

CONTENTS

Illustrations vii

Acknowledgments ix

- 1 Introduction 1
 - 2 Strategies of Nuclear Proliferation and Their Sources 15
 - 3 The Varieties of Hedgers: India, Japan, West Germany, Brazil and Argentina, Sweden and Switzerland 53
 - 4 The Sprinters: Soviet Union, France, and China 127
 - 5 The Sheltered Pursuers: Israel, Pakistan, and North Korea 176
 - 6 The Hiders: Iraq, Taiwan, and South Africa 236
 - 7 The Consequences for Nuclear Proliferation and Conflict: Halting Hedgers and Handling Hiders (Libya, Syria, and Iran) 292
 - 8 Conclusion 338
- Bibliography 353
- Index 369

1

Introduction

Just after midnight on September 6, 2007, four Israeli F-15s and four F-16s screamed low over the desert and leveled a nondescript structure in the Syrian hinterland on the banks of the Euphrates River.¹ For years, American and Israeli intelligence satellites had noted the building but were not overly concerned—the “cube,” as it was known, was undefended. There were no suspicious traffic patterns or activity, and the facility was littered with debris, making it appear like one of the many abandoned structures in the area. There was nothing to suggest that the Syrian government even cared about the building. Not until an Israeli intelligence operation in March 2007 copied the contents of a laptop belonging to the head of Syria’s Atomic Energy Agency did the Israelis learn that the “cube”—officially called al Kibar—was in fact a replica of North Korea’s Yongbyon nuclear reactor. The eponymous cube was a superstructure to conceal what lay underneath from satellites passing overhead: a nearly complete graphite-moderated nuclear reactor. With no visible evidence that it was designed to ever plug into Syria’s electrical grid, American and Israeli intelligence concluded that the building had only one purpose: to produce plutonium for a Syrian nuclear weapons program.

As a junior varsity member of the Axis of Evil, Syria’s president Bashar al-Assad had reasonable grounds to fear that, without nuclear weapons, he might be an easy target for mid-2000s America on a regime-change binge.

1. See Amos Harel and Aluf Benn, “No Longer a Secret: How Israel Destroyed Syria’s Nuclear Reactor,” *Haaretz*, March 23, 2018, <https://www.haaretz.com/world-news/MAGAZINE-no-longer-a-secret-how-israel-destroyed-syria-s-nuclear-reactor-1.5914407>.

Nevertheless, the United States was stunned at Assad's sheer audacity: attempting to hide an *aboveground nuclear reactor* built with North Korean assistance, in the year 2007, knowing that America and Israel were continuously watching overhead. The Israelis took no chances and decided to destroy the building on September 6, risking a war with Syria to flatten the reactor. The strike likely occurred weeks before fuel elements were to be added to the reactor core making it "hot," after which it would have been nearly impossible to destroy without significant environmental damage. Syria, a member of the Nuclear Nonproliferation Treaty (NPT) in otherwise good standing, was attempting to pursue a clandestine nuclear weapons program in the most creative and brazen way possible. Syria's nuclear program, though it was ultimately thwarted, illustrates that the way states pursue nuclear weapons rarely resembles the American Manhattan Project or China's determined state-mobilized effort to build the bomb. This is a book about these different strategies of nuclear proliferation and why they matter.

There are two core questions motivating the book. First, how do states pursue nuclear weapons and why do they select a particular strategy of proliferation over the alternatives? Second, how do their choices of strategy affect nuclear proliferation and conflict dynamics? This is the first book to systematically analyze how states seek nuclear weapons, identifying the strategies available to them, and why they choose a particular strategy to do so. It shows that nuclear aspirants' strategic choices follow a clear logic and have important consequences for nuclear proliferation and conflict. Different strategies of proliferation have different likelihoods of success and provide different vulnerabilities that can be leveraged by nonproliferation policies to try to stop states from attaining nuclear weapons. As the world finds itself in a new nuclear era now thirty years after the end of the Cold War, understanding the dynamics and consequences of the proliferation process—which strategies of proliferation are available to states, which strategy a nuclear aspirant might select and why, and what the international community can do to thwart nuclear proliferation depending on the aspirant's strategy—is critical to global security.

The proliferation literature to date has almost exclusively focused on the question of why states pursue nuclear weapons. The question of how states pursue nuclear weapons, once choosing to do so, has received less attention. To the extent that scholars considered it, they have focused on the technical choices states made rather than on political choices and strategies of proliferation. Most scholarship on nuclear proliferation further assumes that states pursuing nuclear weapons prioritize speed of development and attainment over all else—a strategy I call *sprinting*. When nuclear pursuers

stop short of a functional arsenal, scholars often assume that technological barriers or external pressure impeded them.

I correct these misconceptions. I show that states choose from four discrete strategies of proliferation and that the logic that leads them to one of these strategies has little to do with resource constraints. States that seek the bomb—or develop an option to seek it in the future—approach the problem with ruthless pragmatism, weighing their domestic and international constraints and opportunities. Security considerations motivate a state to consider developing a nuclear weapons option, but I highlight the crucial role of domestic political consensus in driving a state toward an active nuclear weaponization strategy. My theory emphasizes the degree to which proliferators anticipate attempts by outsiders to frustrate their efforts. Fear of preventive action drives many of their calculations. The danger of prevention leads proliferators to seek creative alternative strategies to develop nuclear weapons: some cultivate or exploit the protection of great powers who can deter or dissuade adversaries from mounting preventive attacks on the proliferator, while others attempt to hide their proliferation from the outside world with a clandestine nuclear weapons program.

What are these different strategies of nuclear proliferation available to states? The first part of the book offers a novel typology of nuclear proliferation strategies, which I call *hedging*, *sprinting*, *sheltered pursuit*, and *hiding*. Some states, such as Japan and Sweden, choose to *hedge* on their potential path to attaining nuclear weapons, seeking not the rapid development of a nuclear weapons capability but rather to put the pieces in place to weaponize at a later date if necessary. I show that hedgers do not hedge in uniform ways or for uniform reasons. My theory offers insights into what might trigger a particular type of hedger—I differentiate between technical hedging, insurance hedging, and hard hedging—to choose to exercise its nuclear weapons option. Hedgers do not fail to develop nuclear weapons; they intentionally choose to not try, yet. Identifying hedging as a proliferation *strategy*—unpacking it into its various forms, locating it on the continuum of the proliferation process, and identifying the circumstances that will make hedgers resume their pursuit of the bomb or make a U-turn—rather than treating it as a disconnected phenomenon is an important contribution of the book.

For states seeking nuclear weapons, rather than just a future option, there are three active strategies of proliferation. The early nuclear proliferators such as the Soviet Union, France, and China were *sprinters* that sought to build nuclear weapons as quickly as possible, trying to match the first-mover, the United States. Others, like Israel and Pakistan and North

4 CHAPTER 1

Korea, leveraged the complicity of a superpower patron to adopt a *sheltered pursuit* strategy, which exploits forbearance from a more powerful state as a shield against nonproliferation efforts. Other states, such as Iraq and Syria who cannot avail themselves of a major power shelterer, have no choice but to pursue a *hiding* strategy, prioritizing secrecy over speed and aiming to present their completed nuclear weapons as a *fait accompli* to the world. This book is the first effort to systematically identify the various strategies of proliferation available to nuclear aspirants, showing that states pursue nuclear weapons in distinct ways.

Why do states choose a particular proliferation strategy over the available alternatives? I develop a decision-theoretic framework, Proliferation Strategy Theory, identifying a sequence of security and domestic political variables to explain why a state selects a specific nuclear proliferation strategy. I apply this framework to explore empirical cases of each proliferation strategy, often leveraging primary documents and data to highlight novel features of states' proliferation journeys. I use the framework to generate a proliferation strategy prediction for each of the 29 states that have pursued nuclear weapons (46 total strategies including over-time shifts) and find that the framework accurately predicts over 85 percent of all nuclear proliferation strategies since 1945. Subsequent chapters provide detailed case studies on almost twenty of these nuclear aspirants, those that provide crucial variation in the independent and dependent variables showing why states select the strategies they do, and why they may shift strategies.

The chapter on varieties of hedging includes what I call *technical hedgers* such as Brazil and Argentina that most closely resemble the concept of "nuclear latency," *insurance hedgers* such as Japan and West Germany who hedged against the possibility of American abandonment, and *hard hedgers* such as India, Sweden, and Switzerland who stopped short of weaponizing due to ambivalence or a lack of domestic political consensus in favor of nuclear weapons. States typically make the decision to hedge for strategic reasons. I demonstrate, however, that domestic political consensus in favor of nuclear weapons is the crucial regulator for shifting from hedging to an active proliferation strategy, as in the case of India's stilted march to nuclear weapons. This is an important revision to recent scholarship that veers toward one extreme or the other, with some scholars arguing that it is almost exclusively regime type that drives nuclear proliferation,² while others argue that security

2. See Jacques E. C. Hymans, *Achieving Nuclear Ambitions: Scientists, Politicians, and Proliferation* (Cambridge: Cambridge University Press, 2012).

considerations alone explain proliferation.³ I argue that both are important, but in a particular sequence, with security threats providing the stimulus and domestic political consensus providing the momentum for nuclear weapons.

External protection or prevention at this stage can prove critical to whether the state ultimately attains nuclear weapons. For powerful states with the luxury to openly march for nuclear weapons without fear of prevention, *sprinting* for a bomb is the optimal proliferation strategy. Most states that are powerful enough to sprint, though, already possess nuclear weapons—the Soviet Union, China, and France, for example—although some potential sprinters such as Australia, Japan, and potentially Germany remain should they ever decide to pursue nuclear weapons. The remaining nuclear weapons aspirants are forced to be more creative. A preferable option, if it is available or if it can be cultivated, is building nuclear weapons under the *shelter* of a major power that shields the pursuer from outside pressure and refrains from applying any pressure itself. The major power essentially tolerates nuclear proliferation in pursuit of higher-priority geopolitical goals, while the proliferator attempts to weaponize before the shelter disappears. This is how Israel, Pakistan, and North Korea all successfully developed the bomb. The rest of the states who seek nuclear weapons—those that fear external coercion because they are likely the states the world least wants to possess nuclear weapons—have no choice but to hide and pursue nuclear weapons clandestinely. The very threats that motivate nuclear pursuit drive the program underground. *Hiding* is a high-risk, high-reward strategy that attempts to present the world with a nuclear fait accompli before the program is detected—as South Africa succeeded in doing—but risks military strikes if it is caught before it gets there, as Syria discovered.

Why are these strategies of proliferation important? First, states adopting different strategies experience differing rates of success in attaining nuclear weapons. Hedgers do not fail to attain nuclear weapons, for example. They simply have not actively tried, yet. Among active proliferation strategies, almost *half* of those states that have attempted to develop actual nuclear weapons have succeeded in doing so, with sprinters and sheltered pursuers reaching the finish line at very high rates. Hiders may fail at high rates, but the seduction of potentially succeeding as South Africa did motivates many to keep trying. The typology offers a valuable first cut at assessing the danger that a proliferation threat might come to fruition. Second, and

3. See Alexandre Debs and Nuno P. Monteiro, *Nuclear Politics: The Strategic Causes of Proliferation* (Cambridge: Cambridge University Press, 2017).

related, the typology and my explanation of what drives nuclear aspirants' choices offer hints as to how to stop different kinds of proliferators. Notably, in states that have not generated the domestic consensus for explicit weaponization, keeping domestic political consensus fractured is key to forestalling proliferation and keeping a hedger hedging. Third, the typology offers predictions about the likely consequences for international politics as a function of proliferation strategies. Hiders, for example, are especially dangerous and disruptive to the international system since they either successfully attain a nuclear weapons capability, irrevocably altering the global power structure, or they are discovered, potentially triggering military crises as external powers try to destroy a previously unknown clandestine nuclear weapons program. Indeed, pushing active hidiers, such as Iran, back to hedging is in itself an important nonproliferation success, as I show in chapter 7. Given that the pool of likely future proliferators is dominated by potential hidiers, the focus on hidiers is especially important to understand the looming nuclear landscape. This book is therefore the first effort to identify the variety of proliferation strategies and analyze both their sources and their profound consequences for international security.

Existing Proliferation Scholarship: Focusing on Why, Not How

Why is a focus on strategies of proliferation so novel? First, the literature on nuclear proliferation since the end of the Cold War has generally focused on the *motivations* for state pursuit of nuclear weapons. Scott Sagan's landmark article outlined "three models in search of the bomb," three canonical motivations for nuclear weapons: security, prestige, and domestic politics.⁴ Subsequent literature offered additional or refined motivations such as a state's political economy, more nuanced and sophisticated security dynamics, supply side temptations, and oppositional nationalism.⁵

4. Scott D. Sagan, "Why Do States Build Nuclear Weapons? Three Models in Search of the Bomb," *International Security* 21, no. 3 (Winter 1996–97): 54–86.

5. T. V. Paul, *Power versus Prudence: Why Nations Forgo Nuclear Weapons* (Montreal: McGill-Queen's University Press, 2000); Etel Solingen, *Nuclear Logics: Contrasting Paths in East Asia and the Middle East* (Princeton: Princeton University Press, 2007); Matthew Kroenig, *Exporting the Bomb: Technology Transfer and the Spread of Nuclear Weapons* (Ithaca: Cornell University Press, 2010); Matthew Fuhrmann, *Atomic Assistance: How "Atoms for Peace" Programs Cause Nuclear Insecurity* (Ithaca: Cornell University Press, 2012); Stephen M. Meyer, *The Dynamics of Nuclear Proliferation* (Chicago: University of Chicago Press, 1984); Jacques E. C. Hymans, *The Psychology of Nuclear Proliferation: Identity, Emotions, and Foreign Policy* (Cambridge: Cambridge University Press, 2006); Nicholas

If we know why states might pursue nuclear weapons, however, do we automatically know how they might do so? No. This is the case for several reasons. First, as Sagan shows in an evaluation of the broader literature, and Mark Bell demonstrates with respect to the quantitative literature, the scholarship on why states initiate nuclear weapons pursuit has produced inconsistent and sometimes contradictory answers, yielding no generalizable theory as to which states might do so, and when or why.⁶ Thus any inferences about how states might pursue nuclear weapons based on their underlying motivations may be dubious. Indeed, shifting the focus to strategies of proliferation—which endogenizes a state’s level of desire for nuclear weapons (demand) and its ability to develop them (supply)—is not only important in its own right but may help integrate the presently disconnected literatures on the supply and demand for nuclear weapons.⁷ Second, a review of the almost thirty cases of nuclear aspirants suggests that there is little relationship between the motivations for nuclear pursuit and a state’s ultimate choice of proliferation strategy. States that pursued nuclear weapons for security reasons might select the same strategy of proliferation as those that pursued them for status and prestige reasons. Likewise, states that have had security motivations for pursuing nuclear weapons have chosen every available strategy of proliferation. Therefore, although varying *intensity* of demand—how much a state wants nuclear weapons—is certainly important to the strategy of proliferation a state selects, with lower-intensity demand more likely to correlate with hedging strategies, the *source* of that demand—security, prestige, or domestic—matters less. That is, *why* states pursue nuclear weapons is largely independent of *how* they do so. The literature on why states want nuclear weapons—the overwhelming majority of the proliferation scholarship in the past quarter century—has little to say about how they may attempt to do so.⁸

Miller, *Stopping the Bomb: The Sources and Effectiveness of U.S. Nonproliferation Policy* (Ithaca: Cornell University Press, 2018); Alexandre Debs and Nuno Monteiro, “The Strategic Logic of Nuclear Proliferation,” *International Security* 39, no. 2 (Fall 2014): 7–51. For overviews and evaluations of the literature on the causes of proliferation, see Scott D. Sagan, “The Causes of Nuclear Weapons Proliferation,” *Annual Review of Political Science* 14, no. 1 (June 2011): 225–44; Jacques E. C. Hymans, “The Study of Nuclear Proliferation and Nonproliferation: Toward a New Consensus?” in *Forecasting Nuclear Proliferation in the 21st Century, Volume 1: The Role of Theory*, ed. William C. Potter and Gaukhar Mukhatzhanova (Stanford: Stanford University Press, 2010); and Mark S. Bell, “Examining Explanations for Nuclear Proliferation,” *International Studies Quarterly* 60, no. 3 (September 2016): 520–29.

6. Bell, “Examining Explanations for Nuclear Proliferation”; Sagan, “The Causes of Nuclear Weapons Proliferation.”

7. Sagan, “The Causes of Nuclear Weapons Proliferation,” 227–36.

8. One exception is Hymans, *Achieving Nuclear Ambitions*.

Moreover, analyzing strategies of proliferation is novel because the extant literature on nuclear proliferation tends to treat nuclear pursuit as a binary, a-strategic process: states are either pursuing nuclear weapons or they are not, and those that are uniformly aim to weaponize a nuclear capability as quickly as possible. This literature assumes that all states with nuclear weapons programs invariably seek to create a functional arsenal as fast as technically possible. For example, Jacques Hymans's work on how efficiently states achieve their nuclear ambitions assumes that nuclear aspirants all try to develop a nuclear weapons capability as quickly as possible and vary only in their ability to manage the project and the process.⁹

These assumptions are not always true. For example, states including Japan, Sweden, and India at times have sought to put the pieces in place to weaponize at a later date if necessary but have consciously and strategically stopped well short of attaining nuclear weapons with a form of hedging strategy.¹⁰ Their goal was not nuclear weapons but erecting a nuclear weapons program that could be activated and consummated at a time of their choosing if necessary. Hedgers can stall at this point for years, or indefinitely. Certainly, the early nuclear proliferators such as the United States, the Soviet Union, and China sought to weaponize as quickly as possible in a sprinting strategy. These are the stereotypical proliferators in the extant literature. But under 20 percent of the states that pursued nuclear weapons have followed their strategy. Some states may not prioritize speed but secrecy, pursuing a hiding strategy that aims to present a *fait accompli* before the program is discovered. Still others can leverage the complicity of a major power's knowledge of their program and adopt a sheltered pursuit strategy, which attempts to cultivate major power immunity to shield them from nonproliferation or counterproliferation efforts. Few states after the 1950s fit the archetype of the sprinters, trying to build nuclear weapons as quickly as possible. Many states seeking nuclear weapons may value considerations besides speed and outcomes besides a fully functional nuclear weapons arsenal. The existing literature has little to say about this variation.

Why does variation in strategies of proliferation matter? To begin with, a theory of how a potential nuclear aspirant goes about trying to seek nuclear weapons identifies additional opportunities and policy levers to halt nuclear weapons proliferation. How a state chooses to pursue nuclear weapons

9. Ibid.

10. E.g., Ariel E. Levite, "Never Say Never Again: Nuclear Reversal Revisited," *International Security* 27, no. 3 (Winter 2002/2003): 59–88; Avner Cohen and Benjamin Frankel, "Opaque Nuclear Proliferation," *Journal of Strategic Studies* 13, no. 3 (1990): 14–44.

matters as much as—if not more than—its underlying motivations when it comes to identifying and implementing policies to prevent nuclear proliferation. There are different *types* of nuclear proliferators, and the distinctions between them are important for scholars hoping to understand the proliferation landscape and for policymakers hoping to shape it. Understanding the different strategies of proliferation allows the international community to tailor inducements or punishment to try to dissuade or deter states from developing nuclear weapons. This book outlines these different strategies, develops a theory for why states might select one strategy over another, and demonstrates the power of the theory on a variety of cases. Three decades of scholarship on *why* states want nuclear weapons has neglected that *how* they pursue them has crucial implications for international security. This book thus opens new terrain in the proliferation literature by systematically analyzing how states pursue nuclear weapons and why strategies of proliferation matter to the nuclear landscape and international politics.

Why States Need to Think about Proliferation Strategies: Duress

Why do states have to carefully devise a strategy of proliferation? As the Syrian example demonstrates, states that pursue nuclear weapons often do so under duress. On average, nuclear proliferators, as they approach the point of weaponization, experience systematically more pressure—whether the threat of sanctions or military conflict—than they did prior to and after weaponization.¹¹ There are three reasons why this might be the case. First, of course, there may be some reverse causality where increased levels of duress further motivate pursuit of nuclear weapons. Second, as states approach the point of weaponization, other states might have motivations to destroy a state's nascent nuclear capabilities.¹² Third, anticipating the attainment of nuclear weapons or in the immediate aftermath of attaining them, proliferators might become emboldened, relying on ambiguous or limited capabilities to deter retaliation.¹³ These are often treated as distinct mechanisms,

11. David Sobek, Dennis M. Foster, and Samuel B. Robison, "Conventional Wisdom? The Effect of Nuclear Proliferation on Armed Conflict, 1945–2001," *International Studies Quarterly* 56, no. 1 (March 2012): 149–62.

12. Matthew Fuhrmann and Sarah Kreps, "Targeting Nuclear Programs in War and Peace: A Quantitative Empirical Analysis, 1941–2000," *Journal of Conflict Resolution* 54, no. 6 (December 2010): 831–59.

13. See Mark S. Bell, "Beyond Emboldenment: How Acquiring Nuclear Weapons Can Change Foreign Policy," *International Security* 40, no. 1 (Summer 2015): 87–119.

but they are related to each other. Proliferators that others fear might be emboldened are more likely to be the potential target of greater coercive or preventive efforts. Similarly, these efforts might trigger greater emboldenment or aggression by the proliferator. This is not a new phenomenon. The historical record is dotted with conflicts where targeting nuclear weapons programs was salient: the 1967 Arab-Israeli Six Day War, episodes in 1984 and 1986–87 where India contemplated using a broader conflict to target Pakistan’s uranium enrichment facility, Israeli strikes against Iraq and Syria, and the multiple wars with Iraq.¹⁴ For potential nuclear aspirants, such as Libya and Iran, these examples can be powerful demonstrations of what may be awaiting them if they try to pursue nuclear weapons against the will of major powers.

The pursuit of nuclear weapons can therefore result in substantial international turbulence and conflict. There is a “window of volatility” for proliferators that becomes pronounced in the decade prior to weapons attainment and that seems to last until a decade after. To illustrate the extent of this duress on the most extreme indicator—military conflict—I show that a state experiences systematically more military conflict as it approaches the point of weaponization. This analysis understates the true level of duress a proliferator faces on average, because it does not include other forms of pressure a state may experience, such as economic threats or military harassment that falls below the militarized threshold. I align all non-superpower nuclear possessors by their date of nuclear possession (normalizing that date as t_0) and plot the level of conflict that they experience in the two decades prior and subsequent to achieving a nuclear capability, using militarized interstate disputes (MIDs) as a reasonable indicator for conflict.¹⁵ This approach takes the point of nuclearization as the uniform moment to assess conflict levels for proliferators, so it normalizes China in 1964 with, for example, Pakistan in 1987 to observe conflict levels across the proliferation process.¹⁶

14. Also see Muhammet Bas and Andrew J. Coe, “A Dynamic Theory of Nuclear Proliferation and Preventive War,” *International Organization* 70, no. 4 (Fall 2016): 655–85.

15. Dates are from Philipp C. Bleek, “Does Proliferation Beget Proliferation?: Why Nuclear Dominoes Rarely Fall” (PhD diss., Georgetown University, 2010), appendix A, <http://hdl.handle.net/10822/558060>. I exclude the United States and USSR here because they had wartime proliferation programs, and the number of MIDs around their programs is artificially high.

16. This approach necessarily restricts the sample to nuclear states. In theory, this bias favors the null hypothesis because these are the successful proliferators; those states whose programs were terminated by the counterproliferation efforts of others are not included but would strengthen the results.

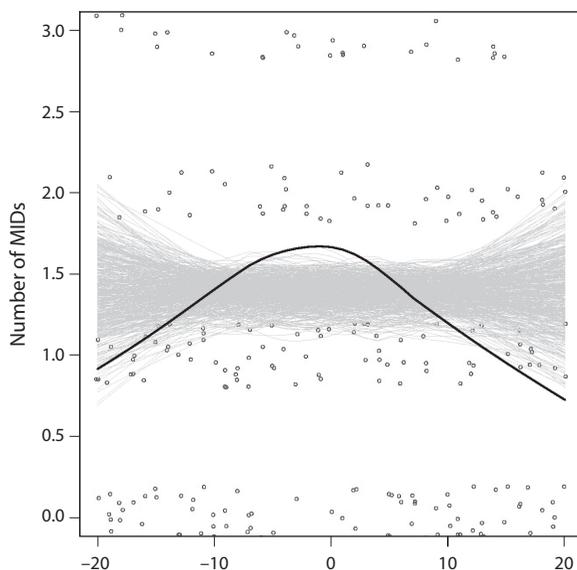


FIGURE 1.1. Window of Volatility. This illustrates the relationship between armed conflict and nuclear proliferation, where t_0 is the point of attainment (bold line). Compared to conflict levels twenty years prior to, and subsequent to, weaponization, states face an average of one additional armed dispute per year. This uses randomization inference and 500 random draws (light lines) from the reference distribution under the null hypothesis ($p < 0.001$).

I use randomization inference, which tests the sharp null hypothesis that there is no relationship between nuclearization and conflict level for any unit through many random draws. Compared to the null hypothesis, figure 1.1 shows a significant and substantively large relationship between the proliferation process and conflict levels.

States pursuing nuclear weapons thus face more average armed conflict through the *process* of nuclear proliferation.¹⁷ Nuclear proliferation can be a rough process for the international system and the proliferator. Potential proliferators must therefore carefully decide *how* to pursue nuclear weapons and succeed in developing them under this duress. That is, they must carefully choose a strategy of proliferation that tries to minimize their exposure to pressure. This book is about how states think about their strategies of nuclear proliferation given their domestic and international constraints and opportunities, as they navigate this potential window of volatility.

17. The results in figure 1.1 are robust to different attainment dates, removing any one regional nuclear power, MIDs 4.0. Contact author for any desired robustness checks.

Plan of the Book

The book is organized as follows. Chapter 2 identifies the various strategies of proliferation available to states and develops a decision-theoretic framework to explain why a given state might select a given strategy at any point in time, based on a clear sequence of systemic and domestic political variables. The theory generates a determinate prediction for whether a state will select a variety of hedging—technical, insurance, or hard hedging—or an active nuclear proliferation strategy: sprinting, hiding, or sheltered pursuit. This chapter makes a substantial theoretical contribution by providing a testable and falsifiable theory for why states might select a particular strategy of nuclear proliferation, giving insights into future potential proliferators and which strategies they may select and which variables might be manipulated to possibly stop them.

After conducting a full analysis in tabular form in chapter 2, the empirical chapters that follow perform a medium-*n* analysis covering 19 of the 29 nuclear aspirants thus far, testing the theory against several alternative explanations such as technological determinism, a rigorous (realist) security model, and international nonproliferation regime explanations for state behavior. I focus on key cases in each of the empirical chapters to highlight novel mechanisms and illustrate important variation across the independent or dependent variables. The cases are not randomly selected but chosen because they are important cases of proliferation that highlight key theoretical mechanisms or offer novel historical value. These chapters demonstrate the power of the theory by identifying and establishing the crucial variables that pushed states to select a particular strategy of nuclear proliferation. These chapters provide substantial empirical value. I offer the first systematic coding of strategies of proliferation, providing an original framework to analyze the 29 states that have pursued nuclear weapons—and those that may pursue them in the future—and illuminate key and novel features of their proliferation experiences. Where possible, I present new or primary data to best understand the strategic decisions nuclear aspirants and great powers such as the United States made during the proliferation process.

Chapter 3 focuses on the varieties of hedging. As I highlighted at the outset, hedging is an important waypoint in the proliferation process. States often consciously choose variants of it for strategic reasons—seeking not the bomb but a bomb option. I present new and primary data on hard hedgers such as India, Sweden, and Switzerland, insurance hedgers such as Japan and West Germany, and technical hedgers including Brazil and Argentina. These

cases show why hedging is central to the proliferation process as some, like India, opt to resume their quest for nuclear weapons, while others such as Sweden and Switzerland forswear them entirely, and still others like Japan may remain idle at the hedging stop indefinitely. Chapter 4 presents the case of the sprinters, the stylized version of proliferation in the literature: the states who openly and quickly marched to nuclear weapons without fear of prevention or reprisal. Chapter 5 centers on three important sheltered pursuers—Israel, Pakistan, and North Korea—who probably would not have been able to develop nuclear weapons if not for the shelter afforded them by the major powers that valued these countries for more important geopolitical reasons and essentially turned a blind eye to their development of nuclear weapons and shielded them from nonproliferation efforts. Chapter 6 focuses on three crucial hidiers: Iraq, Taiwan, and South Africa. These cases illustrate how allied abandonment can generate proliferation pressures and, even though Taiwan was unsuccessful in eventually hiding its nuclear weapons program, it highlights the need to remain vigilant against potential hidiers—both adversaries and allies alike. South Africa is a case of a successful hider, showing that it is indeed possible even against immense intelligence capabilities—both the United States and Soviet Union opposed South African nuclearization—to successfully build nuclear weapons through hiding under the right conditions. The case of Iraq shows how disruptive hidiers can be to the international system as Iraq's clandestine program in the 1980s set the stage for two decades of tumult and conflict—once he was suspected of being a hider, Saddam Hussein was presumed to always be a hider.

The penultimate chapter focuses on the consequences of these choices. First, which strategies are more likely to successfully lead to nuclear weapons? This chapter highlights the variation in successful nuclear proliferation as a function of strategy, showing that although sprinting rarely fails for those who select it, sheltered pursuit is also a particularly successful strategy, with profound implications for future nuclear proliferation and the major powers that may extend shelter and tolerate additional nuclear states. Second, what are the different nonproliferation consequences of these strategies? What are the key variables that have been, and can be, manipulated to successfully halt states from attaining nuclear weapons depending on which strategy they select? Finally, what are the consequences for international conflict? In particular, hiding is a very disruptive strategy. An effective hider, such as a South Africa, can entirely bypass the so-called window of vulnerability identified earlier and substantially improve its global power position. But a hider that is caught, like Iraq or Syria, can generate very high likelihoods of preventive

conflict and war. Knowing which states might be hidiers, then, helps highlight future potential flashpoints for conflict and war. It also highlights why diplomatic initiatives, such as the 2015 Joint Comprehensive Plan of Action (JCPOA) between Iran and the so-called P5 + 1 that pushed Iran back from hiding to hard hedging by attempting to empower moderates in Tehran who opposed nuclear weapons, are such important nonproliferation successes.

This book is the first systematic attempt to analyze the diversity of strategies of nuclear proliferation, their sources, and their consequences. It shows that states have systematically selected *different* strategies to try to attain nuclear weapons, and that these choices matter deeply to international security. It advances scholarship on nuclear proliferation by opening new terrain, showing that although why states want nuclear weapons is undoubtedly important, how they go about pursuing nuclear weapons is fundamental to the global nuclear landscape. Understanding this dynamic is crucial for the United States as it confronts the increasing possibility that a growing number of states—friends, foes, and frenemies—may pursue nuclear weapons in the future.

INDEX

Page numbers in *italics* indicate figures and tables.

- AB Atomenergi (AE), 111
- Abe, Shinzo, Japan's possession of nuclear weapons, 79
- Achieving Nuclear Ambitions* (Hymans), 173
- acquire, term, 43–44n52
- acquisition, term, 43–44n52
- active proliferators, stopping, 300–308
- Adelman, Kenneth, 220–21; Arms Control and Disarmament Agency (ACDA), 214, 219
- Adenauer, Konrad: Mendès France and, 149; West Germany and nuclear weapons, 89–91, 93–95
- Afghanistan, Soviet Union invading, 38, 203, 204, 210, 222, 224, 303, 343
- Agreed Framework (1994), North Korea, 225, 228–30
- Ahmadinejad, Mahmoud, Iran and, 324–25
- al-Assad, Bashar, Syria, 1, 24
- Al-Bakr University, Saddam Hussein speech, 240
- Albright, David, on South Africa's cold test, 277
- Algeria: Es-Salam reactor, 46; exception to theory, 46; proliferation strategies over time, 44; proliferation strategy, 43, 349
- al Kibar: “cube”, 1; on Israeli strike on, 315–16, 319; strike on, 312; Syrian reactor, 313; U.S. intelligence of, 314
- AMAD Plan, Iran's active clandestine nuclear weapons plan, 320, 326–29
- Arab-Israeli Six Day War (1967), 10
- Argentina: hard hedging, 100, 107; proliferation strategies over time, 44; proliferation strategy, 42, 348; Proliferation Strategy Theory (PST) testing, 107–9; proliferation track, 55; as rivals and not enemies, 100–101, 102–3; technical hedging, 100–107; as technical hedger, 4, 12, 18
- Arif, K. M., on U.S. and Pakistan, 218
- Arms Control and Disarmament Agency (ACDA), 214, 219
- Aron, Raymond, on Suez Crisis, 152
- Arunachalam, V. S., Defence Research and Development Organisation, 62
- Aso, Taro, on Japan's nuclear defensive, 84
- Atherton, Alfred, Pakistani nuclear program, 207
- Atomic Energy Act (1954), France and, 161
- Atomic Energy Agency, Syria, 1, 313
- Atomic Energy Commission: India, 60, 64, 65; Iraq, 240, 241, 245, 251; Israel, 256; Pakistan, 204; South Africa, 273, 280
- Atoms for Peace program, 181; Argentina, 103; South Africa and, 273
- Atucha I, uranium-fueled heavy water reactor, 103
- Australia: as potential sprinter, 5; proliferation strategies over time, 44; proliferation strategy, 42, 348
- Axis of Evil: Iran as member, 328; North Korea as member, 230; Syria as member, 1
- Aziz, Tariq, on illegal programs, 252
- Barak, Ehud, on Israeli strike, 315
- Barakah reactor, United Arab Emirates, 18
- Barbour, Walworth, Dimona and, 193
- Barletta, Michael, on Brazil and Argentina, 101–2
- Barlow, Richard, Pakistani nuclear program, 215–16
- Barnard, Neil, 286
- Baruch Plan, 142
- Barzel, Rainer, visit to White House, 96
- Basic Studies of Japan's Nuclear Policy* (Cabinet Research), 78, 80
- Battle of Stalingrad, 133
- Beg, Aslam, on Pakistan, 219

370 INDEX

- Begin, Menachem: Operation Opera destroying Iraqi reactor, 241; Saddam rhetoric toward, 242
- Bell, Mark, on states' nuclear weapons pursuit, 7
- Ben Gurion, David, nuclear weapons pursuit, 180–81, 183, 185–89, 199, 201
- Bergmann, Ernst: on novel reactor design, 181; Taiwan, 256
- Bhabha, Homi, 71; India's Nehru and, 57–58
- Bharatiya Janata Party (BJP), 70, 73
- Bhutto, Benazir, on Pakistan, 219
- Bhutto, Zulfikar Ali: agreement with China, 206; Carter administration and, 203; Ford and Kissinger with, 207; nuclear weapon development, 204, 223; on testing nuclear weapons, 60–61
- Bidault, Georges, France requesting U.S. assistance, 147
- Binder, Julius, on national defense, 123
- bin Salman, Mohammed, Saudi Crown Prince, 304, 344
- Blair, Tony, Libya and, 310
- Bleek, Philipp, nuclear aspirants data, 41, 41n50
- Blitz* (magazine), 62
- bluff/bluffing, 26, 185, 203
- Botha, P. W.: military program approval, 280; nuclear program, 272; Reagan and, 283; resignation, 285; secrecy goal, 281
- Botha, Pik, South Africa, 277–78, 282–83
- Brandt, Willy, West Germany civilian nuclear industry, 95, 98
- Brasstacks Crisis (1986–87), 64, 67, 218, 219, 222
- Brazil: hard hedging, 100, 107; proliferation strategies over time, 44; proliferation strategy, 42, 348; Proliferation Strategy Theory (PST) testing, 107–9; proliferation track, 55; as rivals and not enemies, 100–101, 102–3; technical hedging, 100–107; as technical hedger, 4, 12, 18
- Brom, Shlomo, on strike on Syria's program, 312
- Brown, Harold, Deng on Pakistan, 210
- Brzezinski, Zbigniew, on U.S. policy for Pakistan, 210
- Buchalet, Albert, military authorities on bomb, 153
- Buff, William, Eisenhower administration and Israel, 185
- Bundy, McGeorge, on China possessing nuclear weapons, 169
- Burgess, Stephen, on Vastrap Incident, 280
- Burr, William, Carter administration and Japan, 82
- Bush, George W., overthrow of Hussein, 237. *See also* George W. Bush administration
- buying time, sabotage for, 316–20
- Buys, André, ARMSCOR, 278, 280
- Campbell, Bob, on nonproliferation A-list, 287
- Carter administration: Japan and, 82–83; Pakistan and, 203, 206–11, 343; South Africa and Vorster, 277–79; Taiwan and, 265–67; visit to Pyongyang, 228
- Castro Neves, Luiz Augusto de, Argentina's Pilcaniyeu facility, 104, 106
- Celio, Nello, on nuclear weapon acquisition, 123–24
- centrifuges, uranium enrichment, 105
- Chandra, Naresh: endless studies of pro-bomb figures, 65; India's nuclear program, 67–69, 72–73
- Chang, Alan, on Taiwan's nuclear program, 259, 267–68
- Chang Hsien-Yi: defection of, 268; Taiwan's uranium enrichment, 266–67
- Chaudet, Paul, Mirage Affair, 120, 123
- cheater's dilemma, 295, 307, 316
- Cheney, Dick: on Iraq, 251; North Korea and Japan, 84
- Chen Yi, on China developing nuclear weapons, 168
- Chiang Ching-Kuo, Taiwan, 257, 259, 260, 263–66, 268–69
- Chiang Kai-Shek, Taiwan and, 255–57
- Chibu, Chon, North Korean reactor, 313
- Chien, Fred, on America and Taiwan, 264
- China: assisting Pakistan, 38; calculation on North Korea, 228–29; International Crisis Group (ICG), 228–29; Mao, 129, 162; Nie Rongzhen and, 162–64, 168, 172, 173; North Korea and, 30; North Korea's pursuit of nuclear weapons, 23; Partial Test Ban Treaty, 170; proliferation strategies over time, 44; proliferation strategy, 42, 43, 348, 349; Proliferation Strategy Theory (PST) testing, 171–74; providing tolerance and protection, 22–23; sheltered pursuit (1955–58), 162, 163–65; as shelter for North Korea, 225–27, 232; as sprinter, 3, 5; sprinting (1958–64), 162, 165–71; sprinting strategy, 8, 22, 127; uranium for bomb program, 164–65. *See also* Mao *China Builds the Bomb* (Lewis and Xue), 163
- Christopher, Warren, U.S. intelligence of South Africa, 277

- Chungshan Institute of Science and Technology, 257
- Clinton administration: Libya and, 310; North Korea, 228, 230
- Coats, Dan, on Iran and JCPOA, 334
- Cohen, Avner: on American pressure for Israel's nuclear program, 186; on intelligence activity, 184; Israel and Eisenhower presidency, 184–85; on Meir and Nixon, 198; on Peres and French nuclear assistance, 182–83; on Six Day War, 194; U.S. tolerance of Israel's nuclear capability, 191
- Cold War: NATO's security architecture, 109; nuclear era after, 2, 45, 306, 352; nuclear status of West Germany, 89; Pakistan and, 38; uranium enrichment, 88; West Germany, 74
- Cole, Paul: on moratorium to nuclear program, 116–17; on Sweden's nuclear weapon research, 114
- Commissariat à l'Énergie Atomique (CEA), 182; de Gaulle and, 145, 183
- Commission Supérieure des Applications Militaires de l'Énergie Atomique, Mendès France and, 150
- Comprehensive Test Ban Treaty, 72
- Congressional Research Service (CRS), 227, 249
- Constable, Peter, on Pakistan, 208–9
- Coon, Jane, Pakistan's nuclear program, 212
- countries: empirical coding of nuclear proliferation strategies, 42–43; nuclear proliferation strategies over time, 44
- Craig, Campbell, on U.S. nuclear monopoly, 136
- Cranston, Alan, Pakistan's nuclear program, 214
- cube. *See* al Kibar
- Dagan, Meir, on challenge of Iran, 318
- Daitoku, Takaaki, nuclear weapon hedging of Japan, 76
- Defence Research and Development Organisation, 62, 64
- de Gaulle, Charles, 92, 143; France as nuclear power, 153–57; France as sprinter, 129; informing Eisenhower of nuclear intentions, 144; terminating cooperation for Israel, 183
- de Klerk, F. W.: announcing South Africa's program, 272–74, 276; dismantling nuclear program, 285–86; pursuit of programs, 287, 289
- Deng Xiaoping, on Pakistan, 210
- Desai, Morarji, 61, 72; aversion to nuclear weapons, 62
- de Shalit, Amos, on plutonium, 181
- Deshmukh, B. G., on nuclear policymaking, 63, 67–68
- de Villiers, J. W., South Africa's Atomic Energy Commission, 280
- Dobrynin, Anatoly: on Chinese nuclear capability, 162, 170; on Chinese nuclear test, 171
- domestic consensus: fracture of political, 33–34; French nuclear program, 153; India's nuclear program, 71–72; measuring political, 34; Proliferation Strategy Theory (PST), 31–35; Soviet Union and, 141
- domestic political will, active weaponizers with, 342–43
- Doyle, James, on Brazil's nuclear intentions, 104
- Dulles, John Foster: Adenauer on West Germany, 90–91; on de Gaulle determination, 154, 156, 157
- duress, states and nuclear proliferation, 9–11
- economic vulnerability: measuring, 36–37; Proliferation Strategy Theory (PST), 35–37
- Eden, Anthony: on Stalin and American bomb, 135
- Egypt: proliferation strategies over time, 44; proliferation strategy, 42, 348
- Eisenhower administration: Atoms for Peace program, 181, 273; on de Gaulle determination for France, 155–56, 158, 161; U.S. shelter for Israel, 183–86; West Germany and, 90–92
- Eitan, Rafael, on Operation Opera, 241
- Elbrick, Charles, on de Gaulle determination, 154
- electromagnetic isotope separation (EMIS), Iraqi program, 243–45, 254
- Ely, Paul, France requesting U.S. assistance, 147
- Erhard, Ludwig, on Germany's relationship with United States, 94–95
- Erlander, Tage, 118, 300; international disarmament, 116; on Sweden's nuclear weapon program, 111–13
- Eshkol, Levi, nuclear weapons and, 189–90, 193, 201
- Es-Salam reactor, Algeria, 46
- European Defense Community (EDC), France and, 146–47, 149

372 INDEX

- Fakhrizadeh, Mohsin, assassination of, 335
Falklands War (1982), 101
Feng Chi-tsung, Taiwan nuclear programs, 265
Fitzpatrick, Mark, on Taiwan and NPT claims, 261
FOA. *See* Swedish National Defense Research Establishment (FOA)
Ford administration, Pakistan and, 206–7
Foreign Affairs (journal), 83
Foreign Assistance Act, Symington and Glenn Amendments, 36, 51
France: Atomic Energy Act (1954), 161; defying Proliferation Strategy Theory (PST) theory, 128–29; de Gaulle on nuclear power for, 153–57; Dimona complex and, 182, 184, 188; European Defense Community (EDC) and, 146–47, 149; exception to theory, 46–47; experience at Dien Bien Phu, 47, 147–49, 160, 161; experience at Suez Canal, 47, 151–52, 160, 161; insurance hedging (1945–54), 145–47; Marcoule reactor design, 161; Osirak reactor assistance, 240–41; Pakistan and, 203, 205, 207; perceived U.S. abandonment at Dien Bien Phu, 143–44, 147–49; prime minister Mendès France and, 149–51; proliferation assistance to Sinai operation, 182; proliferation strategies over time, 44; proliferation strategy, 42, 142–43, 348; proportional deterrence concept, 122; PST and, 143–44; PST testing, 157–62; Saint Gobain and, 183, 205, 262; as shelter for Israeli arms, 181–83; South Africa and, 278, 289; as sprinter, 3, 5, 127, 128–29; sprinting (1954–60), 142, 147–57; structural realism, 159–60; Suez Crisis (1956) and, 47, 143, 144, 151–52; Taiwan and, 262; technological determinism, 160
France, Mendès: France and, 149–51; Mollet and, 159
France-Italy-Germany (FIG) nuclear consortium, 91–92
Fuchs, Klaus: Manhattan Project espionage, 134; test design, 137, 139
Fukushima, Mayumi, nuclear weapon hedging of Japan, 76
Gaddafi, Muammar: interest in nuclear weapons, 309; Libya requesting weapons, 26; Libya's surrender, 310–11. *See also* Libya
Gaillard, Félix: on nuclear-sharing stockpile, 92, on nuclear test, 152
Gandhi, Indira: assassination of, 61, 63; test of peaceful nuclear explosion (PNE), 60
Gandhi, Rajiv: Action Plan, 63; advisory circle, 64; on Congress sanctioning Pakistan, 217; personal aversion to nuclear weapons, 63; weaponization activities, 67–69, 300; weaponization with undeniable threat, 72–73; weaponization with President Zia, 65–66
gaseous diffusion, Iraqi program, 243–45, 254
Gates, Robert: Pakistani nuclear weapons, 218, 219–20; on Syria as U.S. target, 314; testifying on Iran, 323
George W. Bush administration: Iraq and Saddam, 252–53; Libya and, 310; North Korea, 230; sabotage model, 317
Germany: as potential sprinter, 5; proliferation strategies over time, 44; proliferation strategy, 42, 348. *See also* West Germany
Gerzhoy, Gene, on United States and Germany, 95
Gilpatric Committee Report, 190, 190n48
Glenn and Symington amendments, 36, 51, 203, 220, 224, 263
Goldstein, Avery: France's experience with allies, 148; on Suez Crisis, 151
Great Leap Forward, Mao, 129, 163, 167, 168, 172–74
Gromyko, Andrei, on China and Soviet nuclear umbrella, 165
Groves, Leslie, uranium deposits, 138, 140
Gulf War, first, 239, 245, 247–50, 252. *See also* Iraq
hard hedgers, 54, 293, 342; halting, 299–300. *See also* hedgers
hard hedging: empirical codings by country, 42; India (1964–89), 58–66; indicators for, 20; nuclear ambivalence, 19; pathways to, 55; proliferation strategies by country over time, 44; proliferation strategy, 19–21. *See also* hedging
Harriman, Averell, on atomic war, 135–36
Harvard Belfer Center, 329
Hau Pie-tsun, Taiwan's nuclear weapons, 267
Hayden, Michael, on Syrian plant, 314–15
heavy water reactor, Taiwan, 256–57
hedgers, 293, 336; bomb option and, 341; halting, 295–300; hard, 54, 293, 342; insurance, 4, 12, 54, 342; technical, 54, 100–107, 341–42
hedging: breakout time, 17; empirical codings by country, 42; goals of, 25; hard hedgers, 4, 12, 54; hard hedging, 19–21,

- 20; indicators for, 20; insurance hedging, 18–19, 20; intentional, political choice, 17, 17n5; Japan and West Germany as insurance, 74–75; pathways to varieties, 55; proliferation strategies by country over time, 44; as proliferation strategy, 3, 17–21, 125–26, 338–39; security environment, 30; South Korea, 298–99; Sweden and Switzerland, 109–10; technical, 4, 12, 17–18, 20, 53, 54; varieties of, 53–54. *See also* Argentina; Brazil; India; Japan; Sweden; Switzerland; West Germany
- hiders: active weaponization strategy, 344–45; disruptive proliferators in international system, 293–94; stopping, 307–8
- hiding, 336–37; active weaponization strategy, 350–51; cheaters dilemma, 295; direct foreign acquisition, 25–26; empirical codings by country, 43; goals of, 25; high-risk, high-reward strategy, 24–25; pathway to, 238; political and strategic considerations, 26–27; proliferation strategies by country over time, 44; as proliferation strategy, 3, 4, 5–6, 23–27, 236–39, 290–91, 340–41; transferring nuclear weapons, 26n22. *See also* Iraq; South Africa; Taiwan
- Hillenkoetter, Roscoe, on timing of atomic bomb of USSR, 139–40
- Hiroshima, 134; Soviet's sprint to atomic weapons, 137–38, 142; U.S. bombing of, 76, 86, 130
- Hitler, Adolf, 129, 132, 133, 142
- Holloway, David, *Stalin and the Bomb*, 132
- Hosokawa, Morihiro, on Japan and United States, 83
- Houghton, Vince, on Truman and Soviet Union, 142
- Hsin Chu Project, Taiwan, 257
- Hughes, Llewelyn, Japan's domestic consensus for nuclear weapons, 76, 86
- Hungarian Revolution, 121
- Hussein, Saddam: Bush administration and, 230; hidden nuclear program, 237; as hider, 13; invasion of Kuwait, 237, 239, 245, 246, 250, 253; nuclear program of, 239–46; son-in-law Hussein Kamel and, 245–47. *See also* Iraq
- Hymans, Jacques: *Achieving Nuclear Ambitions*, 173; on Argentina's nuclear weapons, 104; Japan's domestic consensus for nuclear weapons, 76, 86; on Mao wanting Chinese bomb, 167–68; on North Korea, 225; on states achieving nuclear ambitions, 8; theory of oppositional nationalism, 73
- Ikeda, Hayato, on Japan's nuclear weapons, 77
- India: Atomic Energy Commission (AEC), 60, 64, 65; Bharatiya Janata Party (BJP), 70, 73; conflict with Pakistan, 10; domestic consensus and weapons, 70–71; final sprint (1989–98), 66–70; as hard hedger, 4, 12, 21; hard hedging (1964–89), 58–66; hedging strategy of, 8; international nonproliferation norms of, 72; oppositional nationalism, 73; peaceful nuclear explosion (PNE), 60, 205, 302; proliferation strategies over time, 44; proliferation strategy, 42, 348; reluctant nuclear weapons powder, 56–73; security environment, 29, 31; structural realism and, 71–72; technical hedging (1948–64), 56–58; testing nuclear weapons, 45; testing Proliferation Strategy Theory (PST), 70–73
- Indyk, Martin, Libya's nuclear program, 310
- Institute of Nuclear Energy Research (INER), Taiwan, 264
- insurance hedgers, 54, 293, 342; Japan as, 75–85; West Germany as, 89–97. *See also* hedgers
- insurance hedging: empirical codings by country, 42; France ((1945–54), 145–47; indicators for, 20; pathways to, 55; proliferation strategies by country over time, 44; proliferation strategy, 18–19; security environment, 30. *See also* hedging
- Integrated Guided Missile Development Program, 65
- International Atomic Energy Agency (IAEA), 18, 50, 101, 191, 228, 276, 297, 305
- International Crisis Group (ICG), China and North Korea, 228–29
- international relations, structural realism, 48–49
- Iran: as active hider, 6; Ahmadinejad, 324–25; AMAD Plan, 320, 326–29; breakout time, 295, 331, 335; centrifuge program, 24; discovery of Natanz and Arak, 323–24; Fordow facility, 324–25, 328; hiding strategy, 40; from hiding to hard hedging, 322–35; Joint Comprehensive Plan of Action (2015) (JCPOA), 14; Khomeini and weapons, 322; Nuclear Nonproliferation Treaty (NPT), 322–23, 329; nuclear reversal under Joint Comprehensive Plan

374 INDEX

- Iran (*continued*)
of Action (JCPOA), 294–95, 320–21, 330–35, 337, 351; Parchin facility, 328; PMD (Possible Military Dimensions to Iran’s Nuclear Programme), 326–27, 329; proliferation strategies over time, 44; proliferation strategy, 42, 43, 348, 349; Rouhani in, 320, 329–30; Stuxnet attack on Natanz enrichment facility, 317–18, 319, 325–26. *See also* Joint Comprehensive Plan of Action (JCPOA)
- Iran-Iraq war, 247
- Iraq: destruction of Osirak reactor, 242, 244, 317, 318; electromagnetic isotope separation (EMIS) and gaseous diffusion, 243–45, 254; first Gulf War, 239, 245, 247–50, 252, 286; as hider, 4, 13; Hussein Kamel, 245–47, 251; Israeli strikes, 10; Jafar Dhia Jafar as key scientist, 240, 242–46; Mahdi Obeidi on centrifuge project, 240, 241, 245, 248; nuclear weapon pursuit (1981–91), 239–53; proliferation strategies over time, 44; proliferation strategy, 42, 43, 348, 349; Proliferation Strategy Theory (PST) testing, 253–55; realism, 254; Saddam Hussein’s nuclear program, 239–46; technological determinism, 254; uranium enrichment program, 244–47
- Iraq Atomic Energy Commission (IAEC), 240, 241, 245, 251
- Israel: Begin and Operation Opera, 241; Ben Gurion and nuclear weapons pursuit, 180–81, 183, 185–89, 199; bomb development, 5; definition of introduce, 189; Eisenhower administration as shelter, 183–86; Eshkol and nuclear weapons, 189–90, 193; Gilpatric Committee Report, 190, 190n48; Johnson administration and nuclear weapons, 190–95; Kennedy administration and Ben Gurion, 186–89; Kissinger and nuclear issue, 195–98; major power protecting, 38, 40; National Security Study Memorandum (NSSM) 40 policy study, 196; Nixon administration and, 195–98; Nixon and Meir agreement, 179–80; Peres and France for shelter, 181–83; proliferation strategies over time, 44; proliferation strategy, 42, 43, 348, 349; Proliferation Strategy Theory (PST) testing, 200–202; Rabin and nuclear weapons, 194–95; as sheltered pursuer, 3, 13, 23, 177–78; Six Day War, 180, 193; on strike on Syria’s program, 312; strikes on Iraq and Syria, 10; structural realism, 201; technological determinism, 201; testing nuclear weapons, 45; textile plant at Dimona (1956–67), 179–202; U.S. Middle East policy and strength of, 200
- Israeli Atomic Energy Commission, Bergmann, 256
- Italy: proliferation strategies over time, 44; proliferation strategy, 42, 348
- Jackson, Galen, on U.S. and Israel, 188
- Jafar, Jafar Dhia: key Iraqi scientist, 240, 242–46. *See also* Iraq
- Japan: allergy or addiction (1954–present), 75–85; America’s nuclear umbrella, 80–85, 84n109; bombings of Hiroshima and Nagasaki, 76, 86; defense of North Korea, 79, 84; hedging strategy of, 8, 13; as insurance hedger, 4, 12, 74–75; Nuclear Non-proliferation Treaty (NPT) and, 78–79, 82; as potential sprinter, 5; proliferation strategies over time, 44; proliferation strategy, 42, 348; Proliferation Strategy Theory (PST) testing, 85–88; security environment, 30; South Korea and, 87–88; window of vulnerability, 76, 80, 125
- Jardine, Roger, on South Africa nuclear program, 280
- JCPOA. *See* Joint Comprehensive Plan of Action (JCPOA)
- Jervis, Robert, on Saddam Hussein’s behavior, 252–53
- Johnson (Lyndon) administration: American-Israeli relationship, 179; on China’s nuclear weapons program, 170; Erhard and, 95; Israel’s nuclear program, 190–95; Multilateral Force (MLF) and, 94
- Johnson, U. Alexis, Sato and non-nuclear principles, 77
- Joint Comprehensive Plan of Action (JCPOA), 14: Iran story for nuclear reversal, 294–95, 330–35, 337, 351; Obama administration and Iran, 320–21; Trump administration and, 321–22
- Joint Declaration on the Denuclearization of the Korean Peninsula (1992), 228
- Joint Plan of Action (JPOA), interim deal, 330
- Joliot-Curie, Frédéric: atomic fission and, 145; on atomic weapons, 164, 172
- Jones, G. Lewis, on intelligence of Israel, 185–86
- Jonter, Thomas, on nuclear weapons for Sweden, 110–13, 115, 117

- Kamel, Hussein: defection of, 251; Saddam Hussein and son-in-law, 245–47
- Kampani, Gaurav, weaponization process, 64, 69
- Kanter, Arnold, Pakistan uranium enrichment, 213–14
- Kennan, George, 135
- Kennedy, Andrew, on India's perceived umbrella, 296–97
- Kennedy administration: American inspections of Dimona, 186–89; American-Israeli relationship, 179; Ben Gurion and nuclear weapons, 186–89; on inevitability of Chinese nuclear weapons, 169–70; on nuclear weapons for Europe, 93
- Kerry, John, on Iran agreement, 330
- Khan, Abdul Qadeer (AQ): Libya ordering weapons from network of, 309–10; Pakistan, 223–24; procurement activities of, 208, 245, 344; uranium enrichment, 206
- Khan, Ayub, Pakistani nuclear program, 204
- Khan, Feroz Hassan, Pakistani nuclear program, 204, 206, 213, 222, 223
- Khan, Munir Ahmad: Pakistani nuclear program, 204–5; weapon-grade material, 205
- Khan, Yaqub, 220; Kissinger and, 207–8
- Khomeini, Ayatollah, Iran's interest in nuclear weapons, 322
- Khrushchev, Nikita: assistance to China, 165; on France's atomic force, 144, 158; on Mao, 174
- Kiesinger, Kurt (Chancellor), weapons-grade plutonium, 95
- Kim Jong Il, North Korea, 226, 229, 231–32
- Kim Jong Un: North Korean missile tests, 79; Trump and, 298
- Kishi, Nobusuke, possession of nuclear weapons, 77
- Kissinger, Henry: on nuclear issue, 195–98; opening China, 257; Pakistan, 207–8; pretended ignorance, 197
- Kobelt, Karl, Switzerland and nuclear weapons, 121
- Komer, Robert, U.S. policy with Israel, 192
- Korean War, 228; Mao and atomic weapons, 172, 173; US nuclear threats during, 163–64
- Kubo, Takuya, Japan and United States, 82
- Kuntzel, Matthias, on Germany and United States, 93
- Kurchatov, Igor, Soviet's bomb efforts, 133–34, 137–38
- Kusunoki, Ayako, Japan and United States, 81–82
- Kuwait: Hussein's invasion of, 237, 239, 245, 246, 250, 253. *See also* Iraq
- Kux, Dennis, U.S. and Pakistan, 218–19
- latency, technical hedging, 17n5, 18
- Lee Teng-hui, ending Taiwan's programs, 268, 269
- LeMays, Curtis, 302
- Levite, Ariel, on Japan as hedging, 75–76
- Lewis, John: *China Builds the Bomb*, 163; on Soviet decision to renege, 166
- Libya: agreement to surrender, 310–11; Gaddafi and Iraq war, 310; Gaddafi's interest in nuclear weapons, 309; ordering weapons from Khan network, 309–10, 327; proliferation strategies over time, 44; proliferation strategy, 42, 348, 349
- Liu Jifeng, on Soviet assistance for China, 165, 165n145
- Liu Yanqiong, on Soviet assistance for China, 165, 165n145
- Ljunggren, Gustaf, Swedish nuclear weapon program, 111
- Long, Austin, on intelligence of Israel, 184
- MacArthur, Douglas II, on Japan's nuclear weapons, 77
- McGhee, George, U.S. preempting Chinese nuclear power attainment, 169
- major power immunity, 37–40
- Makovsky, David: on Israeli strike, 315; on plutonium nuclear reactor, 313
- Manhattan Project, 2, 45, 244, 250, 317; nuclear pursuit in, 129–31; Soviet intelligence and, 131–32, 137, 139–40
- Mao, 129, 162; Great Leap Forward, 163, 167, 172–74; U.S. as existential threat, 172. *See also* China
- Marker, Jamshed, U.S. and Pakistan, 218
- Mattis, James, on Iran and JCPOA, 334
- Meir, Golda: Nixon administration and, 195–98; Nixon agreement with, 179–80
- militarized interstate disputes (MIDs), 10
- military coercion, vulnerability to, 35–37
- military conflict: proliferators, 10; window of volatility, 10, 11
- military prevention vulnerability, Proliferation Strategy Theory (PST), 35–37
- Miller, Nicholas: on economic vulnerability, 36–37; on Glenn and Symington amendments, 263
- Mirage Affair, Switzerland and, 120, 122–24

376 INDEX

- Mishra, Brajesh, peaceful nuclear explosion (PNE) and India, 60
- Mollet, Guy: arms agreement with Peres, 181; Mendès France and, 159; on Suez Crisis, 152
- Molotov-Ribbentrop Pact, 132
- Montmollin, Louis de, nuclear weapons in Switzerland, 121
- Morimoto, Satoshi, Japan's nuclear energy program, 80
- Mubarakmand, Samar, Pakistan, 223
- Multilateral Force (MLF): Johnson administration, 94, 191; Kennedy administration, 94
- murder: fear of, 46, 344; political equivalent of, 236, 293; threat of, 49, 254
- Mutual Aid and Cooperation Friendship Treaty, China and North Korea, 178
- Mutual Defense Treaty (1954), Taiwan and, 257–58, 266–67
- Nagasaki, 134; plutonium bomb Fat Man, 136; U.S. bombing of, 76, 86, 130
- Nakasone, Yasuhiro, on Japan's nuclear defensive, 77, 84
- Nasser, Gamal Abdel: arms deal with Czech Republic, 180; Israel against action of, in Suez, 182; nationalizing Suez Canal, 151; seizure of Suez Canal, 181
- National Atomic Energy Commission (CNEA), Argentina, 102
- National Intelligence Council report, 247
- National Intelligence Estimate (1960), 168, 183, 188
- National Intelligence Estimate (2005), 324
- National Intelligence Estimate (2007), 324
- National Tsinghua University, 256
- NATO (North Atlantic Treaty Organization): France and, 46–47, 144, 146, 149, 157–59; Nonproliferation Treaty, 191; Nuclear Planning Group, 94; on nuclear-sharing stockpile, 92; Sweden and Switzerland as neutral states, 109; Warsaw Pact, 97; West Germany, 97–99
- Nazi Germany, 128, 129
- Nehru, Jawaharlal, India and technical hedging strategy, 56–58
- Nephew, Richard, on JCPOA deal, 333
- New York Times* (newspaper), 305, 323, 325
- Nie Rongzhen: dispersing facilities, 172; on nuclear weapons for Chinese, 162–64; organizational genius of, 168, 173
- Nixon administration: American-Israeli relationship, 179–80; Israel's nuclear program and, 195–98; opening China, 257; on Taiwan, 257–58
- nonproliferation regime, international, 50–51
- Nonproliferation Treaty, 191, 201. *See also* Nuclear Nonproliferation Treaty (NPT)
- North Korea: Agreed Framework (1994), 225, 228–30; bomb development, 5; China as shelter to, 225–27, 232; Clinton administration and, 228, 230; International Crisis Group (ICG), 228–29; Japan's nuclear defense, 79, 84; Kim Jong Il, 226, 229, 231–32; Kim Jong Un and Trump, 298; Nixon administration and, 224–25; nuclear-armed China and, 30; nuclear breakdown, 80; Nuclear Nonproliferation Treaty (NPT), 307; proliferation strategies over time, 44; proliferation strategy, 43, 349; Proliferation Strategy Theory (PST) testing, 232–33; realism, 232; replicating Syrian location, 314; as sheltered pursuer, 3–4, 13, 23, 177–78; Six Party Talks, 227, 231, 306; technological determinism, 233; Treaty of Friendship, 226; Yongbyon facility, 224, 225, 227–28
- Norway: proliferation strategies over time, 44; proliferation strategy, 42, 348
- NPT. *See* Nuclear Nonproliferation Treaty (NPT)
- nuclear acquisition, term, 43–44n52
- nuclear latency, concept of, 4
- Nuclear Nonproliferation Treaty (NPT), 45; emergence of, 50–51; empirical record, 51; hidiers, 344; IAEA safeguards and, 307; India's nuclear program, 72; Iran, 322–23, 329; Iraqi, 255; Israel, 201–2; Japan, 78–79, 82, 86; North Korea, 307, 233; Pakistan and emerging, 224; South Africa, 279, 286; Sweden, 118–19; Switzerland, 120; Syria, 2, 316; Taiwan, 271; West Germany, 95–96
- nuclear proliferation: armed conflict through process of, 11; consequences of strategy choices, 13–14; intensity and source of demand, 7; literature of, 2–3, 6–9; states thinking about, 9–11; strategies of, 2–6, 15; supply and demand, 7. *See also* proliferation strategies
- nuclear proliferators: duress and weaponization, 9–11; types of, 9; window of volatility for, 10
- Nuclear Suppliers Group (NSG), 297, 307
- nuclear weapon(s): becoming power, 43–45; bomb development, 5; definition,

- 44n53; direct foreign acquisition, 25; motivations for, 6–9; Proliferation Strategy Theory (PST), 27–41; security environment, 29; stationing, 26n22; technical pathways to, 16n1; transferring, 26n22
- Nutt, Cullen, on strike on Syria's program, 312
- Nye, Joe, U.S. policy to Pakistan, 207
- Obama administration: discovery of Fordow, 325; inspection of Iran's nuclear program, 331–32; Iran and, 324–25; Iran's nuclear program, 330; Joint Comprehensive Plan of Action (JCPOA), 320–21
- Obeidi, Mahdi: Iraqi scientist, 240, 241, 245, 248. *See also* Iraq
- Olmert, Ehud, on Israeli strike on Syria, 315
- Olympic Games program, 317, 318
- Operation Barbarossa, 132
- Operation Desert Storm, 246, 248
- Operation Opera, Israel strike on Iraqi reactor, 241
- Ornstein, Roberto, Argentina and, 102, 103
- Othman, Ibrahim, Syrian Atomic Energy Agency, 313
- Pakistan: agreement with United States, 202–3; bomb development, 5; Carter administration and, 203, 206–11, 221, 343; Ford administration and, 206–7; India and, 10, 21; KANUPP reactor, 204, 205; major power protecting, 38, 40; PINSTECH facility, 204; proliferation strategies over time, 44; proliferation strategy, 42, 43, 348, 349; Proliferation Strategy Theory (PST) testing, 221–24; Reagan administration and, 203–4, 211–19, 221, 223, 224; realism, 222–23; research reactors in, 204; as sheltered pursuer, 3, 13, 23, 38, 177–78; technological determinism, 223–24; testing nuclear weapons, 45; uranium enrichment, 203, 205–6, 213–14; weaponization with President Zia, 65–66
- Pakistan's Atomic Energy Commission (PAEC), 204
- Palme, Olaf, on Swedes on nuclear arms, 113
- Pant, K. C.: India's peaceful nuclear explosion (PNE), 60; nuclear weapons plans, 67–68n48
- Partial Test Ban Treaty, 170
- peaceful nuclear explosion (PNE), 302; India's test, 205; Indira Gandhi and, 60; Vorster in South Africa considering, 274
- Penning Ionization Gauge (PIG), Jafar of Iraq, 244
- Peres, Shimon: definition of introduction of nuclear weapons, 203; France as shelter for Israeli arms, 181–83; Israel's nuclear weapon program, 189
- Perkovich, George, on emergence of Chinese threat, 59
- Permissive Action Links (PALs), Germany, 93–94
- Perrin, Francis, Mendès France and, 150
- Pervez, Arshad, Pakistan seeking components, 216
- plutonium: enrichment, 17n3; Fat Man on Nagasaki, 136; First Lightning test, 139; France reprocessing, 156; hidens concealing reactors, 24; India's reactor, 57; North Korea program, 225; Pakistan enrichment, 223; Pakistan reprocessing, 205; reactor and separation, 181; Soviet Union, 133–34; Taiwan's reprocessing attempt, 262–65; technical pathways to nuclear weapons, 16n1
- Pollack, Jonathan, on North Korea's nuclear program, 227, 230
- Prawitz, Jan, on nuclear weapons research, 112
- Pressler Amendment (1985), 216, 219
- proliferation strategies, 12; countries over time, 44; distribution of, 45–46; duress and, 9–11; empirical coding of, 42–43; empirical record of, 41–47; exceptions to theory, 46–47; goals of typology of, 25; hard hedging, 19–21; hedging, 17–21; hiding, 23–27; indicators for hedging varieties, 20; insurance hedging, 18–19; sabotage for retarding progress, 316–20; sheltered pursuit, 22–23; sprinting, 21–22; stopping active proliferators, 300–308; technical hedging, 17–18; typology of, 16–27. *See also* Proliferation Strategy Theory (PST)
- Proliferation Strategy Theory (PST), 27–41, 52; alternative explanations, 47–51; Argentina, 107–9; Brazil, 107–9; China, 171–74; considerations, 29; core variables, 47; decision-theoretic framework, 4; deterrence, 28; domestic consensus and, 31–35; domestic political consensus, 33–34; domestic political fracture, 33–35; economic vulnerability, 35–37; France, 157–62; halting hard hedgers, 299–300; halting hedgers, 295–300; halting insurance hedgers, 297–99; halting

378 INDEX

- Proliferation Strategy Theory (PST)
(*continued*)
technical hedgers, 296–97; identifying strategies, 345–46; India, 70–73; Iraq, 253–55; Israel, 200–202; Japan, 85–88; major power shelter, 37–40; military prevention vulnerability, 35–37; North Korea, 232–33; outline of, 28; Pakistan, 221–24; pathways to strategies, 346; pathway to hedging varieties, 55; pathway to hiding strategy, 238; pathway to sheltered pursuit, 177; pathway to sprinting, 128; realism, 347; reversing direction of states, 292, 294; security environment and, 29–31; South Africa, 287–90; Soviet Union, 140–42; stopping active proliferators, 300–308; stopping hidiers, 307–8; stopping sheltered pursuers, 303–6; stopping sprinters, 301–2; structural realism, 48–49; Sweden, 110, 118–19; Switzerland, 124–25; Taiwan, 269–71; technological determinism, 48, 49–50, 347; West Germany, 97–100. *See also* proliferation strategies
- Purkitt, Helen, on Vastrap Incident, 280
- Quebec Agreement (1943), 130
- quick reaction alert (QRA), Germany, 92, 93
- Rabin, Yitzhak: exchange with Warnke, 194; Israel's nuclear weapons, 194–95
- Rabinowitz, Or: France and Israel agreements, 182–83; on Pakistan program, 209, 221; on U.S. and Pakistan, 217
- Radchenko, Sergey, on U.S. nuclear monopoly, 136
- Radford proposal, 90
- Rao, P.V. Narasimha, 68; aborting nuclear test, 69–70
- Reagan administration: Japan and, 83; Pakistan and, 38, 203–4, 211–19, 221, 223, 224, 350; South Africa and, 282–83
- realism: Iraq, 254; Japan, 87; North Korea, 232; Proliferation Strategy Theory (PST), 347; Soviet Union, 141; West Germany, 98. *See also* structural realism
- Red Army: Afghanistan invasion, 210; attack on Manchuria, 135; France and, 146; Nazi Germany, 129; Pakistan and, 215; rebuilding, 132–33
- Reid, Ogden, on Israel's nuclear program, 185
- Reischauer, Edwin, on Japan's nuclear weapons, 77, 81–82
- Reiss, Mitchell: Brazil and Argentina as rivals, 100–101, 102; on South Africa nuclear program, 280
- Rice, Condoleezza, on Israeli strike, 315
- Rogers, William, on Israel's weaponization, 196
- Romania: proliferation strategies over time, 44; proliferation strategy, 42, 348
- Rostow, Walt: on Barzel's visit to White House, 96; on independent pursuit of nuclear weapons, 97
- Rouhani, Hassan, Iranian president, 320, 329–30, 333, 335
- Rublee, Maria, on Swedish nuclear weapons, 114
- Rumsfeld, Donald, on Iraq, 251
- Rusk, Dean: on Israel, 195; on U.S. assisting in proliferation, 169
- Sagan, Scott, on models in search of bomb, 6–7
- Samuels, Richard, nuclear weapon hedging of Japan, 76, 80, 85, 87
- Sanger, David, on Bush's covert plan, 317
- Sarney, Jose, on nuclear cooperation, 107
- Sato, Eisaku, on Japan's nuclear weapons, 77, 81–82
- Saudi Arabia: future proliferators, 293; sheltered pursuit strategy, 304–5; Trump administration, 305; United States as shelter, 40, 234
- Schaeffer, Teresita, on U.S. and Pakistan, 217
- Schoff, James, nuclear weapon hedging of Japan, 76, 80, 85, 87
- Schultz, George, Pakistan's nuclear program, 212–13
- Schwarz, Hans-Peter, American policies toward Germany, 90
- Scowcroft, Brent, on Pakistan, 219
- security environment, Proliferation Strategy Theory (PST), 29–31
- Shastri, Lal Bahadur, 72; aversion to nuclear weapons, 58–59
- sheltered pursuers, 293, 336; Israel, Pakistan and North Korea, 13, 176–78; Saudi Arabia, 304–5; stopping, 303–6
- sheltered pursuit: active weaponization strategy, 350; empirical codings by country, 43; goals of, 25; proliferation strategies by country over time, 44; as proliferation strategy, 3, 4, 5, 22–23, 176–77, 234–35, 340; PST pathway to, 177. *See also* Israel; North Korea; Pakistan
- Shiffrinson, Joshua, on intelligence of Israel, 184
- Shigeru, Ishiba, Fukushima nuclear crisis, 79
- Shimoda, Yuki, on Japan reserving nuclear option, 77

- Singh, Swaran, on Chinese nuclear threat, 59
Six Day War, Israel, 180, 193, 194
Six Party Talks, 227, 231, 306
Smith, Gerard: Carter administration and Japan, 82–83; on Pakistan, 209; on Taiwan's uranium enrichment, 265–66
Social Democratic Party (SDP), Sweden, 112, 115, 118
Solarz, Stephen, on Congress sanctioning Pakistan, 216–17
Soleimani, Qassem, assassination of, 335
Soustelle, Jacques, support for Israel, 183
South Africa, 237; Atomic Energy Commission, 273, 280; complete secrecy of, 276, 286–87; de Klerk and, 272–74, 276, 287, 289; de Klerk dismantling program, 285–86; device Hobo/Cabot, 284–85; device Video/Melba, 284; German Becker nozzle process, 273, 289; as hiding strategy, 5, 13, 25; model hider (1974–79), 271–87; nuclearization of, 237; Nuclear Nonproliferation Treaty (NPT), 279, 286; Pik Botha and, 277–78, 282–83; proliferation strategies over time, 44; proliferation strategy, 42, 43, 348, 349; Proliferation Strategy Theory (PST) testing, 287–90; P. W. Botha and, 272, 280–81, 283, 285; Reagan administration and, 282–83; structural realism, 288, 289; technological determinism, 288–89; testing nuclear weapons, 45; three-stage “catalytic nuclear strategy” of, 280; uranium enrichment in, 281–84; Vastrap Incident, 279–82, 284–85, 287–90; Vela Incident, 284n175; Vorster and, 273–81, 283; vortex enrichment process, 273–74; Y Plant in, 273–74, 276–77, 281, 283–284; Z Plant in, 273
South Korea: hedging, 298–99; Japan and, 87–88; proliferation strategies over time, 44; proliferation strategy, 42, 43, 348, 349
Soviet Union: American nuclear monopoly and, 136, 139; bomb design and, 139; CIA on timing of atomic bomb by, 139–40; enrichment methods, 138–39; First Lightning test, 139; invading Afghanistan, 38, 203, 204, 210, 222, 224, 303, 343; Manhattan Project and, 131–32, 134–35, 139–40; nuclear weapons program, 133–34, 137–38; Proliferation Strategy Theory (PST) testing, 140–42; South African nuclearization, 13; sprinting strategy, 3, 5, 8, 22, 45, 127; Stalin's sprint (1945–49), 131–42; technological determinism, 141–42
Special National Intelligence Estimate (1972), 259, 261
Special National Intelligence Estimate (1974), 261
sprinters, 293, 336; France as, 147–57; literature of, 13; Soviet Union and Stalin (1945–49), 131–42; stopping, 301–2. *See also* Soviet Union
sprinting: Australia as potential, 175; empirical codings by country, 42; goals of, 25; India (1989–98), 66–70; proliferation strategies by country over time, 44; as proliferation strategy, 2, 3, 5, 21–22, 174–75, 340, 346–47; Proliferation Strategy Theory's pathway to, 128
Spuhler, Willy, on economics of defense, 123–24
Stalin, Joseph: nuclear weapons and Soviet security, 128; Soviet Union (1945–49) and, 131–42. *See also* Soviet Union *Stalin and the Bomb* (Holloway), 132
START (U.S.-Russia New Strategic Arms Reduction Treaty) agreement, 80–81
Strauss, Lewis, rebuking Israel, 181
structural realism: France, 159–60; India, 71–72; Israel, 201; nuclear proliferation, 48–49; Pakistan, 222–23; South Africa, 288, 289; threshold nuclear states, 54. *See also* realism
Stumpf, Waldo: South Africa's Atomic Energy Commission, 273–75, 280; South Africa's secrecy goal, 281; Vorster abandoning sites, 278
Stussi-Lauterberg, Jurg, on Switzerland's security, 120–21, 123
Stuxnet attack, Iran's Natanz enrichment facility, 317–18, 319, 325–26
Subrahmanyam, K., pro-bomb figure, 65
Subterranean Nuclear Explosion for Peaceful Purposes (SNEPP) program, 59
Suez Crisis (1956), France and, 47, 143, 144, 151–52
Sundarji, Krishnaswamy: India at war with Pakistan, 64; pro-bomb figure, 65
Sweden: as hard hedger, 4, 12, 33; as hedging strategy, 8, 13, 109–10; as neutral, 46–47n57; Nuclear Nonproliferation Strategy (NPT), 118–19; proliferation strategies over time, 44; proliferation strategy, 42, 348; Proliferation Strategy Theory (PST), 110, 118–19; proliferation track, 55; security environment, 29, 32; Stockholm's stockpile (1945–66), 110–17; Swedish National Defense Research

380 INDEX

- Sweden (*continued*)
Establishment (FOA), 110–13, 115–16;
Switzerland and, 109–10
- Swedish National Defense Research Establishment (FOA), 110–13, 115–16
- Switzerland: as hard hedger, 4, 12; hedging, 13, 109–10; Mirage Affair, 120, 122–24; as neutral, 46–47n57; Nuclear Nonproliferation Treaty (NPT), 120; proliferation strategies over time, 44; proliferation strategy, 42, 348; Proliferation Strategy Theory (PST) testing, 124–25; proliferation track, 55; security environment, 32; Sweden and, 109–10
- Syria: aboveground nuclear reactor of, 2; Atomic Energy Agency, 1; hiding strategy, 4, 26, 40; Israeli strikes, 10; Nuclear Nonproliferation Treaty (NPT), 316; proliferation strategies over time, 44; proliferation strategy, 43; surgical strike on, 312–16
- Taiwan: American abandonment, 256, 269; Carter administration and, 265–67; Chiang Ching-Kuo, 257, 259, 260, 263–66, 268–69; Chiang Kai-Shek and, 255–57; China as acute security threat, 256, 258–59; defection of Chang Hsien-Yi, 268; heavy water reactor, 256–57; as hider, 13, 27; hiding nuclear weapons program, 259–62; Hsin Chu Project, 257; Lee Teng-hui ending programs, 268, 269; Mutual Defense Treaty (1954), 257–58, 266–67; Nuclear Nonproliferation Treaty (NPT), 271; plutonium reprocessing, 237, 262–65; proliferation strategies over time, 44; proliferation strategy, 42, 43, 348, 349; Proliferation Strategy Theory (PST) testing, 269–71; Taiwan Research Reactor (TRR), 257, 260–61, 264, 269; technological determinism, 270
- Taiwan Relations Act, 258
- Ta-You Wu, Chungshan Institute of Science and Technology, 257
- technical hedgers, 4, 54, 341–42; halting, 296–97. *See also* hedgers
- technical hedging: Brazil and Argentina, 100, 103, 125; empirical codings by country, 42; indicators for, 20; latency, 17n5, 18; proliferation strategies by country over time, 44; security environment, 30; strategy, 17–18. *See also* Argentina; Brazil; hedging
- technological determinism: France, 160; Iraq, 254; Israel, 201; Japan, 87; North Korea, 233; nuclear proliferation, 48, 49–50; Pakistan, 223–24; Proliferation Strategy Theory (PST), 347; South Africa, 288–89; Soviet Union and, 141–42; Taiwan, 270; West Germany, 98
- Tertrais, Bruno, French nuclear program, 153
- Thornton, Thomas, on U.S.-Pakistan relation, 203
- Three Non-nuclear Principles (1967), Sato declaring, 77
- Time* (magazine), 66, 218
- Treaty of Friendship, China and North Korea, 226
- Treaty of Tlatelolco: nuclear weapons-free zone, 100, 107–8. *See also* Argentina; Brazil
- Tripartite Accord, 285
- Trump administration: allies and, 298; Germany and, 97, 100; JCPOA withdrawal, 321–22, 334; Saudi Arabia and, 305; South Korea and, 88
- Uden, Osten, on Swedish military, 113
- United Arab Emirates, as technical hedger, 18
- United Kingdom: nuclear program, 46n57; proliferation strategies over time, 44; proliferation strategy, 42, 348
- United States: Hiroshima bombing, 76, 86, 130, 131; intelligence of North Korea, 229–31; Israel and Pakistan as sheltered pursuers, 23; major power immunity, 37n44; Nagasaki bombings, 76, 86, 130; nuclear threats during Korean War, 163–64; nuclear umbrella for Japan, 80–85, 84n109; proliferation strategies over time, 44; proliferation strategy, 42, 348; Saudi Arabia as potential proliferator and, 40, 234; South African nuclearization, 13; sprinting strategy, 3, 8, 22, 45; Symington and Glenn Amendments to Foreign Assistance Act, 36, 51
- uranium: bomb Little Boy (Hiroshima), 105, 135; centrifuges and enrichment levels, 105; China and weapons-grade, 170–71; Chinese bomb program, 164–65; enrichment, 17n3, 24; enrichment in South Africa, 281–84; hidiers and, 26; Iraqi enrichment program, 244–47; Joliot-Curie and atomic fission, 145; North Korea program, 225, 233; Pakistan enrichment, 205, 213–14, 223; Soviet's enrichment, 133–34, 138; technical pathways to nuclear weapons, 16n1; URENCO (European centrifuge consortium), 205–6
- Uranium Commission, 133

- URENCO (European centrifuge consortium), uranium enrichment, 205–6
- U.S.-Russia New Strategic Arms Reduction Treaty (START) agreement, 80–81
- U.S. Special National Intelligence Estimate, 106, 115
- USSR: proliferation strategies over time, 44; proliferation strategy, 42, 348. *See also* Soviet Union
- Vaid, Nazir, Pakistan seeking components, 216
- Vajpayee, Atal Bihari: Bharatiya Janata Party (BJP), 70, 73; on party “for the bomb”, 62–63
- Vastrap Incident, South Africa, 279–82, 284–85, 287–90
- Vela Incident, South Africa, 284n175
- Vorster, John: abandoning test sites, 278–79, 283; decision for cold test of device, 277; directive in secret, 276; peaceful nuclear program, 273–75; resignation of, 280
- Walters, Vernon, Pakistan’s activities, 215
- Warnke, Paul, Rabin exchange with, 194
- Warsaw Pact, 89, 274
- Way, Christopher, nuclear aspirants data, 41, 41n50
- weaponization: domestic consensus for nuclear, 31–35; empirical codings by country, 42; mass public opinion, 32n34; states and, 9–11
- West Germany: Adenauer on nuclear weapons in, 89–91, 93–95; as insurance hedger, 4, 12, 74–75; Kennedy administration, 93–94; Nuclear Nonproliferation Treaty (NPT), 95–96; nuclear sharing (1956-present), 89–97; proliferation strategies over time, 44; proliferation strategy, 42, 348; Proliferation Strategy Theory (PST) testing, 97–100; technological determinism, 98
- window of volatility, *II*: armed conflict, 10, *II*; hedging, 30; Iran, 329; nuclear proliferation, 10, *II*, 35, South Africa, 13, 237
- window of vulnerability: Japan, 76, 80, 125; West Germany, 96, 125
- World War II: France and, 47, 142–43; nuclear pursuit during, 129–31; Soviet Union after, 140–41; Sweden after, 118–19
- Xue Litai: *China Builds the Bomb*, 163; on Soviet decision to renege, 166
- Yom Kippur War (1973), 200
- Yongbyon facility, North Korea, 1, 224, 225, 227–28
- Yugoslavia: proliferation strategies over time, 44; proliferation strategy, 42, 43, 348, 349
- Zarif, Javed, on JCPOA deal, 333, 334–35
- Zhang Aiping, on China’s nuclear weapon program, 166
- Zhou Enlai: on atomic bomb, 164; delegating nuclear program to, 168; Gaddafi’s weapon request, 26; insistence on program pace, 173; Nixon and, 257; on Soviet assistance for China, 165
- Zia-ul-haq, Muhammad: Carter administration and, 203, 205, 209; Pakistan’s activities, 220; Reagan administration and, 213–15; uranium enrichment program, 213–15
- Zimmerman, Peter, report on Iraqi nuclear program, 249