Strategies of Nuclear Proliferation

How States Pursue the Bomb

Vipin Narang

How do states pursue nuclear weapons? Why do they select particular strategies to develop them, and how do these choices affect the international community's ability to prevent nuclear proliferation? These questions are important because how states try to acquire nuclear weapons—their strategies of nuclear proliferation—affects their likelihood of success and thus the character of the nuclear landscape. As the world finds itself in a "second nuclear age" in the post–Cold War era, understanding the dynamics of the proliferation process—which strategies of proliferation are available to states, which strategy a state might select and why, and what the international community can do to thwart nuclear acquisition as a function of that strategy—is critical to global security. States pursue nuclear weapons in different ways, and those differences matter.

The literature on nuclear proliferation has focused almost exclusively on the question of why states pursue nuclear weapons. The question of how they pursue them has received little attention. This article seeks to fill that gap. It is the first effort to analyze how states—almost thirty of them thus far—have sought nuclear weapons, and why they chose a particular strategy to do so. It identifies the diversity of proliferation strategies; develops a theory for why states select a particular strategy; and shows, using the case of India, that these different strategies of proliferation affect the character of nuclear proliferation and nonproliferation. It thus expands the scope of the proliferation literature by asking how states try to acquire nuclear weapons.

The article proceeds as follows. First, I explain why focusing on strategies of nuclear proliferation is theoretically and practically important. Second, I show why states must think strategically about acquiring nuclear weapons. Third, I describe the four strategies of proliferation available to states—hedging,

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sprinting, hiding, and sheltered pursuit. Fourth, I develop a testable and falsifiable theory based on neoclassical realism that explains why a state is likely to select a particular strategy at a given point in time. Fifth, I present evidence and codings on the empirical universe of nuclear pursuers.[1] Although a definitive test of the theory is beyond the scope of this article, in the sixth section, I provide evidence, including new details, from India's long march to acquiring nuclear weapons that establishes the analytical power of the theory. I conclude with implications for nuclear proliferation and nonproliferation policies. In doing so, this article provides a fresh lens with which to analyze nuclear proliferation, highlighting that the way in which a state pursues nuclear weapons matters deeply to international security.

Existing Proliferation Scholarship: Focusing on Why, Not How

Why is an analysis of the strategies of proliferation necessary? The literature on nuclear proliferation since the end of the Cold War has centered on states' motivations for pursuing nuclear weapons. Scott Sagan's landmark article presented "three models in search of a bomb," outlining the three canonical motivations for nuclear pursuit: security, prestige, and domestic politics.[2] Subsequent literature offered additional or refined motivations such as a state's political economy, more nuanced security dynamics, supply-side temptations, and oppositional nationalism.[3]

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1. I define the term "nuclear pursuer" as any state that "seriously considers building nuclear weapons," which is any state that is at least a nuclear "explorer" as defined in Sonali Singh and Christopher R. Way, "The Correlates of Nuclear Proliferation: A Quantitative Test," *Journal of Conflict Resolution*, Vol. 48, No. 6 (December 2004), pp. 859–885. Singh and Way categorize nuclear pursuers more narrowly than I do, as having "an active effort to build nuclear weapons." Although important, the distinction between explorers and pursuers in Singh and Way is blurry in practice. I therefore use the less restrictive of the two categories to define my set of "nuclear pursuers," as listed in table 3.

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

3. 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, N.J.: Princeton University Press, 2007); Matthew Kroenig, *Exporting the Bomb: Technology Transfer and the Spread of Nuclear Weapons* (Ithaca, N.Y.: Cornell University Press, 2010); Matthew Fuhrmann, *Atomic Assistance: How 'Atoms for Peace' Programs Cause Nuclear Insecurity* (Ithaca, N.Y.: 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 L. Miller, *Stopping the Bomb: The Sources and Effectiveness of U.S. Nonproliferation Policy* (Ithaca, N.Y.: Cornell University Press, forthcoming); and Nuno P. Monteiro and Alexandre Debs, "The Strategic Logic of Nuclear Proliferation," *International Security*, Vol. 39, No. 2 (Fall 2014), pp. 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*, Vol. 14 (2011), pp. 225–244; Jacques E.C. Hymans, "The Study of Nuclear Proliferation and Nonprolifera-

Knowing why states might pursue nuclear weapons, however, does not explain how they might do so. 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 seek to acquire nuclear weapons has produced inconsistent and sometimes contradictory answers, yielding no generalizable theory as to which states might do so, and when or why.[4] 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 obtain them (supply)—not only is important in its own right, but may help integrate the presently disconnected literatures on the supply of and demand for nuclear weapons.[5] In addition, a review of the roughly thirty cases of nuclear pursuers suggests that there is little relationship between the motivations for nuclear pursuit and a state's ultimate choice of proliferation strategy. Each strategy has been chosen by states that pursued nuclear weapons for a variety of motivations. Likewise, states that have had, for example, security motivations for pursuing nuclear weapons have chosen every available strategy of proliferation. Therefore, although varying intensity of demand is certainly important to the strategy of acquisition that a state selects, with lower intensity demand more likely to correlate with, for instance, hedging strategies, the underlying source of that demand matters less. In short, 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 might acquire them.[6]

Additionally, analyzing strategies of proliferation is novel because the extant literature on nuclear proliferation tends to treat nuclear pursuit as a binary, linear process. This view makes two implicit assumptions. The first is that all states that pursue nuclear weapons seek to weaponize their nuclear capabilities. The second is that states seek to do so as quickly as possible. For example, Jacques Hymans's work focuses on how efficiently states achieve their nuclear ambitions, but assumes that all nuclear pursuers try to develop a nuclear weapons capability as quickly as possible.[7]

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tion: Toward a New Consensus?" in William C. Potter and Gaukhar Mukhatzhanova, eds., *Forecasting Nuclear Proliferation in the 21st Century*, Vol. 1: *The Role of Theory* (Stanford, Calif.: Stanford University Press, 2010), pp. 13–37; and Mark S. Bell, "Examining Explanations for Nuclear Proliferation," *International Studies Quarterly*, Vol. 60. No. 3 (September 2016), pp. 520–529.

4. Sagan, "The Causes of Nuclear Weapons Proliferation"; and Bell, "Examining Explanations for Nuclear Proliferation."

5. Sagan, "The Causes of Nuclear Weapons Proliferation," especially pp. 227–236.

6. One exception is Jacques E.C. Hymans, *Achieving Nuclear Ambitions: Scientists, Politicians, and Proliferation* (Cambridge: Cambridge University Press, 2012).

7. Ibid.

These assumptions are not always true. First, states including India, Japan, and Sweden have at times sought to put the various pieces in place to weaponize at a later date if necessary, but have consciously stopped well short of acquisition by selecting a variety of hedging strategies.[8] The goal was not to build nuclear weapons, but to establish a nuclear weapons program that could be completed at a time of their choosing. Hedgers can stall at this point for years, or indefinitely. Second, although the early nuclear proliferators such as the United States, the Soviet Union, and China sought to weaponize as quickly as possible, more than 80 percent of nuclear pursuers have not. For example, some states may not prioritize speed but rather secrecy, pursuing a hiding strategy that aims to present a fait accompli before the program is discovered. Few states actually fit the portrait in the nuclear proliferation literature of sprinters, trying to acquire 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.

Why does filling this gap in the literature matter more broadly for nonproliferation policy? Although knowing why states might want nuclear weapons may enable one to mitigate the demand for such weapons, these underlying motivations—for example, a state's security environment or a desire for prestige—are difficult to manipulate. Knowing how a potential nuclear pursuer may go about trying to acquire nuclear weapons provides additional avenues to halt nuclear weapons proliferation. There are different types of nuclear proliferators, and the distinctions among them are critical to understanding which states may be more likely to acquire nuclear weapons and the various ways in which the international community may be able to stop them.

Plotting Acquisition Strategies: Proliferation under Duress

States that pursue nuclear weapons often do so under duress. As nuclear proliferators approach the point of weaponization, many experience systematically more pressure—such as the threat of sanctions or military conflict—than they did before or after acquisition.[9] There are three reasons why this might be the case. First, there may be some reverse causality whereby increased levels of duress further motivate pursuit of nuclear weapons. Second, as a state ap-

8. See, for example, Ariel E. Levite, "Never Say Never Again: Nuclear Reversal Revisited," *International Security*, Vol. 27, No. 3 (Winter 2002/03), pp. 59–88; and Avner Cohen and Benjamin Frankel, "Opaque Nuclear Proliferation," *Journal of Strategic Studies*, Vol. 13, No. 3 (1990), pp. 14–44.

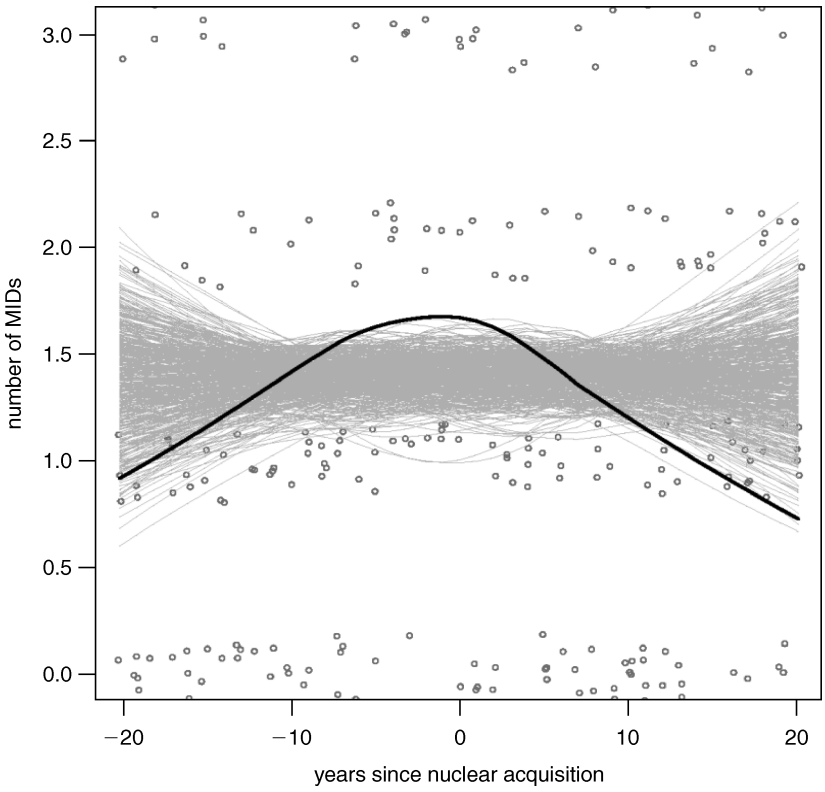
9. David Sobek, Dennis M. Foster, and Samuel B. Robison, "Conventional Wisdom? The Effect of Nuclear Proliferation on Armed Conflict, 1945–2001," *International Studies Quarterly*, Vol. 56, No. 1 (March 2012), pp. 149–162.

proaches the point of weaponization, other states might attempt to destroy its nascent nuclear capabilities.[10] Third, a state that anticipates acquiring nuclear weapons or has recently done so might become emboldened, relying on ambiguous or limited capabilities to deter possible retaliation.[11] Scholars often treat these mechanisms as distinct, but they are related and feed back to one another. Proliferators that other states fear might become emboldened are more likely to be targets of greater coercive or preventive efforts. Similarly, these efforts might trigger greater emboldenment by the proliferator. The historical record is dotted with conflicts where targeting a state's nuclear weapons programs was at least one possible objective: the 1967 Arab-Israeli War, episodes in 1984 and 1986–87 when India contemplated using a broader conflict to target Pakistan's uranium enrichment facility, Israeli strikes against Iraq and Syria, and the two wars with Iraq.[12] For potential nuclear proliferators, as Libya and Iran no doubt observed, these examples are powerful demonstrations of what may be awaiting them if they try to pursue nuclear weapons against the will of major powers.

Thus, the pursuit of nuclear weapons can result in substantial international tumult and conflict. To illustrate this point, 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 that a proliferator faces on average, because it does not include the other forms of pressure that a state may experience, such as economic threats or military harassment, that fall below the militarized threshold. I align all non-superpower nuclear possessors by their date of nuclear acquisition (normalizing that date as t_0 for all regional power acquirers) and plot the level of conflict that they experience in the two decades prior and subsequent to acquisition, using militarized interstate disputes (MIDs) as a reasonable indicator for conflict.[13] This approach takes the point of acquisition as the standardized moment to assess conflict levels for proliferators. Thus, it aligns China in 1964 with, for example, Pakistan in 1987

10. Matthew Fuhrmann and Sarah E. Kreps, "Targeting Nuclear Programs in War and Peace: A Quantitative Empirical Analysis, 1941–2000," *Journal of Conflict Resolution*, Vol. 54, No. 6 (December 2010), pp. 831–859.
11. See Mark S. Bell, "Beyond Emboldenment: How Acquiring Nuclear Weapons Can Change Foreign Policy," *International Security*, Vol. 40, No. 1 (Summer 2015), pp. 87–119.
12. See also Andrew J. Coe and Muhammet Bas, "A Dynamic Theory of Nuclear Proliferation and Preventive War," *International Organization*, forthcoming.
13. Acquisition dates are from Philipp Bleek, "Does Proliferation Beget Proliferation? Why Nuclear Dominoes Rarely Fall," Ph.D. dissertation, Georgetown University, 2010, appendix A. I exclude the United States and the Soviet Union here because they had wartime proliferation programs and the number of MIDs around their programs is thus artificially high. This analysis employs MIDs 4.1. See Glenn Palmer et al., "The MID4 Dataset, 2002–2010: Procedures, Coding Rules, and Description," *Conflict Management and Peace Science*, Vol. 32, No. 2 (2015), pp. 222–242.

Figure 1. The Relationship between Nuclear Proliferation and Armed Conflict



NOTE: t_0 is the point of a state's acquisition of nuclear weapons. Observed disputes are denoted by the circles. The bold line denotes the smoothed average of the observed conflict levels. Five hundred random draws of the null hypothesis are denoted by the light lines. Compared to the null hypothesis, the average observed conflict curve is statistically significant at the $p < 0.001$ level. MIDs stands for militarized interstate disputes.

to uniformly observe conflict levels across the proliferation process.[14] I use Fisher randomization inference, which tests the observed conflict levels against the null hypothesis, constructed through many random draws, that there is no relationship between nuclearization and conflict levels. Compared to the null hypothesis, figure 1 shows a systematic and significant relationship between the proliferation process and conflict levels.

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

On average, states pursuing nuclear weapons face more armed conflict—an additional militarized dispute per year—through the process of nuclear acquisition.[15] There is an intense "window of volatility" for proliferators in the decade prior and subsequent to acquisition. 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 in the face of this duress. The next section describes four broad strategies of proliferation that states can select to try to minimize their exposure to this potential pressure.

Four Strategies of Nuclear Proliferation

What are the strategies of nuclear proliferation available to states?[16] There are several questions that a state asks when pursuing nuclear weapons. First, does it want to fully weaponize its nuclear capabilities? Second, if the state seeks only the option to weaponize in the future, under what conditions might it break out and fully weaponize, and where does it want to stop on the spectrum of its program?[17] If it does seek nuclear weapons, then it must consider how to go about developing them. In this section, I outline the typology of nuclear proliferation strategies available to states. In generating any typology, one must attempt to ensure that the categories are analytically distinct and mutually exclusive, so that states can be identified as being in one category rather than others at any point in time. The categories should also be at least empirically—if not conceptually—exhaustive. The following typology meets these requirements. I identify four broad strategies of proliferation that vary on analytically important dimensions: hedging, sprinting, hiding, and sheltered pursuit.

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15. The results in figure 1 are robust to different acquisition dates and to removing any one regional nuclear power. Contact author for any desired robustness checks.
16. This is a study of the political strategies of acquisition, but the technical pathways to nuclear weapons are also important. To build a nuclear weapon, the key ingredient is weapons-grade fissile material. This can either be the fissile uranium isotope (^{235}U), which must be enriched from its ~0.7 percent content in natural uranium to greater than ~90 percent content using technologies such as gaseous centrifuges or gaseous diffusion, or the fissile plutonium isotope (^{239}Pu), which can be isolated by reprocessing spent nuclear reactor fuel. Developing sufficient weapons-grade fissile material is often the most difficult technical challenge for states. Once a state has sufficient weapons-grade fissile material, it must machine weapons cores and develop explosive designs to compress the cores so that they go critical and sustain a fission reaction, yielding energy on the scale of 15–20 kilotons for a basic fission weapon. A state must also develop the ability to deliver a nuclear weapon and have weapons designs suitable for the delivery system it chooses to use. A strategy of proliferation aims to develop the indigenous capability to produce nuclear weapons and the means to deliver them.
17. If the answer to this question is that the state explicitly forswears the option of nuclear weapons, the state no longer has a strategy of proliferation.

HEDGING

A hedger is distinguished from other proliferators by its intent to develop a bomb option, deferring a decision on actual weaponization. It refrains from actively developing nuclear weapons but has not explicitly forsworn the option, putting the pieces in place for a future nuclear weapons program. Hedgers develop capabilities that are consistent with both the pursuit of nuclear weapons and a peaceful nuclear energy program, preserving a "breakout option" if their desire for nuclear weapons shifts from "maybe" to "yes." Hedgers include states with civilian energy programs that have—or are in a position to achieve—control of the fuel cycle and those that seek to develop indigenous uranium enrichment capabilities that could provide weapons-grade uranium or reprocessing capabilities for plutonium weapons.[18] Importantly, however, hedging is not simply a technological condition or a state of so-called nuclear latency, which is largely related to enrichment and reprocessing technologies.[19] Rather, this strategy focuses on how, where, and why states might consciously choose to hedge on a nuclear weapons program as opposed to acquiring such weapons.[20] There are three varieties of hedging.

TECHNICAL HEDGING. The first variety of hedging is "technical" hedging. Technical hedgers put the technological pieces in place that enable them to pursue a military program at a later date and hedge as a by-product of a civilian energy program and infrastructure. This type of hedging may be characterized by the existence of fissile material production (not weapons grade), but no work is undertaken on weaponization or explosives research, nuclear delivery systems, or organizational routines to manage nuclear weapons. This form of hedging takes the position of "explicitly not now, but implicitly not never." This sort of hedging may arise because access to nuclear technologies may tempt certain constituencies within the state to flirt with the idea of pursuing

18. For an overview of the relationship between plutonium and uranium enrichment technologies and nuclear proliferation, see Scott D. Sagan, "Nuclear Latency and Nuclear Proliferation," in Potter and Mukatzhanova, *Forecasting Nuclear Proliferation in the 21st Century*, Vol. 1, pp. 80–101. On nuclear ambivalence, see Itty Abraham, *The Making of the Indian Atomic Bomb: Science, Secrecy, and the Postcolonial State* (New York: St. Martin's, 1998).

19. See, for example, Matthew Fuhrmann and Benjamin Tkach, "Almost Nuclear: Introducing the Nuclear Latency Dataset," *Conflict Management and Peace Science*, Vol. 32, No. 4 (September 2015), pp. 443–461. See also Tristan Volpe, "Bargaining in the Sweet Spot: Coercive Diplomacy with Latency," George Washington University, 2016.

20. What distinguishes hedging from latency is that the latter is largely a technical condition, whereas the former is a political strategy in which a state intends to preserve the option of developing nuclear weapons. Categorizing hedging behavior according to political motivation rather than technical capacity has the advantage of identifying which types of hedgers are more likely to acquire or forswear nuclear weapons based on changes to their domestic or international conditions.

nuclear weapons.[21] The demand for nuclear weapons, however, is weak and often confined to fringe elements in the state's political, military, or energy institutions. Technical hedging is perhaps closest to the concept of pure latency, lacking centralized—but not entirely absent—intent for further nuclear weapons pursuit. For many years, Argentina and Brazil were quintessential technical hedgers whose interest in nuclear weapons was limited to fringe elements in the military.[22]

INSURANCE HEDGING. The second variety of hedging is "insurance" hedging. Insurance hedging involves putting more pieces of a nuclear weapons program in place than technical hedging to further reduce the time required to build a bomb should a state need to weaponize (for example, if a security threat intensifies or if the hedger is abandoned by an ally). Insurance hedging explicitly threatens breakout under specific conditions, to "collect" on the insurance policy so to speak. Some indicators of insurance hedging include theoretical work on weaponization and nuclear explosions; movement toward indigenous control of the fuel cycle, including exploratory work on the capability to produce weapons-grade fissile material; and work on dual-use delivery vehicles. There is likely little or no thinking, however, about developing organizational routines for the management of nuclear weapons or any physical work on weaponization. In a phrase, this form of hedging is "explicitly not now, but explicitly in the future if X happens." Not only does insurance hedging lay the foundation for the more accelerated development of an independent deterrent should the state face a deteriorating security environment, but it can be leveraged by the potential proliferator to maintain a senior ally's commitment to it, given that major powers often oppose proliferation by their allies for strategic reasons.[23]

HARD HEDGING. The third variety of hedging is "hard" hedging. In this form of hedging, a state attempts to become a threshold nuclear state with many of the pieces in place for a functional weapons program. The state has a potentially intense demand for nuclear weapons, but it consciously stops short of weaponization. Hard hedgers can approximate "turnkey" nuclear weapons states, standing on the precipice of nuclear weapons acquisition but restraining themselves from going over the brink. Hard hedging may include theoreti-

21. See Fuhrmann, *Atomic Assistance*; and Kroenig, *Exporting the Bomb*.
22. See Mitchell Reiss, *Bridled Ambition: Why Countries Constrain Their Nuclear Capabilities* (Washington, D.C.: Woodrow Wilson Center Press, 1995), chap. 3.
23. See Francis J. Gavin, "Strategies of Inhibition: U.S. Grand Strategy, the Nuclear Revolution, and Nonproliferation," *International Security*, Vol. 40, No. 1 (Summer 2015), pp. 9–46; and Gene Gerzhoy, "Alliance Coercion and Nuclear Restraint: How the United States Thwarted West Germany's Nuclear Ambitions," *International Security*, Vol. 39, No. 4 (Spring 2015), pp. 91–129.

Table 1. Potential Indicators for Varieties of Hedging

	Technical Hedging	Insurance Hedging	Hard Hedging
Fissile material production	Nonweapons-grade	Nonweapons-grade; potential work on capability to produce weapons-grade	Capability for weapons-grade production
Weaponization work	None	Possibly limited (secret?) theoretical work	Theoretical work; no physical work
Nuclear delivery vehicles	None	Possibly dual-use delivery vehicles	Dual-use delivery vehicles; potentially dedicated delivery vehicles
Declared interest in weapons	Fringe elements	Surfaces only periodically	Mainstream debate
Intent: explicitly not now but . . .	Implicitly not never	Explicitly if X happens	Explicitly not never

cal work on nuclear explosives, the capability to produce weapons-grade fissile material, work on weapons designs and delivery vehicles, and the development of bureaucratic organizations to manage a nuclear weapons capability. This hedging takes the position "explicitly not now, but explicitly not never." Hard hedging brings the question of nuclear weapons into the potential proliferator's mainstream political debate. Some states in this position, such as India, ultimately opt to pursue an active proliferation strategy; others, such as Sweden, ultimately conclude that nuclear weapons are not in their interest and forswear the option.[24]

VARIETIES OF HEDGING. Table 1 lists the potential indicators for the three varieties of hedging. Not all of them may be present in each case, and states may vary in their specific technical work within each category. In practice, distinguishing among these three types of hedgers may not be straightforward. For example, hard hedging may be difficult to observe in real time because much of the distinctive work is likely done in secret. Perhaps in practice, most adversaries and the international community will assume that anything resembling technical hedging could in fact be hard hedging. Although it may be difficult to locate exactly where a hedger is on the proliferation spectrum in real time, the reasons why states select a particular variety of hedging differ. That is, even if one cannot distinguish among hedgers in real time, they are distin-

24. See Thomas Jonter, *The Key to Nuclear Restraint: The Swedish Plans to Acquire Nuclear Weapons during the Cold War* (London: Palgrave Macmillan, 2016).

guishable by the sources of their hedging. Importantly, identifying the conditions that ought to generate a particular variety of hedging provides insights into what might trigger an active weapons acquisition strategy or encourage abandonment of a nuclear weapons program. For example, knowing that a state under a nuclear umbrella might be an insurance hedger and not a hard hedger allows one to isolate the possibility that changes in alliance commitment or the rise of an acute threat might trigger nuclear weapons breakout. In other cases, knowing that hard hedgers often stall as a result of domestic political fissures provides a different mechanism for triggering nuclear acquisition or inducing nuclear abandonment.

Hedging is a transitory strategy. A state that ultimately wants to acquire a nuclear weapons capability must switch to an active nuclear weaponization strategy. Alternatively, a hedger that decides that it wants to foreclose the option to produce nuclear weapons exits the universe of cases, because its intent to pursue nuclear weapons evaporates.[25] Otherwise, hedging can theoretically persist indefinitely, as hedgers may reap some deterrent benefits without paying the costs of overt proliferation, such as sanctions, reactive proliferation by adversaries, or the financial obligation of maintaining an overt deterrent. For example, when India was a hard hedger, sitting on the threshold of becoming a nuclear weapons state, it may have achieved some deterrent benefits against Pakistan.[26] Other hedging strategies, particularly insurance hedging, may be both a latent deterrent to an underlying threat and a coercive tool that a potential proliferator can use vis-à-vis a senior formal ally that generates security benefits. For a state that decides that it does want nuclear weapons, however, there are three active acquisition strategies from which it can select.

Sprinting

The first active weapons acquisition strategy is sprinting. States selecting this strategy seek to develop nuclear weapons as quickly as possible. The state must be relatively unconcerned with external powers knowing its intent and capabilities. There are almost always efforts at tactical obfuscation to protect the integrity of research and production facilities and activity, but there is little attempt to mask either the intent or capability to develop nuclear weapons. The state is free to openly develop uranium enrichment or reprocess plutonium for expressly military purposes, as well as build delivery vehicles and create organizational routines to manage a nuclear weapons arsenal. Sprinting

25. On this point, see Levite, "Never Say Never Again."
26. See Vipin Narang, *Nuclear Strategy in the Modern Era: Regional Powers and International Conflict* (Princeton, N.J.: Princeton University Press, 2014), chap. 10.

is a strategy that is likely to lead to a nuclear weapons capability. It may take some states longer than others for technical or organizational reasons, but if a state devotes the necessary resources and is immune from economic or military preventive action, its prospects for acquiring nuclear weapons are good.[27] Contrary to the assumptions of the proliferation literature, sprinting is a rare strategy of proliferation. Some acquirers sprint at the end of their quest for nuclear weapons, but few after the first generation of proliferators (e.g., the permanent five members of the UN Security Council) have started and finished with a sprinting strategy.

HIDING

A hider seeks to acquire nuclear weapons, but does so in a fashion that privileges secrecy over speed. Hiders fear prevention or coercion if their activities and capabilities are discovered by other states. They may also fear reactive proliferation by their rivals if their efforts become known. The ideal outcome for a hider is to present the fait accompli of a nuclear weapons capability before it is discovered or to achieve at least sufficient progress to deter prevention. Hiders tend to prefer pathways to nuclear weapons that are easier to conceal, and they are willing to sacrifice efficiency to maximize secrecy. Although uranium enrichment technologies are often presumed to be easier to conceal than plutonium reprocessing technologies, there have been hiders, such as Taiwan, that attempted to conceal their plutonium reprocessing capabilities.[28]

Hiding is a high-risk, high-reward strategy. If a state is able to hide and present its development of nuclear weapons as a fait accompli, it is able to reap all the benefits of a nuclear deterrent while avoiding the external duress of the proliferation process. Once presented with a fait accompli, the international community may have little choice but to accept the state's nuclear weapons capability, given that nuclear weapons, at least theoretically, provide protection against existential threats.[29] But if a hider is caught, diplomatic or military mobilization against it may be more likely because of the perceived illegitimacy of hiding a nuclear capability. Hiding has rarely been successful, however, because maintaining complete secrecy against a global intelligence apparatus designed to detect hidden nuclear weapons programs is difficult.[30] Neverthe-

27. For discussion of states such as China, which was immune from serious preventive threats and able to develop nuclear weapons relatively efficiently, see Hymans, *Achieving Nuclear Ambitions*.
28. See David Albright and Corey Gay, "Taiwan: Nuclear Nightmare Averted," *Bulletin of the Atomic Scientists*, Vol. 54, No. 1 (January/February 1998), pp. 54–60.
29. Vipin Narang, "What Does It Take to Deter? Regional Power Nuclear Postures and International Conflict," *Journal of Conflict Resolution*, Vol. 57, No. 3 (June 2013), pp. 478–508.
30. See Jeffrey T. Richelson, *Spying on the Bomb: American Nuclear Intelligence from Nazi Germany to North Korea* (New York: W.W. Norton, 2007).

less, some states, such as South Africa and North Korea, did achieve a nuclear weapons capability using a hiding strategy.[31] Thus, even a small prospect of success may tempt states to pursue this strategy because of the huge upside.

SHELTERED PURSUIT

Sheltered pursuit involves actively cultivating or opportunistically taking advantage of major power protection against external threats to pursue nuclear weapons. The state offering shelter is often a superpower, but may also include other major powers such as China. The major power is not usually a formal ally, given that major powers often prefer their formal allies not to possess nuclear weapons so that they can alone control nuclear use and escalation within their alliance blocs. Instead, the state may find itself in a transactional client-patron relationship with a major power that is complicit in, or at least tolerant of, its nuclear weapons pursuit and offers immunity against external coercion. The immunity given to the sheltered pursuer often has nothing to do with its nuclear program. The United States, for example, has never wanted another state to acquire nuclear weapons.[32] Instead, shelter may be extended because the state has found itself useful to the major power for other domestic or geopolitical reasons that override nonproliferation objectives.[33] This strategy therefore allows the pursuer to opportunistically acquire nuclear weapons. It opens a window of protection against the major power patron, during which the client can attempt to acquire nuclear weapons, while the patron's diplomatic and military protection provides the client cover against other external powers. The aim of the sheltered pursuit strategy is to develop a nuclear weapons capability before the major power patron abandons the client.

The sheltered pursuit strategy is appealing because it allows a state to proliferate under an umbrella of protection. Israel and Pakistan are the quintessential sheltered pursuers, having taken advantage of protection from the United States to develop nuclear weapons while claiming to other states that its facilities were only for nonmilitary purposes—textile factories or goat sheds, respectively.[34] The proliferator can actively seek protection, as Israel did from the

31. See, for example, Peter Liberman, "The Rise and Fall of the South African Bomb," *International Security*, Vol. 26, No. 2 (Fall 2001), pp. 45–86.
32. See Gavin, "Strategies of Inhibition."
33. See Or Rabinowitz and Nicholas L. Miller, "Keeping the Bombs in the Basement: U.S. Nonproliferation Policy toward Israel, South Africa, and Pakistan," *International Security*, Vol. 40, No. 1 (Summer 2015), pp. 47–86.
34. See "We Have Been Misbehaving a Little," U.S. Embassy Tel Aviv telegram 574 to State Department, December 23, 1960, National Security Archive Electronic Briefing Book (NSA EBB) 510, doc. 15, http://nsarchive.gwu.edu/nukevault/ebb510/docs/doc%2015.pdf; and Muhammed Zia–ul–Haq quoted in Narang, *Nuclear Strategy in the Modern Era*, p. 59.

Table 2. Typology for Strategies of Nuclear Proliferation

Strategy	Intended Outcome
Hedging	Develop the option for a weapon
Sprinting	Weaponize as quickly as possible
Hiding	Weaponize without being discovered
Sheltered pursuit	Weaponize before patron abandons client

United States in the 1960s, or it could find itself an important client state for entirely exogenous reasons. For example, after the Soviet Union invaded Afghanistan in 1979, Pakistan suddenly found itself on the frontline of the Cold War and took advantage of U.S. shelter to redouble its efforts to acquire nuclear weapons.[35] With major power protection, the chances of achieving a nuclear weapons capability are high. If, however, the major power patron abandons the sheltered pursuer, then the program could stall or be terminated by external powers, including by the former protector itself. For example, the United States attempted to goad the Soviet Union, China's erstwhile patron, into destroying Beijing's nuclear program in the early 1960s.[36] A hider whose nuclear weapons program is discovered may also search for protection and attempt a sheltered pursuit strategy to avoid punishment, but this requires the state to swiftly locate a power willing to protect it.

summary of strategies of proliferation

Table 2 illustrates the goals of the four strategies of nuclear proliferation. Except for the sprinting strategy, states pursuing nuclear weapons do not consider speed of paramount importance. For example, hedgers intentionally slow down or even stall the acquisition process, whereas hiders sacrifice speed to maintain secrecy. Sheltered pursuers are in a unique category that balances the desire for speed and secrecy, while their patron state protects them from external efforts to stop them.

This typology is mutually exclusive—nuclear pursuers fall into one category or another. For example, although a hedger can have hidden nuclear compo-

35. See Secretary of State George Schultz to President Reagan, "How Do We Make Use of the Zia Visit to Protect Our Strategic Interests in the Face of Pakistan's Nuclear Weapons Activities?" November 26th, 1982, in William Burr, ed., *New Documents Spotlight Reagan-Era Tensions over Pakistani Nuclear Program*, NSA EBB 377, doc. 16, https://www.documentcloud.org/documents/347090-doc-16-11-26-82.html; and Feroz Hassan Khan, *Eating Grass: The Making of the Pakistani Bomb* (Stanford, Calif.: Stanford University Press, 2012), pp. 124–125.

36. See William Burr and Jeffrey T. Richelson, "Whether to 'Strangle the Baby in the Cradle': The United States and the Chinese Nuclear Program, 1960–64," *International Security*, Vol. 25, No. 3 (Winter 2000/01), pp. 67–72.

nents, it is not pursuing an active strategy of hiding until it decides to fully acquire nuclear weapons. Is the typology exhaustive? Empirically, I would argue that it is. Every nuclear pursuer in the historical record has chosen one of these strategies, and it is difficult to imagine a future proliferator choosing anything else. There is one potential additional strategy, however: direct foreign acquisition of a functional nuclear arsenal, which theoretically offers a quick and cheap route to nuclear weapons, though it can place the recipient's security at the mercy of the provider. The problem, of course, is finding a willing supplier—a nuclear weapons state that is willing to place part of its own arsenal under the sovereign control of another state. Libya's President Muammar Gaddafi is rumored to have sent an aide to ask Chinese leaders on March 24, 1970, to sell him nuclear weapons. Premier Zhou Enlai flatly refused, telling the emissary that Libya should build its own.[37] All of the nuclear weapons states have balked at similar requests, because no state wants to make itself a target for potential nuclear retaliation as a result of decisions taken by another state—and there is little reason to think that this is likely to change.[38] Other possibilities, such as "bluffing"—pretending to have a greater capability than one actually has—are not strategies of proliferation, but rather strategies of deterrence, and are therefore distinct. Furthermore, tactics such as seeking foreign assistance or joint development can be part of a strategy, but they are a means to an end and do not define a strategy itself.

One important implication of this typology is that the process of proliferation is primarily a political and strategic choice, and that the choice of technology flows from the strategy of proliferation. That is, my approach is a challenge to the technological determinist perspective, which argues that states try to proliferate using whichever technology they can acquire or competently develop and that this is what drives the process of proliferation. My argument is the reverse: states select their preferred strategy of proliferation and, based on that strategy, search for the appropriate technical pathway and generate the requisite competence. There is certainly variation in the technical ability of states to implement these strategies, and Hymans shows that some may do so more efficiently than others. I argue, however, that the choice of strategy precedes the development or acquisition of the technology. In the case of sprinting, for example, states choose the pathway that is most expedient, whether through plutonium reprocessing or uranium enrichment or both. Hedgers and sheltered pursuers have the latitude to choose different routes

37. See Richelson, *Spying on the Bomb*, p. 325.
38. Direct transfer of nuclear weapons to the sovereign control of another state is distinct from stationing nuclear weapons on foreign soil or from inheriting foreign weapons without control of them, as Belarus, Kazakhstan, and Ukraine did. It is also distinct from nuclear assistance, such as China's assistance to Pakistan, which does not involve the transfer of weapons.

as well. Hiders are often forced to take the uranium pathway because uranium enrichment facilities can be more easily dispersed and hidden. This is a learned tactic, however, given that some hiders such as Syria and Taiwan attempted to develop hidden plutonium pathways and were perhaps more easily discovered as a result.[39] The conventional wisdom is that hiders often fail because they are technically incompetent. In contrast, my framework suggests that the strategic choice to pursue a nuclear weapons program with a small signature to avoid external coercion forces a state to select technically inefficient pathways, which reduces the likelihood of success.

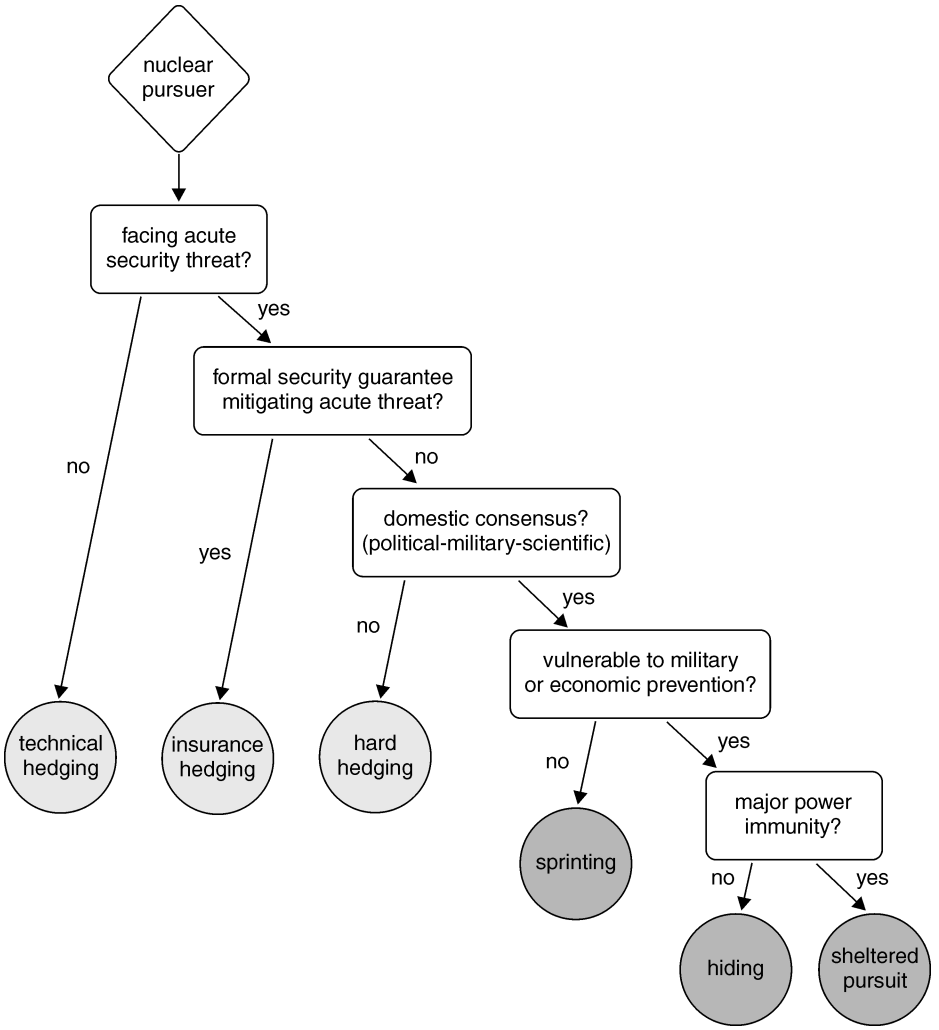
Nuclear Acquisition Theory: Explaining Proliferation Strategies

Why do states select one strategy of proliferation over others? This section outlines a theory for the strategies of proliferation. The theory is structured as a decision tree that, from the view of a state's political leaders, asks: Given the external and domestic political environment, which strategy of proliferation should the state optimally choose? The decision tree makes a prediction for the strategy chosen by a given state at a given point in time, based on the values taken by a sequence of variables at that time. Because the value of each variable can change (e.g., a state's threat environment may change), these predictions are not static. If a change in a variable occurs while a state is pursuing nuclear weapons, the theory would predict that a change in the state's proliferation strategy should also occur.

In the tradition of neoclassical realism, the theory privileges systemic variables but recognizes that unit-level variables are required to capture the richness of state decisions.[40] I take care, however, not to introduce unit-level variables in an ad hoc fashion, or perceptual variables, which are often the source of indeterminacy and degeneration in neoclassical realism. Instead, I specify when and where unit-level variables might intervene and develop ex ante indictors for those variables; in this way, the theory remains both testable and falsifiable. Elsewhere, I employed this broader theoretical approach to predict which strategies of deterrence states might select.[41] Figure 2 outlines my

39. See, for example, David Makovsky, "The Silent Strike: How Israel Bombed a Syrian Nuclear Installation and Kept It Secret," *New Yorker*, September 17, 2012, http://www.newyorker.com/magazine/2012/09/17/the-silent-strike; on Taiwan, see Albright and Gay, "Taiwan."
40. See Gideon Rose, "Neoclassical Realism and Theories of Foreign Policy," *World Politics*, Vol. 51, No. 1 (October 1998), pp. 144–172; Randall L. Schweller, *Deadly Imbalances: Tripolarity and Hitler's Strategy of World Conquest* (New York: Columbia University Press, 1998); William Curtis Wohlforth, *The Elusive Balance: Power and Perceptions during the Cold War* (Ithaca, N.Y.: Cornell University Press, 1993); and Narang, *Nuclear Strategy in the Modern Era*.
41. See Narang, *Nuclear Strategy in the Modern Era*, chap. 2.

Figure 2. Nuclear Acquisition Theory



theory, nuclear acquisition theory, for which strategies of proliferation states ought to select to acquire nuclear weapons.

In deciding how to pursue nuclear weapons, states must consider three sets of variables: (1) their immediate security environment, (2) their internal domestic context, and (3) their international nonproliferation constraints and opportunities. The first two variables in figure 2 capture the intensity of demand generated by a state's immediate security environment; the third variable measures whether the state's political-military-scientific elites agree that nuclear

weapons are necessary for the state to achieve its security needs.[42] These variables determine whether a state is a hedger or actively seeking weapons, selecting among sprinting, hiding, or sheltered pursuit based on the final two variables in figure 2, which capture the state's nonproliferation environment.

Nuclear acquisition theory privileges a state's security environment but explicitly suggests that domestic political consensus is also a crucial variable: the decision to actively pursue nuclear weapons must be filtered through, and subject to, a domestic political process in which a consensus for weaponization emerges. The process may not be easy or expedient, as the case of India shows. In combination, however, the security and domestic variables capture whether the state wants to weaponize its nuclear capabilities. If the values of the security variables or the domestic political variables create ambivalence about acquiring nuclear weapons, then the state should select a strategy of hedging. That is, if a state's security environment is sufficiently benign or a domestic consensus on nuclear weapons is absent, a pursuer is likely to adopt a variety of hedging. If, however, a state faces an acute security threat alone and has the domestic consensus for developing nuclear weapons, the two variables capturing the nonproliferation environment it faces determine how the state pursues nuclear weapons. Both costs—the risk of military prevention or other coercive measures—and opportunities, if a state benefits from major power immunity, dictate the optimal proliferation strategy. Below I explain how, when, and why each of the variables should influence a state's choice of proliferation strategy.

FACING AN ACUTE SECURITY THREAT ALONE?

A potential proliferator must first consider the totality of its security environment. There are two relevant considerations, in sequence. First, does the state confront an acute security environment? That is, does it face either a conventionally superior proximate offensive threat that can pose an existential threat to the state, or a primary adversary that itself possesses nuclear weapons? Second, if so, does it confront that security threat alone or does it have a formal alliance with a major power that mitigates the severity of the underlying threat? If a state is not facing an acute security threat alone—either because there is no such threat or because the state has a formal superpower guarantee mitigating a threat—then it should choose one of the hedging strategies.

Hedging is an attractive strategy for states with a permissive security envi-

42. For an active strategy of proliferation to be sustainable, the theory posits that both an acute security threat and domestic political consensus are necessary. A desire for prestige—the other hypothesized source of demand—should not generate active nuclear weapons pursuit in the absence of these two conditions.

ronment, offering optionality without the risks of an active proliferation strategy. States that do not face the prospect of an acute security threat should be technical hedgers with, at most, fringe interest in nuclear weapons but no significant domestic push for acquisition. These are the states that should be most likely to abandon pursuit on their own, without outside nudging. The demand for nuclear weapons is weak because they face no real security threat for which nuclear weapons offer an attractive solution. Nevertheless, they flirt with the idea of a nuclear program either for idiosyncratic domestic reasons or because they are tempted by the potential military applications of their civilian energy program.[43]

If a state faces an acute security environment but enjoys the formal protection of a superpower, then it should pursue insurance hedging. This strategy offers both a source of leverage to compel the major power ally's continued protection and an insurance policy in the event that the ally abandons the state. A quintessential example of a nuclear hedger is Japan. It faces underlying security threats from a nuclear-armed China and North Korea, but has a formal alliance with the United States and is protected under its nuclear umbrella. Japan thus uses the implicit threat of breakout with its insurance hedge to elicit stronger security commitments from the United States while putting itself in a position to develop an independent nuclear deterrent should it ever face abandonment.[44]

A state confronting an acute security threat alone must consider additional variables in choosing a proliferation strategy. One option is to seek a formal superpower protector or a nuclear umbrella so that it is not forced to pursue an active proliferation strategy. But if it is unsuccessful, it may have little choice but to consider an active acquisition strategy.

Domestic Consensus for Acquisition?

If a state faces an acute security threat alone, the next crucial variable is whether there is domestic consensus for nuclear acquisition. That is, do political elites, the military, and scientific organizations agree that nuclear weapons are a solution to the state's security problems?[45] Nuclear weapons are difficult, expensive, and time-consuming to develop; they can also alter a military's

43. See Fuhrmann, *Atomic Assistance*.
44. See Richard J. Samuels and James L. Schoff, "Japan's Nuclear Hedge: Beyond 'Allergy' and Breakout," in Ashley J. Tellis, Abraham M. Denmark, and Travis Tanner, eds., *Strategic Asia 2013–2014: Asia in the Second Nuclear Age* (Seattle, Wash.: National Bureau of Asian Research, 2013), pp. 233–266.
45. For demand-side work on domestic consensus and nuclear weapons, see Solingen, *Nuclear Logics*; and Hymans, *The Psychology of Nuclear Proliferation*.

missions and arsenal or threaten the budgets of state bureaucracies. A determined pursuit of nuclear weapons therefore requires consensus among the political leaders—the head of state and his/her party, as well as potential veto players, such as major opposition parties in democracies or any veto players in autocracies—as well as among the military leadership, and key scientific bureaucracies that nuclear weapons at least partially solve a state's security concerns.

It is certainly true that an extremely acute security environment may catalyze domestic consensus.[46] The inconsistency with which domestic actors accurately assess and respond to the external security environment means, however, that variation in unit-level consensus can exert independent influence on a state's strategy. That is, domestic politics imperfectly align state behavior with the pressures of the security environment. Even in the face of an acute security threat, domestic consensus can be difficult to obtain or it may lag behind the emergence of the threat. Political leaders or the general public in democracies may have ideological or economic preferences against weaponization, as in Sweden and Switzerland in the 1960s. Several cases, including the Indian case, show that individual leaders can stall or veto weaponization for personal or idiosyncratic reasons. Scientists and the military may worry that nuclear weapons will cannibalize their preferred missions and budgets. Getting these various constituencies to agree on pursuing nuclear weapons is not a trivial exercise, and if there is any fracturing of the domestic consensus, active pursuit of nuclear weapons is not viable.

Given the multitude of reasons why a domestic consensus on nuclear weapons may or may not exist, it is difficult to identify a generalizable explanation for the sources of consensus or fracture. Here I simply identify whether one or the other exists. "Fracture" means that there is lack of agreement at the domestic level that nuclear weapons are an answer to the state's security problems, inhibiting the constituencies that favor nuclear weapons from selecting an active acquisition strategy. Nevertheless, a state facing an acute security threat alone should at least pursue a hard hedging strategy even in the absence of a domestic consensus on nuclear weapons acquisition. For example, though a state cannot achieve consensus on weaponization, domestic constituencies that prefer nuclear weapons as a solution to the state's security threats may be able to assemble the pieces of a hard hedging strategy. Sweden essentially followed this path in the late 1950s.[47] Alternatively, hard hedging may emerge as a com-

46. Peter A. Gourevitch, "The Second Image Reversed: The International Sources of Domestic Politics," *International Organization*, Vol. 32, No. 4 (Autumn 1978), pp. 881–912.
47. See Thomas Jonter, *The Key to Nuclear Restraint*, chap. 3.

promise among opposing constituencies, as in India after 1964. Because the state is facing an acute security threat alone, such hedging is likely to be hard rather than technical or insurance hedging, moving the state closer to the finish line if a consensus emerges.

If, however, a state faces an acute security threat alone and there is a domestic consensus for weaponization, then it should pursue an active nuclear weapons acquisition strategy. The question, then, is which one. The answer depends on the counterproliferation environment the state faces.

vulnerable to economic or military prevention?

If a state or coalition of states were aware of the proliferator's pursuit of nuclear weapons, could it prevent the proliferator from achieving its objective by making the economic or military costs prohibitive? Some states' economies are sufficiently vulnerable to international economic sanctions that achieving a nuclear weapons capability could be incredibly costly, perhaps even crippling.[48]

Other states pursuing nuclear weapons could be vulnerable to military prevention, which is a dynamic variable that depends on the capabilities of both the preventer and the pursuer.[49] That is, an adversary or major power could prevent a state from acquiring nuclear weapons by attacking its nuclear facilities. Vulnerability to military prevention spans a spectrum. Some programs could be vulnerable to covert action or sabotage; others require a single or sustained air strikes to destroy critical infrastructure; still others are dispersed and expansive enough to require a full-scale ground invasion to destroy. The more difficult the mission, the less vulnerable the pursuer. Nuclear pursuers that have few proximate adversaries but expansive territory and strong defenses are in a better position to avoid military prevention than those with smaller territories, limited nuclear infrastructure that is easy to locate and destroy, and weak air defense capabilities. This vulnerability may not change the fact of pursuit if the demand for nuclear weapons is intense enough, but it should change the method.

When a state calculates that it is not vulnerable to economic or military prevention, it can pursue nuclear weapons openly and prioritize speed of acquisition, because it is immaterial if other states are aware of its intentions. States in this category are few and far between. In fact, it may be the case that all

48. The relationship between economic vulnerability and nuclear proliferation has been explored by various authors, including Solingen, *Nuclear Logics*; and Nicholas L. Miller, "The Secret Success of Nonproliferation Sanctions," *International Organization*, Vol. 68, No. 4 (Fall 2014), pp. 913–944.
49. See Fuhrmann and Kreps, "Targeting Nuclear Programs in War and Peace."

the states in the system that meet these criteria have already acquired nuclear weapons: for instance, the United States, the Soviet Union, Britain, France, China, and, at the end of its pursuit, India. Perhaps a country such as Australia, with vast territory, a remote location, and defensible sea borders, could fall into this category if it were ever to actively pursue nuclear weapons.

Most contemporary states that might contemplate active pursuit of nuclear weapons, for example, states in East Asia or the Middle East, have to worry about prevention for two interrelated reasons. First, the efficacy of the nonproliferation and sanctions regime has improved over time, so this variable is more powerful today than it was in, for example, the 1960s.[50] Second, today's potential proliferators are those that the major powers least want to acquire nuclear weapons, and they are often relatively weak compared to the major powers and thus more susceptible to these more powerful military and economic nonproliferation tools. How then might vulnerable states pursue nuclear proliferation?

MAJOR POWER IMMUNITY?

The strategy chosen by states that are actively pursuing nuclear weapons but are vulnerable to prevention depends on a final variable: whether the state has a major power patron—usually a superpower, but possibly other major powers such as China or Russia—that is willing to tolerate its nuclear pursuit and deter others from efforts at prevention. A major power could be actively complicit in, or simply choose to tolerate, a state's proliferation, for a variety of domestic political or geopolitical reasons that outweigh nonproliferation objectives. Importantly, the proliferator should not be in a position where its nuclear weapons threaten, or threaten the freedom of action of, its patron.[51] As a result, states within formal alliances such as NATO, where the senior partner may worry about nuclearization leading to independence of action or recklessness by the junior partner, should not generally expect to receive immunity if they pursue nuclear weapons. Major power immunity is therefore distinct from the formal alliance variable discussed above, but certain client states may enjoy patronage sufficient to facilitate nuclear acquisition under major power shelter.[52]

If a potential proliferator enjoys major power immunity, it should select sheltered pursuit, which allows a state to pursue nuclear weapons under major power protection, increasing its likelihood of nuclear acquisition. For states

50. Miller, "The Secret Success of Nonproliferation Sanctions."
51. Kroenig, *Exporting the Bomb*, chap. 1.
52. Often, this has taken the form of acquisition that stops just short of a full-blown test. See Rabinowitz and Miller, "Keeping the Bombs in the Basement." See also Gavin, "Strategies of Inhibition."

vulnerable to prevention but lacking major power shelter, the only available strategy is hiding. These states must try to present a fait accompli once their nuclear capabilities are sufficiently advanced and hope they remain hidden until that point. Should their facilities or intent be discovered, they run the risk of suffering crippling preventive action. A hider may attempt a tactic of plausible deniability once its activities are discovered, but the fact of discovery undermines the plausibility of such denials. A failed hider may then search for major power immunity, but this might prove difficult if it could not find one prior to pursuit. For recent nuclear proliferators, such as Iran and North Korea, hiding is the most common strategy given the potency of the nonproliferation and counterproliferation regimes against states that the major powers least want to acquire nuclear weapons.

Summary of nuclear acquisition theory

Nuclear acquisition theory provides a framework for thinking about how states pursue nuclear weapons. It generates a determinate prediction for which proliferation strategy a state might pursue, from a particular variety of hedging to a specific active strategy of acquisition. It also identifies which variables may cause a state to shift its strategy or to scale back an active nuclear weapons program to one of hedging. I now turn to the empirical record, showing that the theory explains the nuclear proliferation strategy chosen in the vast majority of cases.

Observed Strategies of Nuclear Proliferation: The Empirical Record

Which proliferation strategies have states selected and when? To establish the universe of cases, I include states that explored or pursued nuclear weapons according to Christopher Way and also Philipp Bleek.[53] Entry into this universe is obviously not random. These states were all exploring or pursuing nuclear weapons for a reason. This selection effect would be problematic if the reasons for nuclear pursuit correlated with the ultimate choice of proliferation strategy (e.g., if all states that pursued nuclear weapons for security motiva-

53. Christopher Way, "Nuclear Proliferation Dates," Cornell University, June 12, 2012, http://falcon.arts.cornell.edu/crw12/documents/Nuclear%20Proliferation%20Dates.pdf; and Bleek, "Does Proliferation Beget Proliferation?" Although Way, Singh and Way, and Bleek make a distinction between explorers and pursuers, I include both categories so long as the explorer expresses a basic level of intent such that it "seriously considered building nuclear weapons." See Singh and Way, "The Correlates of Nuclear Proliferation." Cases of pure technical latency with no serious intent to develop nuclear weapons are excluded. A state requires at least a minimal level of intent and capability to devise a strategy of nuclear proliferation. Although the Way dataset includes Indonesia, I exclude it because it lacked the capability to seriously consider building nuclear weapons. The Way dataset also excludes four cases that I include: Norway, Japan, West Germany, and Italy.

tions chose a sprinting strategy, or if the advent of a stronger nonproliferation regime forced all states into hiding). As noted earlier, however, this is not the case, and the correlation between why states pursue nuclear weapons and how they go about doing so is weak. Therefore, it is reasonable to treat the selection of a strategy of proliferation as a sui generis decision once states decide to embark on it. Furthermore, although fewer states have pursued nuclear weapons over time—both because many that thought about pursuing them have already done so, and because the increasingly robust U.S.-led nonproliferation regime has deterred many states from even exploring nuclear weapons options[54]—a significant number of states have continued to attempt to acquire nuclear weapons.

Twenty-nine states have explored or pursued nuclear weapons. Some states have shifted strategies over time, providing additional observations (forty-seven in total) and allowing me to isolate the causes of shifts in strategies of proliferation. Table 3 shows the empirical distribution of proliferation strategies. There are several important observations about the distribution of strategies. First, sprinting from start to finish is a strategy chosen by—and perhaps only available to—the early proliferators. There are, however, states such as India that pursued other strategies before shifting to a sprint in the end. Second, after the Nuclear Nonproliferation Treaty (NPT) came into force in 1968, the distribution of the other strategies has not been highly skewed toward any particular one. Unsurprisingly, however, the frequency of hiding as a proliferation strategy rises in the so-called third generation of pursuers that have emerged since the end of the Cold War, for reasons noted earlier. Nevertheless, hedging and sheltered pursuit strategies are still selected in the contemporary proliferation landscape.

No theory can explain all forty-seven strategies coded in table 3, given that most theories are probabilistic and proliferation is an extremely complex process. My analysis suggests, however, that nuclear acquisition theory explains the vast majority—more than 85 percent—of the empirical strategies, and for the correct hypothesized reasons.[55] Of course, there are exceptions. For example, it is not clear that the theory explains the case of Algeria, whose alleged pursuit of nuclear weapons with the construction of the secret Es-Salam reactor in the late 1980s is highly murky.[56] If Algeria was pursuing a hiding strategy, it is unclear which state posed an acute security threat to it. Mapping

54. Miller, "The Secret Success of Nonproliferation Sanctions."
55. The cases that the theory predicts incorrectly are denoted with an asterisk in table 3. The theory correctly predicts 41 of 47 strategies, a success rate of more than 85 percent. Full coding appendix available upon request.
56. See "The Algerian Nuclear Problem, 1991: Controversy over the Es Salam Nuclear Reactor," NSA EBB 228, September 10, 2007, http://nsarchive.gwu.edu/nukevault/ebb228/.

Table 3. Empirical Codings of Strategies of Proliferation

	Proliferation Strategy	Country (Approximate Years)
Hedging strategies	Technical hedging	Argentina (1968–76) Brazil (1953–76) India (1948–64) Iran (1974–78)* Libya (1970–81) Norway (1946–62)* South Africa (1969–74)
	Insurance hedging	Australia (1956–73) France (1945–54) Italy (1955–59) Japan (1954–present) Romania (late 1960s–89) South Korea (1975–present) Taiwan (1967–74) West Germany (1956–69) Yugoslavia (1948–60)*
	Hard hedging	Argentina (1977–90) Brazil (1977–90) Egypt (1955–80) India (1964–89) Iran (2003–present) Iraq (1973–81) Israel (1949–55) Pakistan (1954–71) Sweden (1945–66) Switzerland (1945–69)
Weaponization strategies	Sprinting	China (1958–64) France (1954–60)* India (1989–98) Soviet Union (1945–49) United Kingdom (1945–52) United States (1940–45)
	Hiding	Algeria (1986–92)* Iran (1987–2003) Iraq (1981–91) Libya (1981–2003)* North Korea (1992–2006) Pakistan (1972–79) South Africa (1974–79) South Korea (1970–74) Syria (2000–07) Taiwan (1974–88) Yugoslavia (1974–87)
	Sheltered pursuit	China (1955–58) Israel (1956–67) North Korea (1979–92) Pakistan (1980–90)

*Denotes cases that nuclear acquisition theory predicts incorrectly (six of forty-seven strategies, or a success rate of greater than 85 percent).

Algeria's threat assessment in this period to the objective indicators set forth earlier—a conventionally superior proximate offensive threat or a primary adversary with nuclear weapons—is difficult. If one accepts this idiosyncratic threat assessment, however, Algeria nevertheless correctly calculated that it had to select a hiding strategy in response to the very real risk of international, and especially U.S., coercion.

Another exception is France, which, according to my theory, should have selected an insurance hedging strategy. In the early 1950s, France was a formal U.S. ally, protected under NATO's nuclear umbrella.[57] The theory predicts that France would use the threat of breakout to compel greater nuclear sharing or receive security assurances from the United States as, for example, West Germany did.[58] Instead, President Charles de Gaulle decided to sprint to develop an independent nuclear arsenal. Given its experience under German occupation during World War II and subsequent experiences at Dien Bien Phu and the 1956 Suez crisis, France's fear of U.S. abandonment overrode the reassurances provided by NATO's nuclear umbrella. If one accepts de Gaulle's perception that France might be left to face the Soviet Union alone, the theory does explain French acquisition strategy, but otherwise has a difficult time doing so.[59] However, besides such outliers, nuclear acquisition theory explains the overwhelming majority of the proliferation strategies selected by states. Although it is beyond the scope of this article to provide a full test of nuclear acquisition theory, in the next section I establish the analytical power of the theory using the hard case of India.

India: From Technical to Hard Hedging to Sprinting

I illustrate the utility of my typology and provide a plausibility probe of nuclear acquisition theory using the case of India.[60] The methodological justifica-

57. By comparison, because the United Kingdom's nuclear program began simultaneously with that of the United States, before the post–World War II alliance architecture emerged, the United Kingdom is correctly coded as a sprinter and explained by the theory. Sweden and Switzerland stood outside NATO as neutral states and thus potentially faced the Soviet Union alone, but stalled at hard hedging because of a lack of domestic consensus on nuclear weaponization.
58. See Gerzhoy, "Alliance Coercion and Nuclear Restraint."
59. On French threat perception and fears of abandonment by the United States, see Narang, *Nuclear Strategy in the Modern Era*, chap. 6; and Hymans, *The Psychology of Nuclear Proliferation*, chap. 4.
60. On India's nuclear history, see Sumit Ganguly, "India's Pathway to Pokhran II: The Prospects and Sources of New Delhi's Nuclear Weapons Program," *International Security*, Vol. 23, No. 4 (Spring 1999), pp. 148–177; George Perkovich, *India's Nuclear Bomb: The Impact on Global Proliferation* (Berkeley: University of California Press, 1999); Abraham, *The Making of the Indian Atomic Bomb*; Raj Chengappa, *Weapons of Peace: The Secret Story of India's Quest to Be a Nuclear Power* (Delhi: HarperCollins, 2000); Gaurav Kampani, "New Delhi's Long Nuclear Journey: How Secrecy and

tion for focusing on the Indian case is twofold. First, India went through several phases in its pursuit of nuclear weapons, shifting from technical hedging to hard hedging before finally sprinting to acquisition beginning in 1989. These shifts in India's strategy allow me to explore a variety of mechanisms hypothesized by the theory in a single case over time, while holding many variables relatively constant, such as India's primary threats and its dominant Congress Party. Second, India is a hard case for the theory, because the conventional wisdom on India's proliferation trajectory focuses on technological incompetence or organizational dysfunction to explain its slow march to acquiring nuclear weapons. Instead, I show that the delay was a strategic and intentional calculation, a fact missed by most existing accounts.[61]

TECHNICAL HEDGING, 1948–64

India pursued a technical hedging strategy from 1948 to 1964, focusing on civilian nuclear technology—a reactor and reprocessing capability—for economic development. India's scientists and even Prime Minister Jawaharlal Nehru understood that these technologies could have future military applications. Although Nehru is often portrayed as an idealist who abhorred nuclear weapons—which he did—he also understood that, absent universal disarmament, India could ill afford to ignore the possible military applications of inherently dual-use nuclear technology. He stated in legislative debate in 1948, "[W]e must develop [atomic energy] for the purpose of using it for peaceful purposes. . . . Of course, if we are compelled as a nation to use it for other purposes, possibly no pious sentiments of any of us will stop the nation from using it that way."[62] In the mid-1950s, Nehru sanctioned the building of India's plutonium reactor purchased from Canada, which was not under international safeguards, as well as a reprocessing facility at Trombay in the early 1960s, which could theoretically produce weapons-grade plutonium. India's chief nuclear scientist, Homi Bhabha, had a keen interest in India being viewed as a modern scientific state and, like many nuclear scientists of that era, saw the ability to develop nuclear weapons as the pinnacle of scientific achievement.[63]

Nehru did not actively discourage Bhabha's interest, and he understood that intrinsically dual-use nuclear technologies left open the option of nuclear

Institutional Roadblocks Delayed India's Weaponization," *International Security*, Vol. 38, No. 4 (Spring 2014), pp. 79–114; Bharat Karnad, *Nuclear Weapons and Indian Security: The Realist Foundations of Strategy* (Delhi: Macmillan, 2002); and K. Subrahmanyam, "India's Nuclear Policy 1964–98 (A Personal Recollection)," in Jasjit Singh, ed., *Nuclear India* (Delhi: Institute for Defence Studies and Analysis, 1998), pp. 26–53.

61. Works representative of this view to varying degrees are Perkovich, *India's Nuclear Bomb*; and Kampani, "New Delhi's Long Nuclear Journey."

62. Jawaharlal Nehru quoted in Perkovich, *India's Nuclear Bomb*, p. 20.

63. See Abraham, *The Making of the Indian Atomic Bomb*.

weapons in the future. Indian activity during this period, however, amounted to nothing more than technical hedging because India's demand for nuclear weapons was weak. There was nothing in the immediate security environment pushing Nehru to overcome his abhorrence of nuclear weapons and authorize weapons-related work, limiting any discussion of developing nuclear weapons to the political fringes. India enjoyed conventional superiority over its main adversary, Pakistan, and, in this phase, did not yet face an acute security threat from China, which was weak and unable to project ground power against India. At the same time, it is clear that Nehru sincerely wanted to explore the peaceful applications of nuclear technology in this period, saying in the lower house of Parliament: "[W]e are not interested in making atom bombs, even if we have the capacity to do so, and that in no event will we use atomic energy for destructive purposes."[64]

Nehru was not naïve, however. He understood that he was putting the pieces in place for a military program if it ever became necessary, but in a reversible and manageable way: "[T]he fact remains that if one has these fissionable materials and if one has the resources, then one can make a bomb."[65] However, he stated that while "we will have the competence and equipment to make them . . . we have deliberately decided not to do it."[66] Nehru therefore prevented Bhabha from working on anything explicitly related to nuclear weapons. India's strategy in this phase was explicitly not now, but implicitly not never.

HARD HEDGING, 1964–89

India shifted to a hard hedging strategy in 1964—two years after India lost the Sino-Indian War—when China's first nuclear test galvanized mainstream domestic political constituencies to seriously consider acquiring nuclear weapons, despite reservations from Prime Minister Lal Bahadur Shastri. Shastri, who became prime minister following Nehru's death, in May 1964, professed an even stronger aversion to nuclear weapons than Nehru, whose abhorrence of nuclear weapons was counterbalanced by his recognition that India could not be the lone proponent of nuclear abolition in a nuclear-armed world. But with the emergence of the Chinese threat, coupled with Delhi's unsuccessful attempts to receive a nuclear guarantee from either the United States or the Soviet Union,[67] Bhabha and India's opposition parties pressed Shastri to move

64. Jawaharlal Nehru quoted in Perkovich, *India's Nuclear Bomb*, p. 34.
65. Ibid.
66. Jawaharlal Nehru quoted in Karnad, *Nuclear Weapons and Indian Security*, p. 195.
67. See Andrew B. Kennedy, "India's Nuclear Odyssey: Implicit Umbrellas, Diplomatic Disappointments, and the Bomb," *International Security*, Vol. 36, No. 2 (Fall 2011), pp. 120–153; and Ganguly, "India's Pathway to Pokhran II," pp. 153–155.

from a technical hedging to a hard hedging strategy to counter the threat of a now conventionally superior and nuclear-armed power on India's borders. As predicted by my theory, this shift was a response to a material change in the severity of India's security environment. Once it became apparent that there would be no formal allied protection to enable an insurance hedging strategy, India had to shift at least to a hard hedging strategy, which included significant theoretical and physical work on a nuclear weapons program. But because of a lack of domestic political consensus, it stopped short of an active strategy to acquire nuclear weapons.

Under significant public pressure from the popular Bhabha, as well as from the opposition party Jan Sangh and from within the Congress Party itself, Shastri was forced to relent on two key points that pushed India into a hard hedging strategy. First, he publicly announced a policy of nuclear weapons hedging, saying: "I cannot say the present policy is deep rooted. . . . If there is a need to amend what we have said today, then we will say—all right, let us go ahead and do so."[68] Second, he authorized Bhabha and India's scientists to explore the possibility of using peaceful nuclear explosives for development purposes. Shastri's authorization green-lighted theoretical and engineering work to develop weapons-grade fissile material and implosion techniques. India would thus explicitly generate the option of pursuing nuclear weapons, but intentionally halt there.

Shastri's moral aversion to nuclear weapons, coupled with his firm belief that the financial cost of the program would be unbearable, kept India's nuclear weapons program from moving forward. But the authorization for theoretical work on the Subterranean Nuclear Explosion for Peaceful Purposes (SNEPP) program as a concession to domestic forces that perceived the acuteness of the Chinese threat was a hard hedge. India's nuclear scientists understood this authorization for what it was: a license to work on nuclear explosives that were not "weapons," but that still required the same theoretical, though not necessarily engineering, mastery. As George Perkovich notes, the emergence and crystallization of the Chinese threat in 1962–64 caused India's Congress Party to choose a middle-ground strategy: "[They] wanted neither to undertake nor exclude a bomb program but instead to study the issue seriously and enhance technological preparedness."[69] The only constraint on weaponization was a fractured domestic consensus—particularly at the prime ministerial and cabinet levels—on whether nuclear weapons, rather than seeking universal global nuclear disarmament to denuclearize China and

68. Lal Bahadur Shastri quoted in Chengappa, *Weapons of Peace*, p. 95.
69. Perkovich, *India's Nuclear Bomb*, p. 81.

prevent Pakistani nuclearization, were the answer to India's security predicament. Indeed, after China's successful boosted fission test in 1966, Foreign Minister Swaran Singh stated to parliament: "[T]he government still feels that the interests of . . . our own security are better achieved by giving all support to the efforts for world nuclear disarmament than by building our own nuclear weapons."[70] Work on peaceful nuclear explosives continued, however, and debate about whether India should develop nuclear weapons was now both salient and public.

With the theoretical work for the SNEPP proceeding in the late 1960s, and plutonium being reprocessed without any safeguards at Trombay, Shastri's successor, Indira Gandhi, authorized a test of a "peaceful nuclear explosion" (PNE) in October 1972. With no real urgency, it took two years to prepare for the May 1974 explosion, partly because of difficulties with the initiator for the device and partly because of the shifting leadership at India's Atomic Energy Commission (AEC).[71] The PNE demonstrated that India was a nuclear-capable, but not yet a nuclear weapons, state—a distinction with a critical difference. India had demonstrated mastery of a controlled fission detonation. But at roughly four feet in diameter and weighing 1,400 kilograms, the PNE device was unstable and too big to be a deliverable weapon. The PNE dramatically suggested that India had the ability, at some future time, to weaponize its nuclear capabilities, but that India had not yet chosen to do so. In extensive debate in the upper house of Parliament in the months following the PNE, K.C. Pant, the junior minister of energy, stated: "[T]here is no question of our going in for nuclear weapons," that India's PNE was "exclusively for peaceful purposes." He also stated that India's refusal to sign the NPT was a response to its discriminatory structure—separating nuclear haves from have-nots—not a result of India wanting nuclear weapons—yet.[72]

Hard hedging persisted across the tenures of several Indian prime ministers. Indira Gandhi led India after succeeding Shastri in 1966 until her assassination in 1984, except for the period between 1977 and 1979, when India was led by the opposition leader Morarji Desai. After her assassination, Indira was succeeded by her son, Rajiv Gandhi. Indira and, in particular, Rajiv, enjoyed large parliamentary majorities and were the dominant figures in the Congress Party. On policies such as if and how to proceed with developing nuclear weapons, domestic consensus depended almost exclusively on the preferences of these

70. Swaran Singh quoted in Abraham, *The Making of the Indian Atomic Bomb*, p. 127.
71. Subrahmanyam, "India's Nuclear Policy 1964–98 (A Personal Recollection)," p. 30.
72. K.C. Pant, "Rajya Sabha Extensive Debate on India's Peaceful Nuclear Explosion," August 21, 1974, Indian Nuclear History collection, Wilson Center Digital Archive, pp. 251–253, http://digitalarchive.wilsoncenter.org/document/119760.

prime ministers. All three prime ministers persisted with hard hedging as a strategy. They continued to authorize theoretical work on nuclear devices, and in 1983, Indira initiated a parallel missile program for possible delivery capabilities. They also continued to publicly hedge by opting out of the NPT despite India being one of the original proponents of the regime. All three leaders, however, stopped short of ordering an explicit nuclear weapons program.

Two features of the Indian nuclear program stand out as hard hedging in this period: ambivalence about nuclear weapons at the highest political levels, and centralization of the program to inhibit advances on nuclear weaponization without prime ministerial approval. First, and critically, key actors—most notably, India's prime ministers—had not yet decided that nuclear weapons were the solution to India's security issues. Like her father and Shastri before her, Indira Gandhi personally abhorred nuclear weapons and felt misled by her scientists and advisers on the domestic political benefits of the PNE.[73] Perkovich reports that a high-ranking official in her government stated, "After 1974, she didn't want to hear anything about nuclear at all. . . . People say her refusal to allow other tests was due to U.S. pressure and so on, but it wasn't. She genuinely felt horrified by the bomb."[74] In late 1982 or early 1983, India's scientists approached Indira Gandhi to request approval for a series of nuclear-related experiments—failing to mention that they really wanted to initiate a series of tests for weapons development.[75] After tentatively relenting, but then realizing what she was being asked to approve and the implications, she retracted the authorization within hours, according to Defence Research and Development Organisation head V.S. Arunachalam.[76] She was evidently so furious at the incident that she subsequently "refused to entertain meeting with [the scientists] on that subject."[77] She would later tell Arunachalam, "I am basically against weapons of mass destruction."[78] She did not shut down the scientists' theoretical work, however, and it was Indira who initiated the dual-use missile program that provided the potential basis for missile delivery of nuclear weapons, illustrating her conflicted view of the nuclear weapons program.

Scholars agree that when Morarji Desai was prime minister from 1977 to 1979, he "intensified the principled aversion to nuclear weapons . . . [and he]

73. Perkovich, *India's Nuclear Bomb*, p. 188.
74. Ibid.
75. Ibid, pp. 242–243.
76. Ibid, p. 243. See also V.S. Arunachalam to Kampani, cited in Kampani, "New Delhi's Long Nuclear Journey," p. 91. Chengappa, however, doubts whether Indira Gandhi ever gave consent to test or even actively considered it. See Chengappa, *Weapons of Peace*, pp. 257–260.
77. Former high-ranking official quoted in Perkovich, *India's Nuclear Bomb*, p. 244.
78. V.S. Arunachalam quoted in Chengappa, *Weapons of Peace*, p. 260.

remained effectively unchallenged on nuclear policy."[79] Desai prohibited further peaceful nuclear explosions and slowed work on them because he was aware that "[t]he history of development of nuclear research has shown that the temptation to switch over from peaceful to non-peaceful purposes has proved difficult to resist."[80] He ensured that India would resist that temptation under his brief tenure by refusing to authorize any further advances in the program. Although personally opposed to the development of nuclear weapons, Desai did not reverse India's hard hedging strategy.

Rajiv Gandhi became prime minister after his mother's assassination, in 1984. According to Perkovich, he "had no intention of moving toward a nuclear arsenal and requisite operational doctrine. This stemmed from his personal aversion to nuclear weapons, his sense that India had greater priorities, and his determination—like his predecessors—to keep the military from taking a significant role in nuclear policymaking."[81] Cabinet Secretary B.G. Deshmukh says that Rajiv put the brakes on any effort to "exercise [the nuclear] option," but equally "did not want India to give up [the] option for going nuclear" so long as Pakistan was proceeding apace.[82] Although it was derided internationally, Rajiv Gandhi's Action Plan in the late 1980s calling for universal nuclear disarmament derived from a genuine belief that global nuclear disarmament served India's national security interests better than acquiring nuclear weapons; India enjoyed conventional parity in theater against China and, more importantly, conventional superiority over Pakistan, which could be neutralized only if Pakistan acquired nuclear weapons.[83] Rajiv's primary efforts were therefore directed at trying to eliminate China's nuclear weapons and to prevent Pakistan from acquiring them under the auspices of universal disarmament, rather than authorizing Indian nuclear weaponization. Rajiv nevertheless allowed India's scientists to maintain a very "minimum state of readiness" in the late 1980s,[84] although much of their work focused on protecting India's infrastructure and military installations from a nuclear attack.[85]

The second indicator of hard hedging in this period is that all decision-

79. Perkovich, *India's Nuclear Bomb*, p. 224.
80. Morarji Desai, "Rajya Sabha Q&A on the Nuclear Explosion at Pokhran in 1974," December 21, 1978, Indian Nuclear History collection, Wilson Center Digital Archive, p. 136, http://digitalarchive.wilsoncenter.org/document/119759.
81. Perkovich, *India's Nuclear Bomb*, p. 275.
82. B.G. Deshmukh quoted in ibid., p. 282.
83. Author's interview with member of Rajiv Gandhi's prime minister's office advisory staff (hereafter adviser in the prime minister's office), New Delhi, June 2015.
84. See Chengappa, *Weapons of Peace*, p. 303.
85. Ibid., p. 304.

making was carefully concentrated in the prime minister's office so that the prime minister alone could control—and restrain—the nature and pace of the program. Gaurav Kampani correctly notes that "the process of weaponization and operational planning within the Indian state in this period was characterized by inefficiency, delay, and dysfunction" as well as tremendous amounts of secrecy.[86] According to key members of Rajiv Gandhi's advisory circle, however, this situation was not accidental. Although concerns about prying U.S. satellites and nonproliferation pressure existed, they were secondary to Rajiv's desire to centrally manage the program in order to prevent India's scientists and military from entrepreneurially advancing the program beyond the point that India's prime ministers had so carefully calibrated.[87] This was a deliberate strategy designed to regulate the pace of the program and, specifically, to inhibit advances in the nuclear program without authorization of the prime minister. Under the threat of removal, Rajiv told the scientists that at "every step you have to inform [me personally] and seek approval."[88] To augment this control, the various scientific and military organizations were disconnected, operating in isolation. The prime minister wanted to ensure that "the left hand didn't know what the right hand was doing" so that the two did not decide to "clap on their own."[89]

The military leadership expressed frustration at being left out of India's nuclear decisionmaking, but this too was by design. Civilian control increased even more after the 1986–87 Brasstacks crisis, during which Rajiv Gandhi believed that the military, led by Gen. K. Sundarji, almost dragged India into a war with Pakistan as a result of unsanctioned freelancing in a series of large conventional military exercises.[90] On nuclear weapons matters, Rajiv wanted to cede no such possible leeway.[91] As such, the AEC and the Defence Research and Development Organisation were not allowed to conduct experiments or develop bomb components—though they surely worked through the theoretical foundations—for weaponization of the nuclear program. The dual-use mis-

86. Kampani, "New Delhi's Long Nuclear Journey," p. 88.
87. Author's interview with Naresh Chandra, New Delhi, December 30, 2015. This is a key difference in motivations from that presented in Kampani, "New Delhi's Long Nuclear Journey." The military may have believed that secrecy resulted from a desire to avoid potential counterproliferation efforts, but my interviews with civilian managers suggest that they siloed the program because they were much more concerned with managing its pace internally.
88. Rajiv Gandhi quoted in Vinay Sitapati, *Half Lion: How P.V. Narasimha Rao Transformed India* (Delhi: Penguin India, 2016), p. 281.
89. Author's interview with adviser in the prime minister's office, June 2015. This point was also reiterated and emphasized in the author's interview with Chandra.
90. Ibid. Also see Kanti Bajpai et al., *Brasstacks and Beyond: Perception and Management of Crisis in South Asia* (Delhi: Manohar, 1995).
91. Author's interview with Chandra.

sile program initiated in 1983 by Indira Gandhi (the Integrated Guided Missile Development Program) worked in parallel, not in conjunction with, the military and the AEC. Whether the early missiles produced through this program were even considered for potential nuclear delivery is unclear, because unlike the later Agni missile family, the Prithvi missile has such a short range that its survivability in its required deployment areas near the Pakistan border is questionable. Further, the air force was kept isolated from the scientists designing the early-generation gravity bombs.[92] These groups would have had to organize a hasty "arranged marriage" between the gravity bombs and their delivery aircraft if the need to weaponize suddenly arose. Kampani colorfully notes that one air chief was well aware that there was little he could do about being in the dark: "[N]o air chief wants to approach the prime minister about nuclear issues only to be told to go mind his own business!"[93]

Thus, from 1964 through 1989, India's political leaders stopped short of weaponization, even though they authorized significant steps to put the pieces of a weapons program in place to compress the time to acquisition at a later date. This was the strategy of explicitly not now, but explicitly not never.

FINAL SPRINT, 1989–98

In March 1989, India abandoned its hard hedging strategy and initiated a sprint toward acquiring nuclear weapons. The specter of Pakistan achieving a nuclear weapons capability, first noted in a secret Ministry of External Affairs report in 1981, had loomed throughout the decade.[94] But in March 1988, Rajiv Gandhi received nearly definitive intelligence of Pakistani weaponization.[95] As Rajiv told a key adviser, "If Pakistan gets the bomb, even I cannot stop India from going nuclear."[96] Yet, the intelligence on Pakistan alone was insufficient to compel Rajiv to weaponize India's nuclear capabilities. It was only after Rajiv's Action Plan—his final effort to advance global nuclear disarmament and the last chance, he believed, of stopping Pakistan from nuclearizing—fell on deaf ears at the United Nations in June 1988 that Rajiv began to consider changing India's proliferation strategy. Enjoying a huge parliamentary majority after his mother's assassination, Rajiv unilaterally ordered the weaponization of India's nuclear capabilities the next spring. India shifted to a sprinting

92. See Kampani, "New Delhi's Long Nuclear Journey."
93. Ibid., pp. 94–95.
94. See Yogesh Joshi, "How Technology Shaped India's Nuclear Submarine Program," Jawaharlal Nehru University, 2016, p. 25. See also Kargil Review Committee, *From Surprise to Reckoning: The Kargil Review Committee Report* (New Delhi: Sage, 2000), pp. 187–188.
95. Indian intelligence determined that Pakistan probably possessed "at least three nuclear devices" in March 1988. See Kargil Review Committee, *From Surprise to Reckoning*, p. 190.
96. Author's interview with adviser in the prime minister's office, June 2015.

strategy, culminating in it standing on the brink of nuclear tests in 1995 and 1996, before going over the precipice in 1998.

In March 1989, nine months after Rajiv's failed UN speech, Rajiv discreetly ordered Naresh Chandra,[97] his newly appointed defense secretary, to take India's nuclear program over the finish line; the result was "a dramatic change of pace in India's nuclear weapons plans."[98] Cabinet Secretary Deshmukh indicated that the steps were now clearly laid out: "when the trigger would be ready, what type of platform would carry the bomb, how the bomb was to be mated to a delivery vehicle, the type of electronic checks and the command and control system needed. A carte blanche was given for expenses but every time a milestone was crossed, the prime minister was to clear the next step."[99] Chandra indicates that Rajiv's directive was informal, but clear—"[G]et things ready in case we want to test" a nuclear weapon—and that the goal was to get India in a position to test within seventy-two hours of a decision to do so, down from "more than *t*-minus-100 days," which is where India's preparations were in 1989.[100] This was a concerted effort, with Chandra, a permanent bureaucrat who would survive the churn of ministers and governments, directing the effort personally. He and Rajiv (and subsequent prime ministers, particularly Narasimha Rao) were perhaps the only ones with a complete picture of India's weaponization activities.[101] Although the program was still centralized domestically to control its pace, the goal of getting India within seventy-two hours of a test required work and coordination—particularly at the test site—that could not be fully hidden, especially from U.S. satellites.[102] Rajiv and Chandra accepted this reality, but did not alter their goal—they were not priori-

97. Chandra had only become defense secretary the month before, having just come from the Ministry of Water Resources. He quipped that his experience in the previous role came in handy when he had to creatively assign "cattle herding" projects in the Rajasthani desert to allocate appropriations for preparatory work at the Pokhran test site. Author's interview with Chandra.
98. Chengappa, *Weapons of Peace*, p. 335; and Shekhar Gupta, "How We Built the Bomb," *Indian Express*, August 19, 2006, http://archive.indianexpress.com/news/how-we-built-the-bomb/10875/0. These details were confirmed in the author's interview with Chandra. Chandra indicated that not even Minister of Defense K.C. Pant was aware of the order at the time, because Rajiv preferred to empower a civil servant such as Chandra who would outlast the churn of politicians and military leadership. Rajiv believed that Chandra would be able to "marry" the scientific community with the necessary funding bodies, and then ultimately with the military. The military was also "deliberately kept out of the loop because, in any case, they were unnecessary in this phase."
99. Chengappa, *Weapons of Peace*, p. 335.
100. Author's interview with Chandra. Chandra says he initially preferred a goal of *t*-30 days, but accepted Rajiv's directive of *t*-3 days, even though this target required visible signatures such as cables, digging, and instrumentation at the test site that could be detected by the international community. This indicates that hiding the nuclear weapons program from U.S. intelligence was not the paramount consideration.
101. Ibid.
102. See Richelson, *Spying on the Bomb*, pp. 428–433.

tizing secrecy from potential counterproliferators such as the United States. Furthermore, Rajiv approved a slate of highly visible public tests for explicitly nuclear-capable missiles, particularly the longer-range Agni missile, beginning in May 1989.[103] This was not a hiding strategy, but a sprint to swiftly take India from a nuclear hedger to a nuclear weapons state.

The sprinting strategy involved reprocessing and machining weapons-grade plutonium for weapons cores and doing all the necessary work for the production, management, and delivery of nuclear weapons. Chandra indicates that India's scientists had largely completed the weaponization of its nuclear capabilities sometime in 1993 or 1994, putting India in a position to test its fission weapons; higher yield boosted fission designs would be completed several years later.[104] It was at this point that the air force was tasked with potentially delivering India's first-generation gravity bombs with Mirage aircraft, while the missile program moved forward, albeit slowly.[105] As Kampani shows, India certainly paid a price for its stovepiping, because the scientists who designed India's initial gravity bombs were unfamiliar with the rotation problems their designs might cause during takeoff, leading to some "acceptable delays" in reliable delivery.[106] India had compressed its time frame to retaliate with nuclear weapons from many days in 1989, which would have "been a highly improvised affair," to less than twenty-four hours by this point.[107] It therefore took India about five years to complete the process—not much longer than other nuclear weapons states—and it clearly faced challenges along the way given how compartmentalized India's nuclear establishment had become as a result of its long-standing hard hedging strategy.[108] Although India did not formally test until May 1998, it was in a position to do so much earlier, and definitely at the point at which Prime Minister Narasimha Rao allegedly aborted a nuclear test in 1995.[109] India did face pressure from the United States not to test, with Rao worrying that sanctions might affect India's nascent economic liberalization effort.[110] Nevertheless, India did not sufficiently fear coercion to consider rolling back its program; it was just a matter of

103. See Vipin Narang, "Pride and Prejudice and Prithvis: Strategic Weapons Behavior in South Asia," in Scott D. Sagan, ed., *Inside Nuclear South Asia* (Stanford, Calif.: Stanford University Press, 2009), pp. 137–183.
104. Author's interview with Chandra.
105. Kampani, "New Delhi's Long Nuclear Journey," p. 97.
106. Author's interview with Chandra.
107. Ibid.
108. See Kampani, "New Delhi's Long Nuclear Journey," pp. 93–95.
109. See Sitapati, *Half Lion*, chap. 14.
110. Ibid. See also Rabinowitz and Miller, "Keeping the Bombs in the Basement." Chandra also noted that Rao was worried about the economic impact of sanctions, but that "by 1998 the economy was in much better shape." Author's interview with Chandra.

waiting until the economy might be in a better position to withstand the inevitable sanctions after a test. For all practical purposes, however, India's nuclear weapons sprint initiated in 1989 was complete by 1994.[111]

My theory identifies the reasons for India's proliferation strategies and why they shifted over time. Although India had faced a nuclear and conventionally superior China for decades, which forced it to select a hard hedging strategy, it was the prospect of Pakistani weaponization coupled with the recognition that universal disarmament was a nonstarter that ultimately killed Rajiv's, and thus domestic political, opposition to weaponizing India's nuclear program.[112] It was only at this point that India undertook a sprinting strategy. Although it was perturbations in India's security environment that triggered its final sprint to nuclear weapons, India's security pressures were strongly refracted through a domestic political prism. Given India's power and size, its leaders did not have to fear their country becoming the target of counterproliferation efforts. The result was a relatively open weaponization of India's nuclear capabilities over the next five years, including regular and public tests of explicitly nuclear-capable missiles beginning in May 1989.

Nuclear Acquisition Theory versus Alternative Explanations

There are three alternative explanations for India's nuclear proliferation saga. The first is technological determinism, which argues that India took decades to weaponize because its scientific enclave was slow and incompetent.[113] According to this explanation, what looks like shifting strategies was slow technological creep. The evidence, however, suggests otherwise. It was not incompetence that constrained India's nuclear weapons program, but intentional political decisions to choose different strategies over time, two of which were hedging strategies in which the aim was not to develop nuclear weapons but to maintain the option to do so. When Rajiv Gandhi decided to order the weaponization of India's nuclear capabilities, India had a reliable, deliverable capability within roughly five years. Although beset by some challenges when

111. See Narang, *Nuclear Strategy in the Modern Era*, chap. 4.
112. There is certainly evidence of Gourevitch's second image reversed in this case. But domestic consensus for acquiring nuclear weapons nonetheless took almost a decade to form. As noted earlier, the Indian Ministry of External Affairs had, as early as 1981, recognized that Pakistan was developing nuclear weapons. When Rajiv finally agreed to acquisition in 1989, the proximate cause was his realization that universal disarmament—India's preferred solution to the threat posed by Chinese and Pakistani nuclear weapons—was a fantasy. Domestic consensus for nuclearization therefore lagged significantly behind India's security pressures.
113. Kampani's argument focuses on the need for secrecy leading to organizational dysfunction, but it is consistent with the view that India's delay was largely a response to that dysfunction, rather than being strategically motivated. See Kampani, "New Delhi's Long Nuclear Journey."

the military was finally tasked with marrying the bombs to the delivery aircraft, India's progress in the sprinting phase was not significantly slower than that of other nuclear states. Indeed, Naresh Chandra disputes the "incompetence" narrative, claiming that once a concerted decision to weaponize was taken, India needed roughly the same amount of time to implement it as it did other nuclear powers.[114] The typology and theory introduced here suggest, and the evidence demonstrates, that India's slow march to nuclear weapons was both strategically and politically motivated.

The second alternative explanation for India's slow acquisition of nuclear weapons is that India was inhibited by international nonproliferation norms. There is no doubt that the perceived discriminatory nature of the NPT influenced how India approached its decision to hedge by not signing the treaty. The first shift in India's proliferation strategy from technical to hard hedging, however, had to do with a major change in its immediate security environment that predated the NPT. The second shift from hard hedging to sprinting was a product of Rajiv Gandhi ordering weaponization in response to evidence of Pakistani weaponization, coupled with his failed effort to make progress on global nuclear disarmament. This combination of a deteriorating security environment and global derogation of disarmament helped solidify a domestic consensus for weaponization. India's hesitation until 1989, and its decision to sprint thereafter, was not a product of global nonproliferation norms or efforts—in fact, it was the opposite. Certainly, international and U.S. pressure, as well as debates surrounding the Comprehensive Test Ban Treaty and the indefinite extension of the NPT, affected the timing of India's nuclear test decisions. That pressure did not, however, affect India's proliferation strategies or force India to hide or roll back its program.[115] Instead, the perceived discriminatory nature of these treaties empowered those in India who wanted to accelerate the program and testing sequence before they might go into force.

The third alternative explanation for Indian proliferation strategies is Jacques Hymans's theory of oppositional nationalism, which is a domestic political explanation focusing on the "oppositional" nationalism of the Bharatiya Janata Party (BJP) versus the "sportsmanlike" nationalism of the Congress Party, with the former being more likely to demonstrate Indian power and prowess with nuclear weapons.[116] This theory would predict that India would acquire nuclear weapons only under the oppositional nationalist BJP, whereas

114. Author's interview with Chandra. Chandra also noted that time was lost during the V.P. Singh and Chandra Shekhar governments given their instability and short durations.
115. See Hymans, *The Psychology of Nuclear Proliferation*, chap. 7.
116. Ibid.

Congress was content to stop short. This may explain when India tested nuclear weapons, but it cannot explain India's acquisition strategies. Prior to May 1998, the BJP had never been in power for longer than two weeks. The BJP would not have had anything to test if not for Congress prime ministers' management of India's nuclear program to that point. Rajiv Gandhi ordered nuclearization, and Congress Prime Minister Rao almost tested a nuclear weapon. Hymans counters that Rajiv's authorization was more like a "flashing yellow" light, and it was only Prime Minister Atal Bihari Vajpayee who took India over the line by testing in May 1998.[117] Chandra, however, indicates that Rajiv gave him a clear and unmistakable mandate to develop an arsenal of nuclear weapons. Certainly, steps and budgets had to be cleared along the way, but the end goal of developing nuclear weapons and the reliable means to deliver them were indisputable after March 1989.[118] The BJP was keener than the Congress Party to test nuclear weapons for the reasons Hymans suggests.[119] However, it inherited nuclear weapons from Congress. Indeed, Prime Minister Vajpayee bluntly stated, "Rao told me the bomb was ready. I only exploded it."[120] Psychological differences between Congress and BJP leaders do not explain India's proliferation strategies. Although India's tests were a BJP affair, its nuclear acquisition was a Congress affair. The theory offered in this article best captures the distinct strategies of India's nuclear proliferation over time and why Indian leaders shifted strategies when they did.

Conclusion

This article has argued that how states pursue nuclear weapons is as important as why they do so. It introduced a typology and theory for how states might seek to develop nuclear weapons. It coded the acquisition strategies of those states that have pursued nuclear weapons, including when states shifted strategies. The Indian case illustrates both the power of the theory and the utility of the typology, highlighting novel features of India's proliferation history and the different strategies it employed to pursue nuclear weapons over four decades. Different strategies of proliferation offer distinct opportunities and challenges for proliferators, allies, and adversaries alike.

This research makes several important contributions. First, the framework organizes all states that have pursued nuclear weapons into a single comparative typology, allowing scholars and policymakers to compare and contrast the

117. Ibid., p. 190.
118. Author's interview with Chandra.
119. See also Narang, "Pride and Prejudice and Prithvis."
120. A.B. Vajpayee quoted in Sitapati, *Half Lion*, p. 279.

different strategies of nuclear proliferation that states have selected using a common vocabulary and set of indicators. Second, the framework explicitly treats the nuclear proliferation process as a spectrum, allowing for states to progress through various stages and strategies on the pathway to developing a nuclear weapons capability. In particular, it notes that many states may not seek the end goal of acquiring nuclear weapons, but rather the option to develop them, illuminating that varieties of hedging are an intended and important waypoint on the path to nuclear acquisition. There is thus analytical utility in disaggregating the proliferation process: not all proliferators pursue nuclear weapons capabilities the same way.

Strategies of nuclear proliferation also have significant policy implications for the contemporary proliferation landscape. Each of the four proliferation strategies discussed in this article provides different points of vulnerability that can be exploited for nonproliferation purposes, whether it is providing greater security guarantees or assurances or attempting to prevent the formation of domestic political consensus in favor of weaponization. In the Indian case, for example, preventing the development of a domestic consensus for nuclear weapons by making even nominal progress on universal disarmament or keeping Pakistan nonnuclear may have forestalled Indian weaponization.

In contrast, Japan is a quintessential insurance hedger that has developed full control of the nuclear fuel cycle and maintains large quantities of reprocessed plutonium and advanced delivery capabilities.[121] Japan has stopped short of pursuing nuclear weapons, instead choosing to hedge, for two interrelated reasons: to compress its window of vulnerability if it ever faces abandonment by the United States and were forced to confront its regional security threats alone; this breakout threat, in turn, enables Japan to seek firmer commitments from the United States and reassurance that it will not in fact be abandoned.[122] This insurance hedging is precisely what nuclear acquisition theory would predict for a state facing an acute security threat mitigated by a formal alliance with a superpower. It highlights the importance of U.S. security guarantees in keeping this particular type of hedger from shifting to an active nuclear acquisition strategy. The theory also predicts, however, that if Japan were to face U.S. abandonment, it would have to generate a domestic consensus before being able to shift to an active weaponization strategy, which might not be a trivial task despite Tokyo being forced to confront an acute security environment alone.[123]

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121. See Samuels and Schoff, "Japan's Nuclear Hedge."
122. Ibid.
123. Jacques E.C. Hymans, "Veto Players, Nuclear Energy, and Nonproliferation: Domestic Institutional Barriers to a Japanese Bomb," *International Security*, Vol. 36, No. 2 (Fall 2011), pp. 154–189.

Other proliferators such as Israel and Pakistan exploited the U.S. provision of immunity, extended for unrelated geopolitical reasons, to employ sheltered pursuit strategies and weaponize under the protection of the United States, which ultimately tolerated both countries' possession of nuclear weapons (although it insisted that neither country test a bomb). Major powers should be aware that offering temporary immunity to potential proliferators that have sudden geopolitical importance may have significant long-term implications for nuclear proliferation.

Finally, the ongoing strength of the nonproliferation and counterproliferation regime will likely force many future proliferators to select hiding strategies. This possibility has two implications. First, vigilance against potential hiders will always be necessary. Second, the inefficiency of hiding strategies—given the requirement of maintaining a small signature against global intelligence capabilities—may allow more time to detect and stop hiders before they acquire nuclear weapons. Examples include the identification of the hidden Iranian and Syrian programs before they were able to weaponize. In addition, the 2015 nuclear agreement with Iran suggests that where complete rollback of a nuclear weapons program may not be possible, pushing a state from an active hiding strategy to, in this case, hard hedging by fracturing Iran's domestic consensus for nuclear weapons should be viewed as a nonproliferation policy success.

In sum, this article suggests that each of these proliferation strategies provides different points of vulnerability that can be exploited by nonproliferation efforts. This fact is missed when scholars assume that all nuclear proliferators pursue nuclear weapons in the same way. Instead, the different strategies of proliferation suggest that how states pursue nuclear weapons matters to international security and is a rich and important area of research on nuclear proliferation and nonproliferation.