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Doctoral Dissertations, 2011-2026 Public and International Affairs

2017

The Half-Lives of Others: The Democratic Advantage in Nuclear Intelligence Assessment

Bollfrass, Alexander Kai

Princeton, NJ : Princeton University

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The Half-Lives of Others: The Democratic Advantage in Nuclear Intelligence Assessment

Alexander K. Bollfrass

A Dissertation
Presented to the Faculty
of Princeton University
in Candidacy for the Degree
of Doctor of Philosophy

Recommended for Acceptance
by the Department of
Woodrow Wilson School of Public and International Affairs
Adviser: Aaron L. Friedberg

September 2017

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Abstract

An accurate nuclear proliferation assessment requires an understanding of a country's nuclear capabilities and intentions. Capabilities in the form of fissile materials and technologies may be well-hidden secrets that are difficult to detect from abroad. Nuclear intentions are mysteries. All else being equal, the intelligence agencies that can best estimate these mysteries will perform the most accurate proliferation assessments.

To explain the conditions under which intelligence assessments can most accurately capture the likelihood of another country's acquisition of nuclear weapons, this dissertation develops a theory of bounded perception in intelligence assessment. Regime type is the key to this theory: Democratic leaders can politicize assessments, but authoritarian regimes must politicize their assessors. The former episodically corrupts intelligence work while the latter systematically undermines the creation of accurate intelligence assessments. This theory is tested against competing explanations of states as fearful overestimators or rational information processors by comparing the ability of multiple intelligence agencies to assess foreign states' nuclear weapon proliferation intentions and capabilities.

A comparative research design of this dissertation makes it possible to keep several, possibly confounding, variables constant in relation to the intelligence collection capability and nature of the assessed country's nuclear program. In this approach, the strengths of multiple inferential methodologies are leveraged. Each empirical chapter initially conducts tests on a self-coded global panel dataset of nuclear assessments. This step is followed by comparative congruence verifications for assessments of India, Argentina, and Pakistan that were performed by the UK, USA, Sweden, Switzerland, and both Germanys. The theories' causal mechanisms are subsequently tested by tracing the process that led to variations in the accuracy of East German, British, and American assessments of the West German nuclear program.

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Chapter 1

Introduction

The analytic abilities of intelligence agencies in democratic countries suffer from a poor reputation in the eyes of the public and scholars alike. Depending on the academic critic, intelligence analysis is rarely correct because analysts under the sway of policymakers (Rovner, 2011) who are protecting their bureaucratic turf (Zegart, 2009, Lebovic (2009)) or simply lack personal integrity (Bar-Joseph, 2013). Whatever the cause of these errors, intelligence agencies downplay the consequences of poor analysis (Marrin, 2013, 156). The agencies' most robust defense in the academic literature is that they are held to unachievable standards (Betts, 1978).

By contrast, authoritarian intelligence agencies are sometimes envied for their efficiency in intelligence even while they are denounced for reinforcing misperceptions (Andrew, 2004, Garthoff (2004), 38). Considering this theoretical confusion, whether foreign intelligence assessment should be more accurate in democratic or authoritarian states remains a puzzle.

The existing literature on intelligence assessment offers contradictory answers because it is overtheorized and underspecified. It also performs underpowered tests of overdetermined cases. The catalogs of intelligence failures and international misperception provide incisive elaborations of individual cases and describe the inherent

difficulties of assessment (Wohlstetter, 1962, Knorr (1964), Jervis (2011)). Yet, there are no available systematic predictions about the conditions under which intelligence agencies fall prey to any factors on the long list of assessment pathologies.

The answer is relevant to both the theory and the practice. For instance, most theories of nuclear deterrence are based on the assumption that states can read each other's nuclear capabilities and intentions. If perceptions are systematically biased, these assumptions must be revisited. From a policy perspective, both overestimates and underestimates are dangerous.

In the search of the above answer, *The Half-Lives of Others* develops a theory regarding which assessment bureaucracies will produce estimates of another country's proliferation potential that are more accurate in comparison to the others. This "bounded perception" theory identifies the effect of the harmful intelligence-policy harmony in non-democratic intelligence agencies: namely, difficulty in gauging the intentions of an adversary. Alternative theories predict that intelligence agencies function the same no matter which type of regime they serve. If this reflects reality more closely, assessors would always either overestimate the odds of proliferation or achieve accuracy if they are able and willing to expend resources for it.

The foreign intelligence assessments of states are not inherently comparable because governments vary in the type of subjects and global reach they expect their analysts to cover. Nor are successes and failures distinguishable with the benefit of hindsight. A policy reaction to a timely intelligence warning can prevent the emergence of the threat, but that causal relationship will not be apparent in retrospect. However, one topic attracted great interest from nearly all governments with any kind of foreign intelligence assessment process during the Cold War: current and future nuclear weapons capabilities of foreign countries. Here, policymakers demanded the same kind of information from their respective intelligence services. The accuracy of the assessments can also be compared against history and one another.

Mistaken nuclear proliferation assessments

Foreign nuclear activities are difficult intelligence targets. Throughout the nuclear age, governments in all areas of the world have erred in assessing the scope and purpose of other countries' programs. The United States has fluctuated between proliferation panics and surprise over unanticipated nuclear developments. Little is known about the origins of such mistaken assessments, despite their serious consequences.

Predictions that other countries would acquire nuclear arms have influenced policy choices, extending from treaties to war-making. *The Half-Lives of Others* examines why intelligence agencies err in assessing other countries' nuclear weapons programs. In contrast with traditional research into episodes of so-called "intelligence failures," it examines the performance of multiple governments in assessing the same target countries. Its method is collecting historical intelligence assessments and comparing their accuracy through the benefit of hindsight. The comparative framework isolates technical and political factors that explain the variations in analytic accuracy achieved by intelligence agencies from different countries.

Possible In the history of nuclear weapons propagation, episodes of proliferation panic are counterbalanced by moments of shock revelations regarding unanticipated nuclear developments. The former was expressed famously by President Kennedy's 1960 statement that he feared a world in which up to 20 states acquired nuclear weapons in the coming four years (Kennedy, 1960).

Yet, alongside this general sense of nuclear arms inevitably spreading to additional states, the nuclear age has also seen instances in which a state was too sanguine about another's nuclear capabilities. The U.S. underestimation of Iraq's nuclear program in the 1980s had at least two significant consequences: the diplomatic and technical initiative to improve the IAEA's ability to detect undeclared nuclear activities, as well as representing a probable contributing factor to the overestimate of Iraqi un-

conventional weapons activity in 2002 and 2003. A few years later, U.S. intelligence failed to warn its policymakers of a Syrian reactor under construction.

Perilous Nuclear misestimates can involve high costs. Among humanity's inventions, nuclear weapons are unrivaled in the speed and scale of destruction that they can inflict. Even though the theoretical literature has established that nuclear arms have few–if any–offensive uses, their pursuit has been met with alarm rather than relief by governments. Some states have exerted costly coercive pressure and even force to prevent potential proliferators from acquiring weapons, believing that the chances of nuclear reversal are greater before than after acquisition. Because of these high stakes and the short window of opportunity in which coercion can succeed, states value knowledge about each other's nuclear programs.

Despite the deterrence literature's near-consensus that nuclear arms make poor offensive weapons, states appear to interpret nuclear arms as more than defensive (Sagan, 1996, Fuhrmann and Kreps (2010), Sechser and Fuhrmann (2013)). The combination of offense-defense indistinguishability and perceived offensive advantage situates nuclear relationships in a "doubly dangerous" security dilemma (Jervis, 1977). In this perspective, if states were able to distinguish nuclear energy programs from weapons postures with better intelligence, both sides would benefit.[1]

These theoretical expectations have been confirmed empirically. In fact, states give the impression of being concerned about nuclear proliferation and can have strong policy responses to it. Even before the first nuclear detonations at the end of the Second World War, governments invested intelligence resources in discovering their respective nuclear intentions and capabilities (Richelson, 2007). Since then, fear of nuclear coercion by those in possession of the "absolute weapon" (Brodie, Dunn,

[1] A reactor producing electricity can readily be distinguished from a warhead. The problem of distinguishability is that by the time the purpose of the supporting technology become apparent, it is already too late. Intrusive monitoring in the form of nuclear safeguards can reduce the severity of the dilemma, but not eliminate it. Intentions can change.

Wolfers, Corbett, & Fox, 1946) and the anticipated consequences of deliberate or accidental nuclear detonation have elevated nuclear issues to the top of the policy agenda of governments, international organizations, and NGOs.

Even the Soviet Union and the United States agreed in their preference to extend their own nuclear deterrents to allies instead of letting them acquire independent nuclear weapons. In order to support this joint non-proliferation policy, the two superpowers relied on their intelligence agencies to monitor both allied and enemy nuclear programs. The agencies were not always able to provide the desired warning at a policy-relevant moment:

> "In the months prior to India's May 18 nuclear test, the intelligence community failed to warn U.S. decision makers that such a test was being planned. This failure denied the U.S. Government the option of considering diplomatic or other initiatives to prevent this significant step in nuclear proliferation." (Intelligence Community Staff, 1974, i)

There is certainly a foundation for such reproach. Without warnings from intelligence, policymakers would be faced with the challenge of reversing the new nuclear status quo, a more difficult task than preventing changes in the first place (Brooks, 2008). The literature on counter-proliferation strikes finds that the most effective actions occur early in a program (Monteiro & Debs, 2012, Fuhrmann and Kreps (2010)).

Finally, the clandestine elements of statecraft have not received adequate theory-building attention from international-relations theorists, which has prevented scholars from making meaningful policy contributions on the subject, according to Andrew (2004).

Puzzling States are expected to experience difficulty in judging each other's respective nuclear intentions and capabilities. As applies to every subject of intelligence

collection and analysis, nuclear programs can be difficult to assess. After all, "intelligence failures are not only inevitable, they are natural" (Betts, 1978). Intelligence about the present state of the world already faces obstacles, to which several complications are added when considering the future.[2] These are described in greater detail in the review of the intelligence failure literature below. The main theories of international relations recognize this inherent limitation to states' abilities in perceiving each other's intentions and capabilities. Indeed, they place this inherent uncertainty at the center of their research paradigms, but differ in the compensating strategies that they expect states to follow in response.

The puzzle that emerges from this discussion is: Are these misestimates random noise and normally distributed or do some factors produce a systemic bias?

The extant literature related to how states assess nuclear weapons intentions and capabilities provides explanations for individual intelligence failures, psychological reasons why estimators might be biased, and domestic political explanations for dysfunctional policy-intelligence relationships. However, findings have not been consolidated into generalizable theories that compete in explaining variation in misestimation across time and place. Similarly, international relations theories and the proliferation literature have underspecified the conditions and causes of misperception.

Most rationalist theories assume that states can read each other's capabilities and can infer intentions. Yet, literature on intelligence shows that governments' assessments of other states' nuclear capabilities and intentions are prone to serious errors. Non-rationalist theories expect friction in perception, but rarely make systematic predictions. Theoretical progress would make especially valuable contributions to several theoretical and policy domains. For example, theories of nuclear deterrence

[2]The chief obstacles are technical limitations in sensing nuclear work and challenges in recruiting spies. However, these are constant factors that shape the error baseline more than they explain variation in misestimation.

emphasize the signals that states intend to send about their nuclear capabilities and intentions over the way in which they are perceived.

The dissertation also makes a contribution to the research program on the democratic-authoritarian difference in international behavior, building on the emerging work that takes a more nuanced approach to the effect of the regime type on international behavior. If successful, this dissertation would provide an alternative explanation for variations of authoritarian behavior: If they act differently, could it be in part because they perceive differently?

Research question

> *Under what conditions do states misperceive each other's nuclear weapons intentions and capabilities?*

This dissertation seeks to explain under which conditions states overestimate or underestimate each other's nuclear *weapons* capability. Formally defined as a dependent variable, it is the *accuracy of the assessment of another state's nuclear technical capability and intentions of whether that capability will be used for civilian or military purposes.*

This definition combines estimates of current and future capability because they are inseperable. The assessment of whether nuclear programs are weapons-oriented combines technical analysis about the program's dimensions with inferences about the political intention behind the target country's technical choices. Predictions of future capability require a theory of intent. In the case of current capability assessment, notions of the target's intent is a prerequisite for aiming collection activities. This includes knowing which countries may be operating a clandestine nuclear program.

Nuclear intent and capability are harder to separate than uranium isotopes. Tracking physical materials, knowledge, and infrastructure alone is necessary but insufficient to analyse a country's proliferation risk: tomorrow's bombs spring from today's minds.

More formally, to assess whether a country will acquire a nuclear weapon at time t on the basis of its capabilities c at $t-1$, an assessor requires information about the country's intent i at $t-1$.

Any study of the success and failure of intelligence estimation must address the circumstances that intelligence agencies analyze their own performance and take countermeasures against factors that might introduce bias into their assessments. The theory presented here suggests at least two reasons why misestimates still occur despite their precautions: First, the success of countermeasures may be linked to the independent variables. Second, some targets will simply be less predictable.

Proliferation estimates are typically produced by intelligence agencies and involve input from foreign ministries and technical laboratories. The latter organizations are also capable of developing assessments on their own, using either open and/or secret sources. Assessments do not exclusively relate to security concerns. They are also produced to support bilateral, multilateral, or international organizations' diplomatic engagement. Examples of this include the nuclear Nonproliferation Treaty (NPT) review process or arms control negotiations. Assessments can also be generated for commercial purposes; either to discover export opportunities or as the basis for export controls. Assessments can be made public or distributed privately to key constituencies as propaganda to demonstrate the malign intent of an adversary.

Judging nuclear misestimation

Even as they differ in their assumptions about the role of misperception, various theoretical approaches face a common challenge: the operationalization of misperception in empirical work. The process in which an estimate of a country's nuclear program is classified as mistaken matters to policy and theory alike. In the policy realm, this process is linked with assigning responsibility for serious errors and frequently causes friction between policymakers and intelligence services (Jervis, 2010). Categorizing

some estimates as correct and others as mistaken inherently provokes debate about the standard to which intelligence analysis can or should be held (Betts, 1978).

In empirical work that seeks to explain rather than blame, misestimates can only be measured against a baseline of correct estimation. Establishing this baseline can be difficult, especially once it includes non-material elements of intent. In addition, a danger that does not materialize because policymakers acted on an intelligence warning should not be deemed as a failure. Fortunately, these factors can be taken into account through cautious coding and rigorous process tracing in the nuclear domain. Over time, sufficiently detailed information about most nuclear programs has emerged and can be used to assess the correctness of other states' contemporaneous estimates.

The study of intelligence has not found its rightful place in theories of international relations as a major variable of study. Even a study dedicated to the theory of intelligence suggests eight dependent variables worthy of investigation, none of which are related to the effects of intelligence on the relationship between states (Treverton, Jones, Boraz, & Lipscy, 2006, 10).

1.0.1 Organization

The dissertation proceeds as follows: The next short chapter explains the mixed methodologies and empirical evidence that can be used to distinguish each theory's explanatory power.

As noted above, sources of systematic bias can originate in either the technical or the political component of the assessment. Before developing and testing three general theories of intelligence assessments, *The Half-Lives of Others* takes each of these in turn: The third chapter isolates several characteristics of the target program's capabilities, identifying which of them make it especially difficult for foreign intelligence agencies to differentiate military from peaceful programs. The fourth chapter does

the same for political factors that distort perceptions of countries' nuclear intentions, finding that these are the more difficult side of proliferation assessment. In combination, these two chapters provide the foundation for generating and comparing three general theories of intelligence assessment that includes characteristics of the assessor and target states, as well as the relationship between the two.

The fifth chapter surveys the existing literature on intelligence assessment and state perception of nuclear programs. As the chapter identifies gaps and contradictions in the explanations, it also divides their concepts and insights into three theories. The first of these theories describes *all* states as being forced into acting as fearful overestimators by the inherent threatening nature of the international system. The second theory also views intelligence assessment as similar across time and place, but posits states as being rational seekers and processors of information. The final and favored theory of *bounded perception* describes a fundamental difference in intelligence assessment by regime type. Autocratic weakness in perceiving foreign capabilities and intentions are reinforced by democratic strengths in the same. Governments with greater openness are better at processes that can improve their understanding of other states because openness facilitates the process of aggregating available information into a summary judgment.

Each of the three empirical chapter conducts a series of hypothesis tests using three methodologies. The first test of the hypotheses uses a dataset of several global nuclear proliferation estimates produced by US, UK, West German, and East German assessors. The second stage tracks the Chinese, Indian, Pakistani, and Argentinean nuclear programs over time, testing hypotheses against the accuracy of contemporary assessments created by the American, British, (West and East) German, Swedish, and Swiss governments. The chapters then trace the causal mechanisms by using three matching assessments of West Germany's (Federal Republic of Germany) nuclear program during the Cold War.

A concluding chapter summarizes the findings and provides a series of implications for the study of state perception and intelligence assessment. It also offers a catalog of considerations for the producers and consumers of intelligence assessment.

Table 1.1: Dissertation method and data source overview

	Large N	**Medium N**	**Process tracing**
Inferential leverage	Variation on assessor/target relationships across time	Assessment inputs, details on bilateral relationship	Acquisition and processing of information, changes in FRG nuclear capabilities and intentions
Unit of analysis	Country-year dyads	Assessor-target pairs over time	Detailed assessor-target pairs over time
Data	$> 10,000$ c/y assessments by US, UK, GDR, FRG	$\sim$12 cases. Assessors: US, UK, FRG, SWE, GDR. Targets: ARG, IND, PAK, PRC	UK, US, and GDR assessment process of FRG
Source	Self-coded intel assessments, standard IR databases	Primary sources on assessment and assessor policy toward target country	Primary sources on assessment, assessor policy, and target program

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Chapter 2

Data Sources and Mixed Methods

Social scientists have found it difficult to build theories of intelligence that are simultaneously generalizable and testable. There are good reasons for this, most of which relate to the availability of empirical evidence and methodology. This chapter addresses these barriers to comparing intelligence agencies' assessment performance over time and place and presents a methodological framework.

The main driver of methodology should be the nature of the theory and its competing explanations. The number of the theory's observable implications should be maximized and subjected to rigorous testing (King, Keohane, & Verba, 1994). At the same time, attempts must be made to find ways of distinguishing between competing explanations by maximizing for diagnostic power, i.e. uniqueness in their predictions: "A unique prediction is a forecast not made by other known theories." (Evera, 2015, l. 325) There is also no sense in generating starkly diverging implications if they cannot be observed in practice. Consequently, the aforementioned theoretical imperatives must also be balanced against the constraints of the available evidence. The practical limits of theory articulation must be established at the outset.

Although it is unconventional to discuss the methodology before articulating the theory, addressing the methodological concerns that have prevented serious attempts at

creating generalizable theories of intelligence assessment at the outset avoids burdening the subsequent empirical chapters with it.

This chapter is divided into three main sections: The first part treats the nature of the research question. A robust methodology includes the need to precisely define concepts of the theory and develop reliable measurement strategies in order to articulate "what is important about an entity" (Goertz, 2012, 27). Within this context, the main difficulty is to provide a properly conceptualized and measured dependent variable. This step requires a sound foundation in understanding the concepts of nuclear proliferation and intelligence assessments, as well as measuring whether these were accurate. Successful inference also demands avoiding bias by the deliberate and precise selection of cases, as well as articulating strategies for drawing broad conclusions from statistical analysis at the country-year level.

In the second part, the chapter discusses the limitations in using historical archival documentation to provide rigorous answers. Few states are willing to grant researchers access to records pertaining to nuclear weapons or intelligence. Consequently, intelligence records about nuclear weapons are some of the least likely documents to be released by governments. The second part introduces the source of new records secured from multiple governments that make the dissertation's inferences possible.

The chapter's third part describes the mixed methodology design to overcome as many of these limitations as possible. With a limited and biased evidentiary basis, it is necessary to make the most of it. Questions of unit homogeneity, bias, and other common social scientific inferences are addressed here. Most explanatory variables do not change greatly over time; they are also not independent observations. In the broadest terms, the overall philosophy is a combined comparative large N global panel, across-case comparisons, and within-case causal process tracing. The process of case selection begins by articulating the possible universe of cases to study and how to select from among the available data, which is the step that most risks the

introduction of bias. Next, cases are selected based on their expected value of yielding the respective inferential leverage for quantitative and qualitative analysis. In conclusion, a description of the quantitative and qualitative tools that are used to test the theory's observable implications is provided.

2.0.1 Explaining nuclear proliferation assessment accuracy

All coding is theoretical; theory and measurement are never independent. Variables in social science research are intended as instantiations of concepts, the relationships between which form a discipline's theories. Goertz argues persuasively that "concepts have causal theories embedded" (12). The type(s) of measurement chosen to represent a concept is a theoretical choice, and so is the relationship between these measures. An atheoretical measurement process is therefore impossible, and any attempt to subject a social scientific theory to an empirical test must grapple seriously with the choice of how to measure its concepts.

In order to analyze the coding models and choices in the recent proliferation literature, the method of conceptualization that was described in Goertz (2012) is applied. With this approach, concepts are rigorously measured on three levels, each of which involves unavoidable theoretical choices. The concept itself exists as the basic level, and its constituent parts are the secondary level; in turn, the latter are measured empirically at the (third) indicator level.

Goertz characterizes the basic level as the "most important level, theoretically" because it articulates the concept as it is "used in theoretical propositions" (Goertz, 2012, 6). A key dimension of the basic level is how to characterize the space between the positive and negative poles, and therefore whether to think of the concept as dichotomous or continuous (Goertz, 2012, 30).

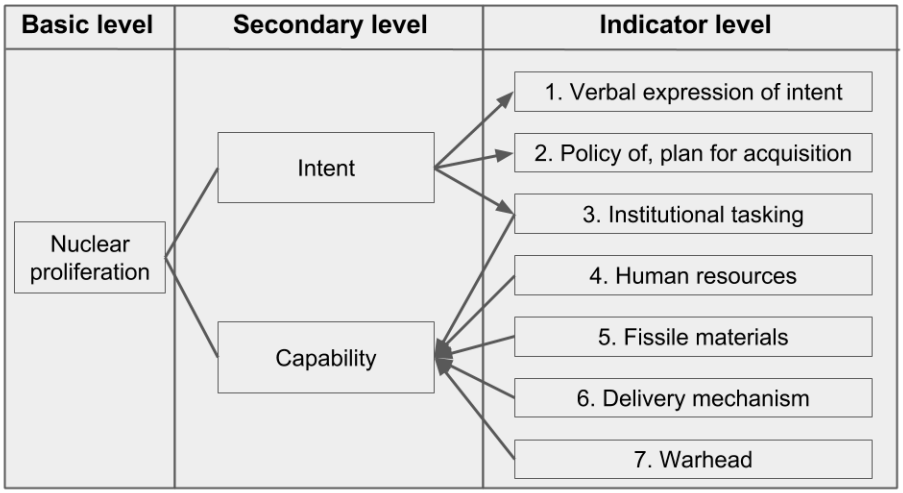


Figure 2.1: Nuclear proliferation: concept and measurement

The nuclear proliferation concept

Conceptualizing nuclear proliferation as a dependent variable is important for case selection: On the left, what is the minimum threshold for being a potential proliferator? On the right, when does the case drop out–when does a proliferator pass into a nuclear-armed state?

Goertz's approach can be applied to the proliferation concept in order to illuminate the strengths, weaknesses, and theoretical foundations of the various proliferation measures, as discussed above. The following graph illustrates the suggestion that the secondary level consists of the willingness and ability to develop nuclear weapons, each of which has a set of indicators that could be recommended for use in any study that codes the proliferation status of a state.

The basic level concept is nuclear weapons proliferation. This means a state's process of moving toward some kind of an operational capability to detonate a fission reaction.[1] Following Goertz's expectation, the proliferation literature is defined by

[1]There is no theoretical reason non-state organizations could not also move through these stages of proliferation. In fact, there is every indication that at least one–Al Qaeda–explored the possibility of acquiring nuclear weapons (Albright, 2010, 169). As the example demonstrates, there are serious practical barriers to non-state proliferation, leaving us free to set aside this dimension of the proliferation concept.

a positive value of the proliferation concept: Why do states build nuclear weapons? While the field has long ceased to select based on the dependent variable and has explored the question of why states refrain from proliferation, this bias toward the concept's positive pole apparently continues to shape the literature.

The sub-concepts of *intent* and *capability* exist at the secondary level. Both are necessary to fulfill the nuclear proliferation concept and cannot be substituted. A nuclear weapon is not built by accident, and even the most fervent wish for one does not create the necessary material components. However, intent and capability do not need to be present simultaneously. A state can accumulate capabilities that would be necessary for the construction of nuclear weapons without intending to do so. Indeed, the inherent dual-use nature of nuclear energy technologies is at the heart of the proliferation policy problem. Conversely, a state can be driven by the intent to acquire nuclear weapons even in the absence of the initial capability to do so. In summary: While states can progress independently along the *intent* and *capability* spectrum, they cannot successfully proliferate until the two are combined.

Indicators of *intent* and *capability*

Extant measures of proliferation can be combined into the following seven indicators of *intent* and *capability*:

1. Verbal expression of intent (Intent)

Somewhere in the government or even broadly in the selectorate, a statement is made or a question is raised about the possible desirability or feasibility of nuclear weapons. Measurement is a continuous variable and weighted through context-aware observations about the (potential) decision-making authority or influence over decision-makers. Whose expressions are salient will depend on policy. For instance, a general's desire for nuclear weapons would be far more indicative of intent in a junta than in

a Communist Party-led state or a democracy. Verbal expressions form a continuous variable.

2. Policy of, plan for acquisition (Intent)

This is a concrete plan that acquires, arranges, funds, and directs the relevant capabilities toward the production of nuclear weapons. There may be a smoking gun in the form of a plan that can be discovered by researchers, or it could be a tacit agreement within a state. While it is a dichotomous variable in most cases–a state either has a policy of nuclear acquisition or it does not-a state can also have the intent of keeping its options open.

3. Institutional tasking (Intent and capability)

The creation of a deliverable nuclear weapon requires advanced technical and scientific skills in a variety of disciplines. In order to combine the necessary labor and direct the capital, a state must task (and possibly create) some form of organization(s) with the objective of pursuing a nuclear weapon for the state. The fact that this is a significant component of nuclear proliferation is evident from a finding that weak institutions in some states "have permitted political leaders to unintentionally undermine the performance of their nuclear scientists, engineers, and technicians" (Hymans, 2012). The institutional prerequisite combines elements from *intent* with *capability*. Tasking an organization with nuclear acquisition is an expression of intent, while having such an institutional arrangement forms the prerequisite for acquiring and organizing the other materials capabilities. The variable is dichotomous.

4. Human resources (Capability)

As noted above, a state must have scientists and engineers who are willing and able to develop whichever material components are needed for nuclear weapons, as well as those that cannot be acquired otherwise. For instance, a state that can import highly enriched uranium does not need the expertise to enrich uranium. Because of this substitutability, this variable can be considered as continuous.

5. Fissile materials (Capability)

A state will need sufficient quantities of fissile materials–a critical mass of either highly-enriched uranium or plutonium–to fuel a nuclear detonation. The precise quantity that is required will depend on the warhead design, a factor that nuclear weapon states have maintained as closely guarded secrets. In lieu of exact details, it is common practice in academic and policy research to rely on the International Atomic Energy Agency's (IAEA) concept of a significant quantity (SQ): "The approximate amount of nuclear material for which the possibility of manufacturing a nuclear explosive device cannot be excluded. Significant quantities take into account unavoidable losses due to conversion and manufacturing processes and should not be confused with critical masses" ("IAEA Safeguards Glossary", 2001, 23). For plutonium, the IAEA has set this amount at 8 kilogram. For highly-enriched uranium, a significant quantity is 25 kilogram. If a state possesses either, the dichotomous variable should be coded as positive.

6. Delivery vehicle (Capability)

While initiating nuclear fission is one capability, ensuring the device's delivery at the desired time and place is another. Many options are available: They range from trucks and barges to gravity bombs and submarine-launched missiles, but not all will meet the military's requirements of accuracy, reliability, and vulnerability to countermeasures. To avoid prejudging the force structure or nuclear doctrine, it is better to set a low bar for meeting this requirement and err on the side of coding the dichotomous variable positively.

7. Warhead (Capability)

The final ingredient in a nuclear weapon being acquired by a state is its having the means to turn fissile materials into an operational capability by mating them with one of its delivery vehicles. Whether or not a state has a functioning warhead is a dichotomous measure, even if it may be difficult to observe in the absence of a

test detonation. Achieving that capability may require testing the warhead design. If successful, this alone is a confirmation that the proliferation process has been completed. However, as discussed below, the absence of a test is not an absence of proliferation.

Defining the finishing line

When does a state join the ranks of those with nuclear arms? Hymans (2010) addressed the question of when a state should be considered as having completed the process of proliferation and having joined the ranks of the nuclear weapon states. He notes that a test–the traditional marker of a weapons state–has been losing favor among academic researchers and policy analysts because "from a technical point of view, an explosive test may not be strictly necessary for the construction of weapons of fearsome and unparalleled destructive power" (Hymans, 2010, 161). Instead, "there is a growing belief that the real red line, between nuclear and non-nuclear weapon states, should actually be drawn at the acquisition of an SQ of fissile material" (Hymans, 2010, 166). Hymans rejects this new standard and advocates in favor of the testing criteria, partly because "the accumulation of an SQ is much less visible than a nuclear test." This means that "using that metric to assess nuclear weapon status introduces much greater uncertainty and even opens the door to politically biased misinterpretation" because "the SQ/no-SQ indicator considerably underestimates the obstacles, both technical and political, that stand between the accumulation of fissile material and the production of operational bombs" (Hymans, 2010, 168-9).

Yet, he cautions that a weapon's test cannot be divorced from its underlying purpose, reminding that "a nuclear test does not, in itself, equal a nuclear arsenal." Rather, it is "merely a signal of intent and capacity" (Hymans, 2010, 165).

The proliferation index that is proposed here captures this dynamic: The hypothetical goal for a state is an operational warhead. One prominent indicator that it is making progress in that direction is the nuclear test.

Fortunately, an existing dataset provides a measure of what a correct estimation would have been. Singh and Way divide states into four categories of nuclear intent and capability, and this typology will be used for the purpose of establishing the baseline against which US intelligence estimates will be measured (Singh & Way, 2004, 866):

- *Acquisition of weapon capability.* This stage is marked by the assembly of a warhead and/or a nuclear detonation.

- *Substantial efforts to develop weapons.* In this category, states must take "steps aimed at acquiring nuclear weapons, such as a political decision by cabinet-level officials, movement toward weaponization, or development of single-use, dedicated technology" (*ibid.*).

- *Exploration of the possibility of developing/acquiring weapons.* Inclusion requires that a state's nuclear weapons interest is "demonstrated by political authorization to explore the option or by linking research to defense agencies that would oversee any potential weapons development" (*ibid.*).

- *No interest or effort.* States that have convincingly renounced prior weapons interest also fall into this category.

The seven proliferation indicators developed above provide a new set of criteria for the Singh and Way variables, which guides the categorization of cases for this dissertation. *Explore* includes any activity in the first indicator. *Acquire* is satisfied when the state achieves the last two indicators (delivery mechanism and warhead). *Pursuit* is everything in between.

The following indicators must be treated with caution because they are dual use. Verbal expressions of intent (1) can be used as a diplomatic tactic (for instance, as

an inter-alliance tactic). Researchers should use caution in coding cheap talk about nuclear options. Careful consideration should be given to the context because it is not as simple as taking private comments more seriously than public ones. Human resources and expertise (4) and fissile materials (5) have applications in both nuclear energy and weapons. Finally, most delivery systems (6), with the exception of state-of-the-art missile technology, can also bring conventional munitions to their targets.
Additionally, the scale suggests the appropriate criteria for case selection. The universe of possible proliferators are those states with at least one non-zero indicator. A proliferating state is one that works to move these indicators above zero. A nuclear weapons state has all of the indicators set to 1.
From the perspective of causal inference, the foundation of any empirical analysis must be the comparison between correct and incorrect estimates in order to overcome the problem of the dependent variable being selected by the intelligence failure literature. Even a simple descriptive need for failure rates requires knowledge of mis-estimates (the numerator) and correct estimates (denominator). A rigorous coding of intelligence success includes every possible problem of coding failure; it also has no inherent limit.

The proliferation assessment concept

Having developed this concept of proliferation, what defines a state's perception thereof?
A state's perception is difficult to locate. Unique among their governmental institutions, foreign intelligence organizations "are specifically designed to collect information about foreign capabilities and intentions" (Rovner, 2011, 198). Intelligence services reporting to the state's highest decision-makers on other country's nuclear programs are therefore treated as the default generators of such assessments. If they did this, their view can be considered as the state's proliferation risk assessment.

An assessment need not be created by an intelligence agency. In practice, policymakers receive signals through many channels and not only from intelligence agencies (Teitelbaum, 2005, 24). Diplomatic communications have received pride of place, perhaps due to a combination of ample archival data and because they are a direct reflection of this inter-state bargaining and signaling process. States also receive information through publicly accessible indications such as news reports or exchanges via international organizations. In addition, the information acquired by intelligence services may not always be filtered through a formal analytic process because "policymakers occasionally request access to the raw data itself, bypassing the formal analytical process entirely" (Rovner, 2011, 21). This is likely to occur when an issue is of pressing importance or if the policymaker believes that the intelligence professionals have erred in their judgment.

The theory should therefore be able to explain the propensity for the accuracy of any assessment produced by a government bureaucracy charged with issuing an authoritative judgment. Empirically, this dissertation only uses non-intelligence assessments if there is a very low chance that a secret intelligence product was created and treated as more authoritative by policymakers.

2.0.2 Available proliferation assessment data

Finding evidence from the universe of eligible cases is a challenge. It requires assessments from multiple countries' intelligence agencies about the same nuclear program, ideally at the same time, and sufficient knowledge about the nuclear program's capabilities and the intentions behind it to judge their accuracy in retrospect. This section describes how the research for this dissertation overcomes some of the challenges and confesses to remaining limitations.

The first difficulty is the reliability of archival sources. George and Bennett (2005) warn that "those who produce classified policy papers and accounts of decisions of-

ten wish to leave behind a self-serving historical record" (101). The same can be expected of intelligence reports, even if the expectation of their becoming public was far lower in the Cold War than it would be today, and even then with a 25-to-30 year delay (Andrew, 2004, 6). East German intelligence officers, on the other hand, most probably did not expect their records to become public. The more serious problem with intelligence documentation is that it is rarely released to the public, especially outside of the United States (Garthoff, 2004, 22-3). If it is, it will likely be redacted or withheld in a bias-introducing way.

It is also hard to know if intelligence about nuclear programs was correct because states hide the histories and technical details of their nuclear weapons efforts for many reasons (they broke rules acquiring them, do not want to pass along design information, etc.). Public domain information often comes from intelligence reporting itself, which is obviously problematic.

Cases for which no reliable baseline narrative exists cannot be studied. The leading example is the Israeli nuclear program, for which there is an abundance of intelligence estimates, but no authoritative account against which to judge their accuracy. In fact, most accounts of this and other secretive programs depend on these assessments, making it impossible to independently verify the accuracy of the intelligence reporting.

The assessors

Proliferation assessments from six countries were collected for this chapter. The US intelligence estimates were already in the public domain. The West German, Swiss, Swedish, and British assessments, when not already in the assessing country's archives, were released using a variety of applicable declassification and Freedom of Information laws and regulations. The East German assessments were provided by the archivists in charge of the surviving Ministry of State Security's (MfS) files. The military intelligence files were found in the military archive of unified Germany.

This section also provides a cursory overview of the bureaucratic arrangements that Western intelligence used to conduct nuclear assessments. The East German process is not as well known in the English literature and merits a more detailed description. It is not a given that an intelligence agency will be the source of the assessment. Typically, smaller states do not have a global intelligence coverage comparable to that of the bigger powers. This means that whatever intelligence capability that the former have will be trained on their top priorities.

Even when they are created by intelligence agencies, proliferation estimates often require the input of other government bodies, which may be scientific expertise or diplomatic reporting. Consequently, it is best to maintain a wide aperture and admit any proliferation assessments that were passed to the leadership, regardless of their institutional provenance. There is also rich variation in how these estimates are created, across time and within states. Even the United States, one of the earliest and most active proliferation estimators, has enjoyed the benefits and has suffered the drawbacks of competing assessments from multiple inner-governmental channels. If there are multiple competing assessments, this is endogenous to the theory and may reflect the leadership's desire to have multiple views to choose from. This *could* be a symptom of politicization and would therefore need to be examined as an integral component of the theory. It is equally informative if a country's assessments are authored by non-intelligence organizations. States that do not produce such assessments most likely depend on open sources or briefings from other states, for instance in the context of the international nonproliferation regime.

United States

Between 1951 and 1973, the Office of National Estimates (ONE) provided assessments of nuclear programs abroad in the form of National Intelligence Estimates (NIEs). Freedman (2014) describes the following process:

> "After being scrutinised by the Board of National Estimates they were checked, usually as a matter of course, by the United States Intelligence Board (USIB). Though the drafting process was supposed to be an effort which would draw on all the resources of the intelligence community, leading to 'composite assessments' representing the views of all agencies, and though the USIB was expected to ensure that all NIEs met this standard, ONE acted as far more than an impartial arbiter between competing estimates. Certain sources were favoured, and a distinctive style and flavour was conveyed to the final NIEs." (32)

During the Nixon administration, ONE was replaced with National Intelligence Officers "responsible for both intelligence collection and production in his particular field" (Freedman, 2014, 55). Subsequent bureaucratic evolution exceeds the period under study.

Most of the available American assessments are intelligence community-wide consensus reports, in the form of National Intelligence Estimates. When individual intelligence agencies–or, occasionally, the NSC staff–created independent assessments, these were included if there was evidence that these assessments had been presented to policymakers.

Because of the US intelligence community's comparative openness and previous scholarly interest, many of the documents used for this study were previously available at the National Security Archive. The major exceptions are from the recently released tranche of documents about its policy toward Argentina and the Presidential Daily Brief series.

United Kingdom

Since the time before WWII, Great Britain's central assessment infrastructure had been the Joint Intelligence Council (JIC), which was brought into the Cabinet Office

in 1957 (Aldrich, Cormac, & Goodman, 2014, 1). The JIC's staff collected inputs from a variety of intelligence and other sources (the Foreign Office, later the Foreign and Commonwealth Office, contributed substantially). They drafted reports and then circulated them among the experts of the Current Intelligence Groups before seeking the Council's approval (Aldrich et al., 2014, 3).

Some of the British assessments and policy documents used below were previously released for public access in The Kew National Archives, others were unsealed upon request, and a select few JIC reports were released upon direct petitions. At the time of writing, several Freedom of Information requests are still being processed by the British Cabinet Office and the Ministry of Defense.

Federal Republic of Germany

The West German assessments are the result of a request for declassification from the *Bundesnachrichtendienst*, or BND, which produced proliferation estimates for the government. The documents include longer reports for broader government leadership distribution, as well as contributions to the chancellor's brief.

German Democratic Republic

In East Germany, the task of assessing the foreign threat environment was assigned to the Ministry of State Security's foreign intelligence branch, with the military intelligence service creating parallel and subordinated judgments.

The Ministry of State Security (*Ministerium für Staatssicherheit*, from which the colloquial ''Stasi" is derived, hereafter referred to by its German acronym, MfS) was both a domestic secret police and a foreign intelligence service. At the time of its founding in 1950, the MfS was tasked by the Communist Party[2] to "unmask and eliminate the enemies of the working class and agents of imperialism" (Süß, 2014,

[2]Officially the Socialist Unity Party, or *SED*.

88). Whether knowingly or not, one in ten East Germans provided information about their fellow citizens to the MfS.

The department that was charged with foreign intelligence gathering came to be known as the Main Department A (*Hauptverwaltung A*, or HVA). By 1955, the HVA had a staff of 430, which grew to 524 in 1961, and then expanded further to 1,066 by 1972 (BStU, 2013, 21). By the time of reunification, that figure had tripled.

The East German military intelligence service was focused almost exclusively on West German military capabilities. The service also reported regularly on the rival state's nuclear program. Its reports were submitted to the MfS, which exercised a close supervision of the military's intelligence branch and recruited informants widely from its ranks.

The HVA's main intelligence collection focus was West Germany, which it called its ''operational area" (*Operationsgebiet*) (Knabe, 2010, 1). It primarily collected human intelligence and ran about 6,000 agents in the Federal Republic and West Berlin, over the course of its existence (BStU, 2013, 21).

Most sources were recruited in order to procure Western technology. Vast effort was put into the collection of information in West Germany, which was largely overlooked by Western counter-intelligence. West German counter-intelligence detected 765 recruitment approaches in 1971 (JIC, 1973). The HVA managed to successfully infiltrate several West German decision-making circles, including top NATO officials, the head of the BND's Soviet division, and a chancellor's aide. The HVA also recruited sources in other European NATO countries.

HVA analysts conducted their analyses without input from the foreign ministry or other bureaucratic entities. The agency also did not have a designated technical assessment department or capability, so the source of its technical expertise is difficult to track. But as an organization whose main activity was procuring Western technology, the HVA presumably had scientific and engineering expertise.

By the 1970s, an office in the MfS's minister's office had established itself as the central collector and assessor of all threats to the regime and state. The Central Evaluation and Information Group (*Zentrale Auswertungs- und Informationsgruppe, or ZAIG*) would generally not alter HVA reports before forwarding them to East German leadership (Engelmann & Joestel, 2009, 7). The main recipients of these assessments were Politburo members (Knabe, 2010, 2). The Soviet KGB was also on the distribution list for most reports.

Assessments are drawn from the MfS archives and the military archive for the People's Army's intelligence records.

> In the case of the now defunct East Germany, the internal security records of the State Security Ministry (Stasi) are open, but most of the Stasi's foreign intelligence collections are not accessible, having been sealed by the German government. However, reports from the Stasi chief to the East German Politburo are available, and memoirs by the former head of East German foreign intelligence, Markus Wolf, and other former Stasi officers are often quite revealing. (Garthoff, 2004, 26)

Are satellite states like East Germany comparable with the United States? According to West German intelligence, 80% of NATO intelligence received by Soviets came from the GDR. This has the benefit of creating a paper trail between the client and patron states. In addition, the USSR backstop may have distorted the internal East German regime dynamics that are at the center of the theory. But which country lacks a patron backstopping the regime? This may be correlated with non-democracy, but West Germany had the same situation (from a functional, not legitimacy perspective).

Sweden

Formal Swedish proliferation assessments were produced by the state defense laboratory, FOA. The foreign ministry, which had assigned this task to FOA, also created

them. The fact that the intelligence agency did not regularly produce competing assessments comes from an interview with Hans Blix, a former prime minister, IAEA director general, and active participant in Swedish nuclear policy.[3]

Switzerland

A former Swiss intelligence chief claims that proliferation was not a priority for his service.[4] Instead, the foreign and defense ministries provided assessments. These were retrieved at the Swiss Federal Archive in Bern, as well as in response to declassification requests with the ministries.

Differences and similarities

Each state's assessment process evolved over time. Each of them had a designated central assessment process and staff who attempted to provide comprehensive assessments, based on the best information available across government departments.

Some differences are evident: The UK typically incorporated more diplomatic input than either the GDR or the US. The East German foreign ministry's lack of information about the non-Communist world before it began opening embassies in the 1970s is a simple explanation for this. US assessments received diplomatic input through the State Department's INR, but it competed with other perspectives in the vast US intelligence community. Both the UK and the US had designated scientific expertise through DSTIB and the Department of Energy, respectively. The HVA's technical expertise was likely in-house.

In summary, despite the fundamentally uneven distribution of collection capability, these assessments can be treated as homogenous for the purposes of explaining their accuracy across a broad range of nuclear programs (King et al., 1994, 91).

[3]Interview with author. July 2014. Stockholm, Sweden

[4]Email correspondence with author.

2.0.3 Research design

Having established that these assessments form like units, a method for carrying out these comparisons is required. As described below, this dissertation evaluates each theoretical claim first at a coarse, country-year level using standard political science datasets to explore relevant independent variables. As an intermediate step, it uses available assessments from multiple agencies of the same four nuclear programs over time. Finally, it traces the causal mechanisms of the competing hypotheses in the observation of West Germany's controversial nuclear program in the early Cold War. This provides "more leverage over a theory by making observations at a different level of analysis of the theory" (King et al., 1994, 86-7).

Table 2.1: Dissertation method and data source overview

	Large N global panel	**Medium N case studies**	**Process tracing**
Inferential leverage	Variation on assessor/target relationships across time, control variables	Assessment inputs, details on bilateral relationship	Acquisition and processing of intelligence, tracking changes in FRG nuclear capabilities and intentions, identical target program
Unit of analysis	Country-year dyads	Assessor-target pairs over time	Detailed assessor-target pairs over time
Data	>12,000 c/y assessments by US, UK, FRG, GDR	∼12 cases. Assessors: US, UK, FRG, SWE, GDR. Targets: ARG, IND, PAK, FRG, PRC	UK, US, and GDR assessment process of FRG
Source	Self-coded intel assessments, standard IR databases	Primary sources on assessment and assessor policy toward target country	Primary sources on assessment, assessor policy, and target program

2.0.4 Building a global nuclear proliferation assessments panel dataset

The country-year level provides a fertile initial testing ground for general theories of intelligence assessment. Especially those theories derived from general accounts of state behavior across place and time experience a fair test here. TheIt also guards against the possibility that intelligence agencies are biased toward releasing assessments that proved correct. he documentary sources of intelligence assessment were described above. This section introduces how these raw assessments were coded and converted into a global panel dataset to test hypotheses derived from the three competing theories.

Eligible for inclusion were estimates of current and future nuclear capabilities that form the official information set of foreign policymakers. For the United States, a series of National Intelligence Estimates on nuclear proliferation serve this purpose. Eight of these, written between 1958 and 1983, have been declassified and are publicly available. The redactions in these documents appear chiefly related to technical details and Israel's nuclear program. The former are not required because the qualitative assessments are intact. Information relating to the latter can be readily inferred with the assistance of other historical sources.

The U.S. intelligence community did not compile globally inclusive estimations of nuclear capability and intent into a single document before 1958. Instead, the estimates are distributed among country-specific intelligence products, of which sufficient documents are available to establish how US policymakers were informed about current and future nuclear intentions and capabilities. Because of ongoing classification, US global proliferation estimates after 1982 are available only in truncated form. British

intelligence analysts were similarly active as their close American collaborators, producing a series of global nuclear forecasts.[5]

West Germany, East Germany, Switzerland, and Sweden only produced (or have been willing to release publicly) episodic proliferation trend assessments. These were also typically more modest in geographic and temporal coverage. They were also were more sparing in committing themselves to definite predictions of future nuclear weapon proliferation.

These assessments were used in the construction of the dataset:

East Germany:

- MfNV, 1956, *Bericht über das militär-ökonomische Potential der Länder der Europäischen Wirtschaftsgemeinschaft*[6]
- MfS, 1981, *Aktuelle Informationsuebersichten, Nummer: 44/81*[7]
- MfS, 1989, *Information ueber das Kernwaffen-, Chemiewaffen- und Raketenpotential ausgewaehlter Schwellenlaender*[8]

Switzerland:

- EPD, 1974, *Perspektiven der Atomrüstung*[9]

West Germany:

- BND, 1974, *Beurteilung der Kernwaffenentwicklung in einigen Nicht-Industrie-Staaten*[10]

[5] Despite this close collaboration, British and American assessments can still be considered independent. As shown in the following case study chapters, the two intelligence communities preferred to issue their own assessments about a common set of facts.

[6] *Report on the military-economic potential of EEC countries.*

[7] *Current information overview.*

[8] *Information about the nuclear weapon, chemical weapon, and missile potential of selected developing countries.*

[9] *The future of nuclear armament.*

[10] *Evaluation of nuclear weapons development in some non-industrialized countries.*

United Kingdom:

- JIC, 1960, Development of Nuclear Weapons by Fifth Countries during the Period 1960/70
- JIC, 1963, Development of Nuclear Weapons by Additional Countries During the Period 1963-1973
- JIC, 1965, Development of Nuclear Weapons by Additional Countries
- JIC, 1966, Consequences of the Development of Nuclear Weapons by Additional Countries up to 1975
- JIC, 1973, Development of Nuclear Weapons by Additional Countries up to 1980

United States:

- CIA, 1958, Development of Nuclear Capabilities by Fourth Countries: Likelihood and Consequences
- CIA, 1960, Likelihood and Consequences of the Development of Nuclear Capabilities by Additional Countries
- CIA, 1961, Nuclear Weapons and Delivery Capabilities of Free World Countries Other than the US and UK
- CIA, 1963, The Advanced Weapons Programs of the UAR and Israel
- CIA, 1963, Likelihood and Consequences of a Proliferation of Nuclear Weapons Systems
- CIA, 1964, Prospects for a Proliferation of Nuclear Weapons over the Next Decade

- CIA, 1966, The Likelihood of Further Nuclear Proliferation
- CIA, 1974, Prospects for Further Proliferation of Nuclear Weapons
- CIA, 1975, Managing Nuclear Proliferation. The Politics of Limited Choice
- CIA, 1982, Nuclear Proliferation Trends Through 1987

The unit of analysis is the continuous dyadic relations between a perceiving and a target state.

Converting NIEs to country-year estimates

To test these competing claims, this chapter introduces a self-coded dataset for the historical performance of intelligence analysts from six countries. These states are Sweden, Switzerland, the United Kingdom, and the United States, as well as the German Democratic Republic (East Germany) and its Western counterpart, the Federal Republic of Germany. The scope of the dataset is perceptions of potential horizontal proliferation during the Cold War. New nuclear aspirants are viewed as a bigger policy problem and researchers have invested more efforts in making primary source estimates available for public inspection.

The assessments are coded as follows: Countries named are recorded either as having no nuclear military intent or capability, as exploring or pursuing the nuclear option, or whether and when they will acquire an explosive capability. If the document makes predictions with an indicated timeframe, the prediction is recorded for those future years. If no timeframe is given, the prediction is coded at a default of three years.[11] If a state is not named, it is coded as lacking non-peaceful nuclear intent.[12]

[11] In the slow-moving realm of nuclear technology, anything less than two years barely amounts to a prediction. At the same time, it may be unfair to hold intelligence estimates to five years or more, especially if they were not intended as such. A period of three years is a somewhat arbitrary midpoint, although it has the benefit of approximating the optimistic end of a state's nuclearization during the study period.

[12] Detection of nuclear tests are coded as correct estimates only if the target tried to keep it secret.

Table 2.2: Intelligence Estimate Coding Rules

		Explore	*Pursue*	*Acquire*	*Not explore*	*Not pursue*	*Not acquire*	*Not evaluated*
Actual nuclear behavior	*Explore*	C	O	O	U	C	C	U
	Pursue	U	C	O	U	U	U	U
	Acquire	U	U	C	U	U	U	U
	Not explore	O	O	O	C	C	C	C
	Not pursue		O	O	C	C	C	C
	Not acquire				O	C	C	C

C = correct intelligence estimate; O = overestimation; U = underestimation

Some coding decisions are more difficult than others and are resolved according to the following rules: When they are observable in the historical record, conditional estimates are evaluated with knowledge of what actually happened.[13]

As a result of these coding rules, each target country-year can have several estimates attached to it, each from a different assessment. As an example, Swedish nuclear capability in 1965 was the subject of three US NIEs from 1961, 1963, and 1964. The first is the result of an assurance that other than the states discussed in the document, no other nuclear candidates were likely to emerge (CIA, 1961, 2). All three nuclear indicators are therefore coded as ''0," which was a correct assessment. The second relevant NIE addresses Sweden's nuclear program directly (CIA, 1963, 10):

> We believe that if a decision to go ahead is made in the next year or two, the Swedes could test a first device two or three years later.

From this prediction, it is not clear whether Sweden is expected to *explore* its nuclear option, so it is coded as "NA." However, the document communicates that Sweden would *not* be acquiring nuclear weapons in 1965. The remainder of the assessment

[13]For example, the following was coded as an estimate that the Federal Republic of Germany would abstain from nuclear pursuit for five years. After which it would presumably initiate a military nuclear program because neither of the conditions occurred. "If neither a common Western program for the production of nuclear weapons nor a substantial disarmament agreement is reached in the next five years, we believe West Germany will then seek to enter into independent development and production of nuclear weapons and delivery systems." (CIA, 1958, 1). Some conditional statements relating to beliefs are not observable; consequently, coding depends on other information. For instance: "Pakistan would try to get nuclear weapons if it became convinced India was developing them." (CIA, 1964)

Table 2.3: Illustrative Sample Codings of U.S. Nuclear Estimation

Case	Explore	Est.	Pursue	Est.	Acquire	Est.	Quote
Australia1963	1	0	1	0	0	0	[Canada and Australia are] much more likely to seek close cooperation in defense planning and some form of nuclear sharing with the US and UK than to undertake an independent nuclear weapons program.
Belgium1962	0	0	0	0	0	0	We believe it unlikely that any other Free World country or possible grouping of countries will initiate weapons programs during the next several years.
Canada1958	0	0	0	0	0	0	Canada now has agreements for the sale to the US of all its plutonium production
Germany1961	0	0	0	0	0	0	If neither a common Western program for the production of nuclear weapons nor a substantial disarmament agreement is reached in the next five years, we believe West Germany will then seek to enter into independent development and production of nuclear weapons and delivery systems.
Israel1964	1	1	1	0	0	0	[T]he chances are better than even that Israel will decide to develop nuclear weapons within the next few years.
Japan1967	0	0	0	0	0	0	[B]arring the unlikely return to power of a right-wing authoritarian government, we believe that Japan will not undertake a nuclear weapons program of its own in the next few years.
Pakistan1973	1	0	1	0	0	0	Barring unforeseen technological breakthroughs, only seven other powers now have or are in the next decade likely to have the potential to develop nuclear weapons: [Redacted. Infer: Israel, West Germany, Netherlands, India, Sweden, Japan, and Canada]
Poland1963	0	0	0	0	0	0	We believe that the Eastern European satellite countries will not initiate nuclear weapons programs.
Spain1966	0	0	0	0	0	0	[N]one of [Canada, Belgium, Denmark, Italy, the Netherlands, Norway, Portugal, Spain, Argentina, Brazil, Czechoslovakia, East Germany] will undertake a nuclear weapons program in the foreseeable future.
Switzerland1958	1	0	0	0	0	0	Other countries which could commence nuclear weapon programs 5-10 years hence if they could obtain access to fissionable materials without restriction as to use, are Japan, Italy, Switzerland, Norway, and the Netherlands.

leans in the direction of Swedish nuclear abstention, so the *pursue* variable is also set to "0." Judged against the Singh and Way database, this was a correct estimation. Finally, the NIE in the year before claimed that (CIA, 1964, 2):

> Sweden will continue its peaceful nuclear program, but we believe the chances of its developing nuclear weapons during the next decade are less than even. [14]

This was coded as a nuclear exploration estimate, which concurs with the Singh and Way baseline.

[14]The expression of estimates in probabilistic terms begins in the mid-1960s. For the current dataset, the outcome with the highest probability is coded. Future iterations of this project that include more documents with probabilities could weight the predictions by their given odds.

Descriptive statistics

The resulting dataset has over 12,000 country-year assessments. Ten percent are assessments of the same year, and the remainder are predictions of future nuclear proliferation status. Perhaps surprisingly, estimates were more likely to be accurate when they were predictions about future years than when they assessed the state's current nuclear status.



Figure 2.2: Population of incorrect assessments

These rates fluctuated moderately over the study period:

The table demonstrates that British and American intelligence estimates aimed to assess more nuclear programs and enjoyed a higher rate of success. The resulting

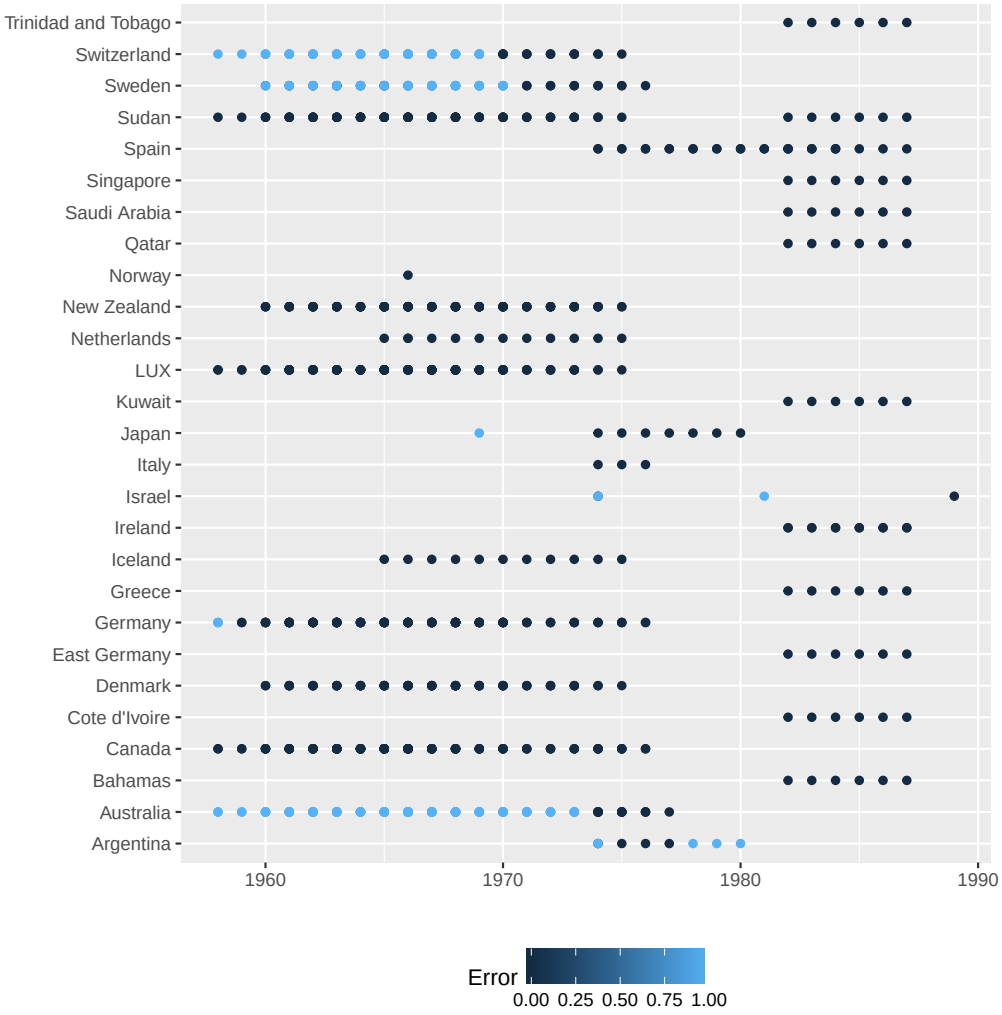


Figure 2.3: Accuracy of assessments of countries with high GDP per capita

disparity in numbers and accuracy are explained by the following illustrative example: While a German (whether East or West) intelligence report might report on, say, Argentina's nuclear program in 1975, their British and American counterparts would extend that analysis with a prediction of how it will develop until 1980. If their initial assessment is correct, the odds are high that the subsequent years will also prove accurate. In addition, both American and British intelligence typically made global assessments, assuring their readers that no other countries beyond those covered in

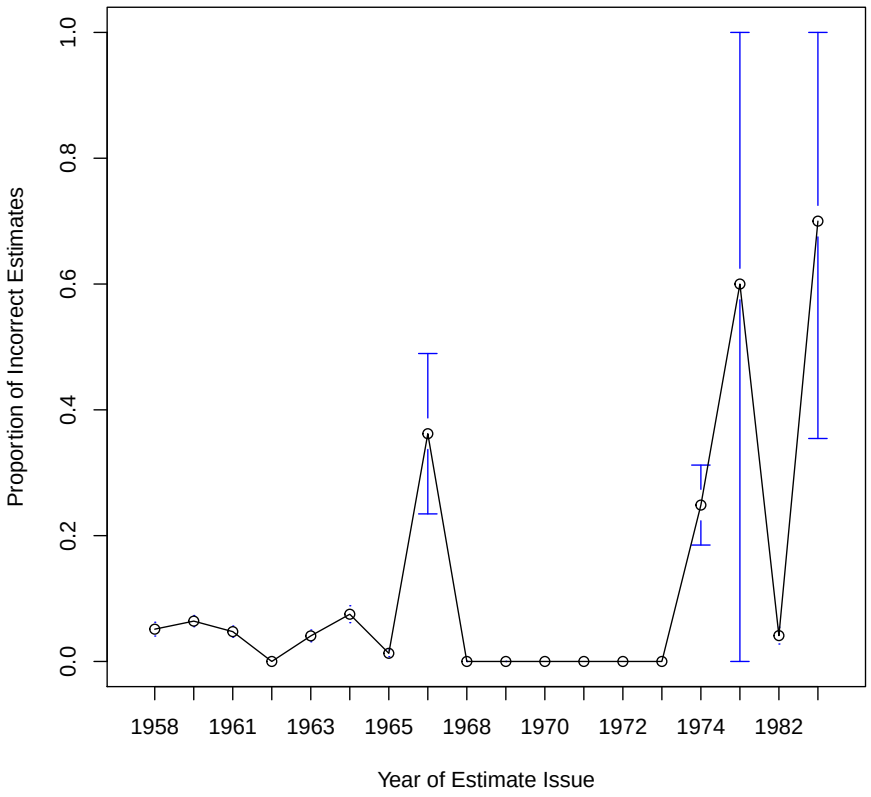


Figure 2.4: Proportion of Estimation Error, 1958 to 1989

the proliferation estimate could possibly go on the path of proliferation.[15] This further inflates both the number and accuracy of country-year estimates.

Table 2.4: Erroneous country-year assessments

	0	1
German Democratic Republic	6	14
German Federal Republic	5	19
United Kingdom	4609	144
USA	7364	515

[15]If they were wrong, these were counted as "passive underestimates," as described further below.

2.0.5 Case studies of proliferation assessment

Each potential nuclear weapons program presents individual challenges to intelligence assessors. After the coarse country-year measurements of the prior statistical tests, each chapter follows a panel-type setup for a series of capsule case studies in which four nuclear programs' available assessments are traced over time. This allows for empirical theory testing by comparing assessors' performance on the same target program against each other.

The available data permits four short case studies with a total of 20 assessor-target pairings. It is possible to measure several key variables better at this level in order to provide stronger tests for the hypotheses that do not involve broad patterns across time and place. The latter are tested in the large N chapter.

In the first test, the explanatory, dependent, and control variables used in the quantitative study are operationalized into country-year measures. With the exception of the dependent variable, that test also relied on the coding of other researchers. The case studies rely on the author's own reading of primary and secondary sources, which allows for a closer treatment of the variable's ambiguities and complexities over time. Consequently, variables such as policy salience, assessor-target relationship, target program characteristics, and assessment accuracy can be traced across time without the need to coarsen or aggregate them.

The cases below compare assessors' accuracy regarding the same target programs over time. As a result, features of the target program are kept constant and deliver the further inferential benefits of a panel dataset.

Variation occurs across the cases from the regime type of the assessing state. This remains constant for each of the assessors during the Cold War period, as well as from the assessors' ability to collect intelligence on a target state. There are variations in policy salience and the target's nuclear capabilities and intentions within the cases. Variation in the dependent variables occurs both across and within the cases.

While hypotheses such as the fearful isomorphic hypothesis, which makes a prediction of general frequency, were suited for testing at the aggregate level, the case study approach is especially well useful for differentiating the information that processes isomorphic theory from the bounded perception theory. The reason for this is that the latter establishes whether contrasting regime types perform differently in assessing the same target program. Explanations for this difference will subsequently be tested in the following chapter on process tracing.

Case selection

Table 2.5: Unique assessments available for case studies (assessor x targets)

	Argentina	India	Pakistan	China
German Democratic Republic	3	2	1	1
German Federal Republic	2	2	1	2
Sweden	2	3	1	0
Switzerland	1	0	2	1
United Kingdom	7	10	10	0
United States of America	14	25	14	5

Case selection

Table 2.6: Unique assessments available for case studies (assessor x targets)

	Argentina	India	Pakistan	China
German Democratic Republic	3	2	1	1
German Federal Republic	2	2	1	2
Sweden	2	3	1	0
Switzerland	1	0	2	1

	Argentina	India	Pakistan	China
United Kingdom	7	10	10	0
United States of America	14	25	14	5

These cases were chosen from the proliferation assessments gathered in the exploratory phase of this project to provide variation regarding the assessor's regime type and relationship with the target program. Unfortunately, the data that is currently available does not include a case in which one regime type assesses an adversary with the same regime type. These cases are missing due to a high correlation between regime type and security relationship among industrialized states during the Cold War. However, a comparison across cases still makes it possible to differentiate between the two variables.

East German assessments of India provide a case in which an authoritarian state evaluates a neutral democracy.[16] Neutral non-democracies are seen monitoring Pakistan and Argentina. The US and UK respectively assess China and Argentina, providing instances of democracies assessing authoritarian adversaries.[17] American, British, Swedish, Swiss, and West German assessments of India are democracy-on-democracy assessments. These assessors' evaluations of Pakistani and Argentine nuclear activities vary as a reflection of changes in the latter's type of regime over time.

Another features is that the Chinese program demonstrates how the democratic US assesses an adversary. The Indian case is an opportunity to compare the assessment performance of multiple democracies with one authoritarian state in the evaluation of a neutral democracy. The Pakistani program takes an equivalent approach to an authoritarian target program. The same can be said about Argentina, but with the

[16]Its evaluation of West Germany in the following chapter is an example of evaluating a democratic adversary.

[17]British assessments of Argentina after the Falklands War are still in the declassification process, but should become available in the coming months.

added inferential benefit of its relationship with Britain becoming adversarial during the period under examination.

2.0.6 Tracing assessments of the West German nuclear program

The West German case study will serve as a hoop test for the presence or absence of causal mechanisms underlying the theories (Mahoney, 2015). East German assessments of West Germany represent a case of a non-democracy evaluating an adversary: These are precisely the conditions under which accurate nuclear estimation is least likely to occur.

Trachtenberg (1999) places the Soviet fears of a German nuclear weapon at the center of events during the early Cold War. In his version, these fears led to the period's crises and forged the post-WWII division of Europe by the Iron Curtain. Not only did the "German nuclear problem" drive US and USSR policy and relations, its solution yielded the foundation of the proliferation regime in its first tentative incarnation as the Limited Test-Ban Treaty and then the nuclear Nonproliferation Treaty (D. Swango, 2014).[18]

The Federal Republic case is marked by a high policy salience, strong alliance dynamics, a democratic target program, and its existence in a threatening security environment. It was also an early stage, highly technically capable state with security concerns that posed a large analytic challenge.

[18] "In the context of the superpowers' views of the emerging proliferation problem in the 1960s, Germany was actually a unique case. It was a key motivation for the development of the NPT. But emphasis on Germany stemmed more from concern over the consequences of German proliferation than an analysis of how likely it was. The Soviets were extremely sensitive to the possibility of German"revanchists" obtaining an independent ability to use nuclear weapons. Because the United States took the Soviet threat to use force to prevent Germany from obtaining nuclear weapons seriously, and because the United States shared the Soviet Union's concern about Germany, it was willing to pressure Germany to join the NPT." (D. E. Swango, 2009, p. 112)

The process tracing method is used to test whether the posited mechanisms drove the observed outcomes. Hedstrom (2008) describes the locus of mechanisms at the level of individual behavior, which are expected to be driving the large social phenomena under investigation (2008). This chapter uses the historical record to verify the competing theories as follows.

The first step establishes a timeline of the target country's nuclear program that best reflects current scholarly understanding. The timeline can be compared to the extent to which the assessor state's intelligence apparatus collected and evaluated information about the program. A second timeline takes the available intelligence reporting and assessments and attempts to verify claims that have not previously appeared in accounts of the target program.

As with the case studies, this two-sided approach might miss the successful secrets kept from both contemporary intelligence and posterity. In practice, it seems likely that the lower the level of nuclear activity, the more probable it is that ambitions were missed. Using the categories from the large N chapter, assessors were more likely to miss the "explore" than the "pursue" or "acquire" stages. Once a target country moved to *pursue*, contemporaneous intelligence and today's scholarly observers are able to go back to see evidence of exploration. The West German case study is suited to avoiding any bias that would result from this selection effect, as it is a low-end nuclear exploration episode.

The process-tracing approach makes it possible to treat assessments as dynamic processes rather than events. This is especially important for high-salience target programs such as the West German ones, where the topic was a recurring feature of intelligence reporting and the (tacit) assumption behind current policy issues.

Sources

The rare combination of access to the intelligence records of three states and a full record of the assessment target's nuclear capabilities and intentions allows for thorough testing; however, none of the records can be considered to be complete, which raises the possibility of systematic bias that could threaten causal inference. The assessing government's capability to collect intelligence on the target must also be held constant. Process tracing is particularly useful to show which information was available and what was made of it, as well as the boundaries of permissible assumptions about an adversary.

The German case is one of the earliest cases of "proliferation panic." Access to records that reflect the German policymakers' contemporary sentiments are excellent. Not only is the documentary record of events less encumbered by the classification of sensitive documents (because it is older than five decades): Because it was a democracy then and now, Germany can be expected to have a more transparent and complete record. Due to ongoing scholarly contestation, additional primary documentary research was necessary.

The HVA, unlike the rest of the domestically-targeted MfS, was permitted to destroy its archive prior to German reunification. However, about 47 meters of records have been recovered in various ways, including 250 files of reports written by the HVA for policymakers (BStU, 2013, 11). Some of the records used in this project had not been examined since their discovery. Additional documented reviewed included files of the ruling party's central committee, the foreign ministry, the military intelligence branch, autobiographies of former intelligence officers, as well as the secondary scholarly literature on the Stasi.

In the United Kingdom, it was possible to carry out original archival research into intelligence documents and acquire documents through Freedom of Information requests. The U.S. component mostly relies on documents discovered by prior re-

searchers at the Woodrow Wilson Center, National Security Archive, and other foreign policy historical repositories. Several Freedom of Information Act requests have not succeeded as of the date of writing.

2.0.7 Conclusion

The subsequent three chapters will implement the research design developed above. First, they identify which technical choices make nuclear programs difficult to assess. Second, the same is done for political variables. The third chapter reviews the intelligence and international relations literature for the building blocks of theories that can explain the broader conditions under which states over- or under-estimate each other's nuclear proliferation potential–and when they get it right.

Appendix A: Archives consulted

Germany

- Berlin: Federal Commissioner for the Stasi Records (*Der Bundesbeauftragte für die Stasi-Unterlagen*)
- Berlin-Lichterfelde: Federal Archive (*Bundesarchiv*)
- Koblenz: Federal Archive (*Bundesarchiv*)
- Freiburg: Federal Archive (*Bundesarchiv*)

United Kingdom

- Richmond: The National Archives

United States

- Yorba Linda, CA: Nixon Presidential Library

Sweden

- Stockholm: War Archives (*Krigsarkivet*)
- Stockholm: Foreign Ministry Archives

Switzerland

- Bern: Federal Archive (*Bundesarchiv*)

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Chapter 3

Assessing Nuclear Capability: Finding the Fissile and the Missile

States conceal their nuclear activities from curious foreign eyes. The aim is usually to protect trade secrets, but sometimes the purpose is to safeguard the ultimate state secret–plans to build nuclear weapons. In abstract terms, states "spend a lot of time estimating one another's capabilities" (Waltz, 1979, 131). In practice, intelligence analysts are employed to act as curious eyes.

Clues about whether a state is planning to power its national grid or supersize its military firepower can be found in the type of materials and technologies that it acquires. However, the nature of the nuclear dual use problem creates a large gray zone in which few reliable indices exist. Some of this ambiguity can be reduced with the answers to this chapter's research question: Which technical characteristics of nuclear programs hinder accurate proliferation risk assessment?

To identify the implications of this problem, the chapter begins by distilling predictions about which nuclear technologies and materials are especially difficult to assess. Although the existing open literature has not addressed this topic systematically, a convenient diagnostic framework of nuclear technologies serves as a guide in the

search. After a series of hypotheses has been established, they will be tested at three levels of analysis: The first level is a global panel dataset introduced in the previous chapter. This is followed by case studies of two Asian states whose nuclear intentions were plain, but whose technological evolution proved elusive to European and American intelligence analysts. The third empirical section tests the proposed mechanisms by comparing how East German, American, and British intelligence tracked West German nuclear capabilities during the Cold War. The conclusion summarizes the balance of evidence.

3.1 Counting nuclear capabilities

The creation of a nuclear weapon is an advanced industrial and engineering process involving the construction or acquisition of a large nuclear infrastructure. In the broadest terms, the more nuclear material, personnel, and equipment collected by a state, the more realistic its nuclear weapons option becomes. This development may be intentional latent proliferation or innocent investment in a capital-intensive energy production sector.

Consequently, the shorter a country's theoretical timeline to a weapon's capability, the more difficult it becomes to assess the program from abroad. This leads to the first hypothesis about intelligence assessments and the target program's technical characteristics:

C1: The larger and more complex a nuclear program, the less accurate proliferation assessments will be.

To make the most of the three-level testing strategy, size and complexity can be operationalized and tested differently for each level. At the global panel level, it is possible to measure whether a country feeds nuclear energy into its national grid. This admittedly inexact proxy of a program's complexity is whether it is producing

nuclear energy, an approach discussed by Brown and Kaplow (2014). The case studies draw upon a large body of secondary literature describing the target programs in terms of number and sophistication of nuclear-relevant facilities. Detailed information on nuclear-relevant facilities makes it possible to trace the process since intelligence agencies might be misled by the complexity of a nuclear program.

Intelligence assessors face another closely related problem: The generation of nuclear energy, propulsion, or medical materials shares many of the same prerequisites. This is the core difficulty of nuclear proliferation assessment, which is known as the "dual use" problem.

The problem exists within the context of a dual-use spectrum that can be illustrated by Toby Dalton and Zhao (2017) 's "firewall" framework. One end of this spectrum encompasses technologies or materials that have very few non-weapons applications, such as weaponization research and development, weaponizable fissile material, and nuclear-capable delivery vehicles [12]. However, some ambiguity remains even for these highly specialized capabilities, as in the case of nuclear explosions for terraforming or to test military forces' ability to operate on a nuclear battlefield.[1] Therefore, ambiguities on this side of the spectrum can only be resolved by understanding the underlying intent. Intent changes faster than capability, raising its salience at this end of the spectrum.

At the other end of the spectrum are capabilities naturally associated with peaceful uses, including "most basic reactor and fuel-cycle R&D activities" (Toby Dalton & Zhao, 2017, 14). With these kinds of activities, countries can operate a large fleet of electricity-producing reactors and/or conduct basic scientific research. However, a government intent on pursuing nuclear weapons would need to begin at these lower

[1]Sweden, for instance, tracked developments in nuclear weapons design closely following this reasoning. No state has taken the logic to its extreme in the nuclear domain, but it is common the chemical and biological domains.

levels. Once again, information about intent is critical for interpreting these capabilities.

Across the entire fuel cycle, greater numbers of facilities and personnel require more collection and analysis resources. In the firewall framework, fuel-cycle activities and a variety of science, research, and development work are arrayed between two extremes. At the front end of the fuel cycle, more raw materials should–all else being equal–prove more difficult to track. Toward the back end–the steps of the cycle involving the production or isolation of fissile materials–the problem articulated by *C1* applies. To make the most of a nuclear-explosive capability, states require a delivery vehicle that will deliver the weapon to its intended target. A version of the dual-use problem appears here, too. The most acute problem is that the long-range rocketry used for delivering satellites into orbit can also complete their ballistic trajectory and detonate a nuclear warhead. The more advanced a country's missile capability, the harder it is to distinguish from a weapons system capable of delivering nuclear weapons.

As a net effect, materials and technology that can be used for both fissile weapons and advanced civilian nuclear or conventional weapons activities make the work of intelligence assessors less reliable in terms of providing a guide to the nuclear present and future:

C2: The more dual-use materials and technology a country acquires, the less accurate the assessment.

At the global panel data level, the degree of dual-use material and technology in a target program can be measured by whether the country has an operating laboratory or pilot facility for the production of fissile materials (uranium enrichment or plutonium reprocessing). A dataset by Fuhrmann [2014] provides this information, indicating whether a country operates one or more of these facilities in a given year. In the case studies, the secondary literature offers an overview of dual-use materials

and technology. Detailed information on the facilities and their operation is available for the causal mechanism stage.

International interaction

None of the known nuclear weapon programs throughout modern history have been pure domestic projects isolated from their international environments. Beginning with the American Manhattan Project, countries have always depended on foreign personnel, material, and scientific information. These international interactions generate information helpful for intelligence assessment, even as they vastly expand the universe of potentially relevant activity and capability.

International commerce in nuclear materials and technology has countervailing effects. On the one hand, a country's interactions with foreign suppliers increase intelligence collection affordances. On the other hand, it is harder to track the overall scope of a program that includes the wholesale import of materials and technologies. This situation is less predictable than the observed evolution of a closed, autarkic program. On balance, this latter effect should prevail because intelligence collected about a specific import provides less information about the scope and purpose of a program than the variation introduced by imports.

C3: Intelligence assessments of programs with international imports will be less accurate.

Joint ownership of fuel or facilities should provide foreign intelligence assessors with more insight into the purpose of a country's nuclear program. There are three reasons for this: First, opportunities for collection increase when two countries are involved and must coordinate across borders. Second, the purpose and scope of international agreements must be articulated and negotiated with greater precision than is necessary for domestic programs. Third, a country is rather unlikely to invest in a project

that promotes an independent, clandestine nuclear weapons program in another country.

Fuhrmann (2009) provides a dataset of international nuclear agreements, divided by the factors of nuclear safety, a category of intangibles, nuclear material transfer, research cooperation, comprehensive power agreements (subdivided by whether they restrict enrichment or reprocessing), and military assistance. With the possible exception of nuclear safety agreements, all of these agreement types indicate the possibility of importing expertise, equipment, or materials that would make it more difficult to assess the current and future purpose of a country's nuclear program. This information can test the hypothesis at the country-year level. The case studies will draw on secondary sources for the description of import activities. The process-tracing stage can leverage primary sources on international agreements, including archival evidence about their negotiation and implementation.

Nuclear safeguards are intended to detect the use of nuclear technologies and materials for unauthorized ends. Throughout the nuclear age, safeguards have been applied by supplier countries, Euratom, and the IAEA. The scope and procedures of safeguards vary, but their presence should make assessments more accurate through four mechanisms: First, the acceptance of safeguards serves to screen countries with proliferation intent. Clandestine proliferators would presumably resist the application of safeguards. Second, external monitors are an additional source of information about a program. For instance, a cost-effective way for intelligence agencies to monitor the world's nuclear programs is to spy on the IAEA. Third, if elements of a safeguarded program were used to construct a nuclear weapon capability, the odds of detection are higher than they would be in the absence of safeguards. Fourth, a country under safeguards would need to generate a secret and separate infrastructure, the detection of which would provide strong evidence of proliferation intent.

C4: Intelligence assessments of programs with international ownership will be more accurate.

International ownership or operation information is not directly available at the country-year level, so this hypothesis will be tested at the case study and process-tracing levels. Information on the presence or absence of multinational ownership is available at the facility level.

A second form of international involvement is the application of safeguards to nuclear facilities or materials.

C5: Intelligence assessments of programs under safeguards will be more accurate.

At the global panel level, dates of entry-into-force of IAEA administered safeguard agreements are publicly available from the agency. However, those administered by the country supplying the facility or materials or regional bodies are not available. To conduct a statistical analysis on the effect of safeguard agreements regarding the accuracy of proliferation assessments, dates of safeguard agreements were retrieved from the IAEA website and converted into a binary country-year format. The number 1 denotes the presence of an agreement, while 0 shows its absence.

Case studies benefit from information about which facilities were subject to IAEA, supplier, or multilateral safeguards, as well as the type of inspections and verification measures that they involved. The process-tracing section draws inferences based on the same information.

3.1.1 Testing with global panel data

Several effects of the target country's nuclear technological capabilities on assessment accuracy can be tested at the country-year level. The creation of the global panel dataset is described in detail in the preceding chapter. The tables and plots summarize the resulting coverage.



Figure 3.1: Misestimates by assessor and target countries

To control for the confounding effect of comparing current assessments and predictions, the regressions include a variable for the difference between the year the assessment was issued and the year it describes (*Prediction*). This step can be seen as calibrating for the difficulty of the task and avoiding comparing a present-day evaluation (*Prediction* = 0) with one projecting, say, five years into the future (*Prediction* = 5). To account for any confounding variables associated with the assessing state, such as the capability to collect intelligence information, the model only compares each intelligence agency's assessments with those it created of other countries. Additional confounding effects related to the nature of the target country are held constant

through the use of fixed effects. The controls, as well as the values of the independent variables, are taken from the year in which the assessment was created.

The dependent variable is operationalized in three ways. First, whether an assessment mischaracterized a country's program in a given year. Second and third, whether the assessment was an overestimate or underestimate, respectively. As described in the methodology chapter, misestimates can be either over- or under-estimates, but do not coincide perfectly. The purpose of this three-fold dependent variable is to describe the specific kinds of mistakes intelligence analysts have made as the result of the technical qualities of the programs they were tasked with assessing.

Findings

As shown in the regression table, several technical characteristics of target nuclear program are robustly associated with assessment accuracy. As described in turn below, in this first of three empirical testing stages, many of the hypotheses articulated above find their support in proliferation risk analysis from the Cold War era.

The control variables in the results also show that predictions had higher error rates than present-year assessments and a clear difference in performance by different assessing intelligence agencies. Compared to East Germany, which serves as the base factor in the analysis, West Germany had a much lower rate of error. However, the BND appears to have suffered a relative penchant for underestimation. British and American assessments were significantly more accurate than either of the Germanys. British analysts were especially skillful in avoiding overestimation.

C1: The larger and more complex a nuclear program, the less accurate proliferation assessments will be.

The global panel data results provide *strong support* for this hypothesis. Nuclear programs capable of producing nuclear energy were associated with a higher error

Table 3.1: Effect of technical factors on assessment accuracy

	Error in estimate	**Overestimate**	**Underestimate**
Nuclear safety agreements	−5.06***	−21.41	−2.54*
	(1.33)	(8,222.44)	(1.39)
Intangibles agreements	.03	−.11	−.74**
	(.25)	(.55)	(.34)
Nuclear materials agreements	.15	−19.62	−.58
	(.77)	(9,409.38)	(1.11)
Research agreements	.99**	2.23	.08
	(.47)	(16,116.63)	(.51)
Comprehensive power agreements	.60	1.27	−1.36**
(restricted ENR)	(.38)	(.81)	(.54)
Comprehensive power agreements	.29	1.87***	−3.70***
(unrestricted ENR)	(.66)	(.68)	(.57)
Laboratory ENR facility	.44	.98	.33
	(.27)	(.65)	(.29)
Pilot ENR facility	−.72**	−1.82**	−.48
	(.28)	(.88)	(.30)
Nuclear energy production	2.37***	3.07	.50
	(.42)	(2.05)	(.45)
IAEA safeguards in force	−.75**	5.66***	−1.07***
	(.30)	(1.52)	(.34)
Prediction	.14***	−.07	.03
	(.02)	(.05)	(.02)
Assessor: West German intelligence	−3.64***	−1.33	1.93**
	(1.12)	(1.39)	(.81)
Assessor: UK intelligence	−5.75***	−5.76***	−3.29***
	(.93)	(.95)	(.65)
Assessor: US intelligence	−5.52***	−3.90***	−1.17*
	(.93)	(.83)	(.63)
Constant	−16.66	−22.00	−19.99
	(3,144.41)	(6,583.58)	(3,065.12)
Target country fixed effects?	Yes	Yes	Yes
Observations	10,429	10,426	10,431
Log Likelihood	−1,122.99	−162.28	−907.79
Akaike Inf. Crit.	2,591.98	670.57	2,161.59

Note: *p<0.1; **p<0.05; ***p<0.01

Base assessor: East German intelligence — ENR = enrichment and reprocessing

rate. The lack of significance in the association with overestimates and underestimates suggest that they were equally likely for advanced programs.

C2: The more dual-use materials and technology a country acquires, the less accurate the assessment.

The findings are *contrary* to the expectations of the hypothesis. The presence of enrichment or reprocessing facilities at the laboratory scale was significantly correlated with a *lower* assessment error, which was likely driven by a reduction in overestimates. There was no statistically significant effect for pilot facilities.

C3: Intelligence assessments of programs with international imports will be less accurate.

The data provide *limited support* for the hypothesis: some international agreements demonstrate a weak statistical relationship with assessment error. Only international research agreements have a strong association with overall assessment error; comprehensive power deals that did not restrict fissile materials served to increase the odds of overestimation while also decreasing the likelihood of undestimation. Those agreements that circumscribed enrichment and reprocessing served to reduce underestimation. Countries that signed international nuclear safety agreements were less likely to have the purpose of their programs misunderstood.

C4: Intelligence assessments of programs with international ownership will be more accurate.

In the absence of a suitable data source, the hypothesis could not be tested at the country-year level.

C5: Intelligence assessments of programs under safeguards will be more accurate.

The country-year analysis provides *mixed support* for the hypothesis. Nuclear programs with an active IAEA safeguards agreement were less likely to be assessed incorrectly. However, safeguard agreements were also statistically associated with an increase in overestimates and a decrease in underestimates. This incongruity may be

explained by the fact that the "safeguards" variable did not distinguish comprehensive from facility-specific agreements.

Having collected historical evidence for and against propositions about the effect of a nuclear program's technical specifications on foreign intelligence analysts' to understand its shape and purpose, additional inferences can be drawn at a higher rate of resolution by moving from the coarse country-year analysis to two case studies. The next section, second of three, tests the nuclear capability hypotheses against foreign assessments of the Chinese and Pakistani nuclear programs.

3.1.2 Case studies in capturing nuclear capability

Details and concordance of specific events is not a strength of "large N" statistical analysis, however much it may tell us about broad patterns. This section's case studies seek to complement the analysis above. It begins by describing each nuclear program's technical evolution, scoring the relevant intelligence agencies' assessments of that program, then tests whether the hypotheses above explain part of the variation in analytical accuracy. In evaluating the accuracy of intelligence assessments, especially those not previously available to scholars are quoted at length.[2]

China: neither satellites nor safeguards

Swiss, Swedish, and West German intelligence did not devote much energy to the task until after China's test. Similarly, the East German MfS did not begin operating in China until the 1970s (Knabe, 2010, 1). British and American, on the other hand, intelligence followed Chinese nuclear developments closely and provide the data for this case study. They severely underestimated China's progress toward a nuclear arsenal. The Chinese case took occurred before the satellite surveillance age and the country accepted no foreign safeguards.

[2]The assessing intelligence agencies will be introduced in the fifth chapter.

After commencing government-sponsored basic nuclear reseach in 1949, China's nuclear weapons exploration phase began in 1952 (Bleek, 2015). In January of 1955, China formally initiated a nuclear weapons program. Half-hearted Soviet support ended in 1959. Under its own efforts, China conducted its first nuclear test explosion in October of 1964. The country first demonstrated the ability to deliver a warhead with a missile in 1966 (Lewis, 2007, 63).

Scoring assessment accuracy

This section details British and American underestimates of Chinese nuclearization capability. Both intelligence communities were well aware of the communist adversary's intent, but misinterpreted the limited information available through the lens of an assumed plutonium route. They therefore missed preparation for the first test, which was based on fissile material from a gaseous diffusion plant.

USA

In December of 1960, a National Intelligence Estimate confirmed the existence of PRC nuclear weapons program (Burr & Richelson, 2000, 60).

> *The assessment was correct, but was a delayed recognition of Chinese nuclear intent and capabilities.*

It is not known whether an NIE was prepared on the Chinese nuclear program in 1961, but an April 1962 assessment is available (Burr & Richelson, January 12, 2001). CIA (25 April 1962) reflects greater effort in collecting intelligence and admits great uncertainties, admitting that "while we have been able to make some judgments about Chinese progress and the time periods during which further accomplishments are likely, we cannot reach firm conclusions on these matters, or predict the year in which deployment of a complete weapons system will probably begin" (CIA, 25 April

1962, 1). Under these caveats, the CIA offered an estimate based on the assumption that China would take the plutonium route to an explosive capability:

> "Assuming an accelerated and highly successful program for the production of plutonium since 1960, the Chinese Communists could detonate an all-plutonium device in early 1963. However, in light of all the evidence, it is unlikely that the Chinese will meet such a schedule. We believe that the first Chinese test would probably be delayed beyond 1963, perhaps by as much as several years." (CIA, 25 April 1962, 2)

The possibility of a second route based on uranium was also discussed:

> "We believe that the Chinese would at some point in their program endeavor to produce U-235, but we have no evidence of U-235 production at present. Latest evidence indicates that a facility at Lanchou suspected of being a gaseous diffusion plant has not been completed. If this plant is in fact intended to be a gaseous diffusion facility, it probably could not produce weapon grade U-235 before 1965. The Chinese could probably test an all U-235 or composited device within a year after the activation of a production facility." (CIA, 25 April 1962, 3)

> *The assessment of China's plutonium route was accurate, yet amounts to a strong underestimate because China was in fact taking the uranium path. The uranium assessment underestimated China's enrichment potential. The facility was in fact nearing opearational readiness.*

In support of the July 1963 test ban negotiations, the Arms Control and Disarmament Agency produced a detailed assessment of current US understanding of the Chinese program (Burr & Richelson, January 12, 2001). Drawing on prior NIEs and recent intelligence reporting, ACDA (10 July 1963) claimed that the earliest test of a Chinese plutonium-based device could be carried out in early 1964 (ACDA, 10 July 1963, 3).

> *In spite of the growing collection efforts from U2 flights, the document "also reflects the inaccurate state of the intelligence community's knowledge about the progress of the Chinese nuclear program, particularly the degree of headway made in constructing a gaseous diffusion facility." (Burr & Richelson, January 12, 2001)*

In March of 1964, multiple human intelligence sources suggested a significantly greater intent to test than previously assumed (Richelson, 2007, 158). Intelligence reporting began discussing test imminence in terms of months, not years, in July of the same year (Richelson (2007), 160).

> *This reporting about Chinese intent was accurate.*

At the end of October, following the nuclear test, the US learned that PRC test used self-made HEU and located the likely production facility (Richelson (2007), 169).

> *The information from the test corrected US intelligence understanding of China's nuclear program.*

In summary, the US intelligence community severely underestimated China's nuclear weapons production timeline. Although it reported China's intent accurately, its understanding lagged behind the country's capability and assumed a plutonium route to an explosive detonation.

United Kingdom

In 1956, the JIC certified that China would remain nuclear weapons free for at least a year, owing to technical limitations:

> "The Chinese have no nuclear capability of their own at present and will not develop one within the next twelve months. They also lack the technical ability to handle the weapons and even in the unlikely event of them

being provided by the USSR they would be dependent on the USSR for the training of technicians until they had a nuclear capability of their own. The training of sufficient technicians by the Russians to give the Chinese an independent technical force would take a considerable time." (JIC, 1956, 2)

The overlooked Soviet assistance made this assessment too cavalier and a mild underestimate. Narrowly measured, however, the prediction of a China without nuclear arms over the subsequent year was correct.

In December 1957, British intelligence assessed Chinese intentions again. The conclusion was that as long as the world's Great Powers remained nuclear armed, China would likely seek to join the nuclear ranks.

"Barring any conclusive agreement on nuclear disarmament China will be tempted, as time goes on, to enter the field of nuclear weapons production as the key to establishing herself as a"Great Power." In adopting such a course she would have to concentrate her scientific and technological effort at the expense of the development of her economy as a whole. While therefore we believe that her scientists have the ability to gain the necessary knowledge, the unacceptable diversion of effort from her domestic economy will probably rule out this course. However, with Soviet scientific help and a power-producing reactor China could accumulate a stock of plutonium suitable in some measure for weapons. It is therefore just possible in these circumstances that she could make nuclear weapons in the period." (JIC, December 1957, 10)

The assessment was not correct. Competition with other resources did not ultimately prevent a Chinese nuclear weapons program, nor was Soviet assistance necessary to produce plutonium.

In 1963 British intelligence began to warn of a test and began to speculate about the form of a future nuclear force.

> "As stated in J.I.C. (62) 95 of May 1963 we still estimate that China might be in a position to carry out a first test within the next year or two. We also assess that it would be reasonable to assume the following: (a) One year after the first test, first generation production nuclear weapons could be available. These would be of, say, nominal yield and of relatively unsophisticated design. Such weapons could be carried by BULL (Tu-4) or BADGER (Tu-16) medium bombers. (b) Three years after the first test, second generation warheads suitable for delivery by M.R.B.Ms. and light bombers could be available. (c) We have no means of estimating how the warhead stockpile will grow." (JIC, September 1963a, 11)
>
> *China's nuclear test arrived in the middle of the range of the prediction. The delivery vehicles, however, were built a bit earlier than predicted.*

A June 1964 assessment concluded that "intelligence on atomic energy in China, though still sparse, continues to indicate that the Chinese have an ambitious nuclear energy programme the object of which is likely to be the production of weapons" (JIC, September 1963b, 8).

> "Any forecast of the likely development of the Chinese nuclear weapons programme after the first test must be completely speculative. [...] If Pao T'ou is the only production reactor, the output of fissile material will support only a limited test programme and will permit no warhead stockpile growth at all." (JIC, September 1963b, 8-9)
>
> *British intelligence shared the assumption that China would be producing a plutonium-based weapon with its US counterparts with equally misleading results.*

Following the October 1964 nuclear explosion, the JIC assessed China's path toward deploying and delivering its weapons:

> "The Chinese have so far tested only one nuclear device and this was probably large and heavy. At present we cannot forecast with any confidence the progress that the Chinese will make towards the realisation of smaller and lighter warheads. It is not unreasonable to assume, however, that it will take them some time, perhaps several years, to achieve a design suitable for M.R.B.M. delivery. The development period of a weapon for light bomber delivery should somewhat less. It is equally difficult to arrive at any forecast of how their stockpile of warheads will grow but for purely planning purposes, it would not be unreasonable to assume that they could have, say, fifty warheads of nominal yield, five years from now." (JIC, 1965, 8)
>
> *This was also an underestimate.*

In summary, despite elevated intelligence collection and assessment efforts, and fully understanding the country's weaponization intent, neither British nor American assessors were able to provide their political leadership with an accurate assessment of China's nuclear proliferation progress.

Pakistan: cascades of intelligence failure

Pakistan did not keep its desire for a nuclear weapons capability secret, even as it tried to protect details of its progress. This made it easy for foreign intelligence assessors to understand the intention behind country's nuclear program. Tracking the capabilities proved more challenging.

Pakistan's path to nuclear weapons' possession was more direct than India's. Until 1972, the country's small nuclear program was assembled with peaceful intent, when

the country launched a determined effort to build an arsenal. Pakistan is believed to have succeeded in this by 1987.

Between 1950 and 1971, despite support for the development of nuclear weapons in some political constituencies, the possibility does not appear to have directed the technical and research choices of the program (Bleek, 2015). Following Pakistan's defeat by India, the country initiated a nuclear weapons program in January 1972 (Bleek, 2015).

The biggest uncertainty is the point at which Pakistan came into possession of a deliverable nuclear weapons capability. A prime minister who assumed office later claimed that the components for a complete weapons capability were available in 1988, but were kept separate until the tests in 1998 (VOA, 2009). Other reports place that capability as early as 1984 (*Pakistan could have become a nuclear power in 1984, claims A.Q. Khan*, 2016). In 1998, Pakistan was able to match India's tests in a matter of days, removing any doubt about nuclear explosive capacity.

West Germany, Switzerland, Sweden, the United States, East Germany, and the United Kingdom assessed Pakistan's program. None of them captured Pakistani capability accurately, despite possessing a clear understanding that the country intended to build nuclear weapons.

Federal Republic of Germany

The first of two available West German assessments underestimated Pakistani nuclear intentions. The second accurately described the present intent and future developments, but may have underestimated the country's capabilities.

In its post-Indian PNE assessment from July 1974, the West German BND surveyed the nuclear potential of non-industrialized states, including Pakistan. The country's program did not receive its own discussion, but was included in the states described as follows:

> "All remaining non-industrialized states are more or less at the beginning of the use of nuclear energy. In part, they may fulfill one or the other necessary technical prerequisites for the production of nuclear weapons through their activities in specialized areas, but a closed national fissile material cycle from natural uranium to nuclear explosive material cannot be reached for years." (BND, 1974, 3)[3]
>
> *This assessment missed the Pakistani decision, of two and a half years earlier, to seek nuclear weapons.*

In November of 1985, the BND analyzed Pakistan's use of nuclear technology for military purposes, finding that contrary to the country's position, it was working on the development of nuclear warheads (Moellenberg, 1985, 1). German intelligence reported ongoing implosion experiments with conventional high explosives, which resembled early Chinese warhead designs (Moellenberg, 1985, 1).

> "The main obstacle for the construction of a first nuclear explosive device is the production of the necessary fissile material. At the moment, no nuclear explosive material can be produced in meaningful quantities, even though work on reprocessing (plutonium production) and uranium enrichment (production of highly enriched uranum) is very advanced."[4]

The report predicted that Pakistan would fulfill the prerequisites for the production of nuclear weapons in the second half of the 1980s, but that political factors would prevent a nuclear test (Moellenberg, 1985, 2).

[3] *"Alle übrigen Nicht-Industrie-Staaten stehen erst mehr oder weniger am Anfang der Nutzung der Kernenergie. Sie erfüllen teilweise zwar die eine oder andere der geforderten technischen Voraussetzungen für die Herstellung von Kernwaffen durch Aktivitäten auf speziellen Teilgebieten, ein geschlossener nationaler Spaltstoffluß vom Natururan zum Kernsprengstoff kann jedoch auf Jahre hinaus nicht erreicht werden."* (BND, 1974, 3)

[4] *"Haupthinderniss für den Bau eines ersten Kernsprengkörpers bildet die Produktion des erforderlichen nuklearen Spaltmaterials. Derzeit kann noch kein Kernsprengstoff in nennenswerten Mengen hergestellt werden, obwohl die Arbeiten bei der Wiederaufarbeitung (Plutoniumsproduktion) und bei der Urananreicherung (Produktion hochangereicherten Urans) weit fortgeschritten sind."* (Moellenberg, 1985, 2)

*The BND was correct that Pakistan was working toward a nuclear warhead capability. Its prediction that Pakistan would not be testing was also accurate. However, the claim that Pakistan lacked fissile material for its first bomb may not have been accurate, if AQ Khan's later statement that HEU had been in production since early 1983 are to be believed (*Pakistan could have become a nuclear power in 1984, claims A.Q. Khan*, 2016).*

Switzerland

Like West Germany, Switzerland underestimated Pakistani nuclear weapons intentions and capabilities in 1974. However, the Swiss foreign ministry overcorrected this in its 1979 assessment, claiming advances in capability that Pakistan had not yet achieved.

A Swiss foreign ministry's 1974 global nuclear weapons' status overview noted Pakistan's capabilities, which were deemed about a decade behind India's (EPD, 1974, 2). Regarding intent, the Swiss noted that the country was a proponent of a nuclear-free zone, but that it also threatened to develop its own arsenal, if India did not agree to the proposal (EPD, 1974, 2).

The statement of intent was not much of a guide for policymakers. However, it was broadly in accordance with Pakistan's policy of the time.

Five years later, Swiss assessors directed more attention toward Pakistan's program:

"There can be no more doubt that Pakistan is on the brink of developing nuclear weapons, with enormous effort. A first Pakistani nuclear test, which would probably be concealed as a"peaceful" nuclear explosion and couple with a pro forma offer for mutual disarmament, can be expected as of the end of 1979. Testing grounds are already being prepared, according to unconfirmed reports." (DMF, 1979, 6)

The report speculated that the decision for nuclear armament had been taken following India's 1974 nuclear test and had been partially financed by Libya, under a secret agreement that would exchange completed warheads in return (DMF, 1979, 6).[5]

The nuclear test did not take place, making this a serious overestimation.

German Democratic Republic

East Germany's sole assessment of Pakistan, included its October 1989 global survey, underestimated its nuclear capability. In its only reference to Pakistan's nuclear program, the MfS concluded:

> "Pakistan has been working to create its own nuclear weapons since 1976. At the moment, Pakistan is yearly producing about ten to twelve kilograms of weapons-usable plutonium and about 20 kg of weapons-usable uranium. Significant increases in these amounts cannot be excluded in coming years. A completed device has not been tested because of the absence of a suitable testing site." (MfS, 1989, 241)[6]

Pakistan already had a disassembled weapons' capability. Less important is that Pakistan initiated its weapons' acquisition drive four years earlier than the East German claim.

Sweden

Sweden's FOA produced two underestimations in the 1980s. The first, a global review produced by Sweden's FOA, at the beginning of 1981, concluded that Pakistan had

[5]The assessment was frank in describing the contributions to the weapons program of Swiss companies.

[6] *"In PAKISTAN gibt es seit 1976 Bestrebungen zur Schaffung eigener Kernwaffen. Zur Zeit stellt Pakistan jährlich etwa zehn bis zwölf Kilogramm waffenfähiges Plutonium und ca. 20 kg waffenfähiges Uran her, wobei bedeutende Steigerungen dieser Mengen für die kommenden Jahre nicht ausgeschlossen werden können. Ein fertiger Versuchssprengsatz wurde bisher nicht erprobt, da kein geeignetes Testgelände existiert."* (MfS, 1989, 241)

"shown obvious signs of wanting to retain their freedom to acquire nuclear explosive devices" (Andersson, 1981, 92). The country refused to sign international agreements limiting nuclear capability and accepted safeguards only as a last resort. It also maintained a plutonium and uranium production capability that was vastly out of proportion with its domestic energy infrastructure (Andersson, 1981, 92).

> *This formulation underestimated Pakistani intent to produce nuclear weapons, which went well beyond merely wanting the option of acquiring them. The capability assessment was accurate.*

Three years later, another global review updated the Pakistan assessment.

> "The political rationale for the acquisition of nuclear reactors is believed to be nuclear explosive devices. This strongly related to the relationship with neighboring India. The current regime in the Islamic Republic of Pakistan denies all suggestions on the development of nuclear weapons but has clearly stated that it considers it as its right to develop the technology for the peaceful use of nuclear explosive devices." (Bengt Andersson & Strömberg, 1983, 58-60)
>
> *Either a mild or a wild underestimation. The latter would be true if AQ Khan's history is to be believed and that unassembled weapons were already in preparation at the time.*

United Kingdom

British intelligence tracked Pakistan's nuclear capabilities and intentions closely and provided reliably accurate assessments as of the late 1970s.

A Cabinet-wide conversation about Pakistan's nuclear weapons program was underway by February 1979 (MOD, 1978-1979, 1). In July of that year, the Foreign and Commonwealth Office began preparing formal briefings for ministers.

> "The Pakistan Government maintains its nuclear programme is for peaceful purposes. But it is developing a production scale unsafeguarded centrifuge facility for uranium enrichment for which it has no present or foreseeable civil need. This applies equally to the reprocessing facilities which Pakistan is constructing, which would give it a supply of plutonium capable of use in a nuclear device. Though there have been reports that Pakistan may be in a position to explode a nuclear device within a matter of months our assessment, which is shared by the Americans, is that it will not be able to do so from its own resources in less than 2-5 years. It remains uncertain whether it is Pakistan's intention to explode a nuclear device or to confine itself to developing the capability to do so." (FCO, 1979, 2)[7]
>
> *The assessment was accurate in describing Pakistan as not yet capable of producing a nuclear device.*

In April of 1980, another MOD/intelligence discussion amounted to an informal assessment:

> "Our judgement (and that of Partners) remains.[8] Pakistan would not be in a position to explode a single device, assuming they decided to do so, before 1982 (and probably later) using indigenously produced fissile material. No evidence they have obtained significant quantities abroad. Believe they would use uranium rather than plutonium based device, though are developing both enrichment and reprocessing facilities. We and others continue to exercise tightest controls on exports of sensitive nuclear items." (MOD, 1978-1979, 4)

[7]The brief also claimed credit for discovering covert Pakistani nuclear activities: "We became aware that Pakistan was developing a clandestine centrifuge facility in 1978 and drew the attention of the United States and certain other nuclear supplier governments to this" (FCO, 1979, 2).

[8]A reference to the Five Eyes intelligence-sharing partners.

The Foreign and Commonwealth Office possessed greater certainty. It advised that:

> "Pakistan is giving high priority to a clandestine nuclear weapons programme, based both on plutonium and centrifuge enrichment technology. She is making considerable efforts to acquire enrichment equipment and technology from abroad in the face of international efforts to prevent this." (FCO, 1980a, 1)

> *When the MOD and FCO assessments are aggregated, they amount to an accurate image of Pakistani intentions. Where capability was concerned, it was correct to say that Pakistan would not be able to detonate a nuclear device for several years, but Britain seemed to be unaware of Pakistan's ongoing uranium enrichment.*

An FCO assessment, from October 1980, entitled "Pakistan's Nuclear Programme" described the concern "that Pakistan could produce enough highly-enriched uranium for a first nuclear test as early as 1982" (FCO, 1980b, 1).

> *This was an overestimation of Pakistan's HEU production capability.*

That assessment changed in September of 1981, when a JIC report concluded that:

> "Pakistan is determined to acquire a nuclear explosives capability, and possibly nuclear weapons. We believe, however, that Pakistan will not be capable of conducting a test explosion until the end of 1982 at the earliest. Pakistan's nuclear programme is motivated largely by a fear of India. It was launched in the late 1960's because of the Pakistani leaders' belief that India was developing a nuclear explosives capability and at a time when only India represented a serious threat to Pakistan. The vulnerability of Pakistan's long border with India, and the impossibility of closing the

> gap in conventional forces gives strength to Pakistan's belief that it must continue with its nuclear programme." (JIC, September 1981, 2)
>
> *While British intelligence identified a start of Pakistan's path to the bomb that was too early, the remainder of the assessment was accurate.*

The report saw no danger of a nuclear detonation over the next year and a half:

> "We believe that Pakistan will not be in a position to test a nuclear device before the end of 1982 at the earliest." (JIC, September 1981, 2)
>
> *This appears to have been an accurate reading of both intent and capability in Pakistan's nuclear program.*

Taking British assessments of Pakistan's program as a whole, the UK was able to describe Pakistan's contemporary and future trajectory with high accuracy.

USA

Between 1966 and 1985, American intelligence correctly assessed Pakistan's nuclear weapons capabilities and intentions.

The first US assessment of Pakistan, a January 1964 State Department brief, was rather indirect. It included Pakistan among countries where the proliferation concern was "not so much the possibility that those governments will decide to manufacture nuclear weapons, as that those countries might offer base rights to the USSR or Communist China" (DOS, 1964, 1).

> *This was a clear underestimation.*

A January 1966 NIE posited that "Pakistan would try to get nuclear weapons if it became convinced India was developing them." However, it "would need substantial aid in virtually all phases of a nuclear program and we believe none of the present

nuclear powers is likely to give such help. However, we cannot exclude the possibility that Communist China might do so at some time in the future." (CIA, 1966, 11)

> *The US was partially accurate, in its belief that Pakistan would not be able to develop weapons on its own, but with a touch of underestimation. While China would later assist Pakistan with warhead designs, their major assistance came from URENCO's involuntary centrifuge technology assistance. Pakistan's nuclear weapons decision, in 1972, was not driven by an expectation of Indian acquisition, but by its adversary's conventional superiority.*

A State Department brief on "Pakistan and the Non-Proliferation Issue" in January 1975 interpreted the direction of Pakistani nuclear capabilities as being motivated by the desire to create a weapons option:

> "Assuming nationally produced plutonium is not supplemented by direct purchase of the material from other sources, the earliest the Pakistanis are likely to be able to produce a weapons would be 1980. [...] Given their treaty status, their determination to purchase critical nuclear facilities, and their near declaratory policy of acquisition following the Indian detonation, they may well have already decided to produce a weapon, and they have clearly decided to have the capability to build one." (Galluci, 1975, 1)

> *Correct, even if the Pakistani decision to acquire weapons had already been made three years before.*

State Department documents from January 1976, include a reference to intelligence estimates which "indicate that Pakistan intends to apply that hoped-for capability in a crash program to develop nuclear weapons" (DOS, 1976, 1).

Correct.

In December of 1979, the CIA evaluated China's role in the Pakistani nuclear program.

> "China has almost certainly been involved in some mutually beneficial cooperation with Pakistan, particularly in connection with nuclear power, but the precise nature and extent of this cooperation is uncertain. There have been a number of reports of Chinese assistance, or, more often of promises of Chinese assistance, with various aspects of nuclear weapons technology (including nuclear weapons delivery systems and nuclear test preparations), but none of these reports can be substantiated. The Chinese have, on several occasions, denied providing any direct aid to Pakistan's nuclear weapons development efforts, but lacking firm evidence, we cannot flatly rule out the possibility that some weapons-related aid has been given. Moreover, it is important to note that at the present stage of Pakistani nuclear development, any nuclear aid has some potential for furthering Islamabad's nuclear weapons program." (CIA, 1979, 1)
>
> *While the precise nature of the Chinese assistance was impossible to verify with publicly available information, the recognition that Pakistan was vigorously working toward a nuclear weapon was accurate.*

An NIE from July 1982, about South Asia observed:

> "Both Pakistan and India are preparing capabilities to produce nuclear weapons. Pakistan regards the development of nuclear weapons as critical to its long term security, quite apart from its relationship with the United States." (CIA, 1982, 16)
>
> *This was correct, if non-specific.*

In June 1983 the State Department reported that:

> "There is unambiguous evidence that Pakistan is actively pursuing a nuclear weapons development program. Pakistan's near-term goal evidently is to have a nuclear test capability, enabling it to explode a nuclear device if Zia decides its appropriate for diplomatic and domestic political gains. Pakistan's long-term goal is to establish a nuclear deterrent to aggression by India, which remains Pakistan's greatest security concern. The Government of Pakistan is pursuing both the reprocessing and uranium enrichment routes to obtain fissile material for their program. [...] In addition, they are continuing to seek assistance from supplier countries to complete the larger reprocessing facility located at Chasma. We have no reason to believe, however, that Pakistan has yet produced the fissile material necessary for a nuclear explosive device or a nuclear weapon. To produce sufficient quantities of plutonium for a test device for weapons Zia probably would have to abrogate or violate Pakistan's nuclear safeguards with Canada and the International Atomic Energy Agency. Pakistan is attempting to produce highly enriched uranium, which could support a test or weapons program without involving any safeguards agreements." (DOS, 1983, 1)

> *Correct, with a possible uranium production undestimate.*

The CIA's final available assessment is from November 1985:

> "Pakistan operates facilities dedicated to nuclear weapons development as well as an extensive civil nuclear establishment. Two administrative entities-the Pakistan Atomic Energy Commission (PAEC) and Khan Research Laboratories (KRL)-oversee the network. The PAEC operates a

> major nuclear research facility, the Pakistan Institute of Nuclear Science and Technology (PlNSTECH), as well as specialized research and nuclear power centers. The Khan Research Laboratories run the gas centrifuge uranium enrichment program. [...] PAEC and KRL facilities are involved in basic nuclear research and training; design, fabrication, and testing of high explosives and nuclear weapons parts; and uranium mining, processing feed materials, and uranium enrichment." (CIA, 1985, iii)

Much of the document remains redacted, including any possible net assessment of when and whether CIA expected Pakistan to develop a weapons capability.

A correct assessment of Pakistan's technical capabilities.

In summary, the sampling of intelligence assessors under examination in this chapter performed at their best when assessing Pakistani nuclear weapons intentions and capabilities. British and American intelligence agencies performed best, despite occasional underestimates.

Findings

While all intelligence services struggled to capture the progress of Chinese and Pakistani nuclear capabilities, these errors varied in type and cause. These variations provide the opportunity to investigate this history's concordance with the chapter's hypotheses.

C1: The larger and more complex a nuclear program, the less accurate the proliferation assessments will be.

The case studies provide *moderate support* for this hypothesis. The Chinese and Pakistani programs grew rapidly and increased their complexity over time.

If the hypothesis were true, foreign intelligence assessments of the programs should have become less accurate over time. Instead, they improved slightly over the years,

without ever converging on an accurate understanding. For all intelligence analysts, knowledge of intent was a better guide than their imprecise tracking of Pakistani and Chinese capabilities.

On the other hand, assessments of the Pakistani program conformed more clearly to the hypothesis. Time did not cure the proliferation assessments of their error rate, which skewed heavily toward underestimates and were occasionally overcorrected. Foreign intelligence agencies could not assemble a coherent picture of the rapidly growing program.

C2: The more dual-use materials and technology a country acquires, the less accurate the assessments will be.

On the surface, the Chinese and Pakistani cases *support* this hypothesis, but not through the expected mechanism. Both countries were able to accumulate significant fissile material production capabilities that escaped the attention of intelligence agencies. The target programs' complexity cannot be implicated in that outcome. However, the collection failure was related to an assumption that the country would most likely attain a weapons capability over the plutonium route in both cases.

C3: Intelligence assessments of programs with international imports will be less accurate.

This hypothesis received *support* in the cases examined above.

Errors in British assessments of China's nuclear program can be traced to the country's Soviet imports. The first British assessment failed to consider the boost Soviet technology would give the program. After the oversight was corrected, subsequent assessments overweighted Chinese reliance on Soviet assistance. Consequently, China's domestic ability to develop nuclear weapons on its own was underestimated.

American intelligence assessments placed less emphasis on Soviet assistance. In its first substantive analysis, it argued that "China's future progress in advanced weapons will be determined primarily by native abilities" while admitting that the USSR's

assistance up to 1960 had created "considerable uncertainty" for the analysts (CIA, 25 April 1962, 9).

On the whole, Soviet support was a significant contributing cause of Western intelligence agencies' failure to accurately characterize Chinese nuclear capabilities. There is less evidence that this was true for assessments of the Pakistani program.

Pakistan imported the key technologies for its program, including the centrifuges that it used to enrich uranium. Chinese support to Pakistan's weapons effort created great uncertainty for US analysts about the country's precise technical progress. However, the bigger challenge was Pakistan's import of centrifuge designs for the enrichment of uranium from the European URENCO consortium and its supply network.

While the historical evidence about Pakistani HEU production remains uncertain, it is plausible that part of West Germany's 1985 underestimate of Pakistani progress resulted from the BND's lack of awareness about the country's centrifuge capability. That would have been a noteworthy oversight since the capability was based on an involuntary export of URENCO's centrifuge designs, of which Germany was a part owner. The 1983 Swedish assessment appears to have made the same error.[9]

Pakistani imports may have alerted British intelligence to the presence of a clandestine program (a possible reading of the claims made in the files of FCO, 1979). British analysts continued to track Pakistan's efforts to acquire equipment for its nuclear weapons program abroad, which may have led them to underestimate the enrichment capabilities already operating in that country (FCO, 1980a). The Foreign and Commonwealth Office also became aware of the peripheral support that British companies were providing to the country's uranium enrichment program, although this information does not appear to have contributed to tracking the program's progress (FCO, 1980b).

[9]The East German assessment that underestimated Pakistani capabilities does not provide enough detail to make inferences about the source of the error.

From its first consideration of the possibility of a Pakistani bomb, American intelligence focused on the prospect that it would need to be imported–in whole or in part. China remained a special source of concern. Like the other intelligence communities, the USA used Pakistan's international acquisition efforts as an indicator of the nuclear program's progress. However, American intelligence also appears to have missed the importance of the involuntary export of centrifuge technology from the Netherlands and the advanced fissile material production capability that this gave to Pakistan.

In summary, the import hypothesis receives support from the Chinese and Pakistani cases.

C4: Intelligence assessments of programs with international ownership will be more accurate.

Neither Chinese nor Pakistani facilities involved in the production of nuclear weapons involved international ownership.

C5: Intelligence assessments of programs under safeguards will be more accurate.

In the cases examined above, safeguards only performed their screening role. This provides *narrow support* for the hypothesis.

China's nuclear program was not subject to safeguards during this period. The IAEA had not yet assumed its global monitoring role and the Soviet Union did not seek to surveil its exports because it fully expected them to be put to weapons purposes.[10] Given the era's circumstances, it is not surprising that a safeguard system was not in place to alert the world about the details of China's advancing nuclear capabilities.

However, a counterfactual scenario demonstrates the effect of safeguards on intelligence assessment through the screening mechanism. Had China developed its nuclear program in the world that emerged a decade later, in which countries with nuclear programs were expected to accept some form of safeguards, its likely refusal might

[10]The Soviet government came to regret this decision and seems to have underestimated China's ability to move toward weaponization.

have provoked greater focus from Western intelligence. In such a scenario, China might have accepted inspections of a small number of its sites that it could have kept operating separately. But while safeguarding a subset of its nuclear infrastructure may have raised the risk of detection, China would likely have succeeded with the deception.

Unlike China, Pakistan accepted a series of safeguard provisions on specific facilities. These did not appear to have helped foreign assessors gather useful information about the other facilities that were eventually used to construct a nuclear arsenal. However, Pakistan's extraordinarily reluctant acceptance of safeguards provisions likely solidified the belief that the country was intent on developing nuclear arms, fulfilling the screening role of safeguards.

In summary, these case studies provide strong support for the hypotheses predicting greater error rates for larger nuclear programs with dual-use technologies, as well as for those reliant on international imports. Evaluating the effect of safeguards was less dispositive because neither country accepted international oversight over significant portions of their nuclear programs.

3.1.3 Observing West German isotopes through telescopes

Tracing the efforts of American, British, and East German intelligence agencies to provide an accurate image of West Germany's nuclear capability provides the third and final empirical opportunity to test the hypotheses. As the timeline of German postwar nuclear developments demonstrates, the intelligence assessments were broadly accurate in tracing the Federal Republic's growing nuclear capabilities. This growth took place in the open, although intelligence analysts at the time could not have known that there were no clandestine activities.

1950 to 1954: Nuclear hour zero

The period of 1950 to 1954 was marked by severe restraits on German nuclear capabilities from the policies of the occupying powers, France, Britain, and the United States. Their first policy decision, concerning the young Federal Republic's stance on nuclear weapons, was made during a secret meeting of former Wehrmacht officers at Himmerod Abbey in October 1950. Without a great deal of discussion, the preparatory meeting for the founding of the Bundeswehr concluded that the military uses of nuclear weapons should not be considered in rearmament (Fischer, 1993, 107). Prior to the conclusion of negotiations on the end of Allied rule and the founding of the European Defense Community (EDC) a year later, the Allies had agreed among themselves not to permit the Germans any form of nuclear armament. This agreement was codified in the EDC, which Chancellor Adenauer was instructed to reiterate with a separate public pledge (Fischer, 1993, 108). This pledge was restated and specified in a letter of May 1952, when Adenauer wrote to the Western Allies stating that his government would legislate to ban the "development, production, and possession of nuclear weapons" and to limit the import of nuclear fuel to half a kilo per year (Kuesters, 1994, 527).

In the fall of 1953, the first US tactical nuclear weapons arrived in Germany (Fischer, 1993, 106). Lacking information about the weapons, but seeing their growing importance in the Western alliance's defense against the Soviet Union, Adenauer began to push for some form of German participation in the Alliance's nuclear decision-making process (Fischer, 1993, 130). This demand was not well received. The German nuclear question subsequently became central to the October 1954 London Foreign Ministers' Conference, which was held in preparation for the Paris Treaties. In the closing plenary, Adenauer agreed to "voluntarily" renounce the manufacture of nuclear weapons on German territory and to refrain from the production of weapons-usable fissile material (Fey, Melamud, & Mueller, 2014, 467). This renunciation made entry into

NATO possible, as well as the establishment of de facto sovereignty and the use of nuclear technology for research and energy purposes.

Germany's incipient wartime nuclear research program did not provide much of a foundation for the Federal Republic. Many scientists in nuclear-related fields who did not find themselves in Soviet custody were briefly detained, then released to teach at universities (Cioc, 1988, 74). Laboratory research began after Allied restrictions were lifted in 1952 and more comprehensively in 1954 (Kuesters, 1994, 527).

The United States began equipping its forces in Germany with nuclear-armed cannons and rockets in 1953 (Cioc, 1988, 9).

1955 to 1959: Constrained capabilities

Germany began the nuclear fuel cycle in 1956 by prospecting for uranium (Diehl, 1991). At the same time, research centers were established in Hamburg, Jülich, Geesthacht, Berlin and Karlsruhe. In October 1957, the first research reactor became operational near Munich (*Geschichte der Kernenergie*, 2016). The first power plant was connected to the national grid in 1960 (Link, 2015).

The European Economic Community signatory countries, Belgium, France, Italy, Luxembourg, the Netherlands, and West Germany established Euratom, in February 1957. The research program was officially designated for peaceful purposes although it included plutonium production reactors and uranium centrifuge technology (Mahncke, 1972, 67).

In terms of imported capabilities, at this stage, the US formalized the presence of nuclear weapons in Germany. However, the agreement did not provide Germany with any physical, procedural, or policy authority over these weapons: "If SACEUR/CINCEUR ordered the use of US nuclear weapons to be delivered by German delivery systems, the German government would neither have the right nor the means to withhold German delivery vehicles." (Lutsch, 2015, 3)

1960 to 1969: Up and Euratom

Germany's fuel cycle capabilities expanded quickly in the 1960s. A small uranium milling facility began operating in 1961, giving Germany the ability to convert natural uranium into yellowcake (Link, 2015). Germany's deposits were found to be not commercially or politically viable, leading to a reliance on imports for raw materials (Diehl, 1991). The facility was later found to have altered the provenance certificates for the natural uranium it had sourced from outside Germany. In the same year, Germany's first indigenous reactor became operational at the Karlsruhe research facility (*Geschichte der Kernenergie*, 2016). The site was expanded with the construction of a reprocessing test facility in 1965, followed by the start of work on an industrial-scale reprocessing plant two years later. First uranium enrichment activities started in 1964 (Fuhrmann & Tkach, 2015). Internationally, Germany became involved with the reprocessing facility in Mol, Belgium.

German nuclear scholars have come to the informal conclusion that ''there were particular research-projects, going on until well into the 1960s, which leads one to suspect that Germany intended to maintain at least the kind of minimum capabilities that could have formed the basis for a nuclear-weapons programme." (Mueller, 2000, 6) Presumably this refers to the work at Karlsruhe and, less probably, Jülich.

The early 1960s were also the high water mark for the possibility that West Germany would acquire control over nuclear weapons from its allies. Within NATO, discussions about a Multilateral Force (MLF)–a nuclear-armed surface ship with a multinational crew–were held until they were abandoned in 1966, in part as a price for Soviet agreement to commence negotiations for what would become the nuclear Nonproliferation Treaty (NPT) (Brands, 2007, 408). In its place, the Federal Republic's concerns over the credibility of the American extended nuclear deterrent were much reduced with the establishment of the NATO Nuclear Planning Group, which gave Germany a say in "doctrine, target-setting, and procurement" decisions (Mueller, 2000, 6).

1969 to 1990: Exporting the full fuel cycle

By the late 1960s, Germany had become a leading producer of nuclear energy technology and operated a large nuclear-relevant industrial infrastructure. Domestic fissile material capability moved especially quickly. The Karlsruhe research center expanded its reprocessing work and a pilot facility began separating plutonium in September 1971 (Link, 2015). Construction for another facility began in 1977. The first industrial uranium enrichment facilities became operational in Gronau in 1982 (*Geschichte der Kernenergie*, 2016).

The possibility of importing, or at least gaining independent operational control over, allied nuclear weapons moved further from West Germany's reach. In a "dual-key" arrangement, US tactical weapons in the country would need to be released from American custody to German aircraft. While there may have been continued French offers of nuclear cooperation with a military dimension, none of the joint scientific projects seem to have been directed at the generation of nuclear explosives (Mahncke, 1972, 49-50).

In summary, Germany had developed the necessary preconditions for a weapons' capability in the 1960s, including for its own delivery vehicles. However, rumors of some experiments that had a deliberate dual-use character remain subject to ongoing scholarly contestation (Mueller, 2000).

3.1.4 Scoring assessment accuracy

Between the founding of the Federal Republic and its unification with the former East, American, British, and East German intelligence tracked these developments closely. As the following timeline illustrates, British and American intelligence collected less detailed information about the target nuclear program, yet outperformed their East German counterparts in the accuracy of the nuclear image they could present to their policymakers.

East Germany

The following summary of East German assessments includes an italicized evaluation of their retrospective accuracy.

1956 to 1959

In 1956, a military intelligence report on the "military-economic potential of the countries of the European Economic Community" pointed out that West German industry had the potential to "be active in nearly all areas of the commercial use of nuclear energy" (MfNV, 1958, 111).

> *At this early stage of West Germany's nuclear capability, the military intelligence predictions about the foundations for a nuclear energy capability were generic but accurate.*

The first, available East German assessment of its neighbor's nuclear potential appears in a report, prepared in May 1957, for the Party's first secretary, Walter Ulbricht. Reporting on preparations for West Germany's rearmament, the MfS assessed that the US was more likely to equip West Germany than its other NATO allies, with "atomic and other weapons of mass destruction" (*Der Stand der Vorbereitungen und die Möglichkeiten der Aufrüstung Westdeutschlands*, 1957, 9)

> *The report did not mention that US forces stationed in Germany were already equipped with nuclear weapons.*

In December 1958, the military intelligence service assessed the nuclear component of the Federal Republic's technical cooperation with France in depth:

> "In the final analysis, the financial support of the French nuclear weapons development from the West German side served the West German imperialists' own striving for possession of nuclear weapons. The cooperation

> of the two countries in the development of nuclear weapons occurred at the St. Louis Rocket Research Institute. It was mainly financed by the West German side and technically directed by a West German scientist. In terms of West Germany, the necessity of this cooperation also resulted from a West German nuclear weapons production within the country at that time was still barred by the regulations of the Paris Agreements. Although the demand for eliminating these restrictions has been made repeatedly in recent years, it has no longer officially been presented for some time now. The cause for this must primarily be seen in the West German population's constantly increasing resistance to Bonn's nuclear war policy. Among other things, the cooperation between West Germany, France, and Italy in the so-called "Armament Triangle of Bonn-Paris-Rome" also serves the purpose of developing nuclear weapons." (MfNV, 1958, 112-3).
>
> *The report was an overestimation of German policy. Firstly, German financial contributions to the French program were probably exaggerated. Secondly, the St. Louis cooperation cannot be characterized as a nuclear weapons' cooperation. The project involved short-range missile technology and several private companies (Kocs, 1995, 89). While it is possible that the project explored making the missiles capable of carrying nuclear warheads, that would still be far short of a "development of nuclear weapons."*

In April of the following year, the same military intelligence branch provided an overview of West German nuclear research facilities. Under 'military applications' it listed only a project for nuclear rocket propulsion but noted that the equipping of the Bundeswehr with mobile radiation decontamination units, WMD hazard suits, and radiation detectors were indicators of preparations for nuclear war. The analysts also noted that any nuclear technology and science could have military applications (MfNV, 1959, 6).

Other than the insinuation that the radiation protection equipment indicated preparations for an offensive nuclear intention, this assessment was accurate. However, it made no mention of the exploration with France and Italy, and is therefore best described as an underestimate.

1960 to 1969

MfS' documents on the topic appear again in the archival record of 1960. In July of that year, it reported on the forthcoming visit of a West German general to Washington, where he was to begin a lobbying campaign to persuade Congress to hand over control of its nuclear warheads to the Bundeswehr (R, 1960). The report was evaluated by an adviser to MfS's chief, who judged such a journey likely to occur (R, 1960, 366). In dismissing the accompanying analysis, the adviser noted that West Germany was not capable of producing its own warheads, at present.

This assessment was correct.

In August of 1962, the military intelligence service provided a new assessment of the Federal Republic's nuclear program. The report,

> "treats the West German possibilities of a nuclear weapons production of its own – especially in the detonating category. At the same time, this information reaches the conclusion that the currently existing nuclear facilities in West Germany do not allow its own production of detonating nuclear weapons and that this also results in Bonn's constant striving for the controlling power over nuclear weapons of American or British production – whether this is through the path of the NATO nuclear force or the West European Political Union. The information simultaneously determines that theoretical work is being done on nuclear weapons in

> West Germany and that Bonn supports the French nuclear weapons production in terms of personnel and also attains possession of the French experimental results." (MfNV, 1962a)
>
> *Whether Germany received information from French* weapons *research is doubtful, but not impossible. The concern that weapons-oriented "theoretical work" was being carried out aligns with current suspicions among German technical experts. The West German drive for authority over US weapons is also accurate, but not in the case of the UK.*

MfNV officers also said that they saw several suggestions that pointed to work on "mechanical" detonators for "nuclear fusion weapons" (MfNV, 1962a, 70). The Federal Republic was not believed to have the actual capability of producing nuclear weapons, but that this capability would emerge in the coming years (MfNV, 1962a, 71).

The analysts allowed the caveat that they had neither official (public) nor unofficial (intelligence) documentation about the military applications of nuclear energy; they were forced to speculate in these matters (MfNV, 1962a, 63). However, a summary of the report, which was circulated for policymakers, at the "top secret" level reminded readers of relevant information received a few months earlier:

> "This is what Strauss stated to the scientists at a conference, attended by just a specific circle of people, to the effect "that if West Germany does not receive any controlling power over Anglo-American nuclear weapons, the Bundeswehr will be equipped with those of its own production." [...] In our opinion, this development will still require a number of years contingent on the construction of isotope-separation facilities or plutonium-fabrication facilities and will hardly occur in such large dimensions to conduct a nuclear war. [...] Another source shows that West Germany

> transfers 100 million Deutschmark to France every month without the movement of goods; this amount is primarily intended for the production of nuclear weapons." (MfNV, 1962b, 3).
>
> *The financial claim seems as unlikely as it is difficult to verify. However, the rest of the assessment is accurate. It is likely that the information about Strauss' remarks was left-over news, from the conversation that prompted the Göttingen Manifesto, because it is safe to assume that that experience would have taught Strauss not to speak in this manner in front of scientists. If this is true, the information would have been five years out of date and an inaccurate reflection of current policy. The limits to Germany's fissile materials were assessed accurately.*

In a March 1963, a military intelligence report about West German-French cooperation maintained that the former's objective remained the procurement of nuclear weapons from the latter. Analysts warned that the peaceful nature of cooperation under Euratom and the incompatibility of France and Germany's objectives should not distract from the Federal Republic's desire to acquire nuclear weapons via France (MfNV, 1963, 14).

> *This overestimation relied on an outdated understanding of Germany's objectives for collaboration with France. It also missed fresh French overtures to Germany on nuclear weapons cooperation, which had been rebuffed in Bonn (Trachtenberg, 1999, 373)*

In May of 1966, the Peace Council of the German Democratic Republic presented a public white paper on the threat posed by West Germany. The document was written by the MfS's ZAIG and claimed that Germany's request for decision-making authority over nuclear weapons was intended to support an expansionist revanchism

(*Denkschrift des Friedensrates der Deutschen Demokratischen Republik über die von Westdeutschland ausgehende Kriegsgefahr*, 1965, 20).

> *The document did not reflect German intentions. Military solutions for reunification were not being considered.*

East German military intelligence maintained its alarm over West German nuclear intentions. The report referenced the acquisition of decision-making authority over nuclear weapons as the main military-political goal, describing all of West Germany's nuclear research as being primarily directed "toward the preparation and establishment of a nuclear production cycle that includes all stages of production necessary for the production of explosive nuclear weapons" (MfNV, 1965, 3).

> *Even if it is possible that a small portion of the West German nuclear efforts was being directed with a view toward weapons capability, the entirely of the nuclear enterprise was not.*

A January 1967 HVA report described the Federal Republic's three-pronged approach to the production of nuclear-capable missiles. The report stated that the Federal Republic was relying on European cooperation, bilateral space research with the United States, and the cover of its domestic space program (HVA, 1967).

> *West Germany was indeed working on dual-use ballistic missile/space rocket technology with a variety of partners.*

That same year, the ZAIG drafted another white paper to be distributed to the press and foreign governments as part of the anti-Multilateral Force initiative. The foreign ministry's edits were not welcomed by its primary authors. Under the title, "Efforts by West German Imperialism/Militarism toward Nuclear Weapons and their Delivery Weapons" (*Das Streben des westdeutschen Imperialismus/Militarismus*

nach Kernwaffen und den dazugehörigen Trägerwaffen), the paper argued that West Germany was purposefully preparing its capability for nuclear weapons development (*Das Streben des westdeutschen Imperialismus/Militarismus nach Kernwaffen und den dazugehörigen Trägerwaffen*, 1967, 24). Only the refusal of the United States and other NATO allies to hand control to the Federal Republic had so far prevented it from acquiring nuclear weapons (*Das Streben des westdeutschen Imperialismus/Militarismus nach Kernwaffen und den dazugehörigen Trägerwaffen*, 1967, 35).

> *Strictly speaking, nuclear-capable NATO allies had not given the Federal Republic access to their weapons. The technical claims were also largely accurate.*

In November of 1968, a group of non-intelligence scientists presented a report to the Central Committee:

> "Evidence has been provided that the forced development of a nuclear energy economic system that is as self-sufficient as possible in near future will create an unbroken chain of facilities to enable the production of its own nuclear weapons without a considerable additional investment. The knowledge and specialists necessary for the last step of development and production also already exist at this time." (Steenbeck, 1968, 15)

Further:

> "We have determined that the Federal Republic of Germany has the preconditions for starting the production of A-bombs within a short period of time. Even in the case that all foreign deliveries should be stopped, the Federal Republic of Germany still has the preconditions for a limited production. The end phase of the production can easily be concealed from the international public." (Steenbeck, 1968, 25)

At this point, Germany in fact had developed expertise in all stages of the nuclear fuel cycle. However, "starting the production of A-bombs within a short period of time" would have required research and experimentation for weaponization, which the Federal Republic almost certainly had not undertaken.

A military intelligence report, from May 1969, examined the reasons for West Germany's reluctance to sign the NPT. It argued that the Federal Republic intended to maintain the option for acquiring nuclear weapons, which an effective NPT would eliminate (MfNV, 1969, 5-6).

Other than the optimism over the barrier an NPT signature would pose for weaponization, the assessment was correct in that a very small part of the motivation was to maintain the option.

A detailed MfS assessment of the Jülich nuclear research center's projects, budget, personnel, and purpose appeared in July of 1969. It described the efforts to keep part of the center's work a secret and described it as "one of the most important sites" for the "creation of a nuclear potential with military use" (MfS, 1969, 15).

This claim requires further investigation, but was likely exaggerated.

Around the same time, a letter from a prominent pioneer of centrifuge technology, who had participated in the Team B-like assessment the previous year, wrote to the Party Secretary to warn him that West Germany had very likely already acquired "the atom bomb" (Steenbeck, 1969, 1). This suggestion was dismissed by an adviser in the MfS's chief's office. However, the evaluation warned that plutonium reprocessing and uranium enrichment activities were under way and that they could turn the scenario, described by the scientist, into reality within a few years (Steenbeck, 1969, 16).

The letter was a technical fantasy, however the advisor's overall assessment was accurate.

1970 to 1989

In 1970, an HVA report on the Karlsruhe reprocessing facility called it "extraordinarily important" for West Germany's nuclear military potential (HVA, 1970, 295). The report further informed its readers that the West Germans were attempting to evade IAEA inspections (HVA, 1970, 297).

> *The first claim was objectively true. A German nuclear weapons' program would most likely have drawn upon Karlsruhe's plutonium reprocessing capabilities. The latter claim was most likely a misrepresentation.*

The last available East German intelligence assessment of their adversary's nuclear capabilities and intentions was produced by the military intelligence branch, in January 1971. Military officers reported on internal Western European Union reports from 1965 and 1970 that purportedly claimed that no actual inspections were being carried out by EURATOM (MfNV, 1971, 6). With its reprocessing capability, the Federal Republic was assessed to be capable of producing a plutonium bomb within six to nine months (MfNV, 1971, 19). West Germany's already-accumulated plutonium would "suffice for the production of about 130 nuclear weapons equivalent to 20 kt" (MfNV, 1971, 26).

> *The timeline for a plutonium bomb ignored the same considerations for weaponization work noted above. The absence of EURATOM inspections and West Germany's plutonium stock are currently under investigation.*

United States

In stark contrast to paranoid East German efforts to assess their western counterparts, American intelligence kept a close and accurate accounting of the Federal Republic's nuclear progress.

1957 to 1959

One of the first National Intelligence Estimates to evaluate the spread of nuclear weapons was circulated in June 1957. Given public opposition and its treaty commitments not to build weapons, the US estimators did not see a major risk of German proliferation. The exception was if France developed its own weapons and Germany could not share in the nuclear weapons of its allies (CIA, 1957, 5).

> *This assessment underestimated Germany's nuclear intentions by not addressing the French-German cooperation agreement that was signed in January of that year.*

The global proliferation report was updated one year later, exploring West German capabilities and intentions in greater depth. Independent production was deemed impossible for at least another decade because of an absence of West German fissile materials (CIA, 1958, 4). The assessment also explored possible collaborative arrangements, either among the FIG countries or expanded to include the Benelux countries, as well as the UK. While not believing this to be especially likely, the NIE concluded that, "if begun in the near future, could produce advanced weapons in substantial numbers within five years" (CIA, 1958, 6-7).

> *This assessment was an underestimation because it discussed collaboration with France as a hypothetical possibility rather than an ongoing fact. If the 1958/1959 collaboration did not have a weapons element, and if US intelligence was aware of the full extent of the collaboration, then the assessment would be accurate*

1960 to 1969

In the next assessment, of which countries might be candidates for nuclear possession, West Germany attracted even greater attention.

> "we do not believe that the West Germans now have any definite plans for developing an independent nuclear capability. Moreover, we believe such a course highly unlikely, at least for the next several years, since the obstacles are considerable. Treaty restrictions and lack of space for testing constitute immediate hurdles to an independent effort. Furthermore, undertaking a nuclear weapons program would probably involve serious political dissension within West Germany and act as a provocation to the USSR at a time when the overall West German military strength is still limited. We believe it likely, therefore, that West Germany will seek for the benefits of a nuclear capability by other means." (CIA, 1960a, 8).

These other means included the same menu of allied nuclear sharing. Even if these options failed, Germany may still have preferred a political settlement with the Soviet Union over an independent nuclear program (CIA, 1960a, 9).

> *The assessment accurately described current intentions and future developments in German nuclear policy.*

Also in 1960, US intelligence produced a country assessment of trends in Germany. This raised the possibility that dissatisfaction with NATO could lead it to "further explore the subject of a continental military system with its own nuclear capability" (CIA, 1960b, 4).

> *An overestimation of future German behavior. Despite dissatisfaction with NATO, Germany did not resume exploration of a European nuclear weapons force.*

The next proliferation forecast, in November 1961, allowed that while the Federal Republic had the technical capability to test a warhead in "four to five years if it made a decision to have a crude weapon", the analysts did not "believe that the

West Germans now have any definite plans for developing an independent nuclear capability" (CIA, 1961, 10). The main reasons were Germany's reliance on a US-backed NATO for its security, the treaty restrictions, and lack of suitable territory for conducting nuclear tests.

A correct assessment.

A July 1962 NIE on Germany once again described independent nuclear weapons as a distant third possibility, after a failure to arrange nuclear sharing with NATO or other western European states, while observing that French nuclearization made that decision more difficult as a matter of politics (CIA, 1962, 1).

A correct assessment, even if France's later development of nuclear weapons did not directly lead to pressure for Germany to follow suit.

In December of 1963, a Special NIE addressed concerns among NATO policymakers over German eagerness to develop a nuclear sharing mechanism, and assured readers that it was "motivated not by a desire to move toward acquisition of a national nuclear capability, but rather by a series of political considerations (CIA, 1963b)." The assessors dropped the claim that the Federal Republic ranked European cooperation above its own independent program.

Correct.

The next global proliferation assessment, in June 1963, acknowledged the size of Germany's investments in its nuclear program, but reminded readers that this emerging technical capability would be weighed down by the following obstacles:

"Treaty restrictions, public opposition, the absence of significant deposits of uranium ore within the country, the lack of testing space, and the current lack of large power reactors and a chemical separation plant: All of

> these represent major obstacles to initiating a weapons program. Furthermore, the West German Government almost certainly realizes that to embark on a nuclear weapons program would not only create serious internal political dissension and difficulties with its allies, but offer a grave provocation to the USSR." (CIA, 1963a, 11)

These factors would explain the absence of "indications at the present time that West Germany has plans for developing an independent nuclear weapons capability" (CIA, 1963a, 12). The French program did not seem to have changed German minds about nuclear weapons abstention, although the estimators warned that a loss of confidence in the credibility of US-extended deterrence could lead to a European nuclear sharing arrangement (CIA, 1963a, 12).

> *The assessment was accurate on all counts, although it was a mild overestimation because after Germany lost confidence, in later years, it did not pursue a European nuclear force.*

The December 1964 proliferation overview only mentioned the Federal Republic in passing, noting that its reactors were under safeguards and that it was "unlikely" that it would "begin a weapons program" (CIA, 1964, 11).

> *This was probably a correct assessment. While the reactors were safeguarded, it is possible that no physical inspections were being carried out. This question is still under investigation.*

At the beginning of 1966, estimators placed West Germany among the least likely weapons' candidates on account of domestic and international resistance:

> "There is strong domestic opposition to development of nuclear weapons in West Germany, and there are also treaty prohibitions that the Germans

could not easily breach. Germany would not only face intense opposition from the USSR if it embarked on a national nuclear weapons program, but would also severely damage its relationship with the Western Alliance. Except for a fringe of extremists, Germans of all political leanings are unwilling to do this. [... We] believe that a close US-West German relationship will continue and that West German incentives to acquire nuclear weapons will not outweigh the restraints upon them in the next few years." (CIA, 1966, 7-8)

An accurate reflection of the reasons for West Germany's lack of nuclear appetite.

The last in-depth assessment of West German nuclear proliferation appeared in December 1966 during the NPT negotiations, when the Bonn Embassy added an updated political analysis to the preceding NIE. The update confirmed the unlikelihood of such an event. In addition to a strong opposition to nuclear weapons in important sectors of society and government, the country's international situation disincentivized the development of an independent arsenal:

"As long as the United States has committed itself to defend Europe, has forces physically stationed in Germany as an earnest sign of this commitment, and appears prepared to use nuclear weapons if necessary to defend West Germany, it is not likely that Germans will have any temptation to develop a national nuclear force. Being dependent upon the United States, it is highly unlikely for both military and political reasons that Germany would make a decision to produce or acquire nuclear weapons against American wishes. This lack of desire for nuclear weapons among the public and politicians, reenforced by the military situation, is likely to continue at least as long as the existing power balance continues. A

failure to achieve an alliance nuclear force should not affect this attitude." (DOS, 1966, 5-6)

This final assessment of German nuclear policy accurately predicted developments through to the end of the Cold War.

United Kingdom

Britain assessed West German nuclear capabilities and intentions early and often. Most of its information came from its role as an occupier and later nuclear energy and research collaborator assisted.[11] It had an accurate picture of German domestic weapons policy, but appears to have missed the mysterious and short-lived collaboration with the French as it was taking place.

1950 to 1954

The British began assessing the German nuclear program as an occupying power. In December of 1953, the chancery passed along detailed German press reports about the competition for hosting the "the first new German atomic research establishment" for "basic research, the training of young scientists, and the production of isotopes for medical and technical purposes" (FO, 1954a, 1).

In early 1954, the Foreign Office reported on the Military Security Board inspection of a firm whose mineral production had been measured to include "unlawful quantities of thorium" (FO, 1954a, 1). A sample was examined by a scientist at the Geological and Survey Museum in the UK, who found no cause for alarm (FO, 1954a, 1).

In November of the same year, the Foreign Office began to concern itself with Germany's fissile material capabilities. It was assessed that there was "no likelihood

[11]To speculate, Britain probably collected a good amount of intelligence on their German allies. Evidence would be unlikely to be declassified. In fact, several requests for intelligence documents about the German nuclear program dating from the 1950s were denied. With sensitive technical information from the period or Soviet-related intelligence no longer receiving such protection, allied espionage is the most plausible explanation.

of the Germans being able to produce material with [20%] enrichment for the next three years, at least, and their experimental reactor will presumably not produce uranium enriched more than 2.1%" (FO, 1954b, 1). A plutonium reprocessing capability was even further into the future, noting that the UK did "not want to Germans constructing separation plant of which we know nothing" (FO, 1954b, 1).

Much British reporting on German nuclear intentions came from conversations with Werner Heisenberg, who was the leader of the reconstituting scientific effort. In October of 1954, Heisenberg responded to British queries about uranium enrichment plans, saying "they wished to have slightly enriched uranium for the development of light water moderated reactors and had been considering methods of enrichment" (FO, 1954b, 1). In the course of the conversation, Heisenberg appeared open to sourcing British or American fissile material in place of enriching German uranium. The same official who provided the assessments was also involved in formulating policy and providing recommendations on which technical limitations should be placed on the country's scientific program.

Around the same time, the Military Security Board received an application for "permission to construct an uranium hexafluoride plant for Brazil," which mostly raised concerns relating to Brazilian intentions, but also allowed the possibility of "some significance from the German security point of view" (FO, 1954b, 1).

> *This early reporting does not rise to the level of formal assessment, which the British government did not conduct for the country it partially occupied and over which it enjoyed complete inspection authority for any militarily relevant technologies, let alone nuclear capabilities. It is included here to demonstrate the strong information baseline later assessments could rely upon.*

1955 to 1959

The first complete British assessment was written in May 1955. The assessment emphasized West Germany's limited technical capability, but saw some intent on their part to acquire weapons on their own.

> "[T]he Federal Republic should not be in a position to break her undertakings on atomic control for a long time to come, in spite of the desire on the part of some Germans to do so and the undoubted enthusiasm with which atomic development will be tackled. The Germans are a long way behind in the nuclear energy field and have few specialists with first-hand experience. We think that they may well concentrate on exploring the possibility of developing new techniques. For this purpose they would not require larger quantities of plutonium or U 235 than they are allowed, nor would their research necessarily be directed towards the production of nuclear weapons. We do not underrate the German genius for technology and the results of such work if successful might help them to make up for lost time. We conclude therefore that the important thing to watch is German activity in the nuclear field for some years to come will not so much whether they might make an atomic weapon, but rather what research developments they may achieve which might enable them to produce results which were not contemplated when the limitations on the Germans were imposed." (Dean, 1955, 2)

Summarizing the assessment, the UK believed that, barring any technological changes, there was no conceivable technical path to an independent Germany nuclear weapon.

> *The assessment was accurate in describing the present, though in part because it did not refer to any specific Germans who desired to "break her*

undertakings on atomic control,"" and predicted the future of the West German nuclear program rather well. The "research developments" did not come to pass.

In January of 1958, a Foreign Office brief noted that there were no plans by NATO or European allies to equip "German forces with nuclear weapons in peace-time in the immediate future" (FO, 1958, 1). The country would soon have nuclear-capable missiles, however.

Correct.

In May of 1958, an interagency dialogue sought to establish German nuclear intent. A consensus formed around the position that not only did the West German government not have weapons ambitions at the moment, but that it would face serious domestic constraints if it did (Reilly, 1958, 1). Opinions diverged on what it would take to change that. One official suggested that French weapons acquisition could lead to a change, while others emphasized the power of an assuring NATO to keep Germans from reaching for their own nuclear protection (Reilly, 1958, 3).

The less-alarmist prediction proved to be the correct one, as French nuclear acquisition did little to change Germany's position. And NATO's posture proved sufficiently assuring through the period under study here. However, by failing to address the aborted West German coordination with France and Italy, the assessment of the recent past was an underestimate. Presumably, an accurate understanding of the events underway since November of the previous year would have produced greater alarm.

Eleven months later, the subject of allied provisioning of nuclear weapons to West Germany was at the top of the British security agenda. NATO's American military commander, General Norstad, had proposed to "equip the German forces with tactical

nuclear weapons, the warheads for which would be supplied by the United States and would remain in United States custody" (HMG, 1958-1960, 1). Government policy was set by the Foreign Secretary's memorandum that concluded, "although there is some risk that these plans will increase the probability that Germany will eventually emerge as an independent nuclear power [...] we should accept this risk in order to keep Germany in the Western camp as an equal partner" (HMG, 1958-1960, 1) However, concern lingered that US-Soviet nuclear parity could lead to American retrenchment, by which time Germany could be "on the way to being an independent nuclear power in its own right."

A Cabinet Defence Committee meeting in November 1958, discussed and concurred with the findings in the Foreign Secretary's memorandum. The discussion left "little doubt that these arrangements would increase the difficulty of preventing Federal Germany from ultimately emerging as an independent nuclear power" (CAB, 1958, 4). The committee resolved to consider confidential discussions with the US about procedures for removing the weapons if "the Federal Republic would seek to come to terms with the Soviet Union or would prove in, other respects to be an unreliable member of the Alliance" (CAB, 1958, 5).

> *Despite the hedged language, the Foreign Secretary's memorandum, as well as the discussions in the course of its production, overestimated how much training the Bundeswehr to fire US nuclear weapons could lead to an autonomous West German capability.*

1960 to 1969

In March of 1960, policymaker concerns about an apparent loophole in the 1954 Brussels Treaty, that may have allowed Germany to manufacture weapons abroad (Spain was seen as a possibility), were reassured that German forces were subject to inspections by allies and that the strategic cost of alienating its allies in this way would

be deemed too high. Because of this, "Her Majesty's Government have no suspicion whatever that the German Federal Government have any such intention" (FO, 1960). Investigating the diplomatic records for the reason of the loophole's existence, the Foreign Office provided assurances that the formulation had arisen from the debate at the time, and was not likely the result of German intent of maintaining a nuclear weapons option (FO, 1960).

> *The diplomatic assessors corrected the policymakers concern with an accurate estimate.*

The first publicly available formal JIC assessment of West Germany's nuclear weapons' intentions and capabilities was circulated in October 1960. The report assessed that "Western Germany's industrial and scientific resources are fully adequate to support an atomic energy programme" and that the country was working to build a fleet of reactors. The danger of this developing capability being put to weapons use was deemed remote. However, "if such an intention were to appear within the next year or so it would be technically possible for them to achieve a first test by 1965." (JIC, 1960, 11)

> *The technical estimate may have been an overestimate, but the remoteness of a German nuclear test was accurately established with reference to an absence of intent to do so.*

German intentions were the subject of the next round of assessments. British military leadership, including the chief of military intelligence, were "disturbed by signs of a revival of militarism in certain West German circles (including sections of the army)" (JIC, 1961, 1). In particular, the "arrogant and aggressive manner in which the West German Defense Minister had argued the case for the German acquisition of nuclear weapons" raised concerns (JIC, 1961, 1). Even if the "military view" was not likely

to set policy at present, there was the possibility that it would "reach a dangerous pitch in three to five years' time" (JIC, 1961, 1).

The cabinet asked for an assessment of these trends, which was delivered at the following meeting with additional Foreign Office representatives.

> "There was no evidence to suggest that the West Germans were at present capable of manufacturing their own nuclear weapons and there were no recent indications that the French might offer them clandestine help in this respect. Given the closeness of present Franco/German cooperation, however, this possibility was one which could not be entirely discounted." (JIC, 1961)

The chairman concluded that there was "little danger that the present Government of the Federal Republic would encourage militaristic tendencies," but that "a wider intelligence effort on West Germany" was necesssary, with a focus on "Franco/German collaboration in the nuclear field." (JIC, 1961, 1)

> *The assessment was accurate and strongly suggests that British intelligence had become aware of the brief French/German agreement. It does not mention the Italian role, however.*

As the MLF controversy simmered within NATO, a report from December 1963, reiterated that Germany's recent agitation for decision-making authority over US weapons should not be mistaken for a desire for an operational role.

> "There is certainly no demand in Germany, whether among the politicians or the general public, and, so far as I can judge very little demand even in military circles, for nuclear weapons under German control or for a German finger on the NATO nuclear trigger. But there is a feeling, held by responsible and sensible leaders such as von Hassel, Schroder and Erler,

that the Federal Government should have a voice in the organisation and control of the decisive NATO nuclear weapon. . . " (FO, 1962)

This characterization was true.

Germany's construction of the plutonium reprocessing facility near Karlsruhe invited a renewed scrutiny of its intentions. The lack of domestic energy requirements for such a facility, combined with an existing contract with a Euratom separation facility in Belgium, raised suspicions that Germany was working on a domestic fissile material production capability for non-energy purposes (Stevenson, 1967, 1). The lack of transparency concerning the construction schedule added to these fears. The alarmed technical analysts lost the argument to the regional specialists in the Foreign Office.[12]

As of this writing, the historical record offers no indications of whether West Germany thought of the Karlsruhe reprocessing facility as a latent weapons capability at this point. Absence of evidence, of course, does not provide evidence of absence.

Later the same year, British intelligence was asked to investigate East German public accusations of the Federal Republic's ostensible nuclear dealings with South Africa. They were swiftly dismissed. The only concrete allegation, that West Germany was exploring natural uranium purchases, was seen as aligning with commercial purposes (Stevenson, 1967, 1). However, British intelligence had "no means of knowing for sure if there is anything sinister in Germany's activities" (Stevenson, 1967, 1).
In March 1969, alarm spread through the British security establishment. French officials, at the highest level, had warned them about their common ally's secret plutonium reprocessing projects.

[12] "Western and W.O.C. Departments do not share our doubts about German militarism. I hope they are right. I am still surprised that the Russians have not made [. . .] from this information" (Stevenson, 1967, 1).

The UK Joint Intelligence Committee tasked the Directorate of Scientific and Technical Intelligence and the Foreign and Commonwealth Office with making a bottom-up review of all available indicators that the Germans were preparing to develop their own force de frappe. After months of analysis, the draft technical report found "no evidence that [West Germany] is engaged in a military nuclear programme, and we believe that it would currently be difficult on technical grounds for her to do so, even if she wished, which must at present be extremely unlikely" (FO, 1969).[13]

The assessment process in response to the French allegations was accurate.

The last publicly available assessment of future trends in West German policy summarized its conclusions in December 1970:

> "As an indirect result and by reason of installations which either exist or could be built on the basis of her present knowledge, Germany may well be technically able to embark on a weapons programme in the time period of this paper. There are adequate facilities available to support a large missile and space development programme, provided that the necessary financial support was granted. However, in signing the Brussels Treaty of 1954, the Federal Government declared that it would limit arms production and would not manufacture atomic weapons in its territory. At no time since then has there been any pressure in any of the political parties for renunciation of this provision and for the development of an independent nuclear weapons capability. Not even the extreme right-wing groups have advocated it. Of the politicians who have an significant influence, Strauss, the leader of the CSU and the most vocal opponent of Brandt's

[13]Unable to find evidence that the Federal Republic was a candidate for proliferation, British analysis turned to speculation about French motivations for spreading these allegations, finally settling on the view that it was a way of preventing British-German cooperation in developing centrifuge technology for uranium enrichment.

> negotiations with the communist countries has gone furthest in that direction. He has ideas of a Germany, firmly embedded in West Europe, being a shareholder in a Western European nuclear deterrent, but he has never advocated an independent German nuclear capability. It would require a drastic change in political thinking in West Germany before any government there would authorise an independent nuclear weapons programme. We are quite certain that the present SPD/FDP Coalition Government will not do so. Long term prediction is naturally more difficult, but we are confident that in 1975 West Germany will not have an independent nuclear weapons capability, and that in all probability even then none will have been authorised." (MOD, 1971, 4)

At the time of the assessment, Germany had already signed the NPT, but waited until 1975 to ratify it.

The assessors' confidence in German nuclear restraint had been justified.

East German intelligence was more accurate in tracking West German-French cooperation than its US and UK counterparts. This acuity turned into overestimation when the cooperation became unambiguously non-nuclear in nature. The GDR's second comparative strength was its superior understanding of the individual projects and materials in West German nuclear facilities.

These points aside, the United States intelligence community had a consistently accurate understanding of current activities. Predictions in the estimations generally bore out. However, as the assessments made clear, much of Germany's decision-making was dependent on US policy. For this reason its direction was easier for US intelligence to foresee than it was for East Germany.

British assessors performed best, not only because of an advantage from their close policy integration with the United States. In the face of assertions of German weapons

planning from its military officers, East German propaganda, and French allies, the estimates produced by the bureaucracy and presented to decision-makers reflected the reality as reflected by the surviving and available historical record.

Findings

With the exception of the (*C1*) complexity and (*C4*) international ownership hypotheses, the proposed mechanisms of the capability hypotheses were active in determining the accuracy of assessments in the West German case.

C1: The larger and more complex a nuclear program, the less accurate proliferation assessments will be.

The evidence for and against this hypothesis is limited and ambiguous. As West Germany's nuclear program grew in size and complexity during the 1960s and beyond, intelligence agencies' assessments improved. At the beginning of the growth spurt in 1960, British intelligence maintained an accurate assessment of the program. East German assessments from the period were also accurate in assessing the limited weapons utility of the nuclear program on its rival's territory. American assessments were equally accurate in recognizing that Germany's indigenous nuclear program was not a likely path to a bomb.

However, the evidence supports a modified reading of the hypothesis: Absolute size and complexity can be processed by intelligence agencies. On the other hand, relative changes are more difficult. A nuclear program is least likely to be assessed accurately during a period of decision and planning than during the implementation stage. This is concordant with the case of West Germany, whose proliferation risk was wildly overstated in the late 1950s when it began debating and planning its national nuclear program. For instance, British intelligence struggled in 1955 not with the existing and anticipated elements of the German research program, but with unforeseeable technological breakthroughs that could result from a growing nuclear program in the

Federal Republic. Once the program was underway in the 1960s, foreign intelligence agencies could view the burgeoning capability in its proper context.

C2: The more dual-use materials and technology a country acquires, the less accurate the assessment.

This hypothesis receives strong support from the West German case. New German fuel cycle capabilities were frequently associated with a decrease in assessment accuracy.

Acquisition of dual-use technology was especially effective in feeding East Germany's production of overestimates. Unsurprisingly, West German activities involving fissile materials were the cause of multiple overestimates. Intelligence agencies focused especially on the country's plutonium-reprocessing capabilities. A 1970 British assessment, for example, pointed to the uncertainty generated by the Federal Republic's ability to turn spent reactor fuel toward explosive purposes. Uranium enrichment received relatively less attention, despite West Germany's advanced capabilities in centrifuge technology. Inversely, the late 1950s inference by US intelligence that an absence of a fissile material production capability indicated a lack of a weapons program helped create an accurate assessment. British intelligence had already come to that conclusion in 1954. But in general, the US intelligence community placed lower analytic weight on West Germany's fissile material potential in its assessments than either the British or East German services.

Other dual-use technologies that created uncertainty for intelligence assessors included missile and nuclear propulsion technology. East German intelligence was especially eager in the 1960s to assign nuclear weapons motives to Germany's missile development as part of its space program, much of which was a collaboration with the United States and France. British intelligence shared that concern as late as 1970. A few years before, the GDR's military intelligence service had sounded the alarm over

the explosive applications of nuclear propulsion and that equipping the *Bundeswehr's* soldiers with decontamination equipment signaled preparation for nuclear war.

C3: Intelligence assessments of programs with international imports will be less accurate.

The West German case provides support for this hypothesis.

Both the United States and Great Britain emerged as nuclear trading partners of West Germany. Even discussions about cooperation on nuclear materials and technology helped the supplier country's assessors. For instance, talks with West Germany's leading nuclear physicist about plans for the country's nuclear energy industry helped reduce worries about a weapons element. Perhaps because of its resulting understanding about West Germany's approach to nuclear energy, British intelligence was also not alarmed by reports of West German efforts to import uranium from South Africa. The nature of West German cooperation with proliferating France caused great uncertainty among intelligence assessors and yielded several misestimates. For East Germany, this cooperation with France was first the source of an overestimate for the MfS (1958) and then of an underestimate for military intelligence (1959), all within the span of one year. While the historical record is still ambiguous, US intelligence may have failed to appreciate the seriousness posed by the possibility of Franco-German cooperation in its 1957 and 1958 assessments. Five years later, the possibility of a continental European option contributed to a mild overestimate. British intelligence struggled with the same questions regarding the nature and future of nuclear cooperation between its continental allies, even though its confidence that it would not produce a West German bomb correctly grew in the 1960s. This may have been the result of a 1961 decision to increase its collection efforts on that issue. As with France, British assessors also had difficulty informing their policymakers as to the extent in which the United States would share its nuclear weapons with the West Germans in the late 1950s.

That West Germany would acquire a complete nuclear capability from an ally was a possibility contemplated by the intelligence services of the three countries. Determining the likelihood of West Germany importing entire weapons systems was a far greater challenge for East German intelligence. As the most likely exporter, the United States did not require an estimate of its own policies. Great Britain would have expected to be consulted on such policies (as indeed it was) and had more sources of information about future US policies. The same was true for American and British intelligence when it came to the Federal Republic's nuclear projects with France and Italy.[14]

The first effect of nuclear sharing was an East German underestimate. In 1957, the MfS had failed to detect the deployment of US nuclear weapons to its rival's territory. In the late 1950s, British intelligence overestimated how much US weapons could serve as a gateway drug for the Bundeswehr. However, the British were less alarmist than other countries about the implications of West German efforts to secure a greater say over nuclear matters inside NATO in the early 1960s.

Contrary evidence also exists in this case. In a 1967 estimate, East German intelligence analysts correctly interpreted that NATO countries would not directly share their weapons with the West Germans.

C4: Intelligence assessments of programs with international ownership will be more accurate.

The evidence for this mechanism is weak and inconclusive when excluding the Franco-West German collaboration discussed above. Most intelligence assessors paid just as little attention to West Germany's uranium enrichment capability that was physically under development in the Netherlands as part of a multi-national consortium. That many of the projects in Karlsruhe had multi-national financing did not attract particular comments either. It is conceivable that East Germany was less able to exploit

[14]East Germany's thorough penetration of NATO did not come until later.

this dynamic because it largely focused its intelligence collection on West Germany rather than the latter's international nuclear energy and defense partners.

C5: Intelligence assessments of programs under safeguards will be more accurate.

The evidence was unanimous and overwhelming in favor of the accuracy-enhancing effect of international safeguards. West Germany is an unusual case in that components of its nuclear program were placed under different international safeguards arrangements in the three stages: the occupying powers' Military Security Board, the regional Euratom, and eventually, the International Atomic Energy Agency.

In addition to providing detailed technical information to foreign intelligence agencies, the application of safeguards provided a useful marker of peaceful intent. Assessors frequently invoked West German compliance with the letter of the safeguards law as a litmus test of its peaceful intentions. Because those intentions remained peaceful for the duration of the study, it is not possible to say whether the safeguards deterred a West German nuclear weapons program or would have even detected such an attempt.

It is likely that the world's first nonproliferation inspections were carried out in defeated Germany by the Military Security Board following the Second World War. After the hardening of zones into Soviet and Western, these oversight provisions, which included challenge inspections and export controls, provided both British and American intelligence with a complete and comprehensive understanding of West German nuclear capability. While these provisions expired with the occupation's end, the detailed baseline of West German materials, capabilities, and personnel was likely to have assisted British and American assessors in later years.

On the whole, Euratom inspections apparently did not contribute useful information to the intelligence assessors. It is curious to note that British intelligence did not establish the basic details of whether and how Euratom inspections were conducted.

West German resistance against a transition to IAEA safeguards was a major hurdle to the NPT's ratification. In line with the hypothesis' screening mechanism, West German reticence raised suspicions about the country's nuclear intentions. These suspicions lingered in the minds of Western policymakers even as their intelligence analysts resisted overestimating this indicator. By contrast, West German resistance to inspections fed the consistent paranoia of the MfS. Not many assessments become available once IAEA inspections were underway, possibly because their acceptance removed other states' doubts about West Germany's commitment to its multiple nonproliferation pledges.

3.1.5 Conclusion

States cannot wish nuclear weapons into existence. They must build or acquire advanced materials and technologies, a process that typically takes years and involves substantial imports–and shares many steps with the creation of a robust nuclear energy industry. Those activities emanate information that can be useful for observing intelligence agencies. But that information can also mislead them. The chapter identified which of these activities were especially confusing for proliferation assessors.

Table 3.2: Evidence for and against nuclear capability hypotheses

		Global panel	**Case studies**	**Process tracing**
Evidence	*Confirms*	*C1*	*C1, C5*	*C2, C3, C5*
		C5	*C3*	*C4*
	Mixed	*C3*		*C1*
	Rejects		*C5*	
		C2		

C1: Size stumps spies.

The larger and more complex a nuclear program, the less accurate the proliferation assessments will be. This has been confirmed by the preponderance of evidence available for hypothesis testing in this chapter. Programs that produced nuclear energy were more likely to be mischaracterized by intelligence agencies abroad. As evident in the process-tracing and case studies, the collection of more information does not seem to offset the problems with tracking complex capabilities.

The relationship between size and complexity on one side and misestimation on the other is not linear. The German case demonstrates that the early, planning stages of a national nuclear program can be especially difficult to assess. These difficulties are diminished once analysts can observe the operation of the facilities for signs of peaceful use or military appropriation.

C2: Dual-use for double-dealing?

The evidence is ambiguous when it comes to the effect of dual-use materials and technology on assessment accuracy. The Chinese, Pakistani, and West German cases demonstrate that the accuracy of assessments declined as the countries accumulated dual-use technologies. On the other hand, the global panel data reveals the opposite trend. This tension can be resolved by concluding that dual-use technology can demonstrably create uncertainty and inaccuracy, but that it does not necessarily do so in all cases.

C3: Trade is not transperancy.

The proposition that intelligence assessments of import-heavy programs will be less accurate collected the most empirical support. Whether measured coarsely by the kinds of internal cooperation agreements a country had within a given year or the internal correspondence of assessors wondering whether West Germany would purchase nuclear bombs, the hypothesis was confirmed.

C4: Cooperation grows confidence.

Historical evidence from the West German program suggests that intelligence assessments of programs with international ownership will be more accurate. However, because this is only based on the study of a single program that involved multinational ownership and operation of sensitive nuclear technologies, it is not conclusive.

C5: Safeguards sap suspicion.

The global panel and process-tracing sections lead to the conclusion that intelligence assessments of programs under safeguards will be more accurate. The case studies provide the caveat that this will only work for safeguards that are designed to deter covert nuclear activities. Facility-specific safeguards with narrow non-diversion provisions are less useful for foreign assessors.

Given the inseparability of intent and capability, these conclusions offer only one side of the coin. While intelligence agencies can and must scour the technical capabilities of a target program to determine whether and when a state might field nuclear arms, they cannot provide an answer without knowledge of that state's goals. The next chapter explores how states gain and lose the scent for that nuclear intent.

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Chapter 4

Assessing Nuclear Intent: Separating Isotope Facts from Fiction

Nuclear weapons are a function of a state's capability to acquire them and its desire to do so. Capabilities can be detected, measured, and counted objectively. The same cannot be done for the intent. As a result, while an accurate and complete assessment of a state's physical capabilities may be difficult to generate, an accurate and complete assessment of a state's intent does not exist. Applying Treverton (2001)'s distinction: The former is a puzzle, and the latter is a mystery.

Furthermore, the translation of proliferation intent into a weapons program varies by state. Even for states in which a sole mind would be sufficient to launch it on the path of nuclear pursuit, the position of this individual may change. For some states, just knowing that the majority of flag officers favor nuclear weapons will go a long way toward predicting the nuclear future. In other states, the same information can be useless or misleading. Intelligence analysts can understand this–without knowing which state belongs to which category. To illustrate by stylized contrast, possession

of the same fifty pounds of plutonium would nudge every state closer to a nuclear explosive capability in the same way and for the same distance.

Understanding another state's intentions, including whether it wants to pursue nuclear weapons, is therefore an inherently difficult challenge for intelligence assessors.[1] But under which conditions is it especially difficult to determine a state's intent? This chapter searches for determinants in the political characteristics of the target regime, the international diplomatic posture that the state has assumed, and country's security environment. A concluding section summarizes what can be learned from the available evidence.

As in the previous chapter, these hypotheses about errors that states might commit in estimating nuclear capabilities and intentions are intended to discover the extent to which these errors recur across countries and historical time periods. Conceivably, each individual misestimate is the consequence of idiosyncratic deviations from an otherwise rational baseline or is quite literally in the error term of state perception.

4.1 Behind the poker face

Because any "decision to pursue, assemble, and test nuclear weapons is always a political one," a proliferation assessment "requires estimating the likelihood of those decisions" (Montgomery & Mount, 2014, 8). It also requires knowing who will make that decision. As noted above in the methodology chapter, a state's intent does not reside anywhere and is undiscoverable. However, it can be estimated by acquiring and assessing information that informs answers to four questions:

1. Which actors matter? Inside a state, any person ranging from the head of state to the average citizen is included in the potential population of deciders. Beyond the state's borders, the views and likely (re-)actions of foreign actors

[1] Consider the difficulties encountered by citizens, journalists, and academics in predicting the course of their own country's politics, especially in cases where secret information is of no value.

have the potential to determine the state's intent. The matters over which they need to decide are the first three indicators of proliferation developed in Chapter 2: verbal expression of intent, a plan for nuclear pursuit, and the institutional tasking necessary to implement that plan.

2. What are the preferences of the deciders? The preference ordering of the potentially relevant population of deciders is a second key element. Analysts also need to know the source of that ordering to anticipate the effect of changing conditions or the actions of other actors, including those of foreign states.

3. How will these preferences be aggregated? The procedures by which the preferences of deciders tend to produce policy decisions of the type and salience related to whether or not nuclear weapons should be pursued.

4. What could change the elements above? How likely is it that the answers to the previous questions will change. For example, developing a dual-use capability may not initially be motivated by a weapons intent, but once the relative costs of weapons acquisition is lowered, it may make the option more attractive to some deciders.

The next stage of difficulty for proliferation analysts is that states cycling through this entropic political process are conscious of their audiences, both foreign and domestic. The motivations to manipulate the process are boundless, including advancing domestic political goals and misleading other states into believing that their intent is greater or lesser or more unified than it actually is.

States are active communicators. In the international relations literature, they are constantly bargaining with, coercing, or deterring each other. A casual observation of state behavior confirms that governments are in perpetual communication with each other. A state seeking only to build a nuclear energy industry will be motivated to persuade others of that intent–but so might those with nuclear weapons ambitions.

Intelligence agencies have several sources of information available to separate these intentions and to gather indicators of the first proliferation indicator (the "verbal expression of intent"). The first of these are formal commitment mechanisms, constructed in part for states to declare their intent.

I1: States announcing their intentions through IOs can be assessed with greater accuracy.

If that information influences the accuracy of assessment, by which mechanisms would it be expected to operate? The first of these is screening. While rife with potential for misuse, signing a declaration of non-weapons intent is a potentially resource-saving heuristic of where not to direct attention. Second, the difference between what documents states are willing to sign and what they consider an unacceptable limitation to their freedom of action could be rich in information, too. Finally, this includes the information in negotiation posture as treaties and other nonproliferation agreements are created with the input of the target country.

In the nuclear domain, the Nonproliferation Treaty (NPT) is the major vehicle for states to record their plans to abstain from nuclear armament (Swango, 2009). At the global panel level, which measures assessment accuracy and other variables in country-year units, the effect of a state having ratified the NPT can be tested, conditional on whether the treaty was in force at the time of the assessment. At the case study and process-tracing levels, information about additional elements of the international nonproliferation regime complex is available for states to declare their intentions. The effect of West Germany's formal statements of intent and negotiation positions on the intelligence assessment process can be traced in detail in the third section.

In addition to the intentional signals that states send by making promises about the peaceful nature of their programs, they also broadcast information involuntarily. These signals will be more valuable to intelligence agencies as unmanipulable indices of intent (Jervis, 1989).

I2: States holding open debates about nuclear weapons acquisition are harder to assess.

The mechanism is similar to the previous chapters' hypothesis that assessment difficulty grows with program size: The more information generated by an open debate, the harder it becomes to interpret. Phrased differently, an excess of verbal expressions of intent makes it difficult for assessors to know which one will prevail.

At the global level, the most available binary proxy for openness in security decisions is whether the state is a democracy. The case studies allow the collection of evidence about the scope and secrecy of debate regarding the programs' purpose, while process tracing directly follows the effect of the target country's internal debate on the assessment process.

Alternatively, it may matter less what states signal, whether intentional or not, but how they are governed. Recent international relations scholarship has succeeded in explaining variations in state behavior as a function of domestic characteristics. This progress results from theorizing beyond the democratic/authoritarian distinction and a more differentiated understanding of the international consequences that domestic political incentives can trigger.

What characteristics make one regime's intentions and capabilities harder for other countries to assess? Weeks (2014) argues that the key distinction in international behavior is between unconstrained personalist dictatorships at one extreme and single-party authoritarians and democracies at the other. Military juntas exist in between. As a basic theoretical extension, the least constrained regimes should exhibit greater variance in behavior. That volatility should be comparatively more difficult to estimate. This kind of volatility makes it especially difficult to assess the second ("policy of and/or plan for acquisition") and third ("institutional tasking") proliferation indicators.

I3: States with unconstrained decision-making are harder to assess.

The less constrained a government is, the less predictable it will be, and therefore the more difficult it is to assess. This lack of constraint appears in the fourth element described above. If the identity of the deciding actors and their preferences or patterns of preference aggregation change frequently or unexpectedly, it will be difficult for analysts to determine which information is worth acquiring, how to weight it, and how to assemble it into an aggregate summary of the target state's intent that narrows the bounds of uncertainty for their policy customers.

Unlike authoritarian regime types, successive democratic governments are likely to express policy preferences from a broader spectrum of the electorate. As different coalitions find representation in a government following elections, the preferences and policies relating to its foreign and security policies will be subject to more dramatic shifts than that of the narrowly representative–and therefore consistent–authoritarian governments.

Weeks (2014) provides data on the regime type of the target program in country-year units, which measures the rules of preference aggregation, including how constrained the leadership is in making policy decisions. In this typology, "machine" and "junta" regimes are autocracies respectively constrained by civilian and military elites. "Boss" and "strongman" regimes are personalist dictators, either of civilian or military background, and without such constraints.

The Indian and Argentinian case studies add information on which actors were relevant to deciding the scope and purpose of the countries' nuclear programs, as well as more limited information about their preferences. The process tracing overcomes that limitation and adds data on what intelligence assessors thought about the target country's policy volatility.

The logic of democracy may not apply in nuclear weapons programs, which have a tendency to resemble authoritarian dynamics. Observing the emergence of these dynamics should be a tipoff to intelligence assessors, making democracies less likely

to keep their proliferation intent secret. Still, an empirical pattern in which states are more likely to strike at autocratic proliferators has been demonstrated (Fuhrmann & Kreps, 2010).

I4: The proliferation risk of autocratic states will be overestimated.

The three stages of empirical investigation can use the same sources of data on regime type as employed for the hypotheses as above. But instead of measuring the effect of regime type on overall accuracy, it focuses on the narrower dependent variable of overestimates–when a country's nuclear weapons status was exaggerated by another state's intelligence officers.

The third category of political characteristics likely to affect assessments of nuclear intent relates to the target country's security environment. Would states with contested and militarized environments be more difficult to assess–and what about those facing a (potential) nuclear-armed rival?

States that experience frequent conflict may either be perceived as belligerent–and therefore more likely to acquire nuclear weapons–or as a victim of aggression, which would lead observers to expect that they would have a motive in nuclear armament.

I5: The proliferation risk of states in competitive security environments will be overestimated.

Such a "strategic empathy" bias might arise from psychological mirror imaging or as a result of its own strategic culture–a theme that will be developed further in the next chapter (Booth, 1979). Intelligence agencies would imagine the effect of insecurity, viewing the acquisition of nuclear weapons as the most obvious remedy to chronic threats.

At the global panel level, data is available on the number of Militarized Interstate Disputes experienced between a state and its neighbors. A rolling average of the previous five years provides a proxy of a state security environment. The case studies and process-tracing sections can draw from a large secondary literature on the target

states' threat perceptions, as well as how intelligence analysts viewed their targets' security thinking.

Militarized friction with neighbors is a general environment of insecurity that will make states more secretive and less predictable. A more specific case is the possibility that the target country's potential adversary could build nuclear weapons of its own. The construct of "nuclear proliferation cascades," in which states respond to nuclear programs of rivals by developing weapons of their own, has deep roots in nuclear thought. If intelligence analysts believed in this folk model of the spread of nuclear weapons, they would be expected to overestimate the propensity of states to fight proliferation with proliferation.

The (perceived) nuclear activities of rivals are available at all three levels of analysis. For the global panel, they are provided by the Correlates of War dataset. More details of regional nuclear dynamics, and how the observing intelligence agencies assessed them, can be explored at the case study and process-tracing levels. In particular, the Indian and Argentine programs were evaluated with reference to the nuclear ambitions of rival states: China and Pakistan for the former, and Brazil for the latter.

These five alternative, but certainly not mutually exclusive, explanations for what political characteristics make a state's nuclear intent difficult to assess are tested below. To establish the representativeness of the proposed mechanisms, the first series of tests takes place by conceptualizing the variables as country-year variables. The hypotheses' plausibility and concordance is further examined with two case studies. A process-tracing section seeks to find confirming and disconfirming evidence for the proposed mechanisms as the causal transmitters of the observed correlations.

4.2 Testing with global panel data

Continuing the use of the global panel dataset from the previous chapter, several effects of the target country's political characteristics on assessment accuracy can be tested on proliferation misestimates, underestimates, and overestimates. As in the previous chapter, the models include controls for the state that created the assessment and whether and how far into the future the prediction extends. The statistical tests add a variables for the industrial material resources of the state to control for effects relating to capability.

4.2.1 Findings

At this coarse level of measurement, much of the evidence is conflicting; however, several hypotheses receive support.

I1: States announcing their intentions through IOs can be assessed with greater accuracy.

The evidence for this hypothesis is preliminarily supportive. States that had not ratified the NPT despite having the opportunity to do so, found their programs assessed incorrectly. Countries promising peaceful intentions by ratifying the treaty were easier to assess. However, it violates the mechanism's expectations that a refusal to ratify the NPT would have reduced overestimates of the program and not affect the odds of underestimation.

I2: States holding open debates about nuclear weapons acquisition are harder to assess.

There is strong support for the proposition that observing a debate over a nuclear program's possible weapons purpose reduces the assessment's accuracy–but only to the extent that democracy serves as a reliable proxy for open debate. The binary indicator for democratic regime type in the second row reflects an increase in assessment error for each version of the dependent variable, demonstrating the difficulty

Table 4.1: Effect of technical factors on assessment accuracy

	Dependent variable		
	Error in estimate	**Overestimate**	**Underestimate**
Refused NPT ratification	.29***	−1.36**	.14
	(.09, .49)	(−2.41, −.31)	(−.14, .43)
Democracy	1.04***	1.86**	.36***
	(.85, 1.23)	(.40, 3.33)	(.12, .60)
Boss	.32**	−.02	−.85***
	(.01, .62)	(−2.24, 2.20)	(−1.34, −.35)
Strongman	1.11***	3.18***	.23
	(.85, 1.37)	(1.67, 4.69)	(−.15, .61)
Junta	−.01	−14.41	−1.03***
	(−.52, .50)	(−3,277.53, 3,248.71)	(−1.81, −.25)
Machine	−.62***	−.26	−.79***
	(−1.04, −.20)	(−2.81, 2.30)	(−1.32, −.25)
Other stable authoritarian	.10	−14.41	−.14
	(−.14, .33)	(−1,198.26, 1,169.43)	(−.43, .15)
Recent MIDs	.54***	−.25	1.05***
	(.43, .65)	(−.62, .13)	(.90, 1.21)
Proliferating rival	−3.40***	1.83*	−2.90***
	(−3.96, −2.84)	(−.22, 3.88)	(−3.74, −2.06)
Nuclear rival	.52***	−.01	−.73***
	(.37, .67)	(−.75, .72)	(−.95, −.51)
Material capability	54.83***	23.85***	63.57***
	(47.46, 62.21)	(6.30, 41.39)	(55.94, 71.19)
Prediction	.04***	.001	.01
	(.01, .06)	(−.10, .10)	(−.03, .04)
Assessor: West German intelligence	−.17	−2.90**	3.46***
	(−1.81, 1.47)	(−5.42, −.38)	(1.82, 5.10)
Assessor: UK intelligence	−3.68***	−6.24***	−2.44***
	(−4.99, −2.37)	(−7.97, −4.50)	(−3.56, −1.31)
Assessor: US intelligence	−3.61***	−4.31***	−1.44**
	(−4.92, −2.31)	(−5.73, −2.89)	(−2.54, −.33)
Observations	9,892	9,889	9,894
Log Likelihood	−2,911.28	−243.30	−1,743.96
Akaike Inf. Crit.	5,854.55	518.61	3,519.93

Note: *p<0.1; **p<0.05; ***p<0.01

Base assessor: East German intelligence — Base regime type = New/unstable regime

that the British, American, and both German intelligence services had in assessing democracies' nuclear intentions.

I3: States with unconstrained decision-making are harder to assess.

The findings are predominately favorable to this hypothesis: the more potentially volatile a regime type's security policy, the higher the misestimation rate. The least constrained regime types–civilian boss and military strongman–have their nuclear programs assessed less accurately. There are patterns of overestimates for strongmen and underestimates for bosses. If democracies are considered more prone to volatile shifts in foreign and security policy, the findings mentioned in the previous paragraph lend further support to this hypothesis.

The more constrained regime types with greater stability in their intent were less likely to be misestimated. Juntas and other stable authoritarian systems did not have a statistically significant relationship with assessment accuracy. Civilian machine regimes such as communist systems were robustly less prone to misestimation.

I4: The proliferation risk of autocratic states will be overestimated.

This hypothesis receives no support from the country-year panel data. While strongmen were relatively more likely to be overestimated, other authoritarian regime types had no statistically significant relationship with overestimation. In fact, bosses, juntas, and machines were significantly correlated with underestimation. Intelligence agencies do not err on the side of exaggeration when analyzing authoritarians.

I5: The proliferation risk of states in competitive security environments will be overestimated.

The global panel's evidence is supportive of this hypothesis. A history of militarized confrontations raises the error rate, as does having a nuclear-armed rival. However, if a target country has a rivalrous relationship with a proliferating state, the relationship reverses: the error rate drops.

4.3 Case studies

Building on these coarse results, the second set of empirical hypothesis tests can be conducted with the assessments of the Indian and Argentine nuclear programs. The table below provides an overview of the unique assessments created about the two programs. Reflecting a combination of greater document availability, the respective countries' interest in tracking proliferation, and collection capability, the United States intelligence community generated the most individual assessments. Continental European agencies tracked the nuclear programs in South America and South Asia at lower levels of interest. Between the two target programs, Argentina received less attention.

Table 4.2: Case study dyads

	Argentina	India
German Democratic Republic	3	2
German Federal Republic	2	2
Switzerland	1	0
United Kingdom	7	10
United States of America	14	25

Measured at a coarse binary accuracy score, Argentina's nuclear program was judged accurately in half the cases. India was judged accurately at just over 40% of the time. As an exception to its typically high performance, British intelligence performed unusually poorly when evaluating its former colony and future Falklands War adversary.[2]

4.3.1 India: the blast and the curious

India's path to a nuclear arsenal was long and characterized by policy reversals and ambiguity. There were no major clandestine facilities to mislead foreign intelligence

[2]Freedom of Information requests are still pending for British assessments following the conflict.

Table 4.3: Case study dyads

	Argentina	India
German Democratic Republic	3	2
German Federal Republic	2	2
Switzerland	1	0
United Kingdom	7	10
United States of America	14	25

Table 4.4: Correct assessment by target country

	0	1
Argentina	13	14
India	22	17

agencies, but intent was difficult to divine for all foreign analysts. But given their high level of resources invested in tracking the program, British and American intelligence were least effective in presenting their governments with accurate assessments of the Indian program.

India's circuitous path to acquiring its nuclear arsenal, as well as its policy of deliberate nuclear ambiguity, make it the most difficult of the cases to code (Smith & Institute, 1994, 190). Even if the timeline of capabilities is well established, intentions are more difficult to measure. However, the task below is to compare the historical record with contemporaneous assessments rather than fit Indian intent and capability into discrete categories. Furthermore, the noisiness of policy signals caused the assessment of intent to be more difficult for foreign intelligence agencies, thereby making the case more likely to reveal differences between them.

India's nuclear program was born with the intent to explore the possibility of weapons' applications. In 1948, the country secretly established an Atomic Energy Commission (AEC). The AEC was publicly directed to begin work on nuclear explosives in 1964. At that time, the order described the project in peaceful terms. The subsequent prime minister hinted on May 10 1966 that the effort might be motivated by more

than merely "peaceful purposes" (Bleek, 2015). However, the project was shut down in June. In the late 1960s and early 1970s, India did not develop its nuclear explosive capabilities, nor did the historical record capture other signs of weapons acquisition intent.

In 1971 or 1972, India restarted work on the ability to detonate a nuclear device.

> "India returned to pursuit in 1972, when on September 7 Prime Minister Gandhi apparently authorized work on the 'fabrication of a device for a peaceful nuclear explosion.' It should be pointed out that there is some uncertainty about precisely when this authorization was given, with some sources suggesting it may have taken place in 1971." (Bleek, 2015)

The project succeeded in detonating a device in May 1974, which India described as a "peaceful nuclear explosion" (PNE). However, it is thought that India did not undertake to turn its nuclear explosive capability into one that could be weaponized and delivered as a warhead. Instead, India continued to work more broadly on its nuclear capabilities for the remainder of the 1970s.

In 1980, India seems to have committed itself to the pursuit of non-peaceful nuclear explosives.

> "India returned to pursuit in 1980, based on circumstantial but strong evidence that Indian policymakers had decided to reinvigorate their nuclear program. It bears emphasizing that in the subsequent decade they declined to authorize further testing or overt weaponization, instead pursuing a 'nuclear option strategy,' considerably complicating coding. A credible journalistic account suggests that "from the end of 1980, onwards, work on the development of components needed for another nuclear device was once again stepped up at the BARC [Bhabha Atomic Research Centre]." [...] Prime Minister Indira Gandhi also briefly authorized another

> nuclear test in late 1982, or early 1983, but quickly changed her mind. After she was assassinated in 1984, her son Rajiv Gandhi served as prime minister until 1989 and consistently declined to authorize further testing or acquisition of overt nuclear weapons capability, instead displaying "acquiescence in, if not encouragement of, the ongoing expansion of nuclear weapons capabilities." (Bleek, 2015)

India most likely acquired a deliverable nuclear capability after 1987:

> Prime Minister Gandhi stated publicly in March 1987 that India had not built nuclear weapons, but that "if we decided to become a nuclear power, it would take a few weeks or a few months." Other sources suggest the date should be slightly later; for example, Perkovich writes, "Between 1988 and 1990, according to one source [key former official K. Subrahmanyam], [India] readied at least two dozen nuclear weapons for quick assembly and potential dispersal to airbases for delivery by aircraft for retaliatory attacks against Pakistan." (Bleek, 2015)

Scoring assessment accuracy

Despite its history and deep involvement with the country's affairs, British intelligence agencies had severe difficulty tracking India's changing intentions as its capabilities increased over time. With the exception of the years leading up to India's 1974 "peaceful nuclear explosion," the United States performed better. Germany and Sweden only began tracking the program after this test, but had a fairly accurate understanding.

United Kingdom

Although accurate one year earlier, in 1966, British assessors first underestimated, then overestimated the Indian nuclear program. In the 1970s, the UK assessed India

correctly. The 1979 JIC assessment, which is the last in the period under study, again underestimated weapons intentions.

British intelligence assessments of India began in 1965. An October JIC report indicated that India was well on the way to developing a technical nuclear capability, but had not decided whether to activate that option:

> "India also has the capability to manufacture a nuclear weapon within twelve to eighteen months of a decision (which as far as we know has not yet been taken)" (JIC, 11 May 1966, 2)
>
> *Coming just a few months before India's internal governmental interest in developing its nuclear technology toward non-peaceful uses, the contemporary capability and intent appears to have been assessed correctly.*

An informal British assessment appeared in the prime minister's office in January of 1966. It surveyed the recent tenor of conversations in the government over the "past eighteen months, particularly in the context of the proposed non-proliferation treaty, to talk and perhaps to think of an Indian decision to go nuclear as something that may happen at any moment" (PM, 1974, 1). Instead, the danger of an Indian bomb may have passed:

> "I do not want to question India's nuclear potential or the very real danger that, in the end, an Indian Government will decide that they must go nuclear. But I think it is becoming increasingly questionable whether in fact this decision is likely in anything like as near a future as we have hitherto considered. Indeed it is arguable that a decision was a great deal more [...] about a year ago that it is now." (PM, 1974, 1)
>
> *This view reflected Indian intent and capability well, even if India would increase its weapons interest soon thereafter.*

A January 1969, JIC report predicted that India would not "develop a nuclear capability" over the next five years (JIC, JIC(A)(69) 46: 1970). While the report acknowledged that India's position on the NPT might, in part, reflect the desire to maintain a weapons' option, it was unlikely to exercise it.

> *If the five-year prediction is taken literally; it was correct. India's nuclear test took place five years after this estimate. Furthermore, India proved that it wanted to exercise its weapons option. Therefore, in toto, the assessment was an underestimation.*

In October of the same year, the JIC returned to the question of India's nuclear intentions. The report was accompanied by a deeper investigation of the country's nuclear capabilities and concluded that it was "unlikely that India has decided to start a nuclear weapons programme, or that she will do so over the next five years, unless she has reason to expect large-scale Chinese military hostilities. In this unlikely event, she would also no doubt seek to acquire the means to deliver nuclear weapons on a substantial number of major targets in China" (JIC, 1969b). British intelligence had detected no signs of preparations "either for a full-scale nuclear test or merely to detonate a nuclear device for demonstration purposes" and they promised policymakers that they could provide them with "six months' warning of an atmospheric test and a longer warning of a full-scale underground test" (JIC, 1969b). But if the explosion were "only to demonstrate an Indian ability to detonate a nuclear device, it could be carried out at short notice and the preparations probably concealed for some time" (JIC, 1969b).

> *The six months' warning was not given when, less than five years later, India detonated its first nuclear device. Arguably, that test fell under the "demonstration" caveat. However, the overall impression left by the*

assessment was that the policymakers need not worry about India building nuclear weapons; an unfounded assurance.

The Indian nuclear subject was discussed again in 1971. The possibility of a nuclear test under the guise of peaceful applications was now at the heart of the analysis.

> "[A]lthough the government has so far rejected the option of producing nuclear weapons, it has preserved the option of developing the capability to produce them and, in order to do so, has reserved the option of conducting nuclear explosions for peaceful purposes. The Indian Government is likely to maintain this position at least until it is prepared to undertake a nuclear test. A decision to conduct a test, however, would require at least a reconsideration of its present nuclear policy to take into account the advance toward a weapons capability which a test could provide. After a successful test, the government might find it increasingly difficult to resist domestic pressures for developing nuclear weapons and would find it virtually impossible to convince the international community that any continuing program did not involve weapons." (FO, 1971, 4)

While not a formal assessment, this memorandum moved the British understanding of Indian policy closer to its later manifestation.

The first post-PNE assessment appears in the archives in 1979, reporting an absence of "evidence of a nuclear weapon or explosive programme being initiated by Mrs. Gandhi" (MOD, 1978-1979, 1). Refraining from making its own predictions, the assessment focused on the options that the country's technical capabilities provided to the government and the role that Pakistan's nuclear decisions would play in determining Indian policy.

In May of the same year, a broad survey of proliferation trends identified India and Pakistan as the most likely candidates for weapons' acquisition. An arms race could

be triggered by "a determined Pakistani nuclear weapons" program (FCO, 1979b, 3).

> *Such a Pakistani program was well underway, but it is difficult to judge whether that was the main determinant of India's later nuclear weaponization.*

The final available declassified JIC assessment dates back to February 1982. It warned that if relations with Pakistan could not be stabilized,

> "India might also decide to resume its programme of"peaceful nuclear explosions", an option which Mrs Gandhi has never foreclosed. In this event resources might be diverted from the nuclear energy programme [...]" (JIC, 1982, 13)

> *While relations with Pakistan did not improve significantly, India did not resume explosive testing until 1998, Indira Gandhi would briefly authorize a PNE shortly after this assessment. Therefore, it is considered an accurate assessment.*

In summary, available British intelligence about India's nuclear program through the early 1980s show a pattern of occasional over- and under-estimates that nevertheless hewed closely to the contemporary Indian nuclear intentions. The country's technical nuclear capabilities were reported accurately.

United States

US assessments of India's program varied greatly in their accuracy as the country's capability advanced. In the mid-1960s, assessments were largely overestimates. In the lead-up to the PNE, the intelligence community underestimated India's intentions.

Thereafter, US assessments improved, but still struggled to understand when India would take steps toward building deployable warheads.

The possibility of an Indian nuclear arsenal first came to the formal attention of American intelligence in 1960.

> "India's concern would also be great, and the government might decide to undertake a nuclear weapons program. This would be more likely if, at the time, Nehru has been succeeded by a less neutralist government." (CIA, 1960, 12)

A vague assessment that managed to capture later developments.

A full assessment arrived in a November 1961 NIE that assessed global nuclear proliferation possibilities. For India, domestic and ideological factors were seen to work against a weapons' intention, while the pressure of Chinese nuclear development would push in the opposite direction.

> "There are indications that India is deliberately improving its overall capabilities in the nuclear field, possibly in anticipation that a future decision to develop an operational nuclear capability may be required. India has three nuclear reactors in operation, one of which–a 40 MW type that was constructed with Canadian assistance–is capable of producing quantities of plutonium sufficient for about one or two weapons a year." (CIA, 1961, 8)

A Chinese nuclear test would empower nuclear weapons' hawks, but even that may not be sufficient to sustain a weaponization effort over the long term:

> "The explosion of a nuclear device by Communist China would greatly strengthen the view in India, particularly in conservative and military

> circles, that there is a pressing need for an Indian nuclear capacity, if India is to avoid either bending to Communist Chinese pressure or being forced into a position of outright dependence on Western external support. Even so, we believe India would not decide to devote its nuclear facilities to a weapons program unless its leaders were firmly convinced that no broad disarmament agreements were possible, that Communist Chinese foreign policy was clearly growing more truculent. Such a decision would probably be more likely if, at the time, Nehru had left the political scene and had been succeeded by a right-wing Congress Party Government. If such a program were launched, the anti-nuclear voices would continue strong, and if the program appeared to encounter significant snags or involve excessive costs, the program might be cut back, if not actually abandoned." (CIA, 1961, 8-9)

If India were to decide in favor of a nuclear arsenal over the next year or two, it could hope for a small number of plutonium gravity bombs around 1967/1968 (CIA, 1961, 9).

> *Vague and speculative, the assessment was nonetheless a reasonably accurate reflection of contemporary Indian thinking about its nuclear weapons option.*

A 1963 NIE reported that this decision had not been reached and that it was "unlikely that such a program will be authorized so long as Nehru remains in power" despite ongoing tensions with China (CIA, 1963, 9). However, indications were clear "that India, which already has a fairly advanced nuclear research program including a plutonium separation plant under construction, is actively improving its overall capabilities in the nuclear field, possibly in anticipation that a future decision to develop an operational nuclear capability may be required" (CIA, 1963, 9). The country's

capabilities were constrained by international safeguards, but "India could reach a position of independence from present controls in about two years, after which it would take another two or three years for India to produce its first nuclear device" (CIA, 1963, 9).

> *The NIE was an underestimate because it assumed that India would first break its international agreements before using materials produced under its safeguards agreements with supplier countries.*

The State Department's intelligence bureau reported the community-wide consensus on India's nuclear capability one year later:

> "The estimate of the intelligence community is that India has the capability of producing and testing a first nuclear device in one to three years after a decision to do so. A weapon deliverable by the Indian Air Force's Canberra light bomber could probably be produced about two years after the first test. India now possesses all the basic facilities necessary to produce plutonium. A plutonium separation plant was completed in the first half of 1964. Technical evidence suggests that India is now in a position to proceed with a nuclear weapons research and development program at minimum cost and delay." (DOS, 1964, 27)

The assessment of intentions was less definite:

> "The present policy of the Government of India is to use nuclear energy for peaceful purposes only. This had been Indian policy for many years prior to the detonation by the Chinese Communists of a nuclear device. Since that event, Prime Minister Shastri and his colleagues have restated that policy on a number of occasions. It seems likely, however, that this policy will be kept under review during the months ahead." (DOS, 1964, 27)

This was a correct image of India's nuclear status.

In May of 1964, the same bureau offered an interpretation of incoming information about unusually short fueling cycles at an Indian reactor, which would be consistent with "production of weapons-grade plutonium" (INR, 1964, i). It was possible that the Indian government had taken the first step toward nuclear armament by having "available, on demand, unsafeguarded weapons grade plutonium, or at the least, the capacity to produce it" (INR, 1964, ii). If that were the reason for the fueling pattern, the research memorandum offered the following conclusion:

> "The next decision, to begin weapons R&D could conceivably be taken at any time. While this would involve a major political decision, the political environment in India for undertaking nuclear weapons development appears to be more favorable now than it was a year ago." (INR, 1964, ii)

Correct.

An October 1964 NIE surveying the "Prospects for a Proliferation of Nuclear Weapons over the Next Decade" committed itself to a probabilistic prediction: "We believe the chances are better than ever that India will decide to develop nuclear weapons within the next few years" (CIA, 1964b). By 1970, it could produce "about a dozen weapons in the 20 KT range" (CIA, 1964b).

This proved to be an overestimate.

India was included in a December 1964 CIA report on "Nuclear Weapons Programs Around the World."

> "There is a good chance that India will embark on a weapons program during the next few years, although shortly after the Chinese test the Indian Government reaffirmed its intention not to develop these weapons.

> We think pressure by political and military leaders is likely to eventually force a reversal of this decision. The Indians fear that possession of nuclear weapons will give the Chinese an overwhelming military superiority. They also believe that recognition of China as a nuclear power entitled to a seat at the disarmament negotiations table would be an irreparable blow to Indian political prestige. Finally, they are afraid that underdeveloped nations will attribute India's failure to develop nuclear weapons to scientific and economic backwardness rather than to a moral decision." (CIA, 1964a, 9)
>
> *Another overestimate during a period when India was not inclined toward weapons development.*

The State Department's intelligence bureau contributed a memorandum to accompany NPT negotiations in July of 1965.

> "New Delhi has so arranged its peaceful uses nuclear research program as to keep open the option of diverting it to weapons research and development, if a political decision to do so were made. There have also been indications that India has become somewhat less enthusiastic about piecemeal international arms control agreements that would inhibit future Indian freedom of choice, while leaving Communist China unrestrained in developing its nuclear arsenal." (INR, 1965, 7)
>
> *Correct.*

A second 1965 State Department report on the problem identified US and Soviet policy as a potentially powerful determinant of Indian weaponization: "It seems clear that a major factor in the Indian decision of whether to develop a nuclear capability or not is the question of assurances from the United States and the Soviet Union." (at Large, 1965)

Discussions over guarantees did not produce satisfactory guarantees, although it is difficult to know whether stronger guarantees would have led to Indian nuclear restraint.

An April 1966 NIE assessed the totality of the Indian nuclear policy. On the technical side, it concluded that "India has the capability to produce nuclear weapons" observing that the country "could test a first device within a year of a decision" (CIA, 1966, 7). According to the assessors, India's intent was more complicated to assess. The decision to abandon its anti-nuclear position would involve its relationship with the United States, China, and Pakistan.

This assessment was vague but accurate.

Following China's continuation of nuclear testing later that year, a National Security Council memorandum assessed that the Indian government would not follow domestic public opinion in favor of nuclear weapons' development, but that it would likely not be able to "hold the line" indefinitely (INR, 1966, 1).

A prescient understanding of India's future nuclear development.

In November 1967, in an assessment of nuclear-capable missile systems, the NIE once more identified the centrality of Chinese weaponization to shaping Indian choices and outlined the possible sources of fissile material:

"We estimated in NIE 4-66 that India could detonate a nuclear device about a year after the decision to do so, if it were willing to violate the safeguards associated with the Canada-India Reactor. Using plutonium produced in this reactor, India could probably develop a warhead for an IRBM in about four years after the first test. If India honored the safeguards on the Canada-India Reactor, it could probably construct a

> wholly indigenous reactor and produce missile warheads by the time it developed an operational IRBM. If India used the plutonium from the Canada-India Reactor, it could produce 10 to 20 weapons over a 10 year period at a cost of $200 to $300 million. If the Indians built a new and larger reactor not subject to safeguards, they might produce 50 to 60 weapons over a 10 year period at a cost of about $400 million." (CIA, 1967, 11)
>
> *While the technical analysis was likely accurate, the NIE gave readers little understanding of how likely these courses of action would be.*

State Department intelligence addressed reports of Indian nuclear test preparations in January of 1972, even if no direct physical evidence had yet been detected by the American intelligence collectors (INR, 1972, 2). The INR report offered no conclusion about Indian intentions, but "as capabilities are concerned, there is no question that India could proceed rapidly and with little difficulty to establish a modest nuclear weapons program" (INR, 1972, 1).

> *Correct.*

In August, a Special NIE on India's nuclear program shortened the time between a decision to conduct a test explosion and the detonation to "a few days to a year" (CIA, 1972, 1). The likelihood of such a decision was estimated at 50-50: "The chances are roughly even that India will conduct a test in the next several years and label it a peaceful explosion. It will certainly keep open the option to do so" (CIA, 1972, 2). In the event of such a test, India would "probably go ahead to make a small number of devices–which could be used as weapons" (CIA, 1972, 2).

> *The PNE, which CIA had forecast as equally likely to occur as it was not to, became reality. However, India did not proceed to develop a small*

weaponized arsenal after the test. Therefore, the SNIE was an overestimate.

In January 1974, the American embassy in New Delhi cabled that they had not seen evidence "to confirm an Indian decision to explode a nuclear device or to manufacture nuclear weapons or delivery systems" (Moynihan, 1974, 1). The cable concluded with the speculation "that Indian preoccupation with the economic malaise tends to militate against an early decision to exercise nuclear options." (Moynihan, 1974, 2)[3]

A clear underestimate.

Following India's test in May, in late October of 1974, another Special NIE surmised that "India has had all of the essential materials and facilities for production of plutonium weapons for about a decade" and surveyed the country's many sources of plutonium (CIA, 1974b, 16). In contrast to two years before, and informed by the PNE, the assessors now deemed Indian nuclear armament more likely than not–and that it may already have been underway:

> "As things now stand—given India's aspirations, its possession of fissionable materials, its potential to develop strategic strike forces and the presence of a nuclear power directly to its north—it is likely that India will go forward with a covert weapons program if it has not chosen already to do so. It might begin such a program with the intention of keeping it small. But it is likely that, over time, there would be increasing demands for an effective operational force, particularly as the inventory of weapons accumulated." (CIA, 1974b, 20)

[3]Following the test, the US mission to NATO interpreted those same economic problems as a reason for the test itself: "The timing of the test may also have been keyed to boost sagging Indian morale in the face of increasing domestic economic problems and political discontent" (DOS, 1974, 1).

The SNIE provided guidance on what the next technical steps, taken by India, would mean for its weapons' intentions:

> "An unweaponized device would be more consistent with India's public posture of developing nuclear explosives for peaceful purposes only. And test data are a key element in shaping weapons designs. If the Indians do not have a weapon but seek one rapidly, they probably could begin accumulating a stockpile by 1976. But a more effective approach would be several more tests, spread over a two or three year period, in order to develop a lighter, more efficient weapon." (CIA, 1974b, 17)

US intelligence reacted to the surprise test with eager overestimation of India's future nuclear weaponization. India would neither continue testing to fit weapons onto missiles, nor would it initiate a more modest weapons program.

The publicly accessible record did not include another post-1974 assessment of India's nuclear program until June 1981. An INR assessment led with the finding that "India and Pakistan have decided to keep the option of developing nuclear weapons, and signs of preparation for underground nuclear tests have been identified in both countries" (Andersen & Cohen, 1981, i). Despite these concrete indicators, the assessors saw preparations as the maintenance of an option:

> "Security considerations, prestige, status, and political factors are important in sustaining domestic support for a nuclear weapons option. Both India and Pakistan believe that if they fail to keep this option open, they may be placed in a weakened strategic position vis-a-vis potentially threatening neighbors" (Andersen & Cohen, 1981, i).

The memorandum offered no predictions for likely developments; instead, it articulated the negative consequences of a South Asian nuclear arms race for US policy.

The following July, an NIE expanded the theme of Indian nuclear policy being driven more by Pakistan than China: "Pakistani nuclear activities have caused India to activate its own nuclear explosive development capabilities, which heretofore have been viewed by New Delhi primarily as capabilities for developing a nuclear deterrent against China" (CIA, 1982b, 16). Around the same time, the CIA prepared a study, perhaps as an input paper for the NIE, of India's nuclear capabilities. Unfortunately, the study's declassified version is heavily redacted, including the overall assessment (CIA, 1982a).

In summary, US intelligence assessment of Indian nuclear capability and intent varied substantially. Complacency in the two years leading to the 1974 test explosion gave way to a serious overestimate in response.

Federal Republic of Germany

The West German *Bundesnachrichtendienst* (BND) kept close watch on Indian nuclear progress, although it has not made as many of its assessments available to the public as the American and British governments. West German assessments were also far less inclined to offer future prognoses.

A few days after India's 1974 PNE, the BND provided a background paper on India's nuclear program, focusing on technical capability over Indian intent. It noted that India would not be able to produce more than 10 kg of plutonium until 1976, and that it intended to enrich uranium with centrifuges (Möllenberg, 1974, 1-2).

> *This was an overestimate of what India would later realize in its fissile material production capabilities after the test detonation.*

The second BND assessment of India followed less than two months after the PNE, in a BND contribution to the chancellor's briefing. The memorandum noted that fissile material had been produced and reprocessed in India for several years, providing the

foundation for the production of nuclear weapons. "These possibilities are being used and led to the first Indian nuclear test in May 1974" (BND, 1974b, 1-2).[4]

Without adding much analysis or prediction, the assessment was largely accurate.

Nine years after the Indian test, German intelligence provided a brief to the foreign minister's visit to India. The BND noted a recent increase in the prime minister's references to matching Pakistani efforts toward nuclear acquisition and that an unconfirmed intelligence report had recently arrived about an intensification of nuclear weapons' development (Möllenberg, 1985b, 1-2).

This was likely correct at the beginning of Rajiv Gandhi's term.

In October of the same year, the chancellor's briefing included a discussion of India's nuclear energy program. It also reported that a decision had been taken earlier in the year to be able to match any Pakistani test immediately and that there had been no new reports about the possibility of Indian work toward a fusion weapon (Nauders, 1985, 1-2).

Currently available public accounts of Indian nuclear decision-making does not include information about whether Indian policy explicitly aimed to match any Pakistani test.

To summarize, the Federal Republic's BND reported on India's nuclear program more than it assessed it. As a result, it did not give itself much opportunity to be wrong. This was not the result of poor collection capability, as the reporting was based on detailed technical knowledge and human intelligence.

[4] "Da auch Kernbrennstoff im eigenen Land gewonnen und aufgearbeitet wird, sind seit einigen Jahren alle technischen Voraussetzungen für die Herstellung von Kernwaffen gegeben. Die Möglichkeiten wurden auch genutzt und führten zum ersten indischen Nukleartest im Mai 1974" (BND, 1974b, 1-2).

Sweden

In 1971, Sweden's FOA evaluated possible Indian pathways to nuclear arms production in a lengthy report. Detailing the different pathways to weapons available, the report was less definitive in interpreting intentions:

> "All the necessary materials and facilities to produce plutonium exists in India. India has been pursuing a policy that permits freedom of action when it comes to nuclear weapons. For example, it has not signed the 'non-proliferation agreement'; but on the other hand, signed and ratified the 'partial test ban treaty', which does not prohibit nuclear explosions underground." (B Andersson & During, 1971)
>
> *India's technical status was accurately reflected in the report. However, it offered little analysis of Indian intentions that would give the technical analysis substantive meaning.*

In summary, Sweden had an accurate understanding of Indian pre-PNE capability, but had no insight into the country's intentions.

German Democratic Republic

By contrast to their West German rivals and Sweden, the GDR's foreign intelligence agency, the HVA, delivered correct assessments of India's nuclear program in 1970, 1974, and 1989.

In July of 1970, the HVA circulated a long assessment of Indian nuclear intentions and capabilities. The source for the assessment was a document from the West German government. It noted that "India has the personnel and technology to produce nuclear weapons in about three years" and that the decision to do so would be largely the result of domestic political factors (HVA, 1970, 82-5).

This was correct.

Two months after the PNE, the HVA reported that electoral politics explained the timing of the nuclear explosion. The intent, however, was to advance the military potential of India's nuclear capability, which now included the ability to produce 30 small-yield weapons per year (HVA, 1974, 27).

This was also correct.

Before being disbanded, the HVA produced its last assessment of India's nuclear weapons potential in 1989:

> "India's nuclear weapon potential currently includes 8 aircraft bombs with a yield of about 12 - 30 kilotons. They are stored in disassembled form and preparations for military use take about 12 hours. Research and development work for the creation of nuclear warheads for operational-tactical rockets with a yield of about 15 - 20 kilotons. Assuming the Indian government's decision, their production could begin within 6 months. India is able to produce around 40 kg of weapons-usable plutonium yearly at the nuclear research center Trombay. It currently possesses reserves of about 140 kg. The country is able to advance its nuclear weapons technology indigenously and to develop new nuclear weapons" (MfS, 1989, 238-9).[5]

The assessment was likely correct, but the accuracy of these figures have not yet been evaluated.

[5] "Das Kernwaffenpotential INDIENS umfaßt derzeit 8 Fliegerbomben mit einer Sprengkraft von 12 - 30 Kilotonnen. In demontierter Form gelagert, dauert ihre Vorbereitung für den militärischen Einsatz etwa 12 Stunden. Kurz vor dem Abschluß stehen Forschungs- und Entwicklungsarbeiten zur Schaffung nuklearer Sprengköpfe für operativ-taktische Raketen mit einer Detonationsstärke von 15 - 20 Kilotonnen. Einen entsprechenden Beschluß der indischen Regierung vorausgesetzt könnte ihre Produktion binnen 6 Monaten anlaufen. Indien ist in der Lage, im Kernforschungszentrum Trombay jährlich ca. 40 kg waffenfähiges Plutonium herzustellen. Es verfügt derzeit über Vorräte von 140 kg. Das Land ist in der Lage, seine Kernwaffentechnologie auf eigener Grundlage weiter zu vervollkommnen und neue Kernwaffen zu entwickeln." (MfS, 1989, 238-9)

In sum, East German assessment of India's program was consistently accurate. Of course, a major source of intelligence was its penetration of West German circles.

Summary

India's nuclear program was a difficult intelligence target. The capabilities were tracked with accuracy by all proliferation assessors. India's fluctuating intent and non-linear path to nuclear weaponization, which did not occur until after the study period's conclusion, was harder to capture.

4.3.2 Argentina: An arms race without participants

Argentina never developed nuclear weapons and likely never intended to. Elements of the government, however, pushed for the creation of an option. Interest in the option shaped the desire for independent control over the full nuclear fuel cycle, which included a clandestine uranium enrichment facility. All intelligence assessors missed the facility's construction and operation. Despite these idiosyncrasies of the case, most intelligence assessors performed well.

The Argentine nuclear program

Argentina's historical nuclear intentions are disputed. As in the West German case in the next chapter, the scholars who maintain that Argentina attempted to acquire nuclear weapons do so in the process of arguing that US pressure caused the country to refrain (for example: Sokolski, 1996). While much of the evidence of Argentine behavior is consistent with a proliferator–including the clandestine construction of a uranium enrichment facility–these activities are more likely to have been the result of idiosyncratic political reactions to the US' nonproliferation policies (Hymans, 2001). This ambiguity makes judging contemporaneous intelligence assessments more difficult, but not impossible, as it certainly applies in the German case.

Despite some updates based on more recent scholarship, this section follows the contours of Bleek (2015)'s coding:

> "While it is plausible that it explored nuclear weapons in the 1950s or 1960s, there is no evidence to support this coding. Its nuclear efforts ramped up in the late 1960s and early 1970s, as it moved to acquire a robust civilian nuclear power capability with potential applicability to the development of nuclear weapons. Exploration is coded as 1978, when Argentina decided to construct both a plutonium reprocessing plant and a clandestine uranium enrichment program. These could be the basis for nuclear weapons pursuit, but there is no evidence that this was the case. This paper does, however, judge them sufficiently compelling circumstantial evidence of at least an exploratory interest in nuclear weapons." (Bleek, 2015)

During the period of this study, Argentine nuclear capabilities and intentions can be divided into three phases: from 1950 to 1977, 1978 to 1983, and 1983 to 1990.
In the first phase, Argentina established a National Commission for Atomic Energy (Comision Nacional de Energıa Atomica, or CNEA) in 1950, "under the direct control of the presidency and entrusted with the management of nuclear activities" (Coutto, 2014, 304). CNEA initially focused on purchasing nuclear reactors from abroad. Plutonium reprocessing had succeeded in the laboratory in 1967 (Coutto, 2014, 312). Investment in nuclear technology grew rapidly under the military junta, which assumed control in 1976 (Coutto, 2014, 305). Argentina's nuclear program expanded to pursue a secret fissile material production capability in 1978 (Hymans, 2001, 177). There was also an effort to produce "metallic plutonium"–the form it would need to take for an explosive purpose–between 1980 and 1982 (Coutto, 2014, 312). None of these activities were under safeguards.

Three political developments in 1980 mark this period. The first was Argentina's defeat by the United Kingdom over the Falklands Islands accelerated its nuclear work (Coutto, 2014, 317). The second was a process of regime transition was initiated. Third, Argentina concluded the first nuclear agreement with its Brazilian rival (Coutto, 2014, 315).

While many scholars have taken the secret construction of an enrichment facility at Pilcaniyeu to have been an indication of weapons intent, the configuration would not have allowed for the production of HEU and may have been the "reckless" result of "expressive nationalist policies in the nuclear field" (Hymans, 2001, 176). The low-enriched uranium was likely intended for naval propulsion (Hymans, 2001, 178).

In 1983, marking the final phase of the study period, Argentina had developed the capability to enrich uranium. However, due to "Alfonsın's arrival to power a few months later, the CNEA had its autonomy reduced and the nuclear programme - at that time much more advanced than the Brazilian one - suffered deep cuts to its budget, and virtually stagnated with the economic crisis" (Coutto, 2014, 305).

Scoring assessment accuracy

The U.S. intelligence community managed to simultaneously overestimate the intentions behind the program and undestimate the capabilities. British intelligence underestimated both. West German and Swedish estimates focused more on capabilities, which were largely characterized accurately, than on possible nuclear weapons motivations.

Federal Republic of Germany

West German assessments of the Argentine nuclear program are available from 1974 and 1985. These were correct, but raised possibilities that overestimated the weapons intent and capability.

In the first available assessment, the BND evaluated Argentina as part of a global proliferation survey in July 1974:

> "The state in South America with the most advanced nuclear research and technology possesses not only several research reactors, but also the first power production reactor, from which plutonium can be extracted beginning in 1975. Fuel is produced domestically. It is especially important that Argentina has a reprocessing facility–even if it is small–with which to extract plutonium. For this reason, Argentina has possibly already generated plutonium not under international safeguards from its largest research reactor." (BND, 1974b, 2-3)[6]

The possibility that Argentina had already produced unsafeguarded was not an accurate reflection of reality. That makes the assessment a mild overestimation.

In July 1974, the Federal Republic's intelligence service composed a formal assessment of Argentina's nuclear potential. The report surveyed the country's technical capability, to which a German firm had made the biggest contribution, and stopped short of making any definite predictions.

> "In its nuclear program, Argentina is the most advanced country in Latin America. It owns several research reactors and has constructed the first nuclear power plant in Latin America (a heavy water reactor from the company Siemens near Atucha, with 320 MW electric power). The reactor went critical for the first time in January of 1974 and has delivered

[6] "Der Staat Südamerikas, der mit seiner Kernforschung und Kerntechnik am weitesten fortgeschritten ist, besitzt nicht nur mehrere Forschungsreaktoren, sondern auch den ersten Leistungsreaktor, aus dem ab 1975 Plutonium entnommen werden kann. Der Brennstoff wird im eigenen Land gewonnen. Besonders wichtig ist aber, daß Argentinien auch über eine - wenn auch kleine - Wiederaufarbeitungsanlage für die abgebrannten Brennstäbe verfügt, mit deren Hilfe Plutonium extrahiert werden kann. Aus diesem Grunde hat Argentinien möglicherweise bereits international nicht kontrolliertes Plutonium aus seinem größten Forschungsreaktor gewonnen."

electricity since the first quarter of 1974. Fuel for the nuclear power station comes from its own uranium resources; a small reprocessing facility is available for the separation of the burned-up fuel rods. There is no information about international controls of the Argentinian fuel cycle. The technical preconditions for the production of plutonium are therefore available (around 80 kg annually from Atucha as of 1975). Argentina must be seen - next to Israel and the Republic of South Africa - as the third non-industrialized state that could produce its own nuclear weapons in a relatively short period of time." (BND, 1974a, 156-7)[7]

The characterization of Argentina's technical capability was accurate. Surprisingly, the BND claimed uncertainty over which international safeguards applied.

In July 1985, the BND returned to the topic of Argentine nuclear activities. It reported work on a reprocessing facility that was not expected to be completed before 1987, after which Argentina would be technically capable of producing nuclear weapons (Möllenberg, 1985a, 1). However, only spent fuel under international safeguards was available.

The assessment amounted to a serious underestimate because it neglected to report on Argentina's secret uranium facility.

[7] "Argentinien ist das im Atomprogramm am weitesten fortgeschrittene Land in Lateinamerika. Es besitzt etliche Forschungsreaktoren und hat das erste Kernkraftwerk Lateinamerikas (einen Schwerwassereaktor der Firma Siemens bei Atucha mit 320 MW elektrischer Leistung) errichtet. Der Reaktor wurde im Januar 1974 erstmals kritisch und liefert seit dem I. Quartal 1974 elektrischen Strom. Der Brennstoff für das Kernkraftwerk stammt aus eigenen Uranvorkommen; für die Weiterverarbeitung der abgebrannten Brennstäbe steht eine eigene kleine Wiederaufbereitungsanlage zur Verfügung. Über eine internationale Kontrolle des argentinischen Brennstoffkreislaufs ist nichts bekannt. Die technischen Voraussetzungen für die Produktion von Plutonium (ca. 80 kg pro Jahr aus Atucha ab 1975) sind daher gegeben. Argentinien muss - neben Israel und der Südafrikanischen Republik - als der dritte Nicht-Industrie-Staat angesehen werden, dem es in verhältnismässig kurzer Zeit gelingen kann, eine eigene Kernwaffe herzustellen. Argentinien hat den Atomsperrvertrag bisher nicht unterzeichnet." (BND, 1974a, 156-7)

In summary, in the eleven years that West German intelligence observed Argentina's nuclear program, it provided its policy customers with a largely accurate picture of capability. The main exception was the secret uranium enrichment facility. The BND was reticent to assess intentions, but did not downplay the possibility that Argentina would want to acquire nuclear weapons.

German Democratic Republic

The East German HVA's first assessment of Argentina's nuclear weapons' potential was circulated to policymakers in May of 1980. Unfortunately, only a summary survives and it says little about its conclusions (HVA, 1980). In December of the following year, another such assessment was created that included Argentina as a leading proliferation candidate (HVA, 1981, 59-60). In its 1989 global overview, the HVA noted that while Argentina would have the capability to produce HEU-based nuclear warheads in the coming years, the civilian government had suspended the intended nuclear weapons program (MfS, 1989, 244). Inaccuracies are absent from this sparse documentary record.

Sweden

Swedish assessments from FOA are available from 1981 and 1984. Like the West German assessments, they were detailed in describing technical capability and the uses to which it could be put. Matters of contemporary policy intent were not assessed. A February 1981 assessment discussed the Argentine program in depth:

> "Argentina obviously has the possibility within a relatively near future to be able to manufacture nuclear devices and nuclear weapons. The amount of fissile material in the form of reactor plutonium in irradiated reactor elements Atucha 1 (under safeguards) can be estimated to the range of 900 kg, equivalent to 70 explosive devices. With a simplified reprocessing

procedure, the technique has been demonstrated on a smaller scale in a facility outside safeguards, it may be possible for Argentina to within a period of less than two years be able to obtain materials for a first device. Argentina also has the opportunity to change the running schedule for Atucha 1 for production of weapons-grade uranium to a maximum of 8 explosive devices. This requires a relatively large reprocessing plant with a construction time of 4-5 years. A standalone program with production reactor based on heavy water may be the earliest in function during the latter half of the 1980s. Possible alternative routes over production reactor based on graphite or uranium enrichment plant for something faster result in access to fissile material for nuclear explosive devices." (Andersson, 1981, 63-4)

The technical assessments were correct, but may have overestimated Argentina's ability to combine them into a weapons option in the short time described by the Swedish analysts.

In 1984, FOA updated the assessment:

"With this background, Argentina obviously have the possibilities within a relatively near future to be able to manufacture nuclear devices and nuclear weapons. The amount of fissile material in the form of reactor plutonium in irradiated reactor elements Atucha 1 (under safeguards as before 1983 been somewhat flawed and therefore been criticised) can be estimated to be 1200 kg, equivalent to a 100-number charges. With a simplified reprocessing procedure, the technology has been, on a smaller scale, developed in a facility outside safeguards, it may be possible for Argentina to within a period of less than two years be able to obtain materials for a first charge. Argentina also have the opportunity to change

> the running schedule for Atucha 1 for production of weapons-grade uranium to a maximum of 200 kg/year, equivalent to 20-25 charges. This requires a relatively large reprocessing plant with a construction time of 4-5 years. A standalone program with production reactor based on heavy water may be the earliest in function during the latter half of the 1980s." (Bengt Andersson & Strömberg, 1983)
>
> *The Swedish estimate of Argentina's plutonium route was possibly an overestimate, but it overlooked the country's far greater efforts in producing uranium.*

In summary, Swedish assessments focused on Argentina's technical capability. Like the other intelligence agencies, it missed Argentina's secret uranium enrichment facility.

United Kingdom

British assessments of Argentina are available from 1979 and 1980, with pending declassification requests for additional materials. These persistently underestimated Argentina's nuclear intentions and capabilities.

Argentina's nuclear program appears for the first time in British assessments in May of 1979. Describing the country as "one of the countries in the developing world which will arrive soonest at the point where she can produce much of her own nuclear equipment" and nearing the "capability to make nuclear weapons," there was "no evidence of any intention on the part of the present Government to embark on a weapons programme" (FCO, 1979a, 3).

> *Most likely correct, but depending on one's interpretation of CNEA's activities during these years, plausibly an underestimate.*

An assessment in April 1980, described Argentina as "a country capable of creating a nuclear weapons option, and Argentine government has consistently sought to avoid formal renunciation of it" (FCO, 1980b, 2). The following month, both Brazil and its rival were seen as proliferation candidates, even in the absence of "current evidence of weapons intentions" (FCO, 1979b, 3). In July, Argentina's impending complete and independent fuel cycle was again flagged as a proliferation concern (FCO, 1980a).

Same as above.

To prepare for a meeting with a Swiss representative in July 1980, a British official was provided with an assessment of the nuclear program that Swiss companies were supplying. Argentina was "a country capable of creating a nuclear weapons option, and Argentine Government has consistently sought to avoid formal renunciation of it" (FCO, 1980c, 2).

Correct, though not especially informative.

In October, the nuclear assessment office warned that they had a "more skeptical view of the Argentine position":

> "We would accept that she has no current military nuclear programme. There are however powerful forces working within the regime there against formal renunciation of the nuclear option." (FCO, 1980b, 1)

These 1980 assessments may have underestimated.

Assessments following the Falklands War are less accessible. Freedom of Information requests to the Cabinet Office are pending and will be updated when they become available.

United States of America

Between 1969 and 1985, American intelligence assessments correctly described Argentina's nuclear aspirations. Exceptions included a persistent overestimate of the country's interest in a nuclear arsenal and a failure to detect a secret uranium facility in the early 1980s.

Argentina's nuclear position was first discussed in the context of the campaign to gather signatures for the NPT, in 1969 (Sonnenfeldt, 1969, 1). A deeper examination of its capabilities appeared in an October 1974 global assessment, which concluded:

> "Argentina's nuclear program is fairly new, but it is being pursued vigorously with an eye toward independence of foreign suppliers and controls. If Buenos Aires dedicated itself to the earliest possible achievement of a nuclear weapon and received continuing foreign assistance in building the necessary facilities, Argentina could have an initial device in the early 1980s." (CIA, 1974b, 32-3)

In December the following year, a CIA paper identified Argentina as being among the "current class of threshold states and each could conceivably graduate to nuclear explosives by or before 1985" (CIA, 1975, 9).

A November 1977 intelligence briefing mentioned that "Argentina's rush toward nuclear reprocessing raises the spectre of its becoming a member of the nuclear club" (Todman, 1977, 63).

> *These short assessments were accurate.*

An assessment, found in National Security Council files of September 1978, described Argentine nuclear intent and capability as follows:

> "Argentina has the most advanced and comprehensive nuclear energy program in Latin America. It seeks to become self-sufficient in nuclear energy,

find to become the first exporter of nuclear technology in the hemisphere. It has based its power program on reactors fueled by natural (unenriched) uranium in order to avoid dependence upon suppliers of enriched fuel. Natural uranium reactors require heavy water to operate, and while Argentina can produce small quantities of this material, it cannot produce heavy water in the amounts required to support its ambition of complete independence. Acquiring heavy water production technology is therefore of critical importance to Argentina, and adequate technology is available only from the U.S. and Canada. However, technology of a lower order might be available elsewhere." (NSC, 1978, 128)

Whether this meant that Argentina would seek nuclear weapons was not conclusively predicted:

"Beyond self-sufficiency in its nuclear energy program option, the ultimate intentions of the Argentine leadership in the nuclear field are not clear. Argentina's decision to ratify the Treaty of Tlatelolco represents a limited but welcome step to accept greater restrictions on its freedom of action. At the same time, Argentina is continuing with its plan to construct a sizeable reprocessing plant, and maintains that it is not prepared to forego this program unless parallel action is taken by Brazil. This plant would give Argentina an ample source of safeguard-free plutonium to support a weapons program as early as 1981. There is no evidence of a decision by the government to carry out such a program, but the capability is there." (DOS, 1978, 20)

No errors can be found in the assessment, which confessed its uncertainty about Argentina's weapons intentions.

Following the Falklands War, American intelligence took a much closer look at Argentine nuclear policies than it had before.

> "Argentina's determination to complete an unsafeguarded nuclear fuel cycle which could serve military as well as civilian purposes has been amply demonstrated in recent years. The momentum to achieve this goal appeared to be intensifying in the months prior to the Falklands conflict. The defeat in the Falklands undeniably has raised fundamental issues of sovereignty, prestige, and security that will preoccupy the Argentine military leaders and any possible successor regime for several years to come [...]. The immediate impact of the Falklands defeat cuts two ways. Emotionally, it has probably increased the desire to develop a nuclear weapons option. Politically and economically, however, it has reduced Argentina's capability to fulfill this desire. Consequently, we have great uncertainty concerning the future course of Argentina's nuclear policy decision making, especially over the coming months and possibly for the next several years [...]. We judge, nevertheless, that unfavorable economic prospects and political turmoil will not prevent the Argentine Government from achieving the technical capability to make nuclear explosives before the end of this decade." (CIA, 1982c, 3-4)

Viewed in total, Argentine incentives were assessed to be tilted against weaponization.

> "Whether Argentina will choose to explode a nuclear device in the next five years is difficult to predict, although at present, we would judge it to be unlikely. Elements of the Argentine military probably support nuclear testing and weapons development for national security purposes, but considering the nature of Argentina's defense requirements the military utility

of such a program probably would not be worth the effort." (CIA, 1982b, 21)

American intelligence missed Argentina's clandestine uranium enrichment facility just like the others. However, it correctly assessed the limitations on incentives for nuclear weapons push and the financial constraints.

Another NIE was commissioned in July of 1984, intended to investigate the effect of the democratic transition on the country's nuclear policies. One open question discussed was whether these decisions would remain the purview of the military. In any event, Argentina was believed to have a reprocessing capability in two to three years' time (CIA, 1984, 3).

"We believe that Alfonsin will not open the new enrichment facility at Pilcaniyeu to safeguards inspections by the International Atomic Energy Agency (IAEA). The announced objective of an annual production capability of 500 kilograms of uranium enriched to 20 percent, if achieved, would give Argentina the option to produce weapons-grade material. Once the facility becomes operational, it could take as little as a year and a half to two years to produce sufficient highly enriched uranium for a nuclear device if Pileaniyeu were the only source of enrichment, and six months or less if either 20-percent or 3-percent enriched uranium were obtained from foreign sources. An important constraint on the timing is the difficulty Buenos Aires is likely to encounter in seeking to import the specialized equipment needed to complete its plan. We believe that any effort by Alfonsin to accede to international nonproliferation pressures would be effectively blocked by domestic criticism that he would be sacrificing nuclear independence. Despite early encouraging signals on ratification of the Treaty of Tlatelolco, both Alfonsin and Foreign Minister Caputo are

> now reported as saying that Argentina will not ratify the treaty in the near future. We believe the acceptance of comprehensive safeguards is also unlikely." (CIA, 1984, 4-5)
>
> *The NIE missed that much of the program had been shut down. The prediction about Argentina's unwillingness to sign the regional nonproliferation treaty and subject itself to safeguards was unduly pessimistic, qualifying this as an overestimation.*

In November of the following year, the CIA circulated another assessment of Argentina's nuclear policy. It was still not able to provide a definite assessment of the weapons' dimension, as it lacked evidence of the intentions that animated the decision-making:

> "Thus far, the nuclear program has been motivated by a need for prestige more than a need for energy independence or weapons. Nevertheless, important elements of Argentine society support the nuclear program at least in part because of the weapons options it provides. [...] Argentina could have the essential elements to produce unsafeguarded fissile material for nuclear weapons by 1990, although financial cutbacks and revisions by the Alfonsin government could lengthen the timetable. Further, Argentina is not a party to the international nonproliferation regime. These actions have reinforced international suspicions concerning the ultimate objective of its nuclear program. We judge that Argentina will have the capability to develop nuclear weapons at that time, but we have no evidence of its intention to do so." (CIA, 1985, iii)
>
> *To the CIA's credit, there was no evidence of such weapons intent to be found.*

Summary

Argentina's was a difficult program to assess. All intelligence agencies focused on a possible plutonium route, missing the secret uranium enrichment facility. Because the facility was likely not intended to produce highly enriched uranium for explosive purposes, this was not necessary to arrive at a correct assessment.

4.3.3 Findings

I1: States announcing their intentions through IOs can be assessed with greater accuracy.

The evidence for and against this hypothesis is *mixed*. Formal international commitments helped intelligence agencies at some points–and were misleading in others. India's refusal to agree to join the NPT's nonproliferation limitations helped foreign intelligence officers understand that an Indian nuclear armament was a possibility, even if it did not assist them in pinning down the time of its development. The same was true for the country's reluctance to accept expansive safeguards on imported nuclear equipment. However, the belief that India would not use this safeguarded material for explosive purposes led to the American and British underestimate as the 1974 test detonation approached.

As noted in the timeline above, British intelligence treated the implications of India's international diplomatic posture in particular depth. In October of 1969, for instance:

> "There is no indication that India is preparing either for a full-scale nuclear test or merely to detonate a nuclear device for demonstration purposes. She has signed the Partial Test Ban Treaty, but could test underground. We would expect to get six months' warning of an atmospheric test and much longer of a full-scale underground test." (JIC, 1969a, 5)

The same estimate shows how the safeguards were believed to be a firmer barrier than they turned out to be:

> "We believe that any significant buildup of weapons would take several years from the explosion of a prototype and would involve the use of the planned power reactors, as well as the CIRUS research reactor at Trombay, for military purposes. Safeguards attached to the purchase of the first two power stations should make this difficult if not impossible in those cases." (JIC, 1969a, 5)

U.S. intelligence shared this belief that India would not break safeguards on internationally-supplied materials and equipment:

> "These reactors probably will be safeguarded to prevent their use in a weapons program. The rate of Indian plutonium accumulation could be increased after 1970, however, as other, unsafeguarded reactors become operational." (CIA, 1964a, 9-10)

After the test, U.S. intelligence no longer referred to international commitments to guide its analysis.

Argentina similarly refused to sign the NPT or allow safeguards on much its nuclear program, from which many of the overestimates arose.

I2: States holding open debates about nuclear weapons acquisition are harder to assess.

The evidence does *not support* the hypothesis in either case.

While there was an active and public debate in India about whether to exercise its nuclear weapons option, there was no indication that intelligence assessors struggled with understanding who would make such a decision–or how it would be taken. In the aftermath of the 1974 test explosion, the United States intelligence community produced a post-mortem that suggested a lack of attention to Indian intentions rather than being overwhelmed by a cacophony of voices:

> "The intelligence community had long known that India was capable of producing and testing a nuclear device. It had also estimated as far back as 1965 that India would 'in the next few years' detonate a nuclear device. Its inability to predict the actual event was due essentially to two factors; inadequate priority against an admittedly difficult target, and lack of adequate communications among those elements of the community, both collectors and producers, whose combined talents were essential to resolving the problem. [...] The few reports which did provide indications of Indian intentions were given scant attention by the production analysts and were inadequately followed up by the collectors. Compounding this lack of priority was the general assumption by [...] collectors that the other guy was primarily responsible for producing hard evidence of Indian intentions." (CIA, 1974a, 1)

There is little historical evidence to know whether Argentina debated its nuclear options within the regime, but there was certainly no public debate that could have confused the assessors.

I3: States with unconstrained decision-making are harder to assess.

The Indian and Argentinian cases provide *mild support* for the hypothesis. In India, changes of government introduced uncertainty, but this was not correlated with assessment errors. On the other hand, the Argentinian junta's ability to implement a clandestine nuclear program quickly and quietly seems to have been a factor in American and British intelligence misestimations.

I4: The proliferation risk of autocratic states will be overestimated.

The evidence from the two cases *supports* this hypothesis. The democracy was generally underestimated while the autocracy was generally overestimated.

I5: The proliferation risk of states in competitive security environments will be overestimated.

Strong support for the hypotheses can be found in the empirical record in both cases. India and Argentina were in rival security relationships with other regional states. Indian intent was presumed to be conditional on Chinese and Pakistani behavior, including developments in their nuclear programs. The West German BND, for instance, referred to India wanting to be able to match Pakistani tests. Though similar linkages, British and American assessors also created for themselves an additional dimension of complexity. On the other hand, Swedish and Swiss assessors speculated less about these dynamics and thereby kept closer to the target program's motivations.

The same was true for Argentina, whose intentions were presumed to be linked to those of Brazil. If the most recent scholarship on the program is accurate, this nuclear latency arms race was largely taking place in the minds of Western intelligence assessors. However, they overinterpreted the rivalry's nuclear dimension less than their policymakers.

4.4 Process tracing

While the individual hypotheses did not fare particularly well in the preceding case study tests, the general difficulty of assessing nuclear intent emerges with clarity. Tracing the process of assessing the intentions of West Germany provides the necessary detail to further unpack these difficulties.

Measuring the accuracy of intelligence assessments requires an accurate historical account of the target country's contemporaneous nuclear capabilities and intentions. West Germany's precise record is contested, as demonstrated by two recent articles that have arrived at opposing conclusions:

> "[N]ew historical research shows that Bonn had neither the intention nor the interest to 'go nuclear'" (Lutsch, 2015)

> "Germany sought to acquire an independent nuclear deterrent from 1956 to 1963 [and] fought to retain its weapons option from 1964 to 1969" (Gerzhoy, 2015)

In light of this disagreement, judging the accuracy of intelligence assessments correctly requires a detailed timeline of German nuclear policies. This timeline follows below.

4.4.1 1950 to 1954: Allied constraints

The first policy decision concerning the young Federal Republic's stance on nuclear weapons was made during a secret meeting of former Wehrmacht officers at Himmerod Abbey in October 1950. Without a great deal of discussion, the preparatory meeting for the founding of the Bundeswehr concluded that the military uses of nuclear weapons should not be considered in rearmament (Fischer, 1993, 107). Prior to the conclusion of negotiations on the end of Allied rule and the founding of the European Defense Community (EDC) a year later, the Allies had agreed among themselves not to permit the Germans any form of nuclear armament. This agreement was codified in the EDC, which Chancellor Adenauer was instructed to reiterate with a separate public pledge (Fischer, 1993, 108). This pledge was restated and specified in a letter of May 1952 when Adenauer wrote to the Western Allies stating that his government would legislate to ban the "development, production, and possession of nuclear weapons" and to limit the import of nuclear fuel to half a kilo per year (Kuesters, 1994, 527).

In the fall of 1953, the first US tactical nuclear weapons arrived in Germany (Fischer, 1993, 106). Lacking information about the weapons, but seeing their growing importance in the Western alliance's defense against the Soviet Union, Adenauer began to push for some form of German participation in the Alliance's nuclear decision-making process (Fischer, 1993, 130). This demand was not well received. The German nuclear question subsequently became central to the October 1954 London Foreign Ministers'

Conference, which was held in preparation for the Paris Treaties. In the closing plenary, Adenauer agreed to "voluntarily" renounce the manufacture of nuclear weapons on German territory and to refrain from the production of weapons-usable fissile material (Fey, Melamud, & Mueller, 2014, 467). This renunciation made entry into NATO possible, as well as the establishment of de facto sovereignty and the use of nuclear technology for research and energy purposes.

The intended meaning and contemporary interpretation of this declaration was contested throughout the Cold War and continues to fuel scholarly debate. In one interpretation, Adenauer's declaration did not intend to leave the possibility open for manufacture outside of the Federal Republic's borders and only reflected a reaction to the era's proposals for demilitarized zones. This interpretation seemed to be the majority view among conference participants and is shared by one school of historical thought (Mahncke, 1972, 47).

Adenauer was to later claim that the declaration had been a way to keep Germany's options open for the acquisition of nuclear weapons. He said he believed that "after the full rehabilitation of the Federal Republic, it too would possess, and be entitled to possess, nuclear weapons, as the legitimate insignia of a respectable medium-sized power" (Mueller, 2000, 6). However, these recollections were first made public many years later when Adenauer criticized his successor for surrendering this ostensible option with an NPT signature.

The Eastern Bloc offered a more sinister interpretation of Germany's narrow 1954 pledge, which has recently gained some currency with political scientists. This interpretation was also aided by Germany's offer of a bargain to the Soviet Union, in which it would trade a final and complete renunciation of its weapons' option for steps toward the country's reunification (Mahncke, 1972, 28).

During this period, the German military leadership did not develop an interest in nuclear weapons. Instead, it argued that an eventual US-Soviet nuclear parity would make conventional forces far more important (Fischer, 1993, 114-5).

4.4.2 1955 to 1959: A FIG leaf for weaponization?

The Paris Treaties now permitted Germany to conduct non-military nuclear research. After its establishment in October of 1955, the Ministry for Nuclear Affairs (*Bundesministerium für Atomfragen*) began funding nuclear research. Adenauer's choice of minister, Franz Josef Strauss, who would shape the clarifications of the German nuclear debate, especially once the outspoken advocate of nuclear protection against the Warsaw Pact was elevated to the defense ministry one year later. From this post, he articulated a forceful anti-Soviet view with pro-nuclear inflections. In 1958, he told parliament:

> "Nuclear weapons are not immoral. A gun in the hand of a murderer is immoral. Effective defense weapons are not immoral. A totalitarian state–which considers the use of force a permissible principle, when its goals can be achieved with little risk–is immoral" (Cioc, 1988, 62).

This is how Strauss came to personify the German desire for nuclear weapons, but he was more of a noisy outlier than a policy entrepreneur.

Indeed, if Strauss had truly hoped to mobilize Germany into the independent production of nuclear weapons, he did the cause few favors. Germany's leading physicists reported that Strauss had privately confessed to a desire for nuclear weapons in 1956 (Cioc, 1988, 74). After attempting to recruit them for the French weapons nuclear cooperation agreement, the scientists balked. The ensuing confrontation produced a declaration from Strauss, who "rejected a German atomic armament under national sovereignty" (Cioc, 1988, 74). Insufficiently assured, the scientists refused to

participate in a nuclear weapons program, announcing in the Göttingen Manifesto of December 1957: "Under no circumstances would the undersigned be willing to participate in the production, testing, or use of atomic weapons in any way" (Cioc, 1988, 43). From this point on, it would have been extremely difficult to mobilize the scientific and nuclear engineering expertise of the signatories for an indigenous weapons program.[8]

There is no doubt that Strauss was the most pro-nuclear weapons' politician, with the most influence to push the country toward armament. Still, an independent nuclear weapons program for West Germany does not appear to have been his first (US provision of nuclear weapons), second (co-production with France), or even third choice (Soviet concessions). Even if it had been, it is unlikely that he could have brought about such a policy on his own. As discussed below, Adenauer's consent was not a given. Strauss would have faced serious opposition from the Western allies and several West German governmental constituencies. As an example, Strauss' unsanctioned forays into nuclear policy led to an altercation with the foreign ministry in 1957 (Fischer, 1993, 120).

Chancellor Adenauer had decisive authority over German nuclear policy. He said far less publicly about nuclear issues than Strauss. Some historians have interpreted this as a lack of knowledge and/or interest, while others impute a more calculating approach. Supporters of the latter perspective cite Adenauer's September 1956 view that it was "unbearable if two large countries in the world are solely owned by nuclear weapons and therefore have the fate of all peoples of the world in hand" (Fischer, 1993, 117), as well as his reaction to the suggestion that the US Congress would need to authorize the release of nuclear weapons (Zank, 1996).

However, other evidence suggests that Adenauer viewed the nuclear issue as a bargaining chip in his desire for a firm Western alliance, whose credibility he was beginning

[8]This episode simultaneously winnowed the domestic route to a self-made nuclear weapon, while the public spectacle raised suspicious abroad.

to doubt following proposals for the withdrawal of US troops and the Suez crisis (Fischer, 1993, 117).

The biggest step that West Germany took toward nuclear production was an agreement they made with France, later joined by Italy, which came to be known as the F-I-G accord. Two serious doubts remain concerning the episode. Firstly, the components of the agreement are not known, but there is evidence that several West German ministers understood the agreement to relate to the joint production of nuclear weapons. Secondly, since the pact was struck between Strauss and the French defense minister and included cooperation on conventional armaments projects, it is unclear to what extent Adenauer was aware of any nuclear component.

On January 18, 1957, Strauss and his French counterpart signed a comprehensive defense cooperation agreement (Fischer, 1993, 120). The public agreement made no mention of nuclear weapons, but either a secret or a verbal bargain about nuclear military applications was discussed and reported in the memoirs of the participants (Sutton, 2011, 82). Strauss visited France again in April. The presumed nuclear weapons nature of the visit prompted the West German physicists to register their public protest (Cioc, 1988, 76)

Italy joined the agreement in November of 1957, agreeing to, inter alia, a development of ''military applications of nuclear energy" (Sutton, 2011, 82)[9]. An unconfirmed newspaper report provides the following subsequent timeline:

> "[T]he defense minister of the Federal Republic, France and Italy signed a secret protocol first, in January 1958, she used a joint management committee, and in February they agreed on the construction of an isotope separation plant at Pierrelatte. France and the Federal Republic would pay 45 per cent each, Italy would contribute ten percent. In March came

[9]It is fair to interpret this as meaning nuclear weapons, but at that time, West Germany was also interested in nuclear propulsion.

another agreement establishing an institute for rocket research." (Zank, 1996)

The West German foreign minister, who was an opponent of the nuclear component, presented the initiative on a visit to Washington, in April. It was poorly received (Fischer, 1993, 126). Germany and Italy withdrew from the cooperation in September 1958 after de Gaulle returned to office and unilaterally altered the terms of the agreement (Fischer, 1993, 131-2).

There is no evidence of the West German military arguing for the acquisition of nuclear weapons during this period. Even Bundeswehr access to US weapons provoked international and domestic opposition. The issue was put to rest in public with Adenauer's announcement at the October 1957 London Disarmament Conference that "nuclearization of the Bundeswehr" was not a relevant decision to make at the moment (Cioc, 1988, 45)[10]. However, West German military officers were probably lobbying inside NATO to prevent any measures that would further limit the country's nuclear options (White House memorandum, 1).

Summary

West Germany arrived at the end of the 1950s with a demonstrated willingness to explore nuclear weapons options with its allies, but showing no signs of any intent to manufacture them on their own and severe constraints against self-production. With the possible exception of Strauss, the key decision-makers seemed to have viewed this option largely as a negotiable component of their defense relationship with the French, British, and Americans. While keeping the above exceptions in mind, an aggregation of the nuclear preferences across the government still suggests an absence of intent to develop nuclear weapons for the period.

[10]Krieger (1995) discusses the seriousness of domestic opposition [21]

4.4.3 1960 to 1969: From NATO nuclear sharing to the NPT

The subject of West Germany and nuclear weapons was central to the East-West agenda in the 1960s (Trachtenberg, 1999). US attempts to create a joint nuclear force within NATO in the early part of the decade were abandoned in order to allow the conclusion of negotiations for the NPT. During this time, and under pressure from its allies and adversaries alike, the West German government communicated more about its nuclear options internationally. There is no historical evidence that it saw the development of its own arsenal as a real possibility.

Germany began the decade dissatisfied with its lack of influence over US nuclear forces. In 1961, Strauss argued to NATO that "as long as American law does not permit its allies direct control over these nuclear weapons, the Bundeswehr must possess at least the equipment for launching tactical nuclear warheads and Bundeswehr contingents must obtain the necessary training. Within NATO, a guarantee must be secured that the United States would make nuclear warheads available in an emergency." (Cioc, 1988, 179). Adenauer joined Strauss in calling for the creation of a dedicated NATO nuclear force (Mahncke, 1972, 112). The resulting debates over the establishment of a Multilateral Force (MLF) created strain within NATO and with the Soviet Union, which feared that this was a step toward transferring nuclear weapons to West Germany.

In the course of the MLF debate, a faction emerged in the West German government that favored a European nuclear force (Mahncke, 1972, 191). There is no firm evidence to be found in available historical records, but it is possible that France and West Germany continued to explore the possibility of resuming their previously abandoned nuclear weapons cooperation, if that had indeed been the purpose of the 1957 agreement (Trachtenberg, 1999, 371).

4.4.4 1969 to 1990: The nuclear option becomes unthinkable

The time between West Germany's signing the NPT in November 1969 and its ratification in May 1975 was filled with a contentious debate between supporters and opponents of ratification. Opponents mostly refrained from making public claims about wanting to maintain a nuclear option, instead articulating their opposition in terms of the treaty's discriminatory nature and its effects on the country's nuclear energy industry (Schneider, 2014). Following the ratification, the case was considered closed by the entire government: There would be no West German nuclear weapons production (Rublee, 2010, 187)

Instead, West Germany found its voice in the NATO Nuclear Planning Group and gained other means of influencing the Alliance's nuclear posture. They succeeded in pushing for the deployment of medium-range ballistic missiles in Europe, and then successfully advocated negotiations for their removal four years later. At the time of unification, Germany once again committed itself to nuclear abstention, even making "German sovereignty conditional on the country's being free of nuclear weapons" (Mueller, 2000).

4.4.5 Summary of West German intent

During Germany's partition, the Western state showed strongly conditional weapons' intent without any indigenous capability during the 1950s. By the late 1960s, it had developed the necessary preconditions for a weapons' capability without intent. During the intermediate period, it is possible that intent and capability overlapped in two brief manners: the FIG agreement in the late 1950s and in early scientific experiments that were geared toward the production of fissile materials. After four decades, Mahncke (1972)'s summary of West German nuclear weapons' intent remains the most accurate:

> "Only Franz Josef Strauss, defense minister from 1956 to 1962, was ready to go one step further with various indirect and more or less subtle hints on. These statements, coupled with the influence of his energetic personality, brought him (and the Federal Republic) the reputation of wishing for independent access to nuclear weapons. For the Federal Republic, this desire can be excluded. As for Franz Josef Strauss, he cannot be definitively ruled out yet definitively accepted as proven." (1972, 35)

The historical record holds no indications of West Germany's giving any thought to developing an indigenous nuclear weapons' program after 1959. However, rumors of some experiments that had a deliberate dual-use character remain and are the target of future academic nuclear archaeological investigations (Mueller, 2000).

The table provides an overview of the available assessments of West German nuclear weapons intent and capability produced by British, American, and East German intelligence agencies.[11] A coarse scoring of each assessment's accuracy is included. The underestimates from the years 1957 and 1958 are only counted as such if the darkest historical interpretations of West German intent are to be believed. It is more likely that they were correct–or mild underestimates as the Federal Republic explored whether to explore a nuclear weapons option beyond that offered by the American extended deterrent.

Table 4.5: Assessments of the West German nuclear program

Year	Assessor	Correct	Overestimate	Underestimate	Date
1954	UK	1	0	0	10/23/1954
1954	UK	1	0	0	11/5/1954
1955	UK	1	0	0	5/13/1955

Continued on next page

[11] A small number were generated by foreign ministries.

Table 4.5 – *Continued from previous page*

Year	Assessor	Correct	Overestimate	Underestimate	Date
1957	USA	0	0	1	5/31/1957
1957	GDR	0	0	1	5/9/1957
1957	USA	0	0	1	6/18/1957
1958	UK	0	0	1	1/14/1958
1958	UK	0	0	1	11/12/1958
1958	UK	0	0	1	11/13/1958
1958	UK	0	0	1	11/3/1958
1958	GDR	0	0	1	12/1/1958
1958	UK	0	0	1	5/14/1958
1958	UK	0	0	1	5/22/1958
1958	UK	0	0	1	6/11/1958
1958	UK	0	0	1	6/7/1958
1958	USA	0	0	1	7/1/1958
1958	USA	0	0	1	7/1/1958
1958	UK	0	0	1	NA
1959	GDR	1	0	0	4/22/1959
1960	UK	1	0	0	10/22/1960
1960	USA	1	0	0	11/20/1960
1960	UK	1	0	0	3/7/1960
1960	GDR	1	0	0	7/5/1960
1960	GDR	0	1	0	7/6/1960
1960	USA	0	1	0	NA
1961	USA	1	0	0	11/21/1961
1961	USA	0	1	0	11/21/1961
1961	UK	1	0	0	11/23/1961

Continued on next page

Table 4.5 – *Continued from previous page*

Year	Assessor	Correct	Overestimate	Underestimate	Date
1961	UK	1	0	0	11/30/1961
1962	USA	1	0	0	7/25/1962
1962	GDR	0	1	0	8/16/1962
1962	GDR	1	0	0	NA
1963	USA	1	0	0	12/18/1963
1963	UK	1	0	0	12/19/1963
1963	GDR	0	1	0	3/1/1963
1963	USA	1	0	0	6/28/1963
1964	USA	1	0	0	1/10/1964
1964	USA	1	0	0	12/3/1964
1964	UK	1	0	0	7/13/1965
1965	GDR	0	1	0	5/27/1966
1965	USA	1	0	0	7/15/1965
1965	GDR	0	1	0	NA
1966	USA	1	0	0	1/20/1966
1966	USA	1	0	0	4/12/1966
1967	GDR	1	0	0	1/10/1967
1967	GDR	1	0	0	1/13/1965
1967	UK	1	0	0	11/16/1967
1967	UK	1	0	0	11/28/1967
1967	USA	1	0	0	3/1/1967
1967	GDR	0	1	0	NA
1967	UK	0	1	0	NA
1968	GDR	0	1	0	NA
1969	UK	1	0	0	1/20/1969

Continued on next page

Table 4.5 – *Continued from previous page*

Year	Assessor	Correct	Overestimate	Underestimate	Date
1969	UK	1	0	0	10/22/1969
1969	GDR	0	1	0	5/24/1969
1969	GDR	0	1	0	7/2/1969
1970	GDR	0	1	0	NA
1971	UK	1	0	0	12/8/1970
1971	GDR	0	1	0	NA
1982	USA	1	0	0	7/16/1982

4.4.6 Findings

Evidence for the operation of mechanisms underlying the first three hypotheses were traceable. For the remaining hypotheses, evidence was tenuous and mixed.

I1: States announcing their intentions through IOs can be assessed with greater accuracy.

The case provides empirical *support* for the hypothesis. The mechanisms underlying the hypothesis can be seen in operation in this case. West Germany's international nonproliferation commitments were deemed credible and helped narrow the analysts' understanding of the West German nuclear weapons option. While it did not help them draw a nuclear image that was as close to reality as Western intelligence, even the East Germans interpreted it as helpful boundaries of the Federal Republic's options and intentions.

As a condition for its sovereignty, West Germany made several commitments to the Western alliance not to develop nuclear weapons. Presumably because this was linked to the Federal Republic's core security interests, British and American intelligence analysts understood this constraint to be meaningful and helped them write more

accurate assessments from the very beginning in the late 1950s. The theme would recur in each of their assessments. East German intelligence officers also took these pledges more seriously than they admitted by explaining the absence of a West German nuclear weapon with reference to the restraints placed on it by its allies.

As discussed above, West Germany did not welcome the negotiation of an NPT, which was aimed in no small part toward locking the country into its non-nuclear status. German officials complained vehemently about the negative consequences that the treaty would have on its growing nuclear industry, which were interpreted by many observers as designed to cover up the idea that the country wanted to preserve its nuclear options. American and British assessments were not misled in this way, nor did they simply transpose West German reluctance over to the treaty into a weapons intent. In contrast, the Federal Republic's reluctance in signing and delay in ratifying the NPT suggested to East German intelligence that the treaty would serve as a barrier to West German proliferation. In this case, the international screening mechanism failed the analysts.

I2: States holding open debates about nuclear weapons acquisition are harder to assess.

Process tracing the perceptions of West Germany *supports the hypothesis only weakly*, perhaps because there was never a serious, sustained debate over nuclear acquisition in the country. The heterogeneity of views among relevant actors, partially expressed in public, created some uncertainty for intelligence assessors. However, counterveiling evidence also appears in this case.

In the 1950s, the private and public utterances of the conservative atomic and defense minister Strauss generated particular uncertainty that may have led to errors. In the early 1960s, statements during the debate over Germany's nuclear role in NATO produced alarm. The public debate over the NPT's ratification re-introduced uncertainty in the late 1960s and early 1970s.

As was their habit, East German intelligence privileged viewpoints from the debate that confirmed their belief that their neighbor wanted nuclear weapons. British and American assessors generally paid less attention to the debates, although they made frequent references to the role of public opinion as a constraint on the country's proliferation risk on par with its formal international commitments.

I3: States with unconstrained decision-making are harder to assess.

There is *abundant evidence* of the mechanism at play–or rather, its absence. During the period under study, West German political and policy volatility was low. This narrowed uncertainty helped assessors avoid errors.

Unlike in their reviews of other countries' nuclear futures, American and British assessors never took seriously the possibility that the form of government would change drastically. By the early 1970s, US intelligence even staked its forceful guarantee that West Germany would not pursue nuclear weapons on the predictable nature of its politics.

The GDR shared the assessment of low volatility, but for opposite reasons. The assessors at the MfS perceived little variability in the West German aggressive, militaristic, and revisionist intentions. They were therefore not looking for major surprises in the Federal Republic's politics.

I4: The proliferation risk of autocratic states will be overestimated.

The evidence is *indirectly supportive*. West Germany was not an autocracy. However, lingering memories of its previous authoritarian governments appear to have contributed to some overestimates. As late as 1961, the country's military past cast a shadow over perceptions of its nuclear program in Britain. There is no evidence of past German aggression influencing US assessments.

In the minds of East German intelligence officers, the other Germany was a capitalistic dictatorship. Assuming that belief to be genuinly held, as the following chapter gives cause to do, supports the hypothesis.

I5: The proliferation risk of states in competitive security environments will be overestimated.

Mixed evidence emerges from the case, leaning slightly toward overall support. In the broadest strokes, West Germany was an insecure state whose nuclear ambitions were frequently overestimated.

West Germany began the period defeated and conquered, then became a divided state. It eventually stabilized, but remained the Cold War's frontline state. The security environment was hazardous by any measure, punctuated by recurring Cold War crises.

In several instances, when West Germany's sense of security decreased, American and British intelligence assessments trended toward overestimation. For instance, in 1960 following the Soviet Union's ability to deliver nuclear weapons to the continental United States via missiles, US intelligence pegged the odds of proliferation higher than the historical record suggests. On the other hand, it was generally assumed by the American and British intelligence communities that nuclear weapons would worsen the country's security environment because the Soviet Union would move against such a program.

East German intelligence could not admit that West Germany felt threatened by the Warsaw Pact. Until 1972, its government formally viewed West Germany as a revisionist state intent on regaining its pre-WWII territories, which drove the overestimation. That official perception softened with Chancellor Brandt's Ostpolitik, but any discussion of the West German subjective experience of insecurity was dismissed. Explaining the oddities of this dyadic dynamic is the focus of the next chapter.

4.5 Conclusion

Nuclear intentions are indeed mysteries, but some political variables help intelligence agencies estimate them with sufficient precision. The table summarizes which of them have helped and hindered the creation of accurate assessments.

Table 4.6: Summary of evidence for and against observable implications related to intentions

		Global panel	**Case studies**	**Process tracing**
Evidence	Confirms	*I1, I2*	*I1, I4*	*I1, I3*
		I3, I5	*I2*	*I2, I4*
	Mixed		*I5*	
	Rejects			*I5*
		I4	*I3*	

I1: More screen than scheme. States announcing their intentions through IOs can be assessed with greater accuracy.

Formal diplomatic commitments proved to be information-rich for intelligence assessors and attracted strong supportive evidence across all three levels.

I2: Loose lips sink certainty? States holding open debates about nuclear weapons acquisition are harder to assess.

The chapter accumulated strongly supportive evidence for intelligence officers struggled to separate signal of intent from the noise of domestic political processes accumulated, as well.

I3: Trusting in dictators? States with unconstrained decision-making are harder to assess.

The case studies did not find support for the hypothesis, while the global panel and process-tracing results were more supportive. A lack of constrain on the executive or frequent changes in decision-makers seemed to introduce uncertainty more than inaccuracy.

I4: The proliferation risk of autocratic states will be overestimated.

The global panel, which provides the strongest test of this frequentist hyopthesis, returned empirical results that run counter to this proposition. The other two levels found more supporting evidence.

I5: Competition brings out the worst. The proliferation risk of states in competitive security environments will be overestimated.

Evidence was mixed across all empirical tests. In some cases, states in a hostile neighborhood proved hard targets for assessment. In others, understanding their security situation assissted intelligence assessors in creating an accurate model of the target country's intentions.

In comparison with the previous chapter, the results show that intelligence assessor had a more difficult time establishing intent than capability. It would therefore be expected as a net effect that those states better equipped to assess intentions will be more accurate perceivers and predictors of nuclear proliferations.

The following chapter develops a theory about which states succeed most at estimating nuclear intent, which is tested against two competing generalized explanations for assessment accuracy. This requires moving from unitary characteristics about the target program to dyadic dynamics between observers and observed, as well as a new focus on variables related to the process of generating assessments. The benefit of this approach is that it can explain variation of accuracy over time and place and connect with the theoretical international relations literature.

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Chapter 5

Bounded Perception: Ideological Constraints in Intelligence Assessment

What explains the accuracy in a state's assessment of nuclear technical capability and medium-term intentions, and what clarifies whether that capability will be used for civilian or military purposes? The extant literature fails to provide a general theory for the bureaucratic production of incorrect proliferation estimates because most available theories do not produce testable predictions across time and place. Rovner presents the complexity of this challenge:

> "...intelligence is inherently ambiguous. Precise estimates of foreign capabilities are difficult because the targets of intelligence conceal their activities and use elaborate denial and deception techniques to confuse intelligence collectors. Estimates of foreign intentions are even more difficult, because they usually require high-level human sources that can report on internal discussions. It is not easy to convince a foreign national to spy on his own government, especially given the danger of being discov-

> ered. Intelligence services also worry that their human sources are actually double-agents working on behalf of the target state, meaning that even genuine information is received with caution. Finally, foreign intentions are subject to change. " (Rovner, 2011, 12)

A former practitioner points out that assessors are not given easy assessment tasks because "a topic becomes an issue for intelligence in the first place because important information is ambiguous or missing, often due to an adversary's effort to conceal it" (Pillar, 2010, 479). Accuracy can only be a relative measure in such a difficult task. Consequently, studies of intelligence should be comparative in design.

This penultimate chapter begins by coalescing a broad catalog of theories into three distinct categories. Then it synthesizes the literature into explanatory constructs and derives observable implications. In conclusion, it collects contradictions and creates three theory types that can be tested on assessments of nuclear weapons' proliferation from the Cold War.

A theory should be able to describe the conditions under which intelligence agencies achieve accuracy, which applies to all strategic assessment tasks. Nuclear proliferation allows for crisper measurement strategies. In addition, this theory is not exclusive to intelligence agencies but available to any body creating assessments of the outside world. A useful intelligence assessment theory should also explain broad patterns across time and place. It should be able to capture the long list of previously proposed mechanisms that ranges from politicization to cognitive biases. The aim is not to critique the mechanisms or accounts of individual intelligence failures but develop an explanation for the general circumstances under which these extant mechanisms combine with, compete against, and cancel each other.

Each conceivable theory will leave unexplained variation(s). For instance, a regime type explanation will not be able to account for variation within and across governments with the same institutional arrangements. However, it is better to start

with the major variables at such an early stage of theorization because the inductive case-study approach favored in the intelligence literature has yet to aggregate and accumulate into systematic predictions.

The literature review section gives an overview of what the literature has tried to explain, where it has succeeded, and where large gaps exist at various levels of analysis. From this review (of the literature), it collects the building blocks for systematic explanations, across time and place, for the accuracy with which intelligence agencies perceive foreign states' nuclear programs.

Previous chapters traced how characteristics of West Germany's political actions and nuclear development shaped East German, British, and American intelligence officers' ability to place the country on the proliferation spectrum. Testing the three theories developed above requires turning the focus on the process of assessment itself.

These multiple-methods tests find strong evidence that democratic intelligence assessors were better able to assess the intentions and capabilities of the target nuclear program than their East German (German Democratic Republic) counterparts, despite having fewer technical details. American and British accuracy was enabled by free discussions that included a broad range of perspectives, including on the possible effects of their own government's policy. East German inaccuracy resulted from an inflexible understanding of their adversary's intentions.

5.0.1 Existing explanations for assessment errors

Ever since the surprise attack on Pearl Harbor, prominent American intelligence failures have attracted congressional scrutiny. Calls for accountability have invariably led to the release of information, which in turn has been used by researchers outside of the government to carry out independent investigations. A series of studies on the sources of the most recent respective failures to foresee a consequential event have been made possible through the release of this information. These studies offer

a wide set of (occasionally contradictory) possible explanations of assessment error (Wohlstetter, 1962, K. Knorr (1964), Jervis (2011), Rovner (2011)). The groups and individuals involved in strategic assessment have had their failings thoroughly chronicled, but successes have not received the same degree of public scrutiny.

Although the genre is instructive about the particular circumstances of individual intelligence failures and is a rich source of hypotheses on the causes of intelligence error, it suffers from its inherent selection of the dependent variable. Selecting failure poses a problem to *internal* validity, as information about whether the theorized sources of error also occurred during non-failures is not collected and incorporated into the analysis. If a particular organizational pathology can be identified as having contributed to a failure, it cannot be established whether the same pathology also existed during periods of non-failure. The challenge to *external* validity is that valuable insights from individual cases cannot be generalized to explain state behavior across time and place, if it cannot be established how representative the behavior is at the time of failure with regard to periods of non-failure.

Political science exists to overcome these obstacles to valid inference. In the international relations literature, the causes of mistaken nuclear estimation have not been examined previously at the inter-state level. However, the building blocks for a theory can be found in adjacent research programs, some of which can be adapted for testing at this level of analysis. This section reviews the main strands of research inspired by realism, signaling, psychology, domestic politics, strategic culture, and other fields.

The extant literature on how states assess nuclear weapons' intentions and capabilities provides explanations for individual intelligence failures, psychological reasons for possible bias on the part of the estimators, and domestic political explanations for dysfunctional policy-intelligence relationships. However, these valuable findings have not been consolidated into generalizable theories that compete in explaining the variations in misestimation across time and place. Similarly, the theories and pro-

liferation literature of international relations have underspecified the conditions and causes of misperception.

The extant literature is filled with relevant theories and methodologies. Their summary is followed by a discussion about the puzzle that mistaken nuclear estimation presents to theoretical expectations of state behavior. The chapter then assembles the building blocks for an explanation of intelligence misestimates at the inter-state level by focusing on the dyadic nature of estimation. This conceptualization makes it possible to evaluate the effects of variables that are relevant to both the perceiver and the perceived.

Jervis (1976a) provides four levels of analysis in international politics, which are used here to categorize the relevant literature on intelligence assessment according to the level at which the explanatory variable operates. Starting at the international level, where explanations require the least information to account for misperception, the literature review proceeds downward to the psychological processes of individual analysts. The latter situation requires much more information to explain an individual instance of misestimation.

Following Rathbun (2007), each level is paired with its respective understanding of uncertainty–the variable that intelligence assessors seek to reduce for their governments.[1] Rathbun argues that rationalist and realist explanations at the international system and nation-state levels share a common conceptualization of uncertainty as "a problem of lacking information about others' intentions, but one that can be dealt with decisively" (Rathbun, 2007, 534). In contrast, explanations at the level of individual cognition–the brains of intelligence analysts–"problematize perception and interpretation" (Rathbun, 2007, 534). In other words, there is uncertainty "not only about others' intentions, but also of how to understand the information in front of them" (Rathbun, 2007, 534).

[1]The constructivist perspective will be omitted because of the inherent difficulty in testing these theories' implications empirically.

The international environment

Jervis' first level of analysis is the international environment. Explanations for states' ability to assess each other's intentions and capabilities can be found in this harsh environment's structure. Under pressure from international competition, states' institutions that are tasked with managing their international survival converge into a similar form.[2]

Pervasive uncertainty is one of the main systemic pressures that discipline state behavior in their pursuit of survival within an anarchic system (Waltz, 1979). Especially with the severity of the nuclear threat, much theorizing on international relations suggests that states should be making worst-case assumptions about each other's intentions and capabilities as "prudent insurance" (K. E. Knorr, 1976, 116). As noted above, this assumption is at the core of neorealist work in the security domain (Mearsheimer, 2003).

This uncertainty cannot be remedied by the acquisition of information and worst-case assumptions. Instead, states must fortify their resilience against fundamentally unforeseeable threats. Rathbun summarizes this understanding of the uncertainty challenge as follows:

> "Fearful states systematically discard or discount information about the intentions of others that shows them to be less than hostile. Rather than gather information, they accumulate power." (Rathbun, 2007, 534)

Other theorists emphasize the tragic nature of international politics and offer a more restricted set of circumstances to reduce the fear in states. Overestimates are not the only form of error expected in systems-level explanations, even in such survival-relevant security matters. For instance, Christensen (1997) shows that state leaders

[2]Several bureaucratic explanations also predict an institutional isomorphism. These are reviewed below and instead posit an international organizational mimicry mechanism that is separate from competitive international pressure.

may err in assessing the balance of power among states. There are many examples of existing scholarship that address this empirically observed variation in perception. Jervis argues that when offensive and defensive technologies can be distinguished, it is possible to escape the need for the kind of worst-case assumptions that drive security dilemmas (1977).

Apart from these prominent exceptions, the majority of system- and state-level international relations work on security issues either argues or implies that perceptions are biased toward overstating foreign threats. Taken as a whole, structural system-level theories create a parsimonious and testable set of predictions about states' ability to assess the nuclear intentions and capabilities of other states: fearful overestimators. Systems-level theories are even less helpful in terms of specifying the mechanisms and sub-state actors as they assume that most relevant variation can be explained while keeping the black box of the state firmly shut. Rathbun argues that "realism's conception of fear, a deep concern about the intentions of others" is the missing mechanism at the center of black box theorization (2007, 538).

The rationalist nation-state

Another theoretical tradition seeks to explain world politics by examining the behavior of states as rational actors. Parallel to systems-level explanations assuming that most critical international relations phenomena can be explained by reference to international pressure, nation-state analyses assign that role to international incentives. This exogenous incentive structure, and the preferences and types of other states, is shrouded in uncertainty, much of which arises from each state's strategic incentive to misrepresent critical informatio (Fearon, 1995).

These rationalist nation-state level explanations share a common conception of uncertainty with their structural counterparts. They "have an implicit accuracy criterion consistent with their assumption that states can objectively read information and sig-

nals coming in from the world around them" (Rathbun, 2007, 537). The result is that "individual actors will perceive and interpret the same stimuli similarly" (Rathbun, 2007, 535).

In contrast to the model of states driven by the fear of an unforgiving international system, governments that inhabit a rationalist world "approach international relations more agnostically, carefully parsing evidence to better assess the intentions of others" (Rathbun, 2007, 534).

Rationalist literature theorizes the signals sent by states, but it rarely problematizes the receipt of those signals. Monteiro and Debs (2012) represent this in that their formal model's core assumption regarding the strategic dimensions of nuclear proliferation is that a hegemon maintains a close eye on other states' nascent nuclear capabilities and forms accurate judgments about their activities. Other work conceptualizes misperception as a deficit in information that states only work to overcome when it is necessary (Stein, 1982). While this statement may be true, the empirical record suggests that states are not especially cost-conscious when it comes to acquiring as much nuclear information as possible.

It is also useful to borrow from the concept of war as a bargaining debate. Gartzke (1999) 's "War is in the Error Term" can be borrowed to explain why misestimating may not be explainable: If states knew what led them to commit errors, they would not make them. Consequently, it follows that observable systematic biases would already be a part and parcel of states' calculations. If states cannot discover these reasons, neither can researchers. Any remaining errors would be random and the pond in which to fish for possible inferences would be shallow.

The non-rationalist nation-state

Popular, constructivist, and historical literature brims with non-rationalist explanations at the nation-state level. This literature seeks explanations for state behavior in

their particular strategic environments and history of interacting with other states. These explanations have not been broadly accepted by political scientists. While many acknowledge that these factors drive decision-making at the individual level (Khong, 1992), the anthropomorphic concept of states possessing the personalities and memories of humans has not been successfully adopted by the international relations field.

The two-level state

The collection and assessment of foreign and domestic intelligence have always overlapped.[3] A set of theories that deals with the political role of security services in a state also offers explanations for the varying quality of intelligence assessments. The first of these is the balance of domestic and foreign threats to regime survival, the second is the role of intelligence agencies as domestic and political actors in their own right, the third is how these roles vary by regime type, and the fourth concerns politicization and other policy-intelligence pathologies.

The balance of foreign and domestic threats to a state's–or a form of regime, or a particular leader's–security creates the strategic circumstances. David (1991) coined the term "omnibalancing" to describe how some states must devise interrelated survival strategies at both the domestic and the international level. This view is echoed in the intelligence literature, which argues from empirical observation "that the determination of one-party states to destroy all opposition has a major influence on their foreign as well as domestic intelligence operations" (Andrew, 2004, 177-8).

Consequently, intelligence agencies are inherently political actors. Work on the origins and roles of intelligence services in domestic politics suggests that forces inside the state explain the operation of intelligence services better than the external environment. Comparative research on the origins of intelligence organizations finds that

[3]For a popular account, see Zamoyski (2014).

they are typically formed in response to domestic threats (Herman, 1996). This line of inquiry has concluded that once in existence, they continue to be shaped more strongly by domestic factors than the external threats that they ostensibly counter. For instance, one analysis of the United States' national security agencies found that they are the product of bureaucratic and political incentives and forces "not rationally designed to serve the national interest" (A. Zegart, 2000).[4] Faini (2015) shows that intelligence agencies can also work to subvert their political leaders, theorizing "two ideal types of intelligence agencies" [16]. While the first type acts apolitically and separates foreign and domestic activities, the latter "is on one side of the political spectrum and the divide between foreign and domestic intelligence is blurred." (Faini, 2015, 16)

This work gives rise to the suggestion that intelligence agencies occupied with domestic politics will not be willing or able to produce high-quality assessments of foreign governments. Faini proposes several mechanisms that would make it difficult for intelligence analysts in a political agency to create accurate assessments.

First, and analogizing from Huntington's civil-military theory, he argues that these agencies are staffed according to principles of political loyalty:

> "Objective civilian control is not an option when dealing with an intelligence agency that is not politically neutral. Instead, principals will try to control the agency by selecting personnel that shares their own political preferences and ideological inclinations. Control is not achieved by rendering the agency politically neutral, but by making it politically similar to the government. This parallels what Huntington called subjective civilian control." (Faini, 2015, 35)

[4] These bureaucratic dynamics are developed further in the following discussion of the bureaucratic level of analysis.

The implications for loyalists' ability to conduct assessments are that they crowd out any potential recruits of greater merit.

Second, a political intelligence agency sees itself as a guardian of the regime and higher than the government. If any given government does not combat domestic subversion with sufficient vigor, the agency may act to remove it (Faini, 2015, 39). If this is the nature of the relationship between political and intelligence leaders, it would appear unlikely that high-quality international intelligence analysis will receive prominent organizational priority.

Regime type differences

While it is by no means settled, the international relations field has decided on a majority agreement that there is a democratic difference in international behavior. However, a wide variation concerning its sources and consequences still exists. This section begins with arguments for why states might vary in intelligence assessment performance by regime type. The logical follow-on question is which regime performs better at intelligence assessment and answers with arguments for democracies and against autocracies.

In recent years, the field has moved away from a dichotomous focus on democracy and its absence; instead, it has found explanatory power in further dividing non-democracies. Governments that fall short of the liberal conceptions about democracy and the rule of law have been classified into a variety of taxonomies. In one such division of modern authoritarian regimes, the locus of power in government may be in an individual person, the military, or a dominant party (Geddes, 1999, 2–5). These distinctions will be employed here because a quantitative study using the same three categories offers insights into their varying conflict behaviors (Peceny & Butler, 2004, 565-581).

In a single-party regime, the power to staff the state and thereby to shape its decisions is vested in a political party that may range from revolutionary to reactionary (Brooker, 2000, 40-41). The majority of states that fit this description have been Marxist-Leninist in orientation. Contemporary China is a particularly salient expression of a party in firm control of a state and even the country's economy. Single-party authoritarian governments do not differ greatly from democracies in their levels of aggressiveness, when measured by their involvement in militarized disputes. The exception to this finding is that these regimes are more likely to initiate conflict with democratic states; however, this conclusion may be a result of the data set's domination by Cold War cases in this study (Peceny & Butler, 2004, 577-579).

The second category of authoritarianism is rule by military. This can occur directly and visibly through a ruling junta or indirectly from behind a façade of civilian administration (Brooker, 2000, 45; for a description of indirect rule, see Cook, 2007). This regime type has a strong tradition in the Middle East and Latin America. In their conflict behavior, military regimes are similar to single-party regimes with a penchant for initiating disputes with democracies (Peceny & Butler, 2004, 579).

Single-party and military regimes may construct cults of personality around their leaders, but true personalist rulers are those who are liberated from the organizational restrictions of such governing institutions (Geddes, 1999). The source of the individual's legitimacy may be in their ideology or charisma, but more typically it is in a form of patrimonialism in which personal loyalty earns material rewards [Brooker, 55]. However much loyalty these rulers may inspire domestically, other governments appear to admire them less. Personalist regimes are the most likely to become involved in a war (Peceny & Butler, 2004, 565).

Assessment by regime type The domestic politics of intelligence gathering and assessment varies by the type of regime. To a large extent, the existing literature con-

cerning domestic factors is based on democratic systems because information about intelligence in autocratic regimes is doubly difficult to access. Comparative political work has shown that independent assessment, and even implicit criticism, can be a threat to an autocrat as a source of palace coups. As an example: Saddam Hussein did not permit his intelligence analysts to read US news' sources, which deprived him of a potential second opinion about his personal judgment that the US was a smaller threat to his regime than Iran (*A View of Operation Iraqi Freedom from Saddams Senior Leadership*, 2007). Finally, the institutional explanation for democratic peace, which includes descriptions of democratic states as transparent and autocracies as unpredictable, would suggest that opaque regimes are more difficult to assess.

A literature on the predicted strengths and weaknesses of different regime types' abilities to interact ably with their international system provides theoretical priors for their more specific intelligence performance.

Researchers have made strong predictions that the same qualities inherent to democracies will lead their intelligence agencies to perform better at intelligence assessments. Handel identifies the expectations of democratic leaders: "Leaders in a democratic system are generally more inclined to consider a wide variety of options than those who have always functioned within authoritarian or totalitarian political systems" (quoted in Hastings, 2016, l. 1933). Hastings argues, with conviction, that democracies achieved their edge in WWII by recruiting talented civilians into government service and that "a remarkably open debate was sustained in the Allied corridors of power, including most military headquarters" (Hastings, 2016, l. 565). Maddrell speculates that the key variable was that intelligence analysts in democracies "were expected to think for themselves," which raised their product's salience among government leaders (Maddrell, 2015, 8).

Rovner also erects a version of democratic advantage that he does not believe is supported by the historical record:

> "... the theory of victorious democracies implies that intelligence-policy relations should flourish in democratic states; that politicization should be rare; and that elected leaders should be protect the objectivity of intelligence before making decisions about the use of force." (Rovner, 2011, 198)

Others point to specific weaknesses in non-democratic systems. Handel examines the leadership level and observes that "habits of cooperation and openness are usually less developed" in an atmosphere of power struggle (Hastings, 2016, l. 1933). Maddrell finds that governments ruled by communist parties have no greater capacity for converting criticism into productive policies.

Garthoff identifies a similar weakness among analysts serving the Communist Party: "Ideological preconceptions and the psychological blinders of a secretive totalitarian system led Soviet intelligence agencies to distort and misconstrue much of the information they received on U.S. plans, motivations, and intentions." (Garthoff, 2004, 38)

Dictatorships have not typically been praised for their intelligence assessment prowess, but for their efficiency in implementing policy. However, several possible weaknesses have been discussed. Weeks assigns single-party governments better odds of assessment success than Maddrell. She argues that personalist dictatorships should be worse at this due to the repercussions of delivering countervailing news to a dictator "because fearful subordinates are unwilling to correct the leader's personal biases" (Weeks, 2014, l. 1532). In an extreme empirical instance of this information filtration mechanism during WWII, German intelligence was instructed "to stop submitting intelligence that might upset the Führer" (Hastings, 2016, l. 564) and that its ''first requirement... was not truth, but loyalty to the Führer" (Hastings, 2016, l. 1930). Japan's situation was much the same (Hastings, 2016, l. 3543).

In situations where complete power is vested in one person, that individual's traits can be expected to influence the state's behavior. If a personalist state is led by an enlightened individual who is aware of the risks described here and tolerant of dissent or endowed with unique insight into the other state, the odds of mistaken war decrease. Unfortunately, such enlightened despots are rare: Delusion and incompetence are far more common. Even if a leader begins to reign as the former, the logic of authoritarianism raises the odds of this person exhibiting the kind of behavior that secures domestic survival at the cost of capable foreign policy.

Authoritarian regimes lack the legitimacy of direct and/or regular elections and therefore depend on other sources of popular support for their success and longevity. Providing protection against threats to national security, whether internal or external, is a common and coherent narrative that justifies extraordinary governmental action. The supply of available enemies rarely runs low, but resourceful authoritarians can also aid the creation of such threats. Furthermore, authoritarians in general, and personalist rulers in particular, may not understand the audience costs faced by their opponents – especially if they are democratic regimes.

> "Dictators who surround themselves with sycophants are unlikely to receive much in the way of objective analysis. In some cases intelligence officers may be unwilling to deliver bad news out of concern for their career or their personal safety.29 In other cases leaders may use intelligence agencies for psychological validation of their decisions.30 While these arguments are certainly plausible, we should not assume that politicization is more common and intense in autocratic regimes. In fact, politically biased intelligence appears in democracies with surprising regularity. The record shows that politicization occurs in both kinds of regimes, but for different reasons. Dictators force intelligence officials to water down their

> estimates through fear. Democratically elected leaders force intelligence to toe the line in order to satisfy their constituents.“ (Rovner, 2011, 199)

Unlike the situation in authoritarian regimes, the power of a dictator makes it unwise to speak the truth, even “to correct any misperceptions they may have” (Weeks, 2014, l. 240).

Not all authoritarian rulers enjoy unrestrained authority of appointment over their inner circles. Non-personalist rulers may face a “unionized” elite that has a significant degree of “bargaining power relative to the dictator.” (Frantz & Ezrow, 2009, 3). In military regimes, this is typically formalized in the junta, while party states provide governing input through central committees or similar institutions that cannot be ignored.

This circumstance is thought to increase the quality of information that reaches the ultimate decision-maker, including the receipt of signals from another government and the analysis of its intentions. Therefore, personalist rulers are “less likely to receive accurate information during inter-state disputes and [are] more likely to commit foreign policy blunders.” (Frantz & Ezrow, 2009, 5) In crisis situations, such blunders also include difficulty in evaluating the credibility of another state’s threat (Frantz & Ezrow, 2009, 23). The evidence for this claim is that personalist regimes have more erratic patterns of responses to international threats than other authoritarian regime types. It is unclear whether the elite advisor hypothesis is the only possible explanation, but it is indeed a plausible mechanism.

The collection of information and its presentation to the relevant decision-makers is a great challenge to all bureaucracies, but additional obstacles to the process appear in the authoritarian context. Another study, which used the same data and methods used to build the winning coalition theory, finds that “personalist dictators have a greater say in the selection of their advisory group than military or single-party dictators do and, as a result, are more likely to commit foreign policy blunders.”

(Frantz & Ezrow, 2009, 1) This view posits a particularly hazardous dilemma for the authoritarian: The people supplying intelligence and advice are also those best positioned to remove the dictator. The empirical record confirms the rationality of this paranoia; most dictators are overthrown by their inner circle (Svolik, 2009, 477-494).

Consequently, competence in their advisors and deputies is not necessarily a desired quality for authoritarians concerned about maintaining their position—as all are (Frantz & Ezrow, 2009, 1). Information on its own can also be a rival power source, which is inherently threatening (Schedler, 2013). If rulers exercise discretion in the appointment of their group of elite advisors, they will tend to favor politically unsophisticated individuals. Even the occasionally competent advisor has no incentive to shine with ability. Given the harsh penalties that a strong ruler can administer to those who deliver bad news, the same people who might otherwise present critical information will likely choose to remain silent.

While the foreign policies of democracies have been understood as more prudent in the "democratic peace" literature, their intelligence capabilities receive mixed reviews. In some quarters during the Cold War, there was concern over an "intelligence gap." To illustrate this, Cimbala (1987) mustered a defense that is tepid at best:

> "Comparative study [...] does not demonstrate that democracies are inferior to other regimes in their ability to formulate and use intelligence in policy making. [...] Both centralized and decentralized policy making are subject to enormous ranges of misestimation and policy contortion. Nor do democracies have any monopoly on stupidity or inertia."

Instead, the focus has been on a presumed scourge of democratic intelligence assessment – politicization: "Rather than leading to a more informed and rational discussion of relative power, in all of these cases democratic pressures led to politicization and flawed estimates." (Rovner, 2011, 198) The next section addresses this literature

specifically and explores the relationship between politicization and cross-national variation.

Faini and Rovner argue that the jury is still out on any democratic advantages. Rovner's discussion of the inherent politicization incentives facing democracies leaves him unpersuaded that "democracies are noticeably better at threat assessment" (Rovner, 2011, 199). Faini sees greater variation within democracies' relationships with their intelligence agencies. Intelligence organizations in a democracy will be more similar to their authoritarian counterparts if they are both "designed to preserve the current political distribution of power, or at least to prevent the opposition from gaining power" (Faini, 2015, 253). While Faini does not set out to explain the quality of assessment, a possible implication is that non-political intelligence agencies in democracies will outperform political ones, as well as those of authoritarian states.

There may be some states or cultures that are better positioned for the intelligence enterprise, such as the contrast of Israeli intelligence professionalism against an American tendency to politicize (Bar-Joseph, 2013). Another author finds Germans especially ill-suited for this endeavor (Hastings, 2016).

Politicization

The "politicization" of intelligence consumes a large proportion of the intelligence literature's attention. This section will show that the concept has been used to describe or warn against a variety of phenomena. It has mostly appeared as a dependent variable and is occasionally an independent variable to explain bad assessment. For this project, it would be a possible mechanism by which state perception of nuclear weapons is distorted. These conceptualizations assume that, left to their own devices, intelligence agencies would produce more accurate assessments.

Preferred definitions of and explanations for politicization are deeply entangled in the literature. For instance, the most common view of politicization as "the manipulation

of intelligence to reflect policy preferences“ conveys a theory of its purpose (Rovner 2011, 29). This section therefore applies the levels of explanation, dividing them into whether the hypothesized cause of politicization originates from within the intelligence community (supply) or the policymaking leadership (demand).

The conclusion from the contestation over the underspecification of politicization is that intelligence assessment is an inherently political activity. Observing acts of “politicization” are likely pushing on an open door.

Table 5.1: Illustrative conceptualizations of politicization

Type	Who	What	Why	Citation
Politicization	Intelligence analysts	skewing information or judgement	to support policy or ideology.	CIA Politicization Ombudsman (Marrin, 2013, 173)
Privatization		slanting messages	for personal or organizational goals.	Cohen, May, Godson, and Schmitt (1995)
		presentation of selected facts	to convey misleading messages.	Pillar (2010)
Direct pressure	Policymakers			Treverton 2008
House line	Analysts			Treverton 2008
Cherry picking	Policymakers	picking most convenient assessment		Treverton 2008
Question asking		framing the question	to affect the answer.	Treverton 2008
Shared mindet	Intelligence and policy	sharing strong presumptions		Treverton 2008
Politicization	Intelligence professionals	introducing motivated biases		Marrin (2013)
Politicization	Intelligence officers	manipulating products	to influence policy decisions.	Rovner 2011
Politicization	Intelligence agencies	producing estimates	to undermine policy decisions.	Rovner, 32
Embedded assumptions	Analysts	face political and social assumptions	that confine bounds of debate.	Rovner, 207

Continued on next page

Table 5.1 – *Continued from previous page*

Type	Who	What	Why	Citation
Intelligence parochialism				

Rovner (2011) developed the "oversell" model of politicization to explain this "pathology's" occurrence in democratic contexts. The model specifies two necessary conditions for politicization to occur: Firstly, policymakers must be publicly committed to a policy and secondly, a "critical constituency" must emerge against which the policymaker will seek to mobilize intelligence (Rovner, 2011, 37).[5] The process of fitting the intelligence *ex post* to the policy is Rovner's definition of "politicization," which he further subdivides into "hard" and "soft." The former occurs when the issue is especially salient.

Assessments, such as those seeking to establish nuclear weapons' trends, are especially vulnerable to politicization:

> "Estimative intelligence predicts the future intentions and behavior of potential adversaries. Policymakers have a vested interested in these products because they implicitly evaluate the wisdom of foreign policy." (Rovner, 2011, 40)

The model was developed specifically for democracy but its application to other competitive politics is evident. Whenever policymakers compete for an audience's approval, they will be incented to use intelligence as a "signal that policymakers have access to special information and, as a consequence, are in the best position to make decisions on how to act" (Rovner, 2011, 47).

[5] A critical constituency is "any domestic group with the ability to damage the policy objective or political future of the policymaker." (Rovner 2011, 13)

This model also seems aimed at explaining politicization attempts rather than successes, which would be necessary in order for politicization to diminish the accuracy of an assessment.

The Hastedt (2013) model offers another view of politicization, illustrating a division between the soft and hard varieties. Soft politicization uses what Hastedt describes as "non-coercive means," such as "deliberate attempts to alter the assumptions underlying an analysis, the decision rules by which an analysis moves forward, and the institutional setting within which these deliberations occur" (Hastedt 2013, 10). To qualify as its harder counterpart, there must be "deliberate attempts to coerce analysts into adopting a certain set of assumptions or conclusion or in the extreme overruling analysts and imposing a conclusion on the analysis" [*ibid*].

Effects of politicization

Individual intelligence scholars are either inconsistent or inconclusive in their evaluation of which regime type will produce the best intelligence analysis. The literature as a whole tends to find whichever regime it is studying to be deficient.

> "Whatever the reason, it is not clear that intelligence-policy relations are more harmonious in democratic states, nor that democracies are noticeably better at threat assessment." (Rovner, 2011, 199)

It is reasonably well established that regimes vary in their international behavior. The audience-cost literature and regime-type scholars create an expectation that dissimilar regimes behave differently in the international system. While arguments about the causes and specific expectations for each regime sub-type remain subject to debate, democracies are generally believed to be more peaceful (Maoz & Russett, 1993, and many others). As discussed above, dictatorships are especially likely to select into conflict. Taken as a whole, this scholarship combines to call the isomorphic assumption into question. It could well be that these variances are strategic responses

to differing incentives; however, if governments behave differently based on domestic arrangements, it is a logical conclusion that they also have a contrary perception of the international system.

This assumes that politicization causes misestimation, but not that all errors arise because of politicization. Regrettably, the politicization literature often observes political pressure and the outcome(s) of mistaken assessment. But filling in a causal link does not constitute proof of politicization.

The government bureaucracy

Bureaucratic politics, which are summarized informally as "where you stand depends on where you sit," have also been applied to intelligence analysis (Allison, 1968). The theoretical assumption is that analytic outcomes are as much the result of compromise and competition among bureaucrats as they are the consequence of budgetary decisions.

In the case of intelligence agencies, a leading bureaucratic factor is the tension between relevance to and independence from policymakers (Rovner 2011). Proximity and responsiveness risk politicization and an inferior analytical product, while a remote stance protects analytic integrity but may render intelligence useless in the execution of a state's policies. The nature of bureaucratic institutions may also make them slow to adapt to changes in the environment. A. B. Zegart (2009) discerned a continued post-Cold War focus on Soviet-type threats in the intelligence community's inability to provide an actionable warning of the September 11, 2001 terrorist attacks. These bureaucracies are also resistant to external adjustment. Once again, legislative bodies may not be able to shape intelligence institutions to match their preferences due to a lack of incentive, knowledge, and money (A. B. Zegart, 2011).

Strategic assessment culture

Another type of literature that bears some relevance to possible sources of assessment error describes variations in the strategic culture that estimators inhabit (Johnston, 1998, Booth (1979)). Theories vary on how such a culture arises and when it changes. Some draw direct lines from the interpretation of past experiences; others assign a bigger role to the social construction of threats. For the former, see Brooks (2008), for the latter Rousseau and Garcia-Retamero (2007).

Studies have applied these theories to the examination of changes in strategic culture over time and space (Andrén, 1982, Garver (2002), Hong (2011), Nourzhanov (2009), Saalman (2011), Sarotte (2005), Tamaki (2012)). However, the strategic culture literature has not offered any rigorously tested theories concerning the underlying mechanisms up to now. Are the changes just mere adjustments to new strategic situations? If threat perception shifts, does change occur in reaction to the threat itself or in the perceptive process? Unfortunately, and despite examination of similar dependent and independent variables, the pervasive endogeneity problems and methodological indeterminacy are not ready ot offer testable propositions.

Assessing in Hierarchies

There are also organizational factors. Hierarchical arrangements may influence the order in which information is considered and how it is filtered up the chain of command. Research on the effects of legislative agendas provides reasons to suspect that institutional arrangements for considering information shape how the available information set is aggregated into a "consensus" product (Hammond, 1986).

The problem has been treated extensively in the intelligence literature, which relies on political science studies:

> "Organizational structures can exert enormous, unseen, and unexpected influence over how information is aggregated and what hypotheses emerge

> (Bendor and Hammond, 2010). Organizational structure also affects an organization's ability to learn and improve its own performance. As Vaughan (1996) and Zegart (2007) have noted, the structure of an organization can impede its ability to adapt, even when the need to adapt is clear." (*Intelligence Analysis: Behavioral and Social Scientific Foundations*, 2011, 317-8)

This would explain why assessment performance may not improve over time. Another bureaucratic explanation for a lack of improvement is that "failure chronically generates additional money for poorly performing government organizations and programs of all sorts, including intelligence" (Hedley, 'Learning from Intelligence Failures', 438, quoted in Marrin, 2013, 157).

Groupthink or the wisdom of the crowd

Despite the traditional emphasis on applying laboratory lessons from the study of individual cognitive biases, the intelligence assessments of modern states are not carried out by individuals. They are the products of social interaction in a professionalized bureaucratic hierarchy. Each of these elements may affect the likelihood of success in the estimation process. The effects of social interaction and professionalization are mostly psychological, as discussed below.

Social interaction. Estimates of other states' nuclear programs are not produced by a lone analyst. Even if they were, the thoughts of the estimators are shaped by their interactions with others, including policymakers, fellow analysts, and citizens at large. In some cases, this social dimension can give rise to *groupthink*, where the drive for social consensus truncates analytical thought. This was a theory developed to explain the decision-making of the U.S. in implementing the Bay of Pigs invasion (Janis, 1982). However, not every poor judgment that is made by a collection of individuals can be blamed on this phenomenon. In the case of overestimating Iraq's

unconventional weapons' programs in the early 2000s, Jervis argues that the key analytical work was undertaken by individual analysts (Jervis, 2011).

Professionalization Analysts are presumed to be professionals who are trained to recognize and combat any biases that might arise in their analysis (B. Fischhoff & Cherie Chauvin, 2011). Any insights gained from laboratory experiments, conducted on individuals without such training, may not apply in the same way that professional stockbrokers are better able to correct for biases than lay investors (Malmendier & Shanthikumar, 2007). Notwithstanding these circumstances, even sophisticated analysts and policymakers are susceptible to making cognitive errors. Conscious attempts at internal bias-correction succeed infrequently (Wilson & Brekke, 1994). Intelligence analysts must battle a long catalog of biases held by their policymakers, colleagues, and themselves.

Rational choice approaches do not preclude assessment errors. In light of the technical limitations, as well as the propensity of intentions and capabilities to change, omniscience is not a requirement for rationality. However, arriving at incorrect estimates of another state's nuclear program does constitute irrationality if the perceiving state loses sight of the judgment's confidence interval. In these circumstances, political scientists have often looked to psychology to explain any deviations from an ostensibly rational baseline.

Mercer (2005) argues that one of the flaws of this approach is the ex-ante assumption that psychological factors are absent when accurate judgments are formed.[6] Similar to the intelligence failure genre's selection of erroneous cases, psychological explanations are only invoked in a biased subset of cases. This hampers insights into particular empirical circumstances and prevents theoretical progress in leveraging psychological insights that might advance the understanding of inter-state relations. If psychological explanations are leveraged in the service of social scientific inference, they should be

[6]Mercer's critique is intended to be theoretical, but is persuasive as a methodological comment, as well.

tested against all cases. Where nuclear intelligence is concerned, there is good reason to do so because "selection and interpretation of evidence and one's assessment of risk [...] rely on emotion" (Mercer, 2010, 4).

Despite its narrow application to erroneous judgments, the extant literature on cognition provides a solid foundation for insight into the ways in which states perceive and judge others. This section reviews the potential contributions of psychological findings to nuclear intelligence assessments, drawing on both individual psychological explanations and group processes.

Political scientists have also looked to psychology to explain deviations from an ostensibly rational baseline. Mercer (2005) argues that one of the flaws in this approach is the ex-ante assumption that psychological factors are absent when accurate judgments are formed. Jervis argued that decision-makers' interpretations of history cause "perceptual predispositions" that can lead to errors (Jervis, 1976b, 224). These interpretations distort the perception of incoming signals and lead to cognitive errors without an individual becoming aware of them. For instance, people use their pre-existing beliefs to interpret new evidence, which differs from the pure Bayesian updaters' model of how new information should be used.

Common problems include (a) excessive attention to dramatic events and a supposition that the causes must be equally dramatic, (b) a failure to recognize when the situation has changed to render previous lessons inapplicable, (c) an insufficient examination of counterfactuals in the case of successes and failures, and (d) rare attempts to confirm whether a theory that is derived from one event can explain others before applying it to the situation at hand. These come about because of "the complexity of the subject matter, the small and biased sample of cases available for study, the conditions under which learning takes place, and the decision-makers' failure to realize how much they are influenced by their views of the past" (Jervis, 1976b, 235).

The biggest sources of lessons are events that are experienced firsthand, that influence a person's career, and that have major consequences for the nation at large (such as recent wars and revolutions), as well as an unfamiliarity with counter-examples. Lessons tend to be overgeneralized and oversimplified. In particular, they do not transfer to new situations; they underestimate the causal force of context over internal characteristics, and they are biased against policies that have recently failed and favor those that appear to have succeeded recently (Jervis, 1976b).

Theorists in international relations have invoked newer psychological models since Jervis wrote about the subject, in which emotional and other psychological heuristics are integral to rational behavior (Mercer, 2005, Damasio (2001)). Yarhi-Milo (2013) demonstrates most clearly that governments are not unitary actors in their signal reception. Despite the traditional emphasis on applying laboratory lessons from the study of individual cognitive biases, the intelligence assessments of modern states are not carried out by individuals. Instead, they are products of social interaction inside a professionalized and bureaucratic hierarchy.

Estimators' thoughts are shaped through their interactions with others. In some cases, this social dimension can give rise to groupthink (Janis, 1982). Analysts are also professionals who are trained to recognize and combat biases that might arise in their analysis (B. C. Fischhoff, 2010). Any insights gained from laboratory experiments conducted on individuals without such training may not apply as directly (Malmendier & Shanthikumar, 2007). Yet, even sophisticated analysts and policymakers are susceptible to cognitive errors (Wilson & Brekke, 1994).

Summary

Table 5.2: Explanations of nuclear misestimation

Source of misperception	**Level of analysis**	**Variation**	**Prediction**	**Examples**
Realist	Uncertainty	International	None (possibly alliance)	Overestimation
Signaling	Acquisition cost, misrepresentation	International	None	Correct
Intelligence	Many	Intelligence bureaucracy	Many	Misestimation
Regime	Politicization, coup-proofing	Domestic politics	Regime type	Misestimation
Psychology	Cognitive biases	Intelligence bureaucracy, analyst	None	Misestimation
Culture	Cultural biases	Intelligence bureaucracy	Assessor time and place	Misestimation

The literature reviewed above demonstrates that there are ample extant explanations for why intelligence agencies would produce flawed assessments. However, the active debate about the sources of past misestimates has not yielded a set of generalized expectations about the conditions under which one state will err in assessing another's nuclear intentions and capabilities. System- and state-level explanations typically describe constants, such as overestimations. Cognitive explanations do not provide the conditions under which analysts will be afflicted by biases. Merely reviewing the catalog of pathologies suggests that accurate assessment would be impossible. In

short, even if any number of biases can be identified for a given intelligence failure in retrospect, they do not provide an equilibrium outcome.

Each theoretical and empirical tradition reviewed in this section can offer building blocks for the construction of a research program on the systemic biases in intelligence errors. Realist theories that research the effects of systems-level incentives and strategic situations provide a set of observable implications that are ready for testing at the inter-state level. Psychology certainly has something to contribute, but its hypotheses need to be measured over state-level behavior to see whether predicted patterns of perception conform to practice, or if these factors are ironed out somewhere in the black box of the theoretical state. Rationalist approaches offer a useful reminder that misperception can be optimal under certain conditions, while constructivists and other theorists on strategic cultures have struggled with similar methodological challenges. Finally, focusing on the role of intelligence services in domestic politics provides a possible set of liberal hypotheses about the effect of the regime type for estimators and intelligence targets alike.

The remainder of the chapter will take a step toward consolidating the understanding of intelligence agencies. From the extant literature, it will assemble theoretical building blocks into three distinct theories, each with its respective, empirically observable implications. Hypotheses at the country-year dyadic level will be denoted H, and implications that should be observable by tracing the production of proliferation assessments will be denoted P.

The next section presents two theories that seek to predict the accuracy of intelligence assessment without making reference to the national characteristics of the state carrying out the estimate of another country's nuclear intentions and capabilities. One theory sees intelligence as a function of pervasive fear, which leads to constant overestimation; the other conceptualizes accuracy as being determined by the value that an accurate assessment brings to the state.

5.0.2 Intelligence isomorphism: Fear and information

What does accuracy mean when referring to assessing another state's nuclear technical capability and its medium-term intentions about whether that capability will be used for civilian or military purposes? Intelligence isomorphism predicts that states with equal intelligence collection resources and an identical target program will generally come to the same assessment conclusions. Domestic politics should not affect the accuracy with which one state understands the nuclear capabilities and intentions of another state. Instead, intelligence agencies worldwide should be roughly the same because they perform the same functions and face the same constraints.

Numerous theories, including structural realism and new institutionalism, predict isomorphism. The latter means that intelligence agencies will emerge as homogeneous in form and function. Where structural realism is concerned, the harsh discipline of the international system produces "a tendency toward the sameness of the competitors" (Waltz, 1979, 127).

Isomorphic state institutions can be shaped not only by the competitive pressure to perform but also by the social process of copying others "via worldwide cultural and associational processes" (Meyer, Boli, Thomas, & Ramirez, 1997, 173). As a result, isomorphism may make "organizations more similar without necessarily making them more efficient" (DiMaggio & Powell, 1983, 147).

In the intelligence domain, it is expected that "highly structured organizational fields provide a context in which individual efforts to deal rationally with uncertainty and constraint often lead, in the aggregate, to homogeneity in structure, culture, and output" (DiMaggio & Powell, 1983, 147).

These systems-level theories find support in the comparative studies of individual intelligence agencies. The preponderance of recent intelligence scholarship aligns with isomorphism:

> "Intelligence, broadly or narrowly understood, is ultimately about managing uncertainty where one must and mitigating it when one can. At a certain level it matters little whether that management of uncertainty serves regimes that are benign or malign, actors that are state or substate, or governments or corporations—the process of knowing remains the same." (Davies & Gustafson, 2013, 288)

This is because "where the cognitive task is similar, the resulting formulas resemble each other" (Davies & Gustafson, 2013, 289). States also mimic each other's intelligence agencies explicitly and directly through copying a patron state's service structure or by copying those that appear successful. If outward-facing organizations are disciplined into isomorphic structures, this expectation should also hold for intelligence agencies.

While intelligence isomorphism predicts that assessments will be similar across time and place, it offers no prediction about the possible content of those resulting formulas. Two broad types of predictions can be derived from the literature: a fearful isomorphism and one that rationally processes information.

Fearful isomorphs

According to the realist tradition, states compensate for pervasive uncertainty and danger by erring on the side of overestimation. This is because they fear that underestimation will lead to the death of the state. This perspective predicts a constant exaggeration of the nuclear weapons' ambitions of other states. States that fail to make worst-case assumptions about their potential adversaries should be the exception. The expectation is that they would be selected out of the international system over time. Some conditions, such as the ability to distinguish offensive from defensive weapons, ameliorate this tragic feature of international politics (Jervis, 1977).

However, the dual-use nature of nuclear technology offers no such escape (Lebovic, 2009).

Simplified here as the *fearful isomorphs* theory, these structural approaches draw their explanatory power from treating states as unitary actors; consequently, this makes it challenging to test mechanisms at the substate level. This fearfulness is a kind of informational satisficing. The first available assessment is to assume the worst. Beyond that, returns on additional information diminish rapidly. That fearfulness should be expressed in the assessment process.[7]

Hypotheses

The first hypothesis distills a simple prediction from offensive realism, although the same outcome would be predicted by psychological theories or bureaucratic explanations of an intelligence agency's incentive to inflate threats:

> *Fear: H1* Overestimates of nuclear capabilities and intentions are common, but underestimates rare.

States may trust allies and fear adversaries, which is due to psychological reasons or out of simple realism. If there is reason to overestimate, it would only be in the latter cases. Similarly, a softer version of realism ascribes to states some ability to discern threats on the basis of intentions (Walt, 1985):

> *Fear: H2* States systematically overestimate the nuclear programs of threatening states.

[7]These hypotheses are not intended to be the best possible test of the implications of structural realism. Rather, the aim is to use this literature for its parsimonious insights to explain the phenomenon of interest. For a similar approach, see Tagma (2010).

Table 5.3: Fear: predictions assessment accuracy

Information	Rival	Neutral	Ally
Democracy	Over	Over	Correct or under
Authoritarian	Over	Over	Correct or under

Process tracing implications

While the frequency claim is best evaluated at the country-year level, it is possible to distinguish the implications of psychological and bureaucratic explanations that also predict constant overestimation. A realist might rejoin that the state has reasons to empower the most paranoid humans and organizations as its assessors. The use of implicit or explicit worst-case analysis should be a demonstrable part of the nuclear assessment process. Because the same outcome would be predicted by psychological theories or bureaucratic explanations for intelligence agency's incentive to inflate threats, evidence that assessments are skewed for the purpose of attracting resources to the creating organization must also be assessed.

> *Fear: P1* Use of worst-case analysis during the nuclear assessment process.

Evidence for a competing explanation of overestimation, which holds that assessments are skewed to attract resources to the creating organization, must also be assessed.

> *Fear: P2* Assessing organizations will overestimate, even when it is not in their institutional interest.

These final two may not be fair tests of most realist theories. It would be reasonabe to argue that the institutional locus of a state's fear is not in intelligence agencies, but among the state's leadership. Another caveat is that realists differ on how to treat variables inside the black box. The argument presented here makes the assumption

that realism generates an expectation of isomorphic domestic institutions solely for the purposes of investigating patterns of nuclear proliferation assessment, rather than as an intentional test of foundational realist theory. After all, these theories are oriented more toward great powers, not necessarily the smaller states included in this study.

Information processors

A second family of theories, found in rational choice and signaling models, postulate states as smooth information processors and updaters. These *rational* models of state perception are optimistic about states' abilities, as unitary actors, to update their assessment of external threats or their absence. Accuracy is determined by how much information a state is willing and able to procure.

Some of the intelligence failure literature projects the same theoretical image of the state, expecting perfection in assembling disparate intelligence into an accurate assessment. Errors are idiosyncratic and can be remedied with bureaucratic reorganization and accountability.

The signaling and rational choice models typically do not articulate causal mechanisms. Instead, they imply an absence of systematic barriers to perception and (they imply) states adjusting their assessment efforts according to the salience of the target country's nuclear program to its own interests. That is because "uncertainty is important if, and only if, corresponding surprises would seriously and adversely impact policy outcomes" (Ben-Haim, 2015, 4). Intelligence agencies will be endowed with resources to collect and analyze information about this class of assessment task and will be pressured to deliver accurate assessments for those. Assuming that error tolerance is lower for adversaries, the information theory predicts greater accuracy for them.

The overall concept of intelligence assessment of the rational isomorphic theory is that "[r]educing ignorance merely requires the addition of information about the

intentions of others, either through the process of signaling or the functions provided by international organizations" (Rathbun, 2007, 535). The chapter on the assessment of nuclear intentions already demonstrated that states draw meaningful information from nuclear safeguard agreements and treaty obligations.

Hypotheses

Assessment accuracy is not valued by a rational state for its own sake. Reducing ignorance about the world is costly. Aiming for infinite information is not rational because states need not fear surprise in itself. The true danger is experiencing it in a policy area that is not robust to surprises (Ben-Haim, 2015, 1). Therefore:

> *Rational H3* Assessment accuracy improves with the assessment's salience to the state's policy.

At the same time, an efficient information processing state should be able to make use of additional information and lead to a "convergence on correct beliefs [as] more likely than convergence on incorrect beliefs" (Kydd 2005:19 quoted in Rathbun, 2007, 543).

> *Rational: H4* More information about target nuclear program produces greater assessment accuracy.

Table 5.4: Information processor predictions

	Rival	Neutral	Ally
Democracy	Correct	Over or under	Correct
Authoritarian	Correct	Over or under	Correct

Process tracing implications

It can be observed what happens when new information arrives during process tracing tests. The salience of another country's nuclear program should co-vary with the efforts to understand its present and future dimensions. If this explanation is correct, process tracing should reveal that the expenditure of effort in intelligence collection and assessment is proportional to the target program's salience within the assessing state's policy.

> *Information: P3* New information will be used to update to improve the assessment.

The salience of another country's nuclear program should grow or shrink in co-variance with efforts to understand its present and future dimensions.

> *Information: P4* The expenditure of effort in intelligence collection and assessment is proportional to the target program's policy salience.

The next section relaxes the rationality assumption to admit insights from the non-rational literatures surveyed above. It formulates an alternative theory of governments operating under a condition of bounded perception in assessing the intentions of other states. It also posits an ideological and psychological coup-proofing effect that makes the assessment of adversaries particularly difficult for non-democratic states.

5.0.3 Bounded perception: Between democratic debate and authoritarian harmony

The bounded perception theory proposed in this section combines the explanations of variation in intelligence performance coming from the literature on domestic politics into a predictive theory that can be empirically tested against alternative explanations. The theory provides an explanation for the sources and mechanisms by which

ideological preconceptions and blinders operate in order to produce distortion and misconstrual in foreign intelligence assessment.

The bounded perception theory's core proposition is that states cannot make perfect perceivers of their foreign intelligence services because the former face domestic political trade-offs in organizing their foreign intelligence organizations. The theory posits an ideological and psychological coup-proofing effect that makes the assessment of adversaries particularly difficult for non-democratic states. All states face these trade-offs, but competing considerations in organizing and staffing the assessment workforce rise the more a regime's legitimacy is tied to protecting the selectorate from foreign threats and the more the regime's security depends on a loyal intelligence agency.

Most regimes suffer from excessive harmony within their intelligence apparatus and in relationship to their leadership. Speaking of the latter, Rovner (2011) argues that "the effects of shared tunnel vision are disastrous" (26). The same need for "a certain amount of tension" exists within the analytical bureaucracy, but this is absent here because non-democracies select, train, and promote on the basis of regime loyalty rather than analytic ability. At the conclusion of this process of selection and socialization, intelligence analysts are unlikely to present an unwelcome assessment to policymakers. This situation obviates the need for direct politicization pressure and constitutes an immutable tenet of the bureaucratic culture (Booth, 1979).

This highly bounded ability to perceive the outside world correctly is the natural state for most regimes. Yet, some regimes are able to reduce this boundedness by recruiting a broader set of intelligence analysts and fostering greater internal openness and debate in the assessment process. More often than not, these regimes are democracies. There are certainly other determinates of bounded perception. However, regime difference offers the most direct route to subjecting its implications to rigorous empirical testing for the purposes of theory construction.

Democratic advantage and autocratic weakness in overcoming its bounded perceptions are two distinct sets of mechanisms in determining the boundedness of a state's ability to assess the intentions of other states.

Autocratic weaknesses in perceiving foreign capabilities and intentions are reinforced by democratic strengths in the same functions. Governments with greater openness are better at two processes that can improve their understanding of other states: The first strength is that openness facilitates the process of aggregating available information into a summary judgment in support of a strategy or decision. Secondly, open governments are better able to mobilize the latent expertise from their societies in support of their perceptual processes.

The following section first describes how authoritarian states tend to funnel their assessment apparatus into a condition of bounded perception. It subsequently presents a series of mechanisms that allow democratic states to climb back out of the funnel, giving their perceptual ability a wider aperture. Democratic openness to debate and the authoritarian ideology's recruitment funnel combine to create a net effect that favors democracies over autocracies in their ability to generate accurate nuclear proliferation assessments.

Funneling toward harmony

States have good reasons to avoid the type of unconstrained internal debates within their intelligence agencies, from security concerns to shielding their policy failures from the selectorate. The offset-price for loyalty and security, however, is the net accuracy in foreign intelligence assessment. Personnel selection and the cognitive consequences. Debate variation can be within and across institutions.

In their role as security-providers to a regime, most intelligence agencies are inherently political, with the following effect:

> "[P]rincipals will try to control the agency by selecting personnel that shares their own political preferences and ideological inclinations. Control is not achieved by rendering the agency politically neutral, but by making it politically similar to the government. This parallels what Huntington called subjective civilian control." (Faini, 2015, 35)

The effect this will have on the quality of intelligence assessment comes about as follows:

> "Managers and their policies usually are root causes of intelligence successes and failures because they shape the demography, training, work assignments, performance standards, and ethics of the analyst corps. Even when individual analysts make mistakes that produce corporate analytic failures, they do so as designated agents of managers." (Marrin, 2013, 175)

The authoritarian filter that bounds statse' perception is comprised of five stages of ideological selection: recruitment, selection, training, promotion, and attention. Each is described here, as follows.

1. Recruitment

The first funneling stage determines who is *de jure* eligible to serve as an intelligence officer. As a regime type that theoretically represents and grants equal status to its citizens, democracies should be more expansive in their selection criteria. Almost by definition, authoritarian governments are predicated on the idea that some individuals are more fit to serve the state than others. As a result, recruitment occurs on a combination of merit and loyalty, beginning with "a screening process, whereby elite positions are considered as 'closed' positions in organizations, access to which involves

screening for both education and party membership" (Walder, Li, & Treiman, 2000, 195).

2. Selection

The second stage constitutes who is successfully recruited into an intelligence service. This stage of the funnel is also the de facto implementation of the first phase. In addition, it is where supply (of analysts) meets the demand. Owing to the regime's legitimacy, democracies should have a greater diversity of citizens willing to serve their government–and to be trusted with secrets by that government. In non-democracies, the potential pool of interested applicants will be smaller since it consists of regime supporters and opportunists. Not everyone who applies must be a true believer, but the most ideologically committed are also the most likely to become intelligence analysts in subsequent stages.

3. Training

Once selected, intelligence officers must be trained to perform their analytic duties. In a process of formal education, indoctrination, and socialization, intelligence officers learn their role with respect to their society, government, and political leadership. In democracies, foreign intelligence assessment will be taught as a set of nonpolitical, analytical skills that serve to detect threats to the country as a whole. In contrast, authoritarian states will impress upon analysts their narrower role in protecting the regime from enemies, both foreign and domestic.

4. Promotion

Any bureaucratic advancement will be the combined result of an individual officer's merit and loyalty. In proportion to each another, democracies will reward ability more than correct political views. There is an active debate on the logic of promo-

tion in single-party states, centered on the experience of Communist China. Shirk described the country's pathway of advancement as a "virtuocracy," which requires that bureaucrats must be "politically correct as well as skilled in work" (Shirk (1982), 4). There may be other logics at play in China, over time and in other places; however, the conclusion is that many political considerations, beyond merit, determine a servant of the state's rise in single-party states (for instance, Walder (1986), argues that promotion is more about connections and relationships than party ideals). While democracies may often fall short of the meritocratic ideal, a system oriented toward its fulfillment is more likely to succeed than one that rewards unrelated qualities in its intelligence professionals.

5. Attention

The final regime difference benefits authoritarian intelligence agencies. Given the preceding funneling stages, autocratic leaders will have good reason to accept the assessments arriving from their analysts. Contrary and unwelcome information that is uncongenial to current policy will probably not be presented at the far end of the four-stage funnel. In a democracy, there is more reason to ignore intelligence because the analysts will not have been selected to provide harmonious information.

Intelligence that strays from the party line may be taken as evidence that the ideological filtering process was unsuccessful or that the agency is mounting a power challenge. The least likely option is that it will be taken all the more seriously because it comes from a reliable source. Of course, attention is distinct from impact and occurs according to this project's dependent variable of whether the assessment is accurate.

The ideological constraint

A psychological effect results from this filtering process. By the time they are in a position to challenge the political leadership with analysis, intelligence officers will be psychologically disinclined. The result is an ideological boundary that surrounds the entire process of intelligence assessment.

Understandings of ideology as a the concept abound and depend on the research program. A classic definition describes it as follows:

> "as a logically coherent system of symbols which, within a more or less sophisticated conception of history, links the cognitive and evaluative perception of one's social condition –especially its prospects for the future-to a program of collective action for the maintenance, alteration or transformation of society." (Mullins, 1972, 510)

The link between "evaluative perception" and a "program of collective action" is the mechanism by which mono-ideological intelligence agencies are handicapped. Concepts, predictions, or possibilities that are outside the bounds of the ideology cannot be applied to improving an assessment's accuracy. Once more, a more contemporary psychological definition makes the close link between how the world is and how it ought to be:

> "Ideologies also endeavor to describe or interpret the world as it is—by making assertions or assumptions about human nature, historical events, present realities, and future possibilities—and to envision the world as it should be, specifying acceptable means of attaining social, economic, and political ideals." (Jost, Federico, & Napier, 2009, 309)

Every human mind operates under some form of ideology. The content and salience to intelligence assessment varies (Jost, Federico, & Napier, 2009). A religious world

view qualifies as an ideology and can be relevant in some cases, but not in others. A greater dedication to an ideology has an inverse correlation with an ability to think imaginatively about out-groups (Jost, Federico, & Napier, 2009, 326).

The power of ideology is enhanced by its role in supporting "an elite and to justify the exercise of power" (Apter, 1964, 18, quoted in Fagerholm (2016)). This establishes a link between the cognitive breadth permitted in the intelligence assessment process and the rational interest in regime preservation.

An assessment process that is at the far end of this ideological funneling process will be constricted. However, if the career incentives are as obvious under authoritarianism as they appear to be to scholars, aspiring intelligence analysts should have no difficulty simulating their ideological commitments. If the ideology is only simulated, might it still distort the assessment process?

Two possibilities arise: One is that analysts know their conclusions are false, but are incentivized to present the politically correct assessment. Another is that simulation eventually gives way to adoption of at least some of the ideological principles.

If intelligence officers are merely simulating their belief, that simulation in itself should approximate this effect,. A system in which everyone simulates ideological dedication will perpetuate itself indistinguishably from a system of true believers. In fact, psychological mechanisms illustrate how intelligence officers can turn themselves into unwitting believers. Two similar psychological research programs, known as System Justification Theory and Terror Management Theory, show that individuals increase their commitment to the status quo political system in moments of threat salience (Jost, Kay, & Thorisdottir, 2009, 161).

The more ideologically constrained, the less accurate the assessment. The type of constraint will vary depending on ideological boundaries, concepts, and content. Marxism-Leninism is interesting because it is standardized across countries and still exists. Communism is the most obvious kind of ideology, but could be a more locally

grounded, simpler ideology of protection from foreign or domestic threats. Variation occurs over issues and other countries.

This ideological constraint should be especially pronounced in assessments of adversaries, because protection from foreign threats is at the core of the legitimacy claims for most authoritarian regimes. Consequently, questioning the severity of an adversary's aggressive intent can undermine the regime. The image of the adversary as offense-oriented will be shared by proliferation analysts, who are predisposed to believe this view at an individual level. Consequently, these individuals work inside an institution that is dedicated to the idea of an adversary's inherent aggressiveness. Assessments from authoritarian intelligence agencies are less likely to be accurate because accurate proliferation assessment combines the target's intent and capabilities. However, broader debate should still be observed on issues that are peripheral to the regime's legitimacy.

By contrast, the openness of internal debate in democratic bureaucracies allows them to update images faster, respond to changing intent, and converge on a more accurate picture of intentions. This is sometimes at the possible cost of overcorrection. The comparatively higher instances of friction in democratic intelligence assessments are examples of strength in the long run. They can outweigh the damage that may result from the inherent temptation to politicize intelligence agencies in democracies as described by Rovner. Therefore, the regime difference theory is in line with the accounts of democracies behaving in more nimble and responsible ways on the international stage.

Continuous differences

Ideological funnels operate in any government, but will be systematically wider in open governments and constrict with increasing authoritarianism. However, demo-

cratic and authoritarian systems are not divided dichotomously in the bounded perception theory.

All governments will (attempt to) screen out some of these ideologies when hiring their intelligence assessors. It is quite obvious that intelligence agencies will not be eager to hire those professing a political preference for a different regime type. Democracies will be reluctant to hire monarchists, monarchies will not bring democrats into the inner sanctum. Anarchists need not apply in either circumstances. However, this restriction is not absolute and some democracies may be willing or forced to live with an intelligence corps that has non-democratic leanings; perhaps because it has been inherited during a transition. This means that analysts working at democratic institutions must also pass through a funnel, but one with a wider tube, which makes it possible to have intelligence analysts with a greater diversity of ideologies and whose ideologies have a lower cognitive salience.

How do predictions about ideological selection change across the regime continuum? Starting at the far end of the regime continuum with a dictator, the above-described ideological funnel is less systematic. Ideology may matter less than loyalty, and sometimes competence will be rewarded–but it can also be punished. This allows unstable single-party states with high leadership contestation to function like a dictatorship.

The literature on the differences in state behavior according to their regime type provides expectations of variation within authoritarian regime types. Single-party regimes, where "the atmosphere at the top can be quite open" should outperform dictatorships (Weeks 2014, l. 564). Moreover, democracies should once again outperform these regimes in interpreting intentions.

The openness advantage

The openness of *internal* debate in democratic bureaucracies allows them to update assessments faster, to respond to changes in intent, and to converge on a more accurate

picture of intentions.[8] The comparatively higher friction in democratic intelligence assessments is a strength in the long term and outweighs the damage that can result from politicization. The mechanism of democratic advantage in the bounded perception theory would therefore be aligned with accounts of democracies behaving in more nimble and responsible ways on the international stage.[9] Sporadic and egregious assessment errors will occur nonetheless.

Democratic culture

Democratic intelligence agencies benefit from having the minds and permissive environment that allow productive disagreement. It is possible to agree to disagree. This is not as likely to be possible for high-salience issues in an authoritarian structure. There are two components in this difference: the diversity of individual perspectives and the institutional norms and procedures. Institutional norms and procedures can benefit democratic intelligence agencies over their authoritarian competitors. Information is distributed and aggregated more efficiently in a flatter organization than in a hierarchy (Farrell & Shalizi, 2013, and Knight and Johnson (2014)).

The first observable implication is a broad prediction that–across the expanse of time and place, and with all else being equal–democracies will produce more accurate intelligence assessments.

> *H5* The more democratic a government, the better its ability to assess the intentions of other states.

Predicting another state's behavior requires an accurate understanding of its motivations and decision-making process. Process tracing should reveal an openness in

[8] This argument is separate from claims about the benefits of a more open public debate, such as freedom of the press or the wisdom of democratic crowds, in foreign policy decision-making.

[9] The literature on differences in state behavior according to the regime type provides expectations of variation within an authoritarian regime type. Single-party regimes, where "the atmosphere at the top can be quite open" should outperform dictatorships (Weeks, 2014, l. 564). However, democracies will be inherently superior in interpreting intentions.

the internal dialog of a democratic intelligence process and an ideologically bounded internal dialog in an authoritarian context.

Observable implications

The combination of unique difficulties for autocracies and advantages for democracies suggests that the following should be observed empirically:
The key causal mechanism that requires testing is that authoritarian states select and socialize intelligence officers who share the official image of the adversary. This filtering process should not be as strong in a democratic intelligence service, even though there is good reason to expect that democracies do not draw from all possible viewpoints in their personnel recruitment.

> *H3* Authoritarian states are less accurate at predicting the nuclear proliferation behavior of adversaries than of friendly and neutral states.

Specifically, authoritarian states are less adept at assessing intent when estimating adversaries.

Table 5.5: Implications of bounded perception theory

	Democracy	**Autocracy**
Adversary	Correct	Overestimate
Ally/neutral	Correct	Correct

Hypotheses

The combination of unique difficulties for autocracies and advantages for democracies suggests the following should be observed empirically: Predicting another state's behavior requires an accurate understanding of its motivations and decision-making process.

Table 5.6: Bounded perception

	Rival	Neutral	Ally
Democracy	Correct	Correct	Correct
Authoritarian	Over (under also possible)	Correct	Correct

Process tracing implications

This theory also expects to see openness of the internal dialog in a democratic intelligence process and closed internal dialog in the authoritarian context.

> *Bounded perception: P5* Democracies exhibit intra-governmental dissent in the production of nuclear assessments. Authoritarian states do not.

> *Bounded perception: P6* Authoritarian states select, screen, and constrain intelligence officers to share the official image of the adversary.

5.0.4 Remaining sources of variation

The above theories are *ceteris paribus* predictions. Valid empirical tests of these theories must ensure that any differences in the cases are controlled. Depending on the theory, the target program's political and technical aspects must be held constant in addition to the assessing state's intelligence collection capability.

These controls relate to the technical factors that make some target programs more difficult to estimate. This step involves more than just substantive interest: It is also crucial in establishing which cases are comparable for the purposes of identifying the sources of political bias. A framework is required to account for the potentially confounding effects of technical characteristics–which may correlate with both the

outcome and explanatory variables–in the quantitative analysis and the matching of cases for causal process tracing.

For instance, the presence of more facilities and expertise in the target program should make assessment harder because it is easier for the country to change course. Latent capability may even present a temptation. The more developed the nuclear program's enrichment and reprocessing infrastructure, the more difficult the assessment. The processes of importing uranium, equipment (reactors, centrifuge parts, etc.), and other materials and expertise make proliferators vulnerable to foreign detection. The more the weapons program depends on technological or uranium imports, the less difficult the assessment. Finally, because of their physical and chemical properties, the fissile materials chosen in the weapons program will also affect the likelihood of detection and accuracy of assessment. Plutonium-based programs are more difficult to assess than uranium-based programs.

Conclusion

Table 5.7: Competing country-year level hypotheses

Competing predictions	Rival	Neutral	Ally
Democracy	Fear: O Information: C Regime: C	Fear: O Information: O/U Regime: C	Fear: C/U Information: C Regime: C
Authoritarian	Fear: O Information: C Regime: O	Fear: O Information: O/U Regime: C	Fear: C/U Information: C Regime: C

This comparison is relative. It is not about which state is perfect, but how they fare in relation to each another. Single-party regimes should perform the best among

authoritarians, and yet the democratic advantage should persist when it comes to intentions. If the fear model were confirmed by historical evidence, this would substantiate the merits of searching for the microfoundations of realist and system-level concepts. If this perspective is false, states would not be the paranoiacs that we suspect them to be. In turn, the deterrence literature would receive a boost if states were finely attuned to the actions and capabilities of other states. If not, this raises the possibility that the signaling and bargaining literature has disproportionately favored the broadcasting of signals before verifying that they would be received–even roughly–as they had been intended.

The literature on differences in state behavior according to regime type provides expectations of variation within the authoritarian regime type. Single-party regimes, where "the atmosphere at the top can be quite open," should outperform dictatorships (Weeks 2014, l. 564). Furthermore, democracies should outperform them in interpreting intentions.

Autocratic weaknesses in perceiving foreign capabilities and intentions are reinforced by democratic strengths in the same manner. Governments that are more open are better at the two processes that can improve their understanding of other states: The first is that openness facilitates the process of aggregating available information into a summary judgment in support of a strategy or decision. Secondly, open governments are better able to mobilize latent expertise from their societies in support of their perceptual processes.

Even if there are instrumental reasons for professing one ideology or another, the mechanisms described above posit that a posture assumed for career advancement can lead to a culture bound by that ideology–and may even come to constrain the cynic's cognition.

The hypotheses reveal the difference between perception and assessment. To the fearful isomorph school, perception of another state's nuclear weapons' intentions

and capabilities means the receipt of suspect and not especially valuable indicators of foreign dangers. These indicators mean more to the information isomorphs, who actively allocate their limited perception resources in order to target countries and programs that have the greatest expected salience for their interests. Then they smoothly process the incoming signals. On the other hand, the regime difference theory sees the perception process as a bureaucracy's active creation of an image regarding nuclear intent and capability.

Summary of observable implications

Table 5.8: Summary of observable implications

Theory	*Observable implication*
Fear	*H1* Overestimates of nuclear capabilities and intentions are common, but underestimates are rare.
Fear	*H2* States systematically overestimate the nuclear programs of threatening states.
Fear	*P1* Use of worst-case analysis during the nuclear assessment process.
Fear	*P2* Assessing organizations will overestimate, even when it is not in their institutional interest.
Information	*H3* Accuracy is determined by the assessment's value to the state.
Information	*H4* More information about target nuclear program produces greater assessment accuracy.
Information	*P3* New information will be used to update to improve the assessment.
Information	*P4* The expenditure of effort in intelligence collection and assessment is proportional to the target program's policy salience.
Perception	*H5* The more democratic a government, the better its ability to assess the current intentions of other states.
Perception	*H3* Authoritarian states are less accurate at predicting the nuclear proliferation behavior of adversaries than of friendly and neutral states.
Perception	*P5* Democracies exhibit intra-governmental dissent in the production of nuclear assessments. Authoritarian states do not.
Perception	*P6* Authoritarian states select, screen, and constrain intelligence officers to share the official image of the adversary.

5.0.5 Testing strategy

The empirical tests are undertaken with the same three levels of analysis familiar from the previous two chapters. The table lists the relative diagnostic value of every level for each theory's hypotheses and mechanisms. Before reporting on the results of the quantitative tests, this section discusses the testing strategy for each observable implication in turn.

Table 5.9: Inferential leverage of observable implications

Theory	*Observable implication*	*Global panel*	*Case studies*	*Process tracing*
Fearful isomorphs	*H1* Overestimates of nuclear capabilities and intentions are common, but underestimates are rare.	High	Low	None
Fearful isomorphs	*H2* States systematically overestimate the nuclear programs of threatening states.	High	Low	Low
Fearful isomorphs	*P1* Use of worst-case analysis during the nuclear assessment process.	None	Medium	High
Fearful isomorphs	*P2* Assessing organizations will overestimate, even when it is not in their institutional interest.	None	Medium	High
Info processors	*H3* Accuracy is determined by the assessment's value to the state.	Low	High	High
Info processors	*H4* More information about target nuclear program produces greater assessment accuracy.	Medium	Medium	High
Info processors	*P3* New information will be used to update and improve the assessment.	None	Low	High
Info processors	*P4* The expenditure of effort in intelligence collection and assessment is proportional to the target program's policy salience.	None	Medium	High
Bounded perceivers	*H5* The more democratic a government, the better its ability to assess the intentions of other states.	Low	High	High

Continued on next page

Table 5.9 – *Continued from previous page*

Theory	*Observable implication*	*Global panel*	*Case studies*	*Process tracing*
Bounded perceivers	*H6* Authoritarian states are less accurate at predicting the nuclear proliferation behavior of adversaries than of friendly and neutral states.	High	High	None
Bounded perceivers	*P5* Democracies exhibit intra-governmental dissent in the production of nuclear assessments. Authoritarian states do not.	None	Low	High
Bounded perceivers	*P6* Authoritarian states select, screen, and constrain intelligence officers to share the official image of the adversary.	None	None	High

Fear H1 Overestimates of nuclear capabilities and intentions are common, but underestimates are rare.

This generalized hypothesis predicts a constant bias toward overestimation and can be tested with simple counts and ratios at the global panel level. While there is no guarantee of representativeness, the four cases studies cover sufficient variations of target and assessor types over several decades so that a pattern of overestimation should appear in the history.

Fear H2 States systematically overestimate the nuclear programs of threatening states.

States can be threatening in several ways. A rival's acquisition of nuclear materials would be especially threatening. The first statistical model therefore tests whether assessors are more likely to overestimate the proliferation propensity of states with which they do not enjoy positive relations. The global panel is best suited for this test.

Fear P1 Use of worst-case analysis during the nuclear assessment process.

Fear P2 Assessing organizations will overestimate, even when it is not in their institutional interest.

The West German process-tracing section includes as much information about the process of creating intelligence assessments as was retrievable from the historical record. Some of this evidence, at a lower degree of detail, is also available for the case studies.

Info processors Accuracy is determined by the assessment's value to the state.

Knowledge of another state's nuclear weapons intentions and capabilities can be valuable for three main reasons: The first among these are security interests. So in contrast to the prior *Fear* hypothesis, a state should assess its adversaries with greater accuracy. With an eye toward the balance of power, it should also have a clear understanding of its allies' capabilities. For states that are a distant security concern, assessors would rationally choose to live with broader uncertainty. The second value is economic. Close trading partners, especially in terms of nuclear technology, will have a deep interest in their respective capabilities and intentions. The next version of this article will incorporate tests involving global nuclear trade data. The third reason is diplomatic interests. These are ample in the context of the nuclear nonproliferation regime complex that evolved during the study period. Establishing other states' positions and compliance requires investigation and assessment, even from small intelligence agencies reporting on distant governments.

Policy salience is difficult to measure reliably at the country-year level, especially because it is rarely a purely bilateral dynamic when it comes to nuclear matters. For example, a state may not be affected by economic or trade relationships with a country on the other side of the world, but may find itself under pressure by a global power or the international nonproliferation regime. These measurements are more reliable at the case study and process-tracing levels, where they can be evaluated

against evidence from the archival files of the foreign ministries in each assessing country.

Info processors More information about target nuclear program produces greater assessment accuracy.

At the country-year level, it is possible to measure how long a target state has been active in the nuclear field. A nuclear newcomer's intentions and capabilities provide less information than accumulated years of available evidence.

Info processors P3 New information will be used to update and improve the assessment.

Info processors P4 The expenditure of effort in intelligence collection and assessment is proportional to the target program's policy salience.

Formulated as process-tracing implications, neither of these can be observed statistically. However, evidence for and against the propositions appears in the case studies.

Bounded perceivers H5 The more democratic a government, the better its ability to assess the intentions of other states.

Bounded perceivers H6 Authoritarian states are less accurate at predicting the nuclear proliferation behavior of adversaries than of friendly and neutral states.

The current panel dataset mostly consists of equally democratic intelligence assessors situated in non-political agencies. The sole autocracy is the East German MfS, which did not issue the sweeping global assessments found in US and British intelligence reporting. Fortunately, the Stasi's documentary record compensates with depth for what it lacks in breadth. The bounded perception explanation can therefore be tested in detail with the case studies and through process tracing, which specifically examine the comparative disadvantages faced by East German assessors.

Bounded perceivers P5 Democracies exhibit intra-governmental dissent in the production of nuclear assessments. Authoritarian states do not.

Both implication of the bounded perception theory is observable for the process-tracing stage. Some evidence appears in the case studies as well.

Bounded perceivers P6 Authoritarian states select, screen, and constrain intelligence officers who share the official image of the adversary.

Testing this implication requires evidence from outside of the proliferation-assessment process. To evaluate its accuracy, the West German process-tracing case includes a discussion of what can be known about the bureaucratic careers of intelligence officers from the assessing states.

5.0.6 Global panel results

The country-year observations in the dataset are not independent of each other because they rely on a common information set and analytical framework.[10] Using fixed effects for both the countries and year of estimation would eliminate this threat to internal validity, but too little variation would remain from which to draw inferences in the current dataset. Therefore, the standard errors will be clustered on the countries until more estimates can be added to the dataset. The resulting statistical tests can confidently identify the associational relationship between the variables, which is sufficient for the present purposes.

No support: *Fear* Overestimates of nuclear capabilities and intentions are common, but underestimates are rare.

Contrary to the theoretical expectation found in realist work, the intelligence assessors in the dataset overestimated in 5% of cases when the assessment was erroneous. Excluding passive assessments errors–those in which a program fell under the scope conditions of a given assessment, but was overlooked–the proportion of overestimates

[10]The correlation across time within a country is most worrying if Jervis' argument about the application of preexisting beliefs to interpret new information is indeed a substantively strong effect in the formation of state estimates.

rises to 8%. Dividing the full set of misestimates into which proliferation stages were erroneously assessed, for exploration and pursuit, the proportion of underestimates to overestimates was about 10 to 1. Acquisition was not even overestimated once.

Support: *Fearful overestimators* States systematically overestimate the nuclear programs of threatening states.

Results of the first model in the table show that assessors were significantly less likely to overestimate the nuclear programs of countries with which they had struck entente or neutrality agreements. There was no statistically meaningful relationship for defense treaties, which fails to provide evidence for the hypothesis.

***Information processors* Accuracy is determined by the assessment's value to the state.**

For reasons discussed above, this hypothesis was not tested at the country-year level.

***Information processors* More information about target nuclear program produces greater assessment accuracy.**

The results in the regression results table show that being able to observe a target program over multiple years does not correlate with assessment accuracy. In other words, the longer a country operates a nuclear program, the more difficult it becomes to assess its purpose and future course. This provides strong evidence against the hypothesis.

***Bounded perception* The more democratic a government, the better its ability to assess the intentions of other states.**

There were no predictions in the GDR's intelligence assessments. While this fact makes it impossible to run a quantitative analysis, it offers tacit support to the

Table 5.10: Models for global panel hypothesis testing

	Dependent variable	
	Overestimate	Error in estimate
Nonaggression pact	3.20***	
	(1.70, 4.70)	
Defense treaty	.06	
	(−1.20, 1.30)	
Entente agreement	−2.80***	
	(−3.70, −1.90)	
Neutrality pact	−14.00	
	(−1,465.00, 1,438.00)	
Program years		.24***
		(.17, .31)
Calendar year		−.02**
		(−.03, −.004)
Prediction years	−.08*	.03**
	(−.18, .01)	(.01, .05)
Assessor: West German intelligence	−2.20*	.49
	(−4.40, .04)	(−1.10, 2.00)
Assessor: UK intelligence	−6.00***	−3.20***
	(−7.40, −4.50)	(−4.40, −2.00)
Assessor: US intelligence	−4.20***	−3.10***
	(−5.30, −3.10)	(−4.30, −1.90)
Constant	−.85*	31.00***
	(−1.80, .11)	(7.70, 54.00)
Observations	12,676	12,679
Log Likelihood	−311.00	−3,995.00
Akaike Inf. Crit.	639.00	8,005.00

Note: *p<0.1; **p<0.05; ***p<0.01

Base assessor: East German intelligence — Both models with target country fixed effects.

hypothesis. The authoritarian intelligence analysts were unable or unwilling to extend their analysis of the target countries' current nuclear capabilities into a predictive assessment.

The second table presents a small piece of evidence in favor of the hypothesis. Democratic assessors were statistically more likely to use information about the target country's intent when describing its proliferation potential.

Bounded perception **Authoritarian states are less accurate at assessing the nuclear proliferation behavior of adversaries than of friendly and neutral states.**

Given the small number of non-democratic global proliferation available at the moment, *large N* quantitative tests would be underpowered with the currently coded data.

To summarize, the statistical examination of the three competing theories makes a modest contribution to weighing the evidence. However, some conclusions can be drawn. The fearful isomorph theory failed its "hoop test" (Evera, 2015, l. 333). Contrary to the expectation of constant over prediction, intelligence assessments exhibited great variation in their accuracy. Underestimates were more common. Consequently, the hypothesis can be dismissed without need for causal process testing. The other isomorphic hypothesis, which views intelligence assessments as a function of the target program's policy salience, received mixed support in these tests. The severe limitations on the data currently available for quantitative testing of the observable implications associated with the bounded perception theory does not allow for a full test.

5.0.7 Case studies in bounded perception

How well do the three theories presented above perform in explaining the variation described in performance in assessing the Chinese, Indian, Pakistani, and Argentinian nuclear programs? Surveying evidence from all four case studies from the previous chapter, the fearful isomorphic theory seems to offer little power, while the rational isomorphic and bounded perception seem to account for much of the observed pattern.

Fearful overestimators **Overestimates of nuclear capabilities and intentions are common, but underestimates are rare.**

The cases reviewed above demonstrate that states occasionally overestimate. They also frequently describe the worst-case scenarios for how a state could quickly use its current nuclear capabilities to create a nuclear arsenal, especially when it has little information about the intentions of its adversaries. However, a crude count reveals that overestimates were far outnumbered by correct estimates or underestimates. China's capability was underestimated by USA and UK intelligence agencies because they both focused on the wrong technical path toward fissile material production. Yet, both countries tracked the intent accurately.

For India, the reverse was true. All five assessors were able to accurately report on the country's technological capabilities. This was facilitated by the country's relative openness about its nuclear infrastructure and foreign participation in it. The variable and opaque intent proved more difficult to gauge. However, assessors did not respond to this uncertainty with consistent overestimation. The common approach was to articulate the limits of their understanding, and errors were more likely to be underestimates than overestimates. The major exception to this was the US overreaction to India's 1974 nuclear test.

Errors in assessing Pakistan's program were also more likely to be underestimations than overestimations. The sole exceptions were the British claim that Pakistan had

developed weapons intent before it actually had done so, as well as an exaggeration of future fissile material production. The Swiss also exaggerated Pakistan's ability and willingness to match India's 1974 detonation.

The Argentinian case provides the most evidence of uncertainty leading to overestimation. The majority of observing countries interpreted the country's idiosyncratic nuclear policies as indications of a weapons program. This particularly applies if current scholarship is correct in treating the secretive drive for a full unsafeguarded fuel cycle program as the result of nationalist ideology and if the wish for indigenous HEU was intended for naval fuel.

Fearful overestimators **States systematically overestimate the nuclear programs of threatening states.**

This hypothesis yields *weak empirical support*. The most adversarial relationship in the chapter's sample was between the United States and China. However, US intelligence analysts persistently underestimated the country's progress toward its nuclear arsenal instead of inflating the rival state's nuclear capability.

British intelligence took the same approach and also did not appear to allow increasing tension over the Falkland Islands to affect its pre-war assessments of Argentina's nuclear program. Whether post-war assessments were influenced by the sharpened adversarial relationship is not yet clear. East German assessments of Pakistan, with which it had a distant but officially unfriendly relationship, also consisted of underestimates.

However, neutral and/or small countries like Sweden, Switzerland, and East Germany were rather unlikely to overestimate distant and bilaterally non-threatening states like Pakistan and India.

Information processing **Accuracy is determined by the assessment's value to the state.**

This hypothesis receives *mixed support* from the historical cases described above. In several cases, which include British and American attention to the Indian and Chinese programs, higher security policy stakes did not produce better accuracy than achieved by states such as Sweden and East Germany that made their assessments with less information.

Some of the assessors were (potential) nuclear technology suppliers to the states that they assessed. This increased the salience of the assessment because none of these states wanted to assist or be seen as assisting a weapons program. West Germany and Switzerland provided nuclear technology to Argentina and Pakistan. Britain and the US exported to India and Pakistan, at least in the early stages of the programs. Britain also entered into a competition with West Germany over supplying a reactor to Argentina in the years leading to the Falklands War. These export and cooperative relationships appear to have increased the accuracy of capability assessments, but have no relationship with the assessment quality relating to intent.

Information processing **More information about target nuclear program produces greater assessment accuracy.**

The empirical results for this rational isomorphic theory are *mixed.* Although it may be tautological, this hypothesis certainly was true for capability. The more analysts knew about their target's nuclear infrastructure, the better they could describe it. Intent was a different matter. More raw intelligence about state intent did not reliably lead to a clearer picture of the target's nuclear present and future. Analysts tracking China's and Pakistan's nuclear programs benefited most directly from the expanded collection effort. As noted above, nuclear supplier countries were reasonably well informed about their customers' programs.

However, a serious confounding variable limits the usefulness of these observations. States will endogenously choose to collect more information about other states that are difficult to assess. If the target's decision-making is generally opaque or the nuclear program is deliberately shrouded, states can be observed in trying to collect more information without a resulting expectation of greater accuracy. The above comparative approach can only evaluate the relative performance of assessors across targets rather than track the acquisition and processing of intelligence. The subsequent chapter on causal process tracing accomplishes this objective.

These cases demonstrate the limits on how much information states are able to acquire about another state's nuclear decision-making. For example, although the expenditure of extensive resources allowed the United States to collect hidden information about China's nuclear capabilities, this effort was insufficient for discovering that the country would initially produce a uranium-based bomb. Other incorrect assessments, as well as the many instances in which analysts confessed their ignorance, were the result of absent information about state intent. It appears that the relationship between collection effort and insight into intent is subject to an inherent limit.

Bounded perception **The more democratic a government is, the better its ability to assess the intentions of other states.**

As in the preceding quantitative analysis, most of the above cases originate from strong democracies and only offer a limited variation for testing the hypothesis in full.

When the performance of non-democratic East Germany (GDR) is compared with similarly sized democracies such as Sweden, Switzerland, and West Germany, the former ranks in the same range of assessment accuracy. The GDR's assessment of India was superior, yet its analyses of Pakistan suffered from an underestimation of

capabilities. The available analyses of Argentina are insufficient to make a direct comparison, and the country did not monitor China's program in the early stages. Fortunately, the following chapter on causal process tracing provides a more extensive opportunity to test the effect of the theory's implications for the mechanism by which regime type influences the assessment process.

Bounded perception **Authoritarian states are less accurate at predicting the nuclear proliferation behavior of adversaries than that of friendly and neutral states.**

On the whole, the evidence *supports* this narrower hypothesis. The GDR performed better with India than Pakistan, even though the latter represented an easier target. Relations with India were largely positive, especially once the country extended diplomatic recognition to East Germany. Pakistan was seen as an adversary.

Other observations

It is noteworthy that there is no evidence of politicization among democratic assessors in these cases, even when there was an obvious policy interest in several instances. Especially Swiss and West German intelligence agencies were not hesitant to point out when their own government's policies and private companies were enabling proliferation in India, Pakistan, and Argentina.

The above cases also demonstrate that intelligence assessments are sometimes right for the wrong reasons and sometimes wrong for the right reasons.

It is also apparent that some target programs were easier to assess than others. Countries like India and Argentina with steadily increasing nuclear capability, but waxing and waning weaponization intent, proved especially difficult for intelligence analysts. The rather obvious Pakistani and Chinese intent was not difficult for foreign

intelligence agencies to track, even if the precise technical capability of these countries was not fully appreciated.

5.0.8 Conclusion

The combination of this chapter's case study approach and the previous chapter's large N methodology have shown that both information processing and bounded perception theories explain some of the variation in assessment accuracy. However, the democratic difference theory provides a more extensive explanation. The next chapter will explore the theorized causal mechanisms of the competing theories within the setting of a new case study: East German, British, and American assessments of West German nuclear intentions and capabilities during the first half of the Cold War.

5.0.9 Tracing the sources of assessment error

While the aggregate pattern of democratic assessment superiority held in the prior tests, the mechanisms of authoritarian harmony and productive democratic dissent can be verified in detail by tracing the inner workings of the assessments of the Federal Republic's nuclear program.

After finding that hypotheses predicting isomorphic intelligence assessment behavior are unable to explain broad historical patterns in the preceding large N and case study chapters, the task here is to test the causal processes operating in the information isomorphism and bounded perception theories.

The two democracies of the United States and Great Britain were more accurate in assessing the nuclear weapons capabilities and intentions of West Germany as their ally than the target country's main adversary, the single-party state of East Germany. This finding is congruent with the theory of bounded perception in intelligence assessment. How much evidence is there of the theory's causal mechanism at work?

And even if the construct of intelligence agencies operating as rational information acquirers and processers did not hold well in explaining broad patterns of accuracy, might evidence for that theory's causal mechanisms exist in this in-depth examination? If intelligence assessors behave similarly regardless of regime type, the intelligence process should demonstrate an equal ability in using new information to update and improve assessments. Quality of assessment should only vary with the policy salience of the target program and be a function of how much each state was willing and able to pay for a clearer picture of West Germany's nuclear intentions and capabilities.

Because all three governments were assessing the same state, the difference in assessment quality cannot be explained with any characteristics of the target regime or technical program. Broadly speaking, the three were also comparatively equally well equipped to carry out assessments of West Germany. There were obviously important differences: East German intelligence analysts had to assess whether Germany would receive nuclear weapons from the United States. This was not a challenge for American analysts and only a small one for British assessors. However, all three faced the challenge of determining whether the Federal Republic would be provided access to French weapons.

The US and the UK had the advantage of a large military and intelligence presence in West Germany, as well as many formal and informal connections to the decision-makers and scientists. This cooperation was preceded by both countries having serving as occupiers of a defeated West Germany. Enforcing post-war restrictions on West German war-making capability gave both a detailed baseline of West German capability and personnel, which were verified with challenge inspections.[11]

[11]The Military Security Board's regulations, inspections, and export controls can be considered the world's first international nonproliferation measures. See FO (1950b) for the procedures developed in 1950. These would be adapted over the course of the occupation, which ended in 1954 (FO, 1950a).

To illustrate the intrusiveness of these measures: A mine was inspected for suspicious uranium traces in 1954 (FO, 1954), a professor was investigated for handling radioactive material (MOD, 1952-1961), and both exports and imports with even the most tenuous nuclear connection required approval (FO, 1953, 6 and FO (1958), 1). British intelligence maintained a detailed registry of German scientists and their work, with an emphasis on "those who are likely to play a leading part in the organisation of their science in the future, and to whom the German Government would naturally turn if it wished for scientific advice or assistance" (MOD, 1951-1952). Even that mandate was interpreted broadly, since "it is impossible to predict what future scientific developments will be of major military significance, the Scientific Research Division maintains full documentation on all scientific research and related matters" (MOD, 1951). That explains how British intelligence found itself tracking German leather production in detail (MOD, 1951).

East Germany had advantages elsewhere, all based in being one half of a divided country. Before the construction of a hard border, its intelligence officers and sources could pass between the two states relatively unhindered (Gieseke, 2006). It also maintained a strong ideological appeal (the motives of two-thirds of its West German recruits were recorded by the HVA as ideological) and could leverage family ties and cross-border travel to recruit sources (BStU, 2013, 21).

Information processing

Confirming evidence takes the form of a state investing more resources in intelligence collection and assessment as the salience of the Federal Republic's nuclear capabilities and intentions rose and new information about the target program was used to update the assessment and improve its accuracy. A state failing to make use of all the relevant information available to it–or to seek it–is disconfirming evidence.

East Germany

The German Democratic Republic's performance in assessing the Federal Republic of Germany provides strong evidence against the information-processing theory. In addition to the communist state overestimating to a greater degree than the democracies and being less accurate with vastly better information about the FRG's intent and capability by virtue of its steady stream of human intelligence from the centers of decision-making and the nuclear infrastructure, the quality of the assessment also declined as more information arrived.

Policy salience mechanism: confirm

Policy salience was highest in the 1950s, when there was great concern that a nuclear-armed Federal Republic would intervene in (or even provoke) a domestic uprising in the East. After the West's initiation of *Ostpolitik* in 1969, concerns over military revisionism declined. The absence of assessments in the archives suggests the possibility that this change in policy was credible enough to persuade the intelligence assessors to stop studying the issue. This could have been reinforced by West Germany's concurrent NPT signature and eventual ratification. If so, the evidence would point in the opposite direction to the policy salience prediction: As salience decreased, accuracy increased.

Then again, East German intelligence did not have much of a choice in where to direct its intelligence efforts. It could not look east at its Soviet patron, which proved to be the cause of death for the German communist state.[12].

Information responsiveness mechanism: reject

Unlike in the American and British cases, records of the East German human intelligence collection process are available and can be examined in depth. East Germany's

[12]The HVA did begin to collect intelligence in Poland starting in the 1980s (Knabe, 2010, 1)

massive and successful intelligence collection campaign against its capitalist other half produced an inflow of information about its foreign, security, and nuclear policies. The volume and the quality of sources were not converted into more accurate intelligence assessment.

The MfS tracked the evolution of West Germany's nuclear energy and research program in great detail. In addition to "Klaus," the Karlsruhe reprocessing facility accountant described below, the HVA's department *XIII/1* had sources reporting from all over the Federal Republic's nuclear infrastructure and its international projects. Over the years, these included a nuclear research center in France, engineers with the Nukem and Siemens companies, and a scientist at the Max Planck Institute (BStU, 2013, 208-19). Judging by the evaluations awarded to his reports, the department's top source was a physicist with a reactor manufacturer operating under the code name, "Herzog." He delivered 2,161 items between 1975 and 1988, half of which were original documents. Seventeen of these received the rare and highest evaluation of "very valuable" and 203 they were deemed "valuable" by the East German intelligence officers (BStU, 2013, 226).

Military intelligence most likely had far fewer and lower-quality human sources (or, it is fair to speculate, the MfS would have taken control). It is therefore extremely telling that its assessments were generally more accurate than those produced by the Stasi's foreign intelligence bureau.

United Kingdom

British intelligence tracked German nuclear intentions and capabilities in detail over time. However, the level of detail did not always track the policy salience, providing only weak support to the policy salience mechanism. More support from the case comes to the information responsiveness mechanism: British intelligence used new information to improve their assessments.

Policy salience mechanism: mixed German nuclear capabilities and intentions remained exceptionally salient to British security policy throughout the study period. German nuclear issues were discussed in the cabinet and subjected to a sustained intelligence effort. But aside from the technical analysts and military intelligence, the assessors themselves were not always responsive to the policymakers' level of alarm. This was expressed not only in the content of their reports, but in the priority that they gave their creation. One analyst excused the delayed assessment production by claiming that "the current excitement over Icelandic fishery limits has made it impossible for me to deal with this before now" (Reilly, 1958, 1).

Economic salience fluctuated. In the 1950s and 60s, the potential of a German nuclear energy industry was seen as a potential competitor, which it eventually became. But in the late 1960s, the two countries began cooperating on several nuclear research projects. These included the previously suspect nuclear research institutions near Jülich and Karlsruhe (from early exploration described in Scientific & Administration, 1970, to the intimate exchanges by the mid-1980s, exemplified by Scientific and Administration (1984)). The Foreign Office saw the complexity of the economic relationship:

> "H.M.G.'s policy is not yet fixed and consideration of it is being influenced by the following factors, which work in rather different directions. (a) Western Germany belongs to that group of countries which have the necessary resources to develop nuclear power stations. She should be able to do this within the next few years. (b) She has however to start from scratch and will be glad of assistance either in the form of"know-how" of expensive equipment, or both. (c) The Americans and ourselves are the only two Western countries which could provide this help, but the Americans are at present much better placed to give it. We require all our resources for our own civil and military programme. However, we are

considering expanding our capacity in order to meet foreign requirements. If we do so the problem of Anglo-American competition will have to be resolved. (d) With the future in mind we are cultivating good atomic relations with other potentially atomic European countries and are negotiating bilateral agreements with them about the exchange of information. These countries are not named but Germany is not among them. (e) Germany is not expected to buy a great deal of equipment for her atomic project as she will be able to make her own - but she may buy some. (f) Our main interest in collaborating with Germany is probably in obtaining scientific and engineering information resulting from her own research and the development of her project. We might also thus hope to exercise some indirect control over her development or tie her more firmly in with the West or forestall Russian offers of help." (Dean, 1955, 1)

Economic factors were not the sole consideration:

"First, co-operation is important on account of the need to remain aware of what the Germans are doing in this field. Secondly, there are strong political reasons for co-operating. The Germans are at present atomic-energy mad. They realize that they have been left behind and they are facing rather similar fuel problems to the United Kingdom. They know that we have much to offer, especially in the civil field, and it will undoubtedly react badly on Anglo-German relations if we disappoint them. Thirdly, I suggest with respect that there would seem to be a strong commercial advantage. There are plenty of indications that the Germans will, during the course of the next few years, wish both to buy equipment overseas and also desire expert foreign designers and engineers to assist them in installing it." (FO, 1955, 1)

British assessment efforts varied with the salience of German security behavior, as predicted by the isomorphic hypothesis. Following the Second World War, Britain established an intelligence presence in the country that was initially directed at the Germans. The British endeavored to make the most of the opportunity, arguing in 1951 that at "the present time excellent opportunities exist for intelligence in GERMANY largely due to our ability, under the Occupation Statue, to lay down our own rules and to the provision of adequate manpower for the task. These good days will not last" (JIC, 1950, 1).

With the initiation of the Cold War, the focus moved to developments in the Soviet bloc and overshadowed fears of an implacably aggressive (West) Germany. While the military officers who had recently fought the Germans were slower to update their understanding of German intent, the process of assessment included a willingness to reexamine British understanding of German motivations. Even allowing that "the Germans had always felt the need of a guiding directive", the belief was that "the moving force of the great majority of the younger generation was the desire for a European community" (JIC, 1961, 1). By the 1960s, references to Germans' inherent warlike characteristics disappear from the written record. Ethnic essentialism was, of course, becoming less common in the West.

Information responsiveness mechanism: confirm

It is not known how much British intelligence collected nuclear secrets from West Germany. However, it is evident in the records of the foreign ministries and heads of government that had more contact with high level decision-makers, providing them with volumes of information. As an illustrative example for the kind of information that this could yield, the Ministry of Defense's state secretary met with Strauss in May of 1969 for a detailed conversation about German nuclear thinking (Defense Staff, 1969). British officials queried Strauss about his recent statements regarding

nuclear weapons and received clarifying answers. This conversation also revealed that Strauss believed there were British and French nuclear weapons on German soil–which his British counterpart said was not the case.

British assessments proved very responsive to changes in the German nuclear program and this kind of incoming information.

With regard to West German international commitments, British intelligence drew accurate conclusions. The 1954 Brussels Treaty commitment not to manufacture nuclear arms on West German soil was understood correctly. The later concerns about the commitment's legal gaps was evaluated with a deeper understanding of their origin and not mistaken for the clever ploy that Adenauer and East Germany later sought to portray. Germany's 1970 NPT signature did not influence British assessors, possibly because by that time they had ruled out a German weapons intent and were beginning a research collaboration at the Karlsruhe complex that provided a close-up view of Germany's fissile materials productive capabilities and activities.

Evidence about the accuracy of British understanding regarding German-French weapons collaboration remains ambiguous. The British government appeared to be unaware of the agreements of late 1957/early 1958. Even though the Federal Republic reported (a possibly sanitized version of) the collaboration to the United States in April, the information had not reached Britain a month later when a major assessment was being produced (Fischer, 1993, 126).

US nuclear weapons sharing through NATO did not present a serious analytic challenge for British assessors. Another German multilateral project, Euratom, puzzled British assessors. In 1969, the most that the Defence Science and Technology Intelligence staff could say was that it appeared "that EURATOM control does not in practice entail much physical inspection" and that "work on the ultracentrifuge is classified" and exempt from these controls (FO, 1969, 2). Why Britain failed to

seek clarification on the extent of application for Euratom safeguards is difficult to explain.

United States of America

American intelligence did not perform in line with the isomorphic information processing theory: There was no observed relationship between the policy salience of the issue and the input effort or accuracy of American assessments. As new information became available, however, American intelligence performed reasonably well in exploiting it for more accurate assessments.

Policy salience mechanism: reject Expenditure of effort in intelligence collection and assessment should be proportional to the target program's policy salience, but the United States invested surprisingly few resources into assessment despite being central to the policy.[13] The strength of this conclusion is tempered by the inability to trace the movement of information from the collection stage to the finished assessment.

Information responsiveness mechanism: weak support

The new information that was available to assessing governments did not always integrate smoothly into new assessments. Most egregiously, a German general circulated information about nuclear cooperation with France within NATO that was not reflected in the relevant intelligence assessment (Skogmar, 2004, 224). But when it came to tracking the implications of the Federal Republic's international commitments and cooperation agreements, U.S. intelligence performed well.

[13]Unlike their British colleagues, US intelligence also did not seem able to reach policymakers–who believed West Germany had more serious nuclear weapons intentions than the historical record suggests–with their conclusions.

Summary

The policy salience predictions perform reasonably well, but present mixed results. Both the US and the UK seemed to under-invest in their collection efforts given the issue's position on the Cold War's security and diplomatic agenda. For instance, British intelligence did not know whether Euratom inspections were being conducted in West Germany and never endeavored to find the answer.[14] On the other hand, East Germany devoted great effort toward collecting and analyzing information about the Federal Republic's nuclear program without approaching an accurate representation of West Germany's nuclear program.

Testing the responsiveness to information also returns a conflicted result. The GDR's elaborate collection process focused on tracking their opponent's activities in detail did not improve the quality of its assessment. By contrast, British and American information-gathering, despite some friction in distributing relevant information internally, was generally used to narrow the uncertainty surrounding their frontline ally's nuclear intentions.

Bounded perception

If the bounded perception theory explains the pattern of estimation accuracy, the following three causal mechanisms should be observable in the creation of the respective nuclear assessments. Firstly, the GDR, as a non-democratic state, should assume its West German rival's intent as fixed. Secondly, the democratic assessors in the United Kingdom and the United States should experience intra-governmental dissent in the production of nuclear assessments. East Germany should not. Thirdly, the GDR's assessments should have been conducted by analysts with a more constrained

[14] British intelligence appears to have outperformed the other two in convincing policymakers of their conclusions.

worldview because that worldview was the primary qualification for participation in foreign intelligence.

German Democratic Republic

Despite the critical strategic importance of the question, East German intelligence largely performed under ideologically-imposed boundaries around its perception of West Germany's nuclear program.

Disagreement mechanism: support Evidence of overt disagreement between analysts or departments or with managers is rarely evident in the East German documentary record. The biographies of former MfS officers also suggest a culture of strict hierarchical obedience.

There is little sign of dissent in the GDR's interpretation of West Germany's political and nuclear weapons intentions. Rather than provide feedback, it appears that unwelcome reports by the military intelligence service were buried by the Stasi.

Just as telling is the evidence contained in the East German files of active arguments on subjects other than the adversary's intent. As shown in the preceding chapter, the analysis of Indian nuclear intentions demonstrated a willingness to entertain a variety of theories. There is no evidence of an analytic product on the subject being out of harmony with policymakers' views in East Germany.

However, there is a general sense from the Stasi's records that the quality of intelligence–including expressions of uncertainty–improves as it moves up the chain of command. An example of this is the evaluation that was applied by a member of the intelligence minister's staff of the accusations made by Dr. Steenbeck about West German "plutonium enrichment" capabilities. If representative of a dynamic in which disagreements were synthesized at higher levels, it would be in opposition to the sense that democratic intelligence assessments lose their quality and qualifiers

"as the paper rises in the intelligence bureaucracy" (Weiss, 2007, 62). Regrettably, the present evidence base does not permit more than speculation on this question.

Selection mechanism: support If the bounded perception theory explains assessment performance, there should be evidence that authoritarian states select and socialize intelligence officers who share the official view of the adversary. There is strong evidence of this causal mechanism at work in producing the GDR's overestimates of its adversary. Each West German technical capability was examined for its weapons application. Given the dual-use nature of nuclear technology, these were typically not difficult to find. In contrast, the UK and US assessors attempted to follow political constellations and incentives in discovering current and likely nuclear policies. In other words, the democracies treated their assessment target's behavior as responding to incentives in its environment. The autocracy focused on its inherently hostile nature.

Another indication of how the MfS viewed its adversary's intent as inherently aggressive was first seen in the collection phase due to how it phrased questions put to its informants in the West German nuclear program. For instance, the accountant at the Karlsruhe nuclear research facility was instructed to provide evidence about weapons-related activities with leading language, demanding that he find evidence for proliferation activities (HVA, "Klaus").

East Germany also focused on the Federal Republic as an ex-fascist and currently imperialist state. It used the prior National Socialist affiliations of physicists to infer the weapons-oriented nature of their research (MfS, 1979). Throughout the 1960s, British intelligence also interpreted German military policy with occasional reference to Germany's past character.

The selection of intelligence officers in East Germany followed strict guidelines:

> "Given the political nature of the Stasi's main aim, only carefully selected, politically loyal and faithful individuals were eligible to work for the organization; professional qualifications played only a minor role in its early years. As the guidelines for the Stasi's cadre work from the early 1950s stated, "Employment in the . . . state security service is open only to screened and politically blameless members of the SED and the FDJ [the communist youth organization]." (Süß, 2014, 89)

Loyalty had to be to the party, not the state:

> "...the Stasi tolerated lack of party membership at best only temporarily — in the case of newly acquired cadres or employees in its few civilian services. Particularly in the Stasi's formative years, candidates for recruitment not only had to be party members but they also had to pass a sort of preselection to make the short list. Although it is not mentioned in the directive cited above, eyewitnesses have reported that early on, Soviet "advisers" had to give their consent as well before the MfS could recruit a given candidate." (Süß, 2014, 89)

The pool of candidates was further educated in official views about West German intent during their training. A graduation speech for new military intelligence officers that begins with an admonition for objectivity soon moves to the argument that "it did not require research" to question the professed good intentions of an imperialist state (MfNV, 1971, 65). Further, it would be the officers' duty to:

> "correctly assess the unchanged reactionary and aggressive character of West German imperialism in order to contribute successfully to uncovering its counterrevolutionary activities of any kind [which requires you to] self-critically examine your own views and conclusion for your selfless con-

tribution to solving the tasks established by the Party and government." (MfNV, 1971, 65)

Collecting with comrades

The influence of ideological orthodoxy affected the collection stage as well. One example in particular demonstrates the intrusiveness of ideology.

The MfS' most valuable source on the technical aspects of the West German fuel cycle operated under the codename "Klaus" at the Karlsruhe research center between 1965 and 1977 (BStU, 2013). Rainer Fülle was an accountant and well-positioned to provide information about reprocessing activities at the facility, as well as developments in West German nuclear industry. The demand that he provide confirmatory evidence of nuclear weapons activities was discussed above, but there was an additional way in which ideological requirements seemed to conflict with the intelligence collection.

Klaus' annoyance with the political discussions that were a required part of all in-person meetings shines through in his handler's reports. These included mandatory topics like the 24th conference of the Soviet Communist party and drivers of imperialist aggression (HVA, 1970, 41). To overcome his lack of responsiveness to these topics, his handlers moved them to the top of the agenda for each meeting.

By the early 1970s, Klaus represented to have experienced a political conversion. Either this radicalization succeeded, or Klaus found it best to placate his handlers by simulating interest.

If the political conversion was a genuine success, it included its own dangers:

> "For my part, I could tell that the IM [informal employee, the MfS designation for a source] understands the foundational political questions and apparently takes them as the basis for his actions [than before.] It must be noted that, as the IM himself says, it will be difficult for him to conceal his positive political opinion in the interest of his operational work. This

is especially true, as he says, with respect to his relatives." (HVA, 1970, 52)[15]

Unfortunately, direct evidence of this phase in the intelligence cycle is not available for the democratic intelligence agencies.

United Kingdom

Disagreement mechanism: confirm In contrast to the MfS' burial of military intelligence reports, there were differences regarding interpretation in the US about West German goals, which are expressed formally as footnotes in the National Intelligence Estimates. The creation of British assessments involved contentious debates, especially about the young Federal Republic's departure from past militarism. British assessments even included criticisms of government policy. [.do examples]

Selection mechanism: support

Communist infiltration at the highest levels of intelligence in the early Cold War suggests the absence of an effort to screen for ideological harmony. Intelligence assessment was open to diplomatic, military, and technical expertise. It was also connected with policymakers, allowing their information to be integrated into assessments. Proximity also made it possible to correct mistaken policymaker impressions, as seen in the case of the military's temporary alarm over West German militarism.

USA

Disagreement mechanism: confirm In the US, the intelligence community's sanguine view was a persistent dissent from policymakers' view. Until the early 1970s,

[15] "*Von meiner Seite aus konnte ich feststellen, daß der IM heute die politischen Grundfragen weit besser erkennt und offensichtlich zur Grundlage seines Handelns nimmt, als das bei den persönlichen Treffs in den Jahren 1964/65 und bei dem letzten persönlichen Treffs im Jahre 1966 der Fall gewesen ist. Es ist zu beachten, das wie der IM selbst sagte, es für ihn sehr kompliziert wird, seine positive politische Meinung im Interesse der operativen Arbeit zu unterdrücken. Vor allem, wie er sagt, gegenüber seinen Verwandten.*"

concern that West Germany could develop its own nuclear arsenal was a major driver of US foreign policy (Brands, 2007, 399, and Trachtenberg (1999)). As the assessments reviewed above illustrate, these policymaker concerns could not have been created by their intelligence briefings.

> "In June 1962, [Adenauer] met with Rusk and again told his story about the 1954 pledge and how Dulles had supposedly said that the *rebus sic stantibus* doctrine would of course apply. To Rusk–and this fact shows how poor American intelligence was on the issue–this came as something of a revelation. The Germans, he was surprised to discover would not agree to abandon their nuclear option. He therefore reached the conclusion that the problem was not purely theoretical, but that German nuclear aspirations were to be taken seriously. Other high officials had reached similar conclusions by mid-1962. Kohler, for example. was also struck by the fact that the Germans had been careful to say there were no pressures for a national nuclear program"as of now." " (Trachtenberg, 1999, 341-2)

Confirming Yarhi-Milo (2014)'s findings about policymakers' attraction to vivid information, US leaders relied heavily on their interaction with German leaders to draw their conclusions.[16] Intelligence analysts did not bend their analysis to reflect ongoing policy initiatives and the impressions gathered in private meetings. Contrary to Trachtenberg's conclusion, this policy-intelligence gap in assessing the West German program did not demonstrate "how poor American intelligence was on the issue" but quite the opposite.[17]

[16]Even more evidence is that around the time Henry Kissinger was being briefed that West Germany had little interest in nuclear weapons, he urged US forces to secure their arms against West German seizure based on his impressions from a meeting with Strauss (Strauss, 2015).

[17]While it is troubling that good assessments sometimes did not influence policymaking, the outcome of interest here is the assessment rather than its impact.

Table 5.11: Results of causal mechanisms testing

	US	*UK*	*GDR*
Intelligence isomorphism: Salience	Reject	Mixed	Confirm
Intelligence isomorphism: Responsiveness	Mixed	Confirm	Reject
Bounded perception: Dissent	Confirm	Confirm	Confirm
Bounded perception: Selection	Confirm	Confirm	Confirm
Bounded perception: Collection	N/A	N/A	Confirm

Conclusion

Table 5.12: Empirical support for observable implications

Theory	*Observable implication*	*Global panel*	*Case studies*	*Process tracing*
Fearful isomorphs	*H1* Overestimates of nuclear capabilities and intentions are common, but underestimates are rare.	Reject	Mixed	N/A
Fearful isomorphs	*H2* States systematically overestimate the nuclear programs of threatening states.	Reject	Support	N/A
Fearful isomorphs	*P1* Use of worst-case analysis during the nuclear assessment process.	N/A	N/A	Mixed
Fearful isomorphs	*P2* Assessing organizations will overestimate, even when it is not in their institutional interest.	N/A	N/A	Reject

Continued on next page

Table 5.12 – *Continued from previous page*

Theory	*Observable implication*	*Global panel*	*Case studies*	*Process tracing*
Info processors	*H3* Accuracy is determined by the assessment's value to the state.	N/A	Mixed	Support
Info processors	*H4* More information about target nuclear program produces greater assessment accuracy.	Against	Reject	Reject
Info processors	*P3* New information will be used to update and improve the assessment.	N/A	Mixed	Mixed
Info processors	*P4* The expenditure of effort in intelligence collection and assessment is proportional to the target program's policy salience.	N/A	Mixed	Mixed
Bounded perceivers	*H5* The more democratic a government, the better its ability to assess the current intentions of other states.	Support	Support	Support
Bounded perceivers	*H6* Authoritarian states are less accurate at predicting the nuclear proliferation behavior of adversaries than of friendly and neutral states.	N/A	Support	Support

Continued on next page

Table 5.12 – *Continued from previous page*

Theory	*Observable implication*	*Global panel*	*Case studies*	*Process tracing*
Bounded perceivers	*P5* Democracies exhibit intra-governmental dissent in the production of nuclear assessments. Authoritarian states do not.	N/A	N/A	Support
Bounded perceivers	*P6* Authoritarian states select, screen, and constrain intelligence officers to share the official image of the adversary.	N/A	N/A	Support

The table summarizes the evidence from all three levels of analysis. How does each theory perform on the levels that provide the strongest tests?

The theory of states as fearful isomorphs is best tested at the global panel level, where it soundly fails both tests. Empirically, there is simply no evidence of pervasive overestimation. However, the overestimates that were observable in the case studies did provide some limited support to the posited mechanisms of neorealist fears of nuclear dangers abroad.

The information processing theory's most diagnostic tests occurred at the case study and process-tracing levels, where it collected large amounts of evidence both for and against the rationalist model of state perception. This inconclusiveness could be overcome with more clearly specified causal mechanisms.

Bounded perception received the majority of support in its most diagnostic tests: the case studies and process tracing sections. Large N statistical testing was severely limited because of missing proliferation assessments from other states as strongly

bounded in their perception as the former East Germany. On the basis of these tests, it has the most explanatory power of the three theories developed above.

In summary, this evidence predominately supports the theoretical claim that democratic pathologies–as damaging to the quality of intelligence as they are–still allow democracies to perceive their adversaries more accurately. Democracies and non-democracies may be equal in evaluating neutral and friendly states, but the congruent assumptions held by analysts and policymakers about an adversary's aims in a non-democracy prevents them from developing an accurate estimate of current and future intentions and capabilities.

The misleading idea that democratic intelligence organizations are chronically politicized and therefore produce inaccurate assessments is largely a function of two dynamics: The first is the relative openness of some democracies in matters of intelligence, which primarily applies to the United States and more recently to the United Kingdom. This openness in the second dynamic is especially pronounced when democratic accountability processes—ranging from legislative inquiries to press investigations–disproportionately expose assessment failures rather than the baseline of competence discovered in this chapter. Instead, authoritarian states are more likely to suffer from bounded perception, in which regime security requirements damage their intelligence agencies' ability to assess nuclear weapons intentions of other countries. The West German case presented above illustrates quite clearly that the advantages of democracies in analysis outweigh any collection disadvantage.

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Chapter 6

Conclusion

Intelligence assessments of other countries' nuclear programs are difficult to create. Contrary to much of the academic and policy literature, however, some intelligence agencies are better at the task than others. As the previous chapter illustrated, those high-performing intelligence agencies tend to serve democratic masters, who impose fewer ideological boundaries around their assessment process. In turn, these democracies are rewarded with a better picture of which countries have nuclear weapons, which are pursuing them, and which are innocent suspects seeking only nuclear technologies and materials for idiosyncratic–but peaceful–purposes. These insights were developed as a theory of bounded perception.

The bounded perception theory argues that democratic leaders *can* politicize assessments; authoritarian regimes *must* politicize their assessors. The former episodically corrupts intelligence work; the latter systematically undermines the creation of accurate intelligence assessments. In models of politicization in democracies, policymakers cast a shadow over–or interfere with–the intelligence cycle to distort intelligence assessments. In autocracies, political distortion happens prior to the intelligence cycle. The recruitment and training process produces analysts who are unlikely to produce assessments that are out of harmony with their political leadership. Authoritarian

intelligence assessors are constrained even before the intelligence cycle is set into motion. In other words, autocracies politicize their intelligence analysts and not their intelligence assessments. As a net effect, this makes it far more difficult for these analysts to create accurate assessments.

Still, some evaluations of non-democratic intelligence officers are excessively harsh:

> "Intelligence "analysts" in communist states were not analysts at all but newsmen. They did not try to achieve an understanding of foreign events independent of that of the communist regimes they served. Nor, as a rule, did they make forecasts or prepare long-term analyses of trends. Instead, they summarized incoming information. In American terminology, they provided current intelligence (even though they were well-suited to providing estimative intelligence since they obtained numerous policy documents from ministries and international organizations). As a rule, they only supplied an analysis of a long-term trend or a forecast if one were contained in the information they were summarizing. They passed on news rather than understanding." ("Introduction: Achieving Objective, Policy-Relevant Intelligence", 2015, 8)

As seen in the East German intelligence records, the Stasi and military intelligence could create sophisticated and accurate intelligence assessments–just rarely about the regime's core adversary, against which it derived all legitimacy and from which its insecurity emanated.

This dissertation has also demonstrated that some nuclear programs are more difficult to assess than others. Some of these discoveries come with possible policy implications.

Larger programs involving more stages of the nuclear fuel cycle are difficult to understand from abroad, especially during periods of qualitatively new growth spurts.

Countries embarking on making nuclear energy investments would be wise to consider presenting the economic logic behind their plans well in advance. General transparency is advisable. Protecting trade secrets should not come at the cost of becoming a proliferation suspect. While the evidence for specific dual-use technologies causing bad assessments was mixed, states in precarious security situations may need to think twice before becoming involved in the production of fissile materials if they want to avoid initiating a security dilemma with rival states. Efforts from within the international nonproliferation regime to restrict enrichment and reprocessing technologies are also worth pursuing in this manner.

The possibility of importing technologies and materials for a nuclear weapons program consistently bedeviled proliferation analysis. While the *export* activities of the AQ Khan network have since made this danger rather apparent, the same network's *imports* caused trouble for the world's intelligence agencies as they erred and erred again in assessing the Pakistani program. This reinforces the conclusion that the global market should be as much of an intelligence target as any national program.

Relatedly, it was evident that multinational ownership of sensitive nuclear materials and technologies calm intelligence analysts' concerns– even if the safeguards arrangements are less stringent. This also speaks in favor of arranging international fuel banks.

Finally, while safeguards are not perfect fire alarms, their presence or absence provides useful information to intelligence assessors. These ancillary benefits should be considered against any limitations to individual safeguards agreements.

Formal diplomatic commitments proved to be very helpful for intelligence assessors in reaching accurate conclusions about a country's nuclear intentions. By no means did they naively accept promises of nuclear abstention. Instead, the differentiated posture a state would take in response to international pressure provided clues about which

options governments wanted to save for possible future use. Traditional arguments in favor of the international nonproliferation regime have not addressed this feature. In contrast to measures like the NPT, IAEA safeguards, and other elements of the nonproliferation regime, wide-ranging domestic political debates on nuclear weapons did not assist proliferation assessors. Similarly, the lack of constrain on the executive or frequent changes in decision-makers seemed to introduce uncertainty to the estimates more than inaccuracy. Authoritarian states and those with security problems were also given the benefit of the doubt more often than would have been expected. These considerations, lessons, and warnings for evaluating country's proliferation risk are not just intended for intelligence professionals but all watchers of nuclear programs. In particular, they may serve to remind policymakers of the value that a formal proliferation assessment offers. As seen in the West German and Argentinian cases, policymakers behave more like fearful overestimators when drawing their own conclusions about intentions. By contrast, intelligence assessors can combine their estimates of intent with an understanding of the capabilities. Policymakers should pay closer attention to their briefings.

There are limits to the research presented here. Above all, the inferences were drawn from the early nuclear age, including the period before the spread of IAEA safeguards and plentiful satellite reconnaissance abilities. Intelligence agencies are presumably learning organizations that have drawn some of the same conclusions and adjusted their practices accordingly. However, technological progress has not made assessing intent any simpler, and this is likely to remain the less scrutable side of the nuclear proliferation Janus.

In addition to these theoretical contributions and policy implications noted above, this dissertation contributes the following empirical and methodological innovations to scholarship in the realm of nuclear weapons and intelligence.

Empirically, it provides a novel set of archival documents from multiple countries whose intelligence activities have typically not been analyzed by scholars. The in-depth examination of East Germany's collection and analytical process introduces a particularly novel set of descriptions involving a non-democratic intelligence agency at work.

Methodologically, it provides a structure and dataset with which to directly compare the analytic abilities of multiple intelligence agencies. This dataset could be used to answer research questions other than those posed herein. The way that it was used in the dissertation helps to contextualize the impression that democratic intelligence agencies are poor at understanding and predicting nuclear proliferation. It has rather been the case that they are the only transparent agencies with the poor fortune of having their failures revealed, while the successes remain hidden. Intelligence officers have obviously long advertised this assertion.

In light of these findings, it may be appropriate to revise the CIA's famous biblical inscription. In place of, "And ye shall know the truth and the truth shall make you free," the organization's motto could more accurately reflect the causal mechanism as: "Be free and you will know the truth."

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