algebra-laden article on interest calculations in the *Philosophical Transactions*.[10] In his *Table of Redemption*, he effectively created a pocket-guide showing readers how to carry out the kinds of debt-repayment calculations that occupied pamphlets like Hutcheson's. What was most interesting was that he dedicated the text to the House of Commons and gave the following reason for publishing it:

> The Use of the following Table is for the more ready forming, examining and altering at pleasure, any Schemes that may be made for discharging the Publick Debts; whereby Parliamentary, or other Committees, as well as particular Persons, may find by Inspection, the Effects of any such Models, without adjourning themselves, or retarding their Conferences, for tedious Calculations to be made on every Proposition.[11]

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[9] "T. W. F. R. S." [Thomas Watkins], *A Table of Redemption. Shewing at One View in What Time Any Debt from Three to Six per Cent. May Be Discharged* (London: Printed for W. Wilkins; and Sold by J. Roberts, 1717).
[10] Thomas Watkins, "Rules for Correcting the Usual Methods of Computing Amounts and Present Values, by Compound as well as Simple Interest; and of Stating Interest Accounts," *Philosophical Transactions of the Royal Society of London* 29, no. 340 (1715): 111-127.
[11] Watkins, *Table of Redemption*, p. [3].

Watkins's text shows the remarkable connection between concerns about political deliberation and the public dissemination of mathematical tools and ideas, even if it remains unclear how many MPs might have ever attempted to make use of such a primer. Indeed, one major area of inquiry left unanswered by this dissertation is how we might measure the impact of public economic calculations on broader economic behaviors, particularly in private markets. Further empirical work on market prices would be necessary to show, for example, whether the relative prices of very-long (e.g. 99-year) fixed term annuities and perpetuities did in fact converge to nearly the same value in the eyes of British investors, as Paterson suggested they mathematically should in 1706. Similar scrutiny might illuminate whether the prices assigned to publicly-traded stocks came to more closely follow the kinds of "intrinsic value" models Hutcheson made so central to his popular political and moral judgments about the South Sea Bubble in its aftermath. Perhaps most importantly, such questions provide an ideal site for the cross-fertilization of different scholarly methodologies: the historicist reconstruction of historical computation, as practiced in this dissertation, with cliometrics.

Whatever its effect may have been on day-to-day economic behavior in the eighteenth century, there can be no question that the vibrant computational discourse of the age produced new thoughts about what numbers might be able to do in political and economic life. From Davenant in the 1690s to Gould in the 1720s, Britons came to believe that the tools of arithmetic made it possible to produce knowledge about pressing questions on complex issues like fiscal policy and international trade in the absence of perfect information, and for that knowledge to be sufficiently probable to guide sensitive policy decisions. Many came to believe that skillful arithmetic made it possible to know the real value of a complicated financial instrument, to measure the efficacy of state administration, and to predict future developments in the public's finances. Perhaps most valuably of all, Britons learned that calculation could help to penetrate the barriers of secrecy and deception that seemed to threaten so many aspects of early-eighteenth-century public life. Artful

figuring showed when public funds had gone missing, when an attractive financial project was flawed, when a political or corporate leader was lying.

In the post-1688 era, creative arithmetic seemed to open a world of epistemological possibility, in which the absence of perfect data or demonstrative certainty was not a curse but an opportunity. In this sense, the political history of economic calculation in the period belongs squarely within narratives of the major epistemological shifts characteristic of this early period of "Enlightenment": the rise of probabilistic over certain standards of knowledge, the valorization and theorization of inductive reasoning, the growing acceptance of predictive or forward-looking claims of knowledge. While this dissertation has looked almost exclusively at how questions essentially about epistemology arose organically amidst the practical activities of politics, the converse also merits further exploration. How did the problems about making, communicating, and justifying economic knowledge, which so troubled politicians and propagandists in the period, influence more formal philosophizing about the nature of human understanding?

There is certainly preliminary evidence to suggest such a connection may have been more than tangential. The pioneering "empiricist" epistemologists of the period were all concerned in political debates about money, credit, and trade. John Locke was deeply attentive to the question of intrinsic and extrinsic value as they applied to coinage. George Berkeley wrote a 1721 pamphlet, entitled *An Essay Towards Preventing the Ruine of Great Britain*, which reflected on the South Sea Bubble and the political problems of economic deception it revealed—as he put it, the ability "for cunning Men to make such plausible Schemes, as may draw those who are less skilful into their own and the public Ruin."[12] In his 1748 *Enquiry Concerning Human Understanding*, David Hume explained the

[12] [George Berkeley], *An Essay Towards Preventing the Ruine of Great Britain* (London: Printed: and Sold by J. Roberts, 1721), p. 5. Further, Helena Pycior has cited Berkeley in demonstrating that "fertile interconnections" existed between philosophical epistemology and areas of more practical mathematical concern, particularly algebra. She further argues that we ought to reject "as anachronistic any rigid distinction between the mathematical and philosophical elements of the seventeenth-century and early-eighteenth-century discussion of symbolic reasoning." See: *Symbols, Impossible Numbers,*

challenges humans faced in understanding causes in nature in terms of secrecy and concealment, language that might just as well have been used by Charles Davenant or Archibald Hutcheson to describe their political investigations. "It must certainly be allowed," Hume wrote, "that nature has kept us at a great distance from all her secrets, and has afforded us only the knowledge of a few superficial qualities of objects; while she conceals from us those powers and principles, on which the influence of these objects entirely depends."[13] Such linkages between the politics of economic knowledge and epistemological theory must remain, for the moment, merely evocative, but they point toward a potentially exciting way to rethink the entanglements between representative government, economic change, and conceptions of human reason in the age of Enlightenment.

The gradual emergence of new experts, the cultivation of new computational practices, the discovery of new epistemological possibilities—all of these testified to the calculating political culture that came to be in early-eighteenth-century Britain. This dissertation set out, though, to explain a more covert and more essential modern phenomenon—the strangely robust bond that has come to exist between numbers and political truth. This bond, I argue, was forged largely in the crucible of post-1688 British politics. Perhaps the best evidence for the formation of that connection comes not from John Crookshanks's rather lyrical claim that "Truth and Numbers are always the same," with which this study began, but instead from a comment made by Robert Walpole, with which it ended.[14] In 1735, attempting to fend off accusations of mismanaging public funds and betraying his own fiscal promises, Walpole voiced his worry that "honest and very well-meaning Persons" in the British public were being deceived by the opposition's "Representation of Facts so call'd." Most worrisome was that those supposed facts had been "cloath'd in the Dress and

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and Geometric Entanglements: British Algebra through the Commentaries on Newton's Universal Arithmetick (Cambridge, UK et al.: Cambridge University Press, 1997), quotations on p. 7, and ch. 8 on Berkeley.

[13] David Hume, *An Enquiry Concerning Human Understanding*, ed. Eric Steinberg, 2nd edition (Indianapolis and Cambridge, UK: Hackett, 1993 [1977]), p. 21.

[14] [John Crookshanks], *Some Seasonable Remarks on a Book Publish'd in the Month of July, 1718* (London: *s.n.*, 1718), p. 7.

Appearance of Calculations and Figures," which, Walpole worried, the honest members of the British public "thought could not lie."[15] It was one thing for Crookshanks to opportunistically claim that truth equated to numbers in the midst of a computational battle; it was quite a bit more telling for Walpole to observe that such an equation was widely believed.

The preceding chapters have shown that Britons in the era became attracted to the political virtues of "Calculations and Figures" for a variety of different reasons, which often did not precisely agree with one another. Charles Davenant believed creative numerical calculation could conquer political deception. So did Archibald Hutcheson, but he went even further, contending that calculations could not only combat political immorality, but prove its very existence. John Pollexfen and John Crookshanks thought that true numerical accounts, supported by authentic facts and "vouchers," protected the nation and its honest political representatives from libelous partisan scheming. William Paterson thought Britons worried too much about political corruption and fraud, but he believed mercantile mathematics could conquer governmental ignorance, and bring economic prosperity. John Arbuthnot, Archibald Pitcairne, and David Gregory believed that the highest mathematical learning could make just about everything in British society better: better schools, better doctors, better politicians. Richard Steele even argued that facility with calculation made better gentlemen and more just people.

Many different ideas about why better numbers might make a better nation swirled through the combative spheres of political conversation at the beginning of Britain's long eighteenth century. But these ideas did not always share the same definition of what better numbers were—or what a better nation might be. The Tories of the *Mercator* and the Whigs of the *British Merchant* fought endlessly about the question of what made for good numbers in 1713. Were the best economic

[15] Robert Walpole, *Some Considerations Concerning the Publick Funds, the Publick Revenues, and the Annual Supplies, Granted by Parliament. Occasion'd by a Late Pamphlet, Intitled*, An Enquiry into the Conduct of our Domestick Affairs (London: Printed for J. Roberts, [1735]) p. 7.

numbers the methodologically sophisticated work of experts, designed to distill hidden truths from imperfect information, as the *Mercator* believed? Or, as their Whig opponents contended, were they simple and transparent, legible expressions of commercial experience and common sense? This question found no conclusive answer, in 1713 or since. Each was true to different people and different interests at different times. As the MP John Thompson had said in the 1691 battles in the Commons over Secret Service payments, "Accounts are amazing things."[16] Perhaps the most amazing thing about them was that they proved such an endlessly flexible and fruitful medium for political fights. Calculations could serve many different political functions at once. They could be offensive and defensive, probable or certain, penetratingly sophisticated and refreshingly simple. Every economic computation had some imperfection, and every imperfection was a political opportunity.

Britons in the eighteenth century did not necessarily come to agree clearly about how to make specific economic calculations, who should make them, or what made them correct. Rather, they came to discover that numbers were exceedingly good things to *disagree* about. One of the strange features of the episodes contained in these chapters—and one of the reasons, I suspect, they have been passed over in histories of economic knowledge—is that so many of the problems under consideration never really came to a satisfactory conclusion. This has been a story riddled with arguments that never got closed, theories that never got refined, calculations left incomplete. It is a story that is populated by many people offering numbers that were plausible, but few people offering ones that were clearly brilliant or conclusive or correct. Most often these numbers were driven by the interests of political faction, economic profit, or personal gain. But none of this means that the thinking done by those political arithmeticians and public calculators was any less difficult or any less important, either within their own moment or in the longer history of economic

[16] Grey, *Debates,* Vol. 10, p. 191

understanding. They did much to create the social structure, computational tools, and epistemic assumptions that undergird modern financial capitalism and deliberative politics, without really setting out to do so and with little concern for the niceties of intellectual consistency. Those calculators helped to create the essential idea that the complexities of modern economic life ought to be explicable—ought to be *ruled*—by a more or less unified kind of rationality, discernible through calculation. Yet the bitter and endless computational fights they engaged in showed that, at least in their age of financial revolution, there was no single kind of economic reason upon which everyone agreed. This, perhaps, has not changed.

– APPENDIX 1 –

COMPUTATIONAL NEGOTIATIONS

Hypothetical Values for the Anglo-Scottish Equivalent, 1706

In the preceding discussion of the calculation of the Equivalent in Chapter 2, Section I, several hypothetical values were discussed that represented plausible values the calculating Committee of Six might have come to instead of the final total of £398,085. 10*s*. I acknowledge that there are potential pitfalls in carrying out calculations that *might* have taken place in the past using modern computational tools, given no precise evidence that such calculations ever *did* take place. But the three scenarios discussed below, I argue, were all plausible calculations that the Committee might have come to on the basis of existing information, computational techniques, and justifiable assumptions. All of the calculations below are derived from possible assumptions or approaches that were contemplated at some point by contemporaries. Those three scenarios are:

Scenario 1: Assumes that the Committee had taken a simple ratio of total English tax revenues and total Scottish tax revenues, and not distinguished between those taxes that did and did not contribute to the English National Debt. This technique effectively follows the early "equivalent" calculation offered by William Paterson in his *Inquiry into the Reasonableness* in early 1706, though using the data gathered by the Committee of Six.[1] (Critically, it is based only on *historical* tax levels, not on projected Scottish tax levels under the new English system). This would have produced an Equivalent figure of **£340,000**. This represents one of the most simple calculations that could have been offered (See **Figure App. 2a**).

Scenario 2: Assumes that the Committee had chosen not to use *existing* Scottish revenue levels (namely £30,000 for Customs and £33,500 for Excise) in calculating the proportion of Scottish to English taxes, but instead to use the figures for what Scottish revenues were projected to

[1] William Paterson], *An Inquiry into the Reasonableness and Consequences of an Union With Scotland* (London: Printed, and Sold by Ben. Bragg, 1706), pp. 102-9.

be *after* the English tax rates were imposed there (projected to be £50,000 for both Customs and Excise). This would have increased the size of the Equivalent to over **£610,000.** (Figure **App.2b**)

Scenario 3: Assumes the Committee had chosen an alternative values (5% or 6%) for the interest rate upon which the valuation of future Scottish tax payments was based, rather than the 6.55% rate ultimately used. Those alternate interest rate assumptions would have produced an Equivalent figure of approximately **£501,000** (assuming a 5% rate) or **£430,000** (assuming a 6% rate). (Figure **App.2c**) Note that, in order to model those alternate interest rate assumptions, I have reconstructed the present-value calculations using modern formulae (see **Appendix 2**). The same model, using a 6.55% interest rate, does not produce the same exact figures as those produced by the Equivalent calculators.

	Annual
England	
Customs:	
Crown Hereditary Customs ("Tonnage and Poundage")	£256,841
Temporary or Wartime Customs	1,084,718
Total Customs	1,341,559
Excises:	
Crown Hereditary Excises on Beer and Ale	286,178
Temporary or Wartime Excises	661,424
Total Excises	947,602
Other Crown Hereditary Taxes	148,185
Land Tax	1,997,763
Other Temporary Taxes	1,256,694
Total English Taxes	**£5,691,803**
% of Projected Great Britain Taxes	*98.1%*
Scotland	
Customs, Farmed	28,500
Excise on Beer and Ale, Farmed	33,500
Land Tax	36,000
Crown-Rents, Post Office, Coinage, and Other	12,000
Total Scottish Taxes	**£110,000**
% of Great Britain Taxes	*1.9%*
Total Great Britain Taxes	**£5,801,803**
% of Great Britain Taxes	*100.0%*
National Debts	
England, before Union	£17,763,842
Scotland, before Union	160,000
Total Great Britain Debts, after Union	**£17,923,842**
English Share of Great Britain Debt, by % of Taxes Paid	17,584,013
%	*98.1%*
Scottish Share of Great Britain Debt, by % of Taxes Paid; or, **Equivalent**	**£339,829**
%	*1.9%*

Figure App.2a. Shows the hypothetical calculation of the Equivalent under **Scenario 1**, as described above. This approaches calculates the Equivalent by simply using recent historical figures for total tax revenues in England (£5,691,803) and Scotland (£110,000), and applies the ratio of Scottish to English taxes to determine the appropriate share of the combined Great Britain National Debt (calculated at £17,923,842). The calculation produces a total Equivalent of **£339,829**.

	England	Scotland - *Per Equivalent*		Scotland - *Scenario 2*	
	Annual	Annual	Present Value	Annual	Present Value
Customs:					
Total per Annum	£1,341,559	£30,000		**£50,000**	
For Civil Government	253,514	5,669		9,448	
Unappropriated for Debts	25,480	570		950	
Customs Appropriated for Debt:					
Coffee Duty: to June 1710	116,475	2,605	7,577	4,341	12,628
Impositions: to August 1710	706,471	15,798	47,506	26,330	79,177
2/3 Subsidy: to September 1710	160,000	3,578	11,251	5,963	18,752
1/3 Subsidy: for 98 Years	79,619	1,780	27,145	2,967	45,242
Total Customs Appropriated for Debt	£1,062,565	£23,761		£39,602	
Total Customs	**£1,341,559**	£30,000	£93,479	**£50,000**	**£155,798**
Excise:					
Total per Annum	£947,602	£33,500		**£50,000**	
For Civil Government	269,837	9,539		14,238	
Unappropriated for Debts	85,581	3,026		4,516	
Excises Appropriated for Debts					
For 99-year and Perpetual Annuities	192,400	6,802	103,731	10,152	154,822
From 1692: For 99 Years	132,433	4,682	71,004	6,988	105,976
For the Bank of England	137,460	4,860	70,866	7,253	105,769
For Lottery Tickets	104,624	3,699	56,410	5,520	84,194
Excises on Low-Wines	25,267	893	2,597	1,333	3,876
Total Excises Appropriated for Debts	£592,184	£20,935		£31,246	
Total Excise	**£947,602**	£33,500	£304,607	**£50,000**	**£454,637**
Total Equivalent			£398,086		**£610,435**

Figure App.2b. Shows the hypothetical calculation of the Equivalent under **Scenario 2** as described above. The calculation assumes that the projected value of the Equivalent was calculated not on the basis of historical Scottish tax data (£30,000 for Customs, £33,500 for Excises), but based on the *projected* level of taxes paid by Scottish taxpayers after accepting the English tax system (£50,000 for both Customs and Excises, as shown in the shaded boxes above). The table above provides a side-by-side comparison of how the projected levels of Scottish taxation, and the present value thereof, would change under this alternative assumption. This computational approach would have produced an Equivalent calculation of **£610,435.**

	England Annual	Scotland Annual	Tax Duration (*years*)	Present Value of Scottish Taxes *assuming an interest rate of:* 5%	6%	*6.55%*
Customs:						
Total per Annum	£1,341,559	£30,000				
For Civil Government	253,514	5,669				
Unappropriated for Debts	25,480	570				
Customs Appropriated for Debt:						
Coffee Duty: to June 1710	116,475	2,605	3.25	7,639	7,489	*7,577*
Impositions: to August 1710	706,471	15,798	3.33	47,425	46,481	*47,506*
2/3 Subsidy: to September 1710	160,000	3,578	3.50	11,233	11,002	*11,251*
1/3 Subsidy: for 98 Years	79,619	1,780	98.00	35,310	29,576	*27,145*
Total Customs Appropriated for Debt	£1,062,565	£23,761				
Total Customs	**£1,341,559**	**£30,000**		**£101,607**	**£94,547**	***£93,479***
Excise:						
Total per Annum	£947,602	£33,500				
For Civil Government	269,837	9,539				
Unappropriated for Debts	85,581	3,026				
Excises Appropriated for Debts						
For 99-year and Perpetual Annuities	192,400	6,802	99.00	134,950	113,009	*103,731*
From 1692: For 99 Years	132,433	4,682	84.00	92,082	77,446	*71,004*
For the Bank of England	137,460	4,860	99.00	96,415	80,739	*70,866*
For Lottery Tickets	104,624	3,699	99.00	73,383	61,452	*56,410*
Excises on Low-Wines	25,267	893	3.25	2,620	2,568	*2,597*
Total Excises Appropriated for Debts	£592,184	£20,936				
Total Excise	**£947,602**	**£33,500**		**£399,450**	**£335,216**	***£304,607***
Total Equivalent				**£501,057**	**£429,763**	***£398,086***

Figure App.2c. Shows the hypothetical calculation of the Equivalent under **Scenario 3** as described above. This scenario reconstructs approximate values for the Equivalent assuming alternate interest rate assumptions (5% or 6%) rather than the 6.55% implicitly used by the Equivalent calculators. The calculation produces alternative values of **£501,057** (assuming a 5% rate) and **£429,763** (assuming a 6% rate). Note: The far-right column shows the figures given in the actual Equivalent calculation, not the output of a present-value model similar to that used to construct the hypothetical values for 5% and 6%. The "Tax Duration" figures are general estimates.

– APPENDIX 2 –

YEARS' PURCHASE, READY MONEY, AND THE FINANCIAL VALUE OF THE FUTURE

The question of how to assign a single, present value to a future flow of income was a common computational problem well before the age of the financial revolution, and of course well after. Around 1700, there were standard tools and languages for approaching this problem that would have been well-known to people in many walks of early-modern life. For the majority of Britons who encountered it, the most familiar version of the problem came from the pricing of land. The value of a piece of agricultural property was commonly described in terms of the *annual* income that land produced in rents, rather than in terms of a single number indicating how much it would take to buy the land outright. (Wealth of individuals was, in turn, commonly referred to in terms of annual income, not totals assets). But when land was bought, sold, or mortgaged, parties had to come to some way of rendering the present value of the annual income of that land into a single number. The standard way was to multiply the annual income by a number, called the *years' purchase*, a metric which indicated relatively how valuable land was in a given region. For example, if a property in Yorkshire promised £100 annually in rents, and Yorkshire land was valued at 22 years' purchase (y.p.) at the time of the transaction, the monetary price for that piece of land would be £2,200.

The language of years' purchase provided a common, computationally straightforward way of thinking about how to relate future income and current price, and became readily applied to other forms of property that had long-term annual payouts, like government annuities. Annuities that were not perpetual, but expired in shorter periods of time, might be valued at a lower number of years' purchase to compensate for the shorter period in which income would be received. To give a hypothetical example, a £100 *per annum* government annuity of 32-years duration might be sold at

13½ years' purchase (£1,350), while an annuity of 99-years duration might be sold at 18 y.p. (£1,800), the incremental £450 representing the additional value to the annuity-holder gained from the extra income in years 33-99. Similarly, annuities for "lives" might be assigned a higher number of years' purchase at sale if the beneficiary of the annuity were younger. The market prices of annuities were often quoted using such years' purchase methods.

A slightly different way of thinking about the present value of future incomes made direct use of the tools of the logic of compound interest. This "ready money" technique was strongly advocated by William Paterson in 1706, and indeed remains one of the most essential—almost unconscious—computations in modern financial practice and economic thought (under names like "net present value" and "discounted cash flow"). The basic logic of "ready money" analysis contends that the value of holding £100 some number of years in the future (say, 32 years) is equal to the amount of money that one would need to save *today* at compound interest in order to have £100 at that future date. In such analyses, the most critical variable is the assumption made about the interest rate (often called the "discount rate" in modern terminology). Assuming one could get 4% interest for the 32-year period, for example, the value today of £100 in year 32 is the solution (x) to the following equation:

$$x(1+r)^t = p$$

$$x(1+0.04)^{32} = 100$$

where $r = 0.04$ is the interest rate and $t = 32$ is the time period that would elapse. In the above case, solving for x shows that our "ready money" value is:

$$x = \frac{100}{(1+0.04)^{32}} = 28.506$$

So our £100 in year 32 is worth approximately £28.10*s.* 1*d.* Using the generic formula instead, we see that we can derive the value of any amount of money p in future year t at interest rate r as:

$$x = \frac{p}{(1+r)^t}$$

Long-term flows of payments are more complicated, because they involve not only the value of one single payment at a future moment, but successive, periodic payments across a number of years. So the value of a £100 *per annum* annuity for 32 years is not just the value of the £100 in year 32, but that plus the value of £100 in year 31, plus the value of £100 in year 30, and so forth, all the way up to the first £100 to be received in year 1. By the operation of compound interest, the value of the £100 in year *t* always bears the same proportion to the value of the £100 in year $t-1$, namely $\frac{1}{1+r}$. Mathematically, this makes the flow of payments a *geometric series*. Using modern symbolic notation, the value of an annuity which pays out for *n* years, assuming an interest rate *r* is:

$$\sum_{t=1}^{n} \frac{p}{(1+r)^t} = \frac{p}{r}\left(1 - \frac{1}{(1+r)^n}\right)$$

In the case of our example of a 32-year annuity of £100 per year, the above value is equal to 1,787.35, or £1,787.7*s.* 1*d.* This value is highly sensitive to the chosen interest rate *r*. As that interest rate goes up, the present value goes down. If we assume the interest rate at 5%, rather than 4%, the above value changes to around £1,580. At 6%, it becomes around £1,408. This reflects the assumption that, the higher the rate of return that can be expected, the less money one would have to save today to have £100 at a future date.

In the early eighteenth-century, mathematicians and some very knowledgeable merchants may have carried out these calculations using algebraic tools. Indeed, we saw David Gregory doing exactly that in Chapter 2, Section III, using a formula effectively the same as what we have presented above. More commonly, astute financial thinkers like William Paterson would have learned to carry out these calculations using tables of compound interest, "looking up" the exponential values that are necessary for the above formula and then combining them using various computational recipes.

Skilled observers could have moved back and forth with relative ease between the above "ready money" methods and those of years' purchase. Our 32-year annuity, valued assuming 4% interest, was £1,787.7*s.* 1*d*, or about 17.88 times its annual payment value. In other words, one might state the value of that annuity at 17.88 years' purchase, or about 17 years' 10½ months' purchase.

The above formula makes it possible not only to value future streams of incomes with a fixed term, but also those that promised to pay out indefinitely into the future, called *perpetuities*. Observe that, as *n* gets very large, the value of £100 gets incredibly small, approaching 0 as *n* approaches infinity. (In other words, one would have to invest basically nothing to have £100 a million years from now, assuming you could get steady interest all those years and find some way to legally protect your holdings for some distant heir). In symbolic terms, this becomes:

$$\sum_{t=1}^{\infty} \frac{p}{(1+r)^t} = \lim_{n\to\infty} \frac{p}{r}\left(1 - \frac{1}{(1+r)^n}\right) = \frac{p}{r}(1-0) = \frac{p}{r}$$

This provides a remarkably simple way to value perpetuities: they are simply the value of the annual payment *p* divided by the interest rate. A £100 *per annum* perpetuity, assuming 4% interest, is worth $\frac{100}{0.04}$ or £2,500 (or a value of 25 years' purchase); at 5% interest, it is worth £2,000 (or 20 years' purchase); at 6% interest, it is worth £1,667 (or 16 years' 8 months' purchase). The straightforward implication is that the value of a perpetuity is simply inversely proportional to the prevailing interest rate.[1]

William Paterson made a pedantic point in his 1706 *Inquiry into the Reasonableness* that members of the British public generally misunderstood the relative value of perpetuities and fixed-term annuities with very-long life spans, for example 98 years.[2] His naïve character "Mr. North"

[1] This is the kind of logic, for example, that led Paterson to argue his *Inquiry into the Reasonableness* that the value of the Equivalent would increase from £700,000 to £910,000 if the prevailing interest rates in Scotland dropped from 6.5% to 5%. See: "Lewis Medway" [William Paterson], *An Inquiry into the Reasonableness and Consequences of an Union With Scotland* (London: Printed, and Sold by Ben. Bragg, 1706), p. 108, and Chapter 2, Section II.
[2] Paterson, *Inquiry into the Reasonableness*, pp. 109-111.

claimed that he understood perpetuities to be worth 5-6 years' purchase more than very-long fixed annuities. Paterson countered that, according to the rules of compound interest, the two had at most a negligible difference in value. Using the formulas above, assuming the 6.5% interest rate Paterson assumed, we can see that a £100 annuity for 98 years is worth:

$$\sum_{t=1}^{98} \frac{100}{(1.065)^t} = \frac{100}{0.065}\left(1 - \frac{1}{(1.065)^{98}}\right) = 1{,}535.25$$

The perpetuity, by comparison, is worth:

$$\sum_{t=1}^{\infty} \frac{100}{(1.065)^t} = \frac{100}{0.065} = 1{,}538.46$$

The difference between the two, according to the mathematics of compound interest, is a mere 3.21, or about £3 4*s.* 3*d.* Needless to say this is an insignificant amount, given the annual payments on the annuity equal £100. Paterson claimed that, in years' purchase terms, this difference equaled six *weeks*' purchase, which, strictly speaking, was an overestimate on his part. The £3 4*s.* 3*d* represents only 1.6 *weeks'* purchase.

– APPENDIX 3 –
THE SOUTH SEA COMPANY'S JUSTIFICATION FOR 50% ANNUAL DIVIDENDS

On September 8, 1720, the Directors of the South Sea Company announced that they planned to pay a 30% annual dividend at Christmas of that year, and thereafter to pay annual dividends equal to 50% of the par value of Stock held for the following twelve years. The proposal did little to encourage owners to hold onto their shares and thereby prop up the Company's Stock price, which had begun to sag ominously at the end of the summer. Nonetheless, in the aftermath of the Stock's autumn collapse, angry public commentators and Parliamentary investigators pointed specifically to the Company's September dividend policy as a deceitful violation of the public trust. Chapter 5, Sections IV-V discuss the retrospective uproar about this policy, as well as the Company's own attempt to justify that policy computationally. This Appendix provides a reproduction of the South Sea Company's own computational justification of that policy, entitled "The Scheme or Calculation upon which the Court of Directors of the South Sea Company Grounded the Resolutions of Making the Dividend…," contained in Treasury Papers, TNA T1/231, ff. 163-4. The calculation was originally produced by a Mr. Webster.

"The Companys increased Capitall is":	
"The first Capitall or Joynt Stock"	£11.7
Capital created through the exchange of public debts:	
1st subscripion of irredeemables	9.5
2nd subscription of irredeemables	2.6
Redeemables Subscribed	14.0
Total "increased Capitall"	£37.8
"Stock due to the Proprietors":	
"The first Capitall or Joynt Stock"	11.7
Stock owed to those who exchanged public debts:	
To the 1st subscripion of irredeemables	3.2
Total owed to "first Capitall" and 1st Subscription	15.0
Plus: "Midsummer Dividend" of 10%	1.5
To the 2nd subscription of irredeemables	0.5
To the redeemables subscribed	1.7
Total "Stock due to the Proprietors"	18.8
SSC's "Gain in Stock is" (currently)	**£19.1**
"And if the whole annuities and debts should be taken in the Company's increased Capital would be"	43.4
"Total of the present increased Capital being but"	37.8
"The remaining Stock to Compleat the Scheme"	£5.6
Public debts yet unsubscribed:	
Irredeemables	5.2
Redeemables	2.6
Total public debts left to be taken in	£7.8
"The unsubscribed Debts was (*sic*) reasonably concluded might be taken in Stock at 1000 p[er] Cent":	
Cost (in Stock) of irredeemables, at £1,000	0.5
Cost (in Stock) of redeemables, at £1,000	0.3
Total cost (in stock) of taking in unsubscribed debts	£0.8
"The remaining Stock to Compleat the Scheme"	5.6
"The Company's further Gain in Stock will be"	4.8
SSC's "Total Gain in Stock," incl. future subscriptions	**£23.9**

Figure App.3a: Part I of the abstract of "The Scheme or Calculation upon which the Court of Directors of the South Sea Company Grounded the Resolutions of Making the Dividend…," (Treasury Papers, TNA T1/231, ff. 163-4).

"The Company's increased Capital at Christmas 1720 will Consist of":		
"Stock to the old proprietors and proprietors of ... Annuities"		18.8
"Stock to the Proprietors of the 1st, 2d, and 3d Subscriptions"		9.0
"Stock due to the Proprietors of the 4th Subscription"		1.2
Total "increased Capital at Christmas 1720":		£28.9
Christmas Dividend of 30% on the "increased Capital"		8.7

"The Company's Gain in Money by the Disposal of the" £23.9mm gain in Stock "will arise thus":	Stock Issued	Money Raised
Money already raised in 1st, 2d, and 3d Subscriptions	9.0	56.8
"The Remaining Stock, if sold at 1000 p[er] Cent"	14.9	149.2
Total "Gain in Money" on sale of Stock, incl. future sales	**£23.9**	**£205.9**

"From which gain… deduct":	
"The monys to be payd the Government"	7.7
"Bonds and money for the annuitants"	3.0
"Christmas Dividend" of 30%	8.7
Less: Money owed to the SSC by the Gov't before Christmas 1720	(1.4)
Total deductions	18.0
Total "Gain in Money," after deductions	**£187.9**

	Present Cost	Annual Payment
An annuity for 12 years, at 4% interest, produces:		
To yield £1 annually	*9.42*	*1.00*
Given £187.9mm present cost	£187.9	**£20.0**

Available for dividends:	
Annual proceeds from "Gain in money," as 12-year annuity at 4%	20.0
Annual interest payments from the government	2.1
"The advantages expected on Trade yearly"	0.4
Total available for dividends, annually	**£22.5**
Total "increased Capitall"	43.4
Proposed 50% per annum dividend	21.7

Total avilable for dividends, annually	22.5
Proposed 50% per annum dividend	21.7
"Annual Surplus"	**£0.8**

Figure App.3b: Part 2 of the abstract of "The Scheme or Calculation upon which the Court of Directors of the South Sea Company Grounded the Resolutions of Making the Dividend…," (Treasury Papers, TNA T1/231, ff. 163-4).

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This project would have been far less successful (if even possible) without the magnificent digital archives that have, over the past decade or so, made a vast quantity of seventeenth- and eighteenth-century print available online. The three most useful archives for this study have been:

- *Eighteenth Century Collections Online* (**ECCO**)
- *The Making of the Modern World: The Goldsmiths'-Kress Library of Economic Literature 1450-1850* (**MOME**)
- *Early English Books Online* (**EEBO**)

All have been accessed through the holdings of Princeton University Library. Because nearly all contemporary printed sources used in this study have been accessed through one of the two digital archives above, I have not separately noted when sources were reviewed in digital form.

Given that this study relies heavily on ephemeral and often anonymous pamphlet sources, matters of attribution and publication data are often disputed. Many pamphlets have historically been misattributed, especially to prominent literary figures like Daniel Defoe, on which see P. N. Furbank and W. R. Owens, *The Canonisation of Daniel Defoe* (New Haven: Yale University Press, 1988). Unless otherwise stated, I have chosen to follow the attribution and publication data provided in the English Short Title Catalogue, available online at <estc.bl.uk>. I have indicated where I believe the ESTC information ought to be questioned or revised. Printed primary sources are listed separately based on type of authorship: publications with listed or well-established authorship; governmental publications; anonymous publications without known or well-established authorship; and newspapers. For texts published anonymously, but for which the authorship is relatively clear, the author's name is indicated in square brackets (e.g. [Defoe, Daniel]) in the bibliography and first footnote of each chapter. Texts with the same author are alphabetized by title, regardless of whether some texts have explicit or implicit authorship. As a result, for section on Primary Sources, I have not used the convention of indicating successive texts by the same author using the underscore (___).

In general, all materials are dated according to the nominal date provided within the text. In specific situations in which a publication is explicitly dated in one year (e.g. 1714), but context makes clear the publication must have taken place between January 1 and March 25 of the following year (1715), I have indicated the date as such (e.g., 1714/5) and noted the change.

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[1] The ESTC does not include the Asgill attribution, instead listing Davenant as the author. The text includes large excerpts from Davenant's writings, but the author/compiler is unlikely to have been Davenant. The "Making of the Modern World" (Gale) archive lists John Asgill as the author, so I have opted for that attribution.

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[2] The standard attribution per the English Short Title Catalogue is to a William Black (d. 1745). Crawford Spence, working from a copy in the National Library of Scotland, attributes the pamphlet to a "Mr. Robert Black, Advocate." In an article on the attribution of certain 1706 pamphlets to Daniel Defoe, literary scholars and attribution experts P. N. Furbank and W. R. Owens do not attribute the pamphlet to anybody, leaving the author anonymous. I have found evidence of another possible authorial contributor, Andrew Fletcher, on the basis of the fact that one of the key calculations in the pamphlet can be found in manuscript form in Fletcher's papers ("A Calcull How the Equivalent of 398085.10.0 is Exhausted," Fletcher of Saltoun Papers, NLS 17,499, f. 144.) I have chosen to use the ESTC attribution, though noting its potential pitfalls. See: Furbank & Owens, "Defoe and the Tippony Ale"; Spence, "Accounting for the Dissolution of a Nation," p. 385, esp. n. 10.

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[3] ESTC suggests that, though stated as 1712, the publication date may be 1711.

[4] The ESTC does not list Donaldson as the author, though it notes the possible attribution. I follow Furbank and Owens in attributing the pamphlet to Donaldson.

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[5] The ESTC suggests Edinburgh as the place of publication, though EEBO suggests London.

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[6] Dated 1720 on the title-page, with preface dated 6 February 1720 (i.e. 1721, based on the convention of a 25 March start date).

[7] The ETSC does not list Hutcheson as the author of this brief broadside text, though evidence from other of his writings shows he certainly is. The title of this broadsheet is listed as the "docket title" in the English Short Title catalogue, which begins the (lengthy) title with the opening text of the pamphlet ("*The Capital of the South-Sea Company, at Midsummer 1720, is Computed as Followeth…*)

[8] The ESTC offers a tentative date of 1714, as suggested in the title, but internal evidence suggests the pamphlet was clearly published after January 1, 1715.

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[Paterson, William?]. *England's Great Concern. In the Perpetual Settlement of a Commission of Accounts: With Clauses and Powers Fixing National Benefit Thereby*… London: Printed for D. Brown, and Sold by J. Nutt, 1702.[11]

[Paterson, William?]. *An Essay Concerning Inland and Foreign, Publick and Private Trade; Together with Some Overtures, Shewing How a Company or National Trade, May be Constituted in Scotland, with the Advantages Which Will Result Therefrom.* [Edinburgh?]: *s.n.*, [1704 or 1705].[12]

[10] On attributions, see Snyder, "Daniel Defoe, Arthur Maynwaring."

[11] *England's Great Concern* is attributed to William Paterson in the ESTC, presumably on the basis of Bannister's attribution. (*Writings of William Paterson*, ed. Bannister, vol. 1, p. 253) Yet Bannister only "conjectures" that the pamphlet was written by Paterson, and his evidence is not indisputable. Some of the themes of the pamphlet—particularly the advocacy of Parliamentary committees and the concern with government fraud—are not necessarily in keeping with Paterson's positions in writings of the period.

[12] The pamphlet is anonymous, but attributed by multiple scholars to Paterson. The ESTC does not include the attribution to Paterson in its main entry, instead cataloguing this pamphlet with the author "T. W." The date of publication is disputed as well. The ESTC dates it 1705, while Bannister dates it 1704.

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[14] On attributions, see Snyder, "Daniel Defoe, Arthur Maynwaring."

[15] The ESTC lists the author as simply "Great Britain. Royal Navy," though this was very likely a Walpole-Maynwaring production, and so it makes little sense to list this as a governmental publication. See: Henry L. Snyder, "Daniel Defoe, Arthur Maynwaring."

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[16] The "Making of the Modern World" (Gale) catalogue suggests as author "J. Way," though the ESTC includes no author. The pamphlet is dated 1720, but likely in the first three months of 1721.

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[17] In the first edition, the dedication is signed "A. B." A second edition has the dedication signed "T. P."
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[19] The title-page of this pamphlet lists 1720, though the content suggests it may well have been published in January-March 1721.

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[20] The ESTC does not specify an author for this pamphlet, though notes that the pamphlet has been attributed to Davenant as well as, more recently, to a "Francis Gardner."

[21] The ESTC states the date as "[1720?]," but the dating is unquestionably 1720.

[22] The *Mercator* and *Guardian* were reviewed in microform at Princeton University Library. *The British Merchant*, nos. 1-25, are available online through the collection *Eighteenth Century Journals: A Portal to Newspapers and Periodicals, c1685-1815* <www.18thcjournals.amdigital.co.uk>. Later issues of the *The British Merchant* were reviewed in the 1721 compiled edition, edited by Charles King.

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