

A serious gap exists in scholarly understanding of nuclear proliferation. The gap derives from inadequate attention to the phenomena of nuclear reversal and nuclear restraint as well as insufficient awareness of the biases and limitations inherent in the empirical data employed to study proliferation. This article identifies “nuclear hedging” as a national strategy lying between nuclear pursuit and nuclear roll-back. An understanding of this strategy can help scholars to explain the nuclear behavior of many states; it can also help to explain why the nightmare proliferation scenarios of the 1960s have not materialized. These insights, in turn, cast new light on several prominent proliferation case studies and the unique role of the United States in combating global proliferation. They have profound implications for engaging current or latent nuclear proliferants, underscoring the centrality of buying time as the key component of a non-proliferation strategy.

The article begins with a brief review of contemporary nuclear proliferation concerns. It then takes stock of the surprisingly large documented universe of nuclear reversal cases and the relevant literature.<sup>1</sup> It proceeds to examine the empirical challenges that bedeviled many of the earlier studies, possibly skewing their theoretical findings. Next, it discusses the features of the nuclear reversal and restraint phenomena and the forces that influence them. In this context, it introduces and illustrates an alternative explanation for the nuclear behavior of many states based on the notion of nuclear hedging. It draws on this notion and other inputs to reassess the role that the United States

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1. “Annotated Bibliography of Nuclear Reversal,” unpublished memo, Center for International Security and Cooperation, Stanford University, June 2002.

has played in influencing the nuclear behavior of other states. The conclusion explores some of the policy and research implications of the article's findings.

### *Current Proliferation Concerns*

The nuclear proliferation phenomenon has taken many twists and turns over the years, with the pace, direction, and loci of action varying considerably. In the late 1950s and 1960s, it was widely believed that nuclear proliferation beyond the original club of five (i.e., China, France, Great Britain, the Soviet Union, and the United States) was likely to occur before long, and that it would be led mainly by countries in Europe (most prominently Germany, Italy, and Sweden).<sup>2</sup> With the establishment of the nuclear Nonproliferation Treaty (NPT) regime in 1968–70, however, international concern over nuclear proliferation in Europe began to wane, though worries about proliferation in the developing world persisted, with Latin America and South Africa becoming particular sources of anxiety. More recently, South Asia, East Asia, and the Middle East have become the primary foci of concern. In addition, overall confidence in the stability of the nuclear nonproliferation regime has been shaken by developments in the nuclear arena in India and Pakistan, as well as in Iran, Iraq, and North Korea.

These developments have led two observers to suggest that, despite the remarkable success in producing an indefinite extension of the NPT in 1995, the “complex [NPT] regime intended to contain the spread of nuclear technologies is disintegrating.”<sup>3</sup> Moreover, the prevailing assumption is that Iran or Iraq (or both) is bound to cross the nuclear weapons threshold before long, while Libya is proceeding along the same path. If this happens, further “horizontal nuclear proliferation” (a spillover effect on other states) is likely to occur both in the Middle East and beyond. A similar process is considered likely if the security

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2. According to the Harvard Nuclear Study Group, “In 1963 President [John F.] Kennedy envisioned a world in the 1970s with 15–25 nuclear weapon states.” See Albert Carnesale, Paul Doty, Stanley Hoffmann, Samuel P. Huntington, Joseph S. Nye Jr., and Scott D. Sagan, *Living with Nuclear Weapons* (Cambridge, Mass.: Harvard University Press, 1983), p. 215. A similarly somber assessment (“The world is fast approaching a point of no return in the prospects of controlling the spread of nuclear weapons.”) appeared in a secret U.S. report presented to President Lyndon Johnson in 1965. See the Committee on Nuclear Proliferation, “A Report to the President,” January 21, 1965, [http://www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB1/nhch7\\_1.htm](http://www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB1/nhch7_1.htm) (accessed August 15, 2002).

3. Barry M. Blechman and Leo S. Mackay Jr., *Weapons of Mass Destruction: A New Paradigm for a New Century*, Occasional Paper No. 40 (Washington, D.C.: Henry L. Stimson Center, 2000), p. 4.

situation on the Korean Peninsula and the Indian subcontinent continues to deteriorate. These developments have rekindled interest both in identifying the factors that drive nuclear proliferation and in understanding the processes that govern them.<sup>4</sup>

### *Challenges to the Study of Nuclear Reversal*

Most nuclear proliferation studies have focused on proliferation trends, their prospects, and means of dealing with the challenges they pose. A smaller body of research has focused on the motivations for acquiring or renouncing nuclear weapons. Relatively little has been written on nuclear reversal, although this phenomenon has attracted somewhat greater interest in recent years.<sup>5</sup> Nuclear reversal refers to the phenomenon in which states embark on a path leading to nuclear weapons acquisition but subsequently reverse course, though not necessarily abandoning altogether their nuclear ambitions. Using this definition, a preliminary survey suggests that nearly twenty states have chosen the path of nuclear reversal since 1945 (see Table 1).<sup>6</sup>

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4. For leading works in this genre, see Scott D. Sagan, "Why Do States Build Nuclear Weapons? Three Models in Search of a Bomb," *International Security*, Vol. 21, No. 3 (Winter 1996/97), pp. 54–86; Bradley A. Thayer, "The Causes of Nuclear Proliferation and the Nonproliferation Regime," *Security Studies*, Vol. 4, No. 3 (Spring 1995), pp. 463–519; Benjamin Frankel, "The Brooding Shadow: Systemic Incentives and Nuclear Weapons Proliferation," and Richard K. Betts, "Paranoids, Pygmies, Pariahs, and Nonproliferation Revisited," both in Zachary S. Davis and Benjamin Frankel, eds., *The Proliferation Puzzle: Why Nuclear Weapons Spread (and What Results)* (Portland: Frank Cass, 1993), pp. 37–38 and pp. 100–124, respectively.

5. A study by Harald Muller, using somewhat different criteria, has identified a similar number of nuclear reversal cases. Most of the countries appear in both lists. See Muller, "Nuclear Nonproliferation: A Success Story," paper presented at the Thirteenth Annual Amaldi Conference on Problems of Global Security, Rome, Italy, November 30–December 2, 2000.

6. The most salient work in this area is T.V. Paul, *Power versus Prudence: Why Nations Forgo Nuclear Weapons* (Montreal: McGill-Queen's University Press, 2000). See also Mitchell Reiss, *Bridled Ambitions: Why States Constrain Their Nuclear Capability* (Washington, D.C.: Woodrow Wilson Center Press, 1995); Mitchell Reiss, *Without the Bomb: The Politics of Nuclear Nonproliferation* (New York: Columbia University Press, 1988); James Doyle, "Nuclear Rollback: A New Direction for United States Nuclear Policy?" Ph.D. dissertation, University of Virginia, 1997; Charles Edward Costanzo, "Returning from the Brink: Is There a Theory-Based Explanation for the Attenuation of Horizontal Nuclear Proliferation?" Ph.D. dissertation, University of Alabama, 1998; James Walsh, "Bombs Unbuilt: Power, Ideas, and Institutions in International Politics," Ph.D. dissertation, Massachusetts Institute of Technology, 2000; Barry R. Schneider and William L. Dowdy, eds., *Pulling Back from the Nuclear Brink: Reducing and Countering Nuclear Threats* (London: Frank Cass, 1998); Etel Solingen, "The Political Economy of Nuclear Restraint," *International Security*, Vol. 19, No. 2 (Fall 1994), pp. 126–169; Leonard S. Specter, "Repentant Nuclear Proliferants," *Foreign Policy*, No. 88 (Fall 1992), pp. 3–20; and William C. Potter, *The Politics of Nuclear Renunciation: The Cases of Belarus, Kazakhstan, and Ukraine*, Occasional Paper No. 22 (Washington, D.C.: Henry L. Stimson Center, 1995).

Table 1. Cases of Nuclear Reversal since 1945.

Never Tried (nuclear abstinence)	Tried but Gave Up (nuclear reversal)	Attained but Gave Up <sup>a</sup>	Still Trying	Attained and Maintained
All (?) other states	Argentina Australia Brazil Canada <sup>e</sup> Egypt Germany Indonesia Italy Japan Netherlands <sup>c</sup> Norway <sup>c</sup> Romania <sup>c</sup> South Korea <sup>d</sup> Sweden Switzerland Taiwan <sup>d</sup> Yugoslavia <sup>c</sup>	Belarus <sup>b</sup> Kazakhstan <sup>b</sup> South Africa Ukraine <sup>b</sup>	Algeria <sup>c</sup> Iran <sup>d</sup> Iraq <sup>d</sup> Libya North Korea <sup>f</sup>	China France Great Britain India Pakistan Soviet Union/ Russia United States ----- Israel <sup>g</sup>

NOTE: There have been repeated assertions, but no hard publicly available data, that Finland, Greece, Spain, and Turkey may have also had nuclear weapons aspirations. In the absence of evidence to corroborate these assertions, these countries are excluded here from the category of nuclear weapons aspirants.

<sup>a</sup>For the purposes of this study, the states listed in this category are considered as having undergone nuclear reversal.

<sup>b</sup>These states had nuclear weapons deployed on their territory but not under their command. Only Ukraine appears to have had physical possession of Russian nuclear weapons deployed on its soil, although apparently not the codes necessary to launch them.

<sup>c</sup>The determination and intensity with which these states pursued nuclear weapons remain uncertain.

<sup>d</sup>These are states that appear to have sought to acquire nuclear weapons on more than one occasion.

<sup>e</sup>Canada's nuclear weapons-oriented activity began with its participation in the Manhattan Project in the 1940s. Subsequently, it remained principally tied to the U.S. and British programs.

<sup>f</sup>The status of the North Korean nuclear program remains uncertain, although the North Koreans are suspected of having produced one or two nuclear weapons in the mid-1990s. See National Intelligence Council, *Foreign Missile Developments and the Ballistic Missile Threat through 2015: Unclassified Summary of a National Intelligence Estimate* (Washington, D.C.: National Intelligence Council, December 2001). North Korea appears to have subsequently engaged in a clandestine enrichment project, and in late 2002 threatened to reactivate its plutonium production. But these actions apparently have not yielded any additional weapons-grade fissile material. See the Carnegie Endowment Nonproliferation Project's website at <http://www.ceip.org/files/nonprolif/default.asp> (accessed January 4, 2003).

<sup>g</sup>Israel's nuclear status is unconfirmed.

For all its accomplishments, the literature on nuclear reversal is plagued by a variety of theoretical and methodological problems. Some of these problems are inherent in the very nature of the reversal phenomenon. Consider, for example, the issue of equifinality. Previous studies have been unable to identify the necessary or sufficient conditions for nuclear reversal, in part because different factors and causal paths, none of which is fully understood, can produce it. In the 1980s and 1990s, for example, Libya apparently temporarily scaled back its pursuit of nuclear weapons (though not its nuclear aspirations).<sup>7</sup> Libya's problematic international standing has compounded its inability to find a willing foreign supplier for the finished product or key facilities,<sup>8</sup> while its weak indigenous technological base continues to preclude the development of a strictly domestic program. Nuclear reversals in Argentina and Brazil, on the other hand, are widely attributed to reduced external security threats and domestic regime changes.<sup>9</sup> In Sweden and Switzerland, another factor appears to have been at work—concern over incurring the wrath of hostile nuclear powers.<sup>10</sup> Also in the Swedish case, the implicit extension of the U.S. nuclear umbrella seems to have played an important role.

Previous studies have also had difficulty assessing the influence on nuclear behavior of factors such as sanctions and nonproliferation norms that have a delayed or “nonlinear” impact (i.e., they take effect only after a predetermined threshold is crossed). Nor have they been able to distinguish between factors that lead to nuclear reversal and those that lead toward proliferation. The case of Egypt is illustrative in this regard.

Egypt's interest in developing a nuclear weapons program in the early 1960s is widely attributed to one or more of the following factors: its perception of an evolving Israeli nuclear capability, an inability to defeat Israel using conventional weapons, a desire to lead the Arab world politically and technologically, and strong domestic support for an indigenous nuclear capability. Egypt ultimately decided not to develop a full-fledged nuclear weapons program, how-

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7. See National Intelligence Council, *Foreign Missile Developments and the Ballistic Missile Threat through 2015: Unclassified Summary of a National Intelligence Estimate* (Washington, D.C.: National Intelligence Council, December 2001).

8. See Joshua Sinai, “Libya's Pursuit of Weapons of Mass Destruction,” *Nonproliferation Review*, Vol. 4, No. 3 (Spring/Summer 1997), pp. 92–100; Leonard Spector, *Nuclear Ambitions: The Spread of Nuclear Weapons, 1989–1990* (Boulder, Colo.: Westview, 1990), p. 182; and Director of Central Intelligence, *Unclassified Report to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions: 1 January through 30 June 2001* (Washington, D.C.: Central Intelligence Agency, January 2002).

9. See Paul, *Power versus Prudence*, p. 111.

10. *Ibid.*, p. 97.

ever, because its successive leaders (initially President Gamal Abdel Nasser and later Presidents Anwar el-Sadat and Hosni Mubarak) appear to have concluded that it would be neither necessary nor desirable to do so based on three considerations: the magnitude of the technical and economic challenges involved in the development of such a program, Israel's counterproliferation effort against it, and most important, U.S. diplomatic initiatives toward Egypt employing both carrots (including, apparently, reassurances to Egypt that "Israel will not introduce" nuclear weapons into the Middle East) and sticks.<sup>11</sup> Thus, despite military defeats in 1967 and 1973 and the ongoing development of Israel's nuclear activity, Egypt chose not to join the nuclear club.<sup>12</sup>

Another shortcoming in the existing literature is its failure to explore the possibility that the rationale for developing (or for that matter retaining) nuclear weapons may change over time, with new rationales for doing so emerging to replace older ones that have lost some of their luster. As Alexander George has observed, "Once established, policies often acquire momentum that is difficult to control or reverse."<sup>13</sup> The studies have also failed to acknowledge that to bring about nuclear reversal, it is not enough merely to remove a state's original motivations for obtaining nuclear weapons. This explains why Britain, for example, continues to retain its nuclear arsenal, albeit one considerably smaller than it maintained at the height of the Cold War.

Empirical data on proliferation in general and nuclear reversal in particular often are incomplete or otherwise unreliable because of a combination of extraordinary secrecy, intentional cover-up, and deliberate misinformation. Yet the literature manifests little appreciation of the gravity of these data problems.

Even in democratic countries, nuclear weapons programs are typically compartmentalized (i.e., subjected to especially rigid need-to-know arrangements

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11. For a discussion of the evolution of Egyptian thinking toward the Israeli nuclear option, see Ariel E. Levite and Emily Landau, *In Arab Eyes: Arab Perceptions of Israel's Nuclear Posture* (in Hebrew) (Tel Aviv: Papyrus, 1994).

12. See Michael J. Siler, "Explaining Variation in Nuclear Outcomes among Southern States: Bargaining Analysis of U.S. Nonproliferation Policies towards Brazil, Egypt, India, and South Korea," Ph.D. dissertation, University of Southern California, 1992, pp. 63–97. See also Jan Prawitz, *From Nuclear Option to Non-Nuclear Promotion: The Sweden Case*, Research Report No. 20 (Stockholm: Swedish Institute of International Affairs, 1995), pp. 4, 12. According to Prawitz, among the factors that led to Sweden's reversal of its nuclear policy were the emerging taboo on nuclear weapons and the NPT, neither of which was an issue when Sweden began its nuclear program in the early 1990s.

13. Alexander L. George, *Presidential Decisionmaking in Foreign Policy: The Effective Use of Information and Advice* (Boulder, Colo.: Westview, 1980), p. 41.

even within the government) and shrouded in secrecy. This is intended to prevent potentially harmful information from making its way to prospective proliferants, foreign adversaries, and domestic political foes. The concealment of nuclear know-how, installations, personnel, and materials is often still deemed necessary long after a state reverses its nuclear program. This holds even for democracies such as Australia, Norway, and Sweden, all of which have subsequently become champions of nonproliferation. One reason why Sweden, as well as South Korea, Switzerland, and Taiwan, continue to maintain secrecy over their nuclear weapons programs is to leave open the possibility of restarting them, should circumstances change.<sup>14</sup>

But even where the logic of retaining a nuclear option no longer applies, states typically uphold secrecy for fear of the domestic and foreign political fallout that might result from information about past nuclear activities being made public. Of special concern is the potential of such information to undercut a state's stature as an advocate of nonproliferation. It might also be feared that the release of this information could inspire other countries' nuclear pursuits, whether as a model, source of legitimacy for activity, source of nuclear know-how, or basis for diplomatic leverage in nuclear reversal negotiations. For example, the publication of a semiofficial historical account of the Swedish nuclear weapons program and its later abandonment was designed to persuade Ukraine to give up the Russian nuclear weapons in its possession.<sup>15</sup> The publication, however, deliberately omitted reference to any parts of the Swedish program that could enhance Ukraine's bargaining position in nuclear negotiations with the United States and Russia.

The fear that revelations of past activity could be embarrassing or harmful is a reason frequently given by governments, corporations, and individuals that once were involved in nuclear programs for restricting transparency (Britain in the case of Australia, and Germany in the cases of Argentina and Brazil).<sup>16</sup> Some of the reasons behind nuclear reversal might also prove too politically embarrassing or counterproductive to reveal. For example, did South Africa

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14. On the suspicions aroused by the secrecy surrounding Sweden's nuclear status, see Steve Coll, "Sweden's Quiet Quest: Nuclear Arms Option," *Washington Post*, November 25, 1994, p. A1. Although Prawitz, in *From Nuclear Option to Non-Nuclear Promotion*, rebutted Coll, even he was unable to penetrate fully the secrecy surrounding key aspects of the Swedish nuclear program.

15. See Prawitz, *From Nuclear Option to Non-Nuclear Promotion*.

16. For the most comprehensive discussion of Britain's long-concealed, extensive assistance to the Australian nuclear weapons program, see Wayne Reynolds, *Australia's Bid for the Atomic Bomb* (Melbourne: Melbourne University Press, 2000).

really give up its nuclear weapons because of U.S. concern over what might happen to them when the government was transferred to the black majority? Did Taiwan reverse course in response to intense U.S. pressure motivated by worries over China's likely reaction?

Worse still, data that reach the public domain may have been deliberately manipulated for one of two reasons: (1) to conceal the true nature of a state's nuclear program or to create the impression that the state has an advanced nuclear weapons program, perhaps that it has even reached a "threshold status" (or "standby capability"),<sup>17</sup> in order to deter would-be adversaries or encourage allies to provide greater security assistance;<sup>18</sup> or (2) to coerce allies into abandoning plans for scaling back their current security commitments, as in the cases of Japan, South Korea, and Taiwan.<sup>19</sup>

A reexamination of the data pertaining to the Italian nuclear program illustrates how inadequate awareness of these shortcomings and biases in the data can profoundly distort scholarly understanding of nuclear reversal. It dispels the commonly held belief that Italy's engagement in a nuclear weapons program in the 1950s was guided by a serious desire to acquire nuclear weapons. The Italians deliberately created this perception so they could use it as leverage in bargaining predominantly with the United States. Italy was able to parlay the suspension of its "nuclear weapons program" into greater external security (including nuclear-specific arrangements) as well as political and economic benefits.<sup>20</sup>

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17. Nuclear "threshold status" is commonly understood to mean possession of the indigenous ability to acquire nuclear weapons within a relatively short time frame, ranging from a few hours to several months. It has much in common with the CIA's definition of "standby capability," which is the "possession as of now of all of the facilities needed to produce nuclear weapons." See Central Intelligence Agency, *Response to NSSM No. 9*, Vol. 7: *Disarmament and Miscellaneous*, February 20, 1969, p. 4. NSSM is the acronym for National Security Study Memorandum.

18. See, for example, Leopoldo Nuti, "Me Too, Please: Italy and the Politics of Nuclear Weapons, 1945-1975," *Diplomacy & Statecraft*, Vol. 4, No. 1 (March 1993), pp. 114-148, especially pp. 120-122. Nuti suggests that the trilateral cooperation project created by France, Germany, and Italy in the mid-1950s for military applications of nuclear technology appears to have been intended, at least in part by the Italians, to apply pressure on the United States to disclose information on nuclear weapons to its European allies. Similar logic appears to have guided Gunnar Randers, who promoted transparency of the Norwegian nuclear program in the hope of motivating the United States to assist it. See Astrid Forland, "Norway's Nuclear Odyssey: From Optimistic Proponent to Nonproliferator," *Nonproliferation Review*, Vol. 4, No. 2 (Winter 1997), p. 8.

19. See, for example, Frankel, "The Brooding Shadow," p. 51.

20. Evidence to support such possibilities is difficult to uncover. Pakistan, South Korea, and Taiwan, however, are widely suspected of having used their nuclear programs as leverage in getting the United States to provide them with assistance.



### *What Constitutes Nuclear Reversal and Restraint?*

In this study, I define nuclear reversal as a governmental decision to slow or stop altogether an officially sanctioned nuclear weapons program. At the core of this definition is the distinction between states that have launched (indigenously or with external assistance) a nuclear weapons program and then abandoned it and those that never had such a program in the first place. Nuclear reversal excludes both termination of unauthorized nuclear weapons-related activity within a government and private-sector research and development in a nuclear weapons-related field (e.g., nuclear fuel-cycle technologies) if the latter was not formally pursued as part of an effort either to create a bomb or at least to acquire standby status. As applied here, this definition does include, however, cases in which a governmental decision to acquire the bomb could not be ascertained (e.g., Argentina).

This definition of nuclear reversal is flexible enough to include cases in which neither the initial pursuit of the bomb nor the eventual rollback of the program was reflected in an explicit government decision. The rationale for this is grounded in the characteristics of most nuclear programs. Would-be proliferants rarely make formal decisions to acquire the bomb or for that matter to give it up before they absolutely have to (e.g., before they are on the verge of attaining or eliminating a nuclear capability), if then. National leaderships are usually reluctant to make a formal commitment to acquiring nuclear weapons (even if the intent is clear) until the technical feasibility, affordability, and political (internal as well as external) viability of this undertaking have been ascertained. Such premature decisions are widely seen as politically risky and, perhaps more important, politically and strategically unnecessary, because the absence of such a formal decision does not usually preclude development of a standby capacity to produce nuclear weapons, under the rationale of creating a nuclear “option.”<sup>21</sup> Similarly, rollback processes often begin slowly and hesitantly and proceed incrementally. They are rarely if ever cemented until the trade-offs are apparent and the risks of the decision minimized (in part through nuclear hedging).

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21. Ashok Kapur concurs with this observation in Kapur, “New Nuclear States and the International Nuclear Order,” in T.V. Paul, Richard J. Harknett, and James J. Wirtz, eds., *The Absolute Weapon Revisited: Nuclear Arms and the Emerging International Order* (Ann Arbor: University of Michigan Press, 2000), p. 240.

Nuclear restraint is a phenomenon somewhat akin to nuclear reversal, whereby a state undertakes a policy or external commitment (commonly made to the United States) that, at least initially, falls short of nuclear rollback but nonetheless keeps it from proceeding with some prominent nuclear activities.<sup>22</sup> Such restraint typically pertains to refraining from the construction of certain facilities; the production (of certain or all fissionable materials), testing, assembly, or deployment of weapons; or proclamations of nuclear status. Until conducting their nuclear tests in May 1998, both India and Pakistan had adopted several of these measures—as had North Korea in the domains of plutonium production and reprocessing under the terms of its 1994 Agreed Framework with the United States.

### *What Drives Nuclear Reversal?*

Earlier studies have considered a variety of factors in seeking to explain why states decide to roll back their nuclear weapons programs. Common to all is some diminution of the perceived utility of nuclear weapons either because (1) the external security situation of a state improves or alternatives to nuclear weapons emerge that make them unnecessary; (2) a change occurs within the domestic regime and the state's security and/or economic orientation (central planning vs. market economy); or (3) systemic or state-specific incentives, such as new norms, emerge that diminish the appeal of nuclear weapons.<sup>23</sup> Scholars differ in the weight they assign to one factor (or cluster thereof) over others in influencing the reversal decision. They also often disagree over which domestic entity (the military, the scientific community, a political leader or faction, an interest group) was the driving force for or against nuclear weapons acquisition.

T.V. Paul has argued that no single variable can explain nuclear reversal. According to Paul, the one that comes closest is a state's external security environment, which itself is composed of a variety of factors, including the number, scope, intensity, and duration of militarized disputes in which the state is involved. Paul has advanced instead an explanation based on the notion of "prudential realism," according to which states "balance their interests and capabilities so as to minimize the security challenges they pose to others

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22. Other forms of restraint pertain to a commitment not to help disseminate further nuclear weapons-usable technology, as well as to refrain from first use of nuclear weapons.

23. For a comprehensive review and assessment of these factors, see Paul, *Power versus Prudence*, pp. 3–11.

and in expectation of reciprocal benign behavior in return." Prudential realism distinguishes itself from the worst-case thinking commonly attributed to hard-core realists by replacing it with a "most-probable" threat assessment.<sup>24</sup> Yet even Paul ultimately deemed this rather elaborate construct insufficient to explain certain cases of nuclear reversal, finding it necessary to weave in several additional (and often case-specific) variables to explain actual instances of nuclear reversal.

The nuclear-reversal case studies in this article reaffirm Paul's conclusion that no overarching explanation for nuclear reversal emerges from the literature. It also suggests that there is considerable variation among the characteristics of the reversal processes themselves. This is not surprising given the diversity of the cases in terms of the time frame, type of regime, economic orientation, geostrategic location, and external security environment. In sum, nuclear reversal is typically driven not by one factor but by a combination of factors, the exact combination of which varies between the cases (or clusters thereof) and over time. Moreover, nuclear reversal cannot be fully understood unless both the nuclear hedging phenomenon and the typical characteristics of a reversal process are considered.

#### NUCLEAR HEDGING

Nuclear hedging refers to a national strategy of maintaining, or at least appearing to maintain, a viable option for the relatively rapid acquisition of nuclear weapons, based on an indigenous technical capacity to produce them within a relatively short time frame ranging from several weeks to a few years. In its most advanced form, nuclear hedging involves nuclear fuel-cycle facilities capable of producing fissionable materials (by way of uranium enrichment and/or plutonium separation), as well as the scientific and engineering expertise both to support them and to package their final product into a nuclear explosive charge. Nuclear hedging is a strategy that may be adopted either during the process of developing a bomb or as part of the rollback process, as a way of retaining the option of restarting a weapons program that has been halted or reversed.<sup>25</sup> Nuclear hedging may explain at least some of the difficulty encountered to date in efforts to understand nuclear reversal. Indeed, some of the

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24. *Ibid.*, p. 5.

25. In addition to Egypt and Japan, South Korea and Taiwan constitute more recent examples of nuclear hedging. In the South Korea and Taiwan cases, their reprocessing capabilities were at the center of the nuclear-hedging strategies that led both countries into confrontation with their U.S. ally. For a discussion of South Korea's pursuit of complete fuel-cycle technologies, see Jungmin

cases that have been assumed to involve nuclear reversal may on closer examination be cases of nuclear hedging.

Prime Minister Winston Churchill first articulated the essence of nuclear hedging in a November 1951 memorandum to Lord Cherwell, his ministerial adviser on nuclear matters. In the memorandum Churchill wrote, "I have never wished since our decision during the war that England should start the manufacture of atomic bombs. Research, however, must be energetically pursued. We should have the art rather than the article. A large sum of money will have to be provided for this." Churchill had naïvely expected that he could persuade officials in Washington to allocate some U.S. nuclear weapons to Britain in recognition of the latter's significant scientific contribution to the Manhattan Project.<sup>26</sup> After being rebuffed, Britain launched its own nuclear weapons program.

In the Swedish case, after a period of slow decline in the state's commitment to its nuclear program, the government officially eschewed any desire for nuclear weapons in the mid-1960s. But in practice, not much has changed. Research in all the relevant disciplines of bomb making that had originally been launched in the 1950s continued, under the guise of so-called nuclear defense programs carried out by the Swedish National Defense Research Establishment (FOA)—the same lead agency that had been responsible for Sweden's original nuclear weapons development program. This activity would continue long after Sweden joined the NPT in 1968 and became a champion of non-proliferation.<sup>27</sup> In addition, it means that Sweden is a mere two to three years away from acquiring a nuclear capability.<sup>28</sup>

Kang and H.A. Feiveson, "South Korea's Shifting and Controversial Interest in Spent Fuel Reprocessing," *Nonproliferation Review*, Vol. 8, No. 1 (Spring 2001), pp. 70–78. For a discussion of the Taiwan case, 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.

26. Quoted in Margaret Gowing, *Independence and Deterrence: Britain and Atomic Energy, 1945–1952*, Vol. 1: *Policy Making* (New York: St. Martin's, 1974), p. 406. Cherwell's reply to Churchill is revealing: "If we are unable to make bombs ourselves and have to rely entirely on the United States army for this vital weapon, we shall sink to the rank of a second-class nation, only permitted to supply auxiliary troops, like the native levies who were allowed small arms but not artillery." *Ibid.*, p. 407. I am indebted to David Holloway for drawing my attention to this correspondence.

27. For prominent accounts of the Swedish nuclear weapons program, see Jan Prawitz, "Non-Nuclear Is Beautiful, or Why and How Sweden Went Non-Nuclear," *Kungl Krigsventenskapssakademiens Handlingar och Tidskrift*, No. 198 (Stockholm: National Defense Research Establishment, June 1994); Reiss, *Without the Bomb*, pp. 37–77; Paul, *Power versus Prudence*, pp. 84–99; Paul M. Cole, *Atomic Bombast: Nuclear Weapons Decision Making in Sweden, 1945–1972*, Occasional Paper No. 26 (Washington, D.C.: Henry L. Stimson Center, 1996); and Wilhelm Agrell, "The Bomb That Never Was: The Rise and Fall of the Swedish Nuclear Weapons Programme," in Nils Peter Gleditsch and Olav Njolstad, eds., *Arms Races: Technological and Political Dynamics* (London: Sage, 1990).

28. See Central Intelligence Agency, *Response to NSSM No. 9*, p. 3.

Japan provides the most salient example of nuclear hedging to date. The Japan case illustrates how a state signatory to the NPT and a champion of nonproliferation and disarmament can legitimately maintain a nuclear fuel-cycle capability and possess huge quantities of weapons-grade fissile material. Moreover, according to an official British government report, Japan “has key bomb-making components, including plutonium and electronic triggers, and has the expertise to go nuclear very quickly.”<sup>29</sup> Japan hardly tries to conceal its hedging strategy (though it does seek to keep some of its more specific features out of the public eye). This is evident in repeated statements by senior government officials that, under certain circumstances, Japan could revisit the issue of nuclear weapons acquisition. A statement by former Japanese Prime Minister Morihiro Hosokawa provides one such example: “It is in the interest of the United States, so long as it does not wish to see Japan withdraw from the NPT and develop its own nuclear deterrent, to maintain its alliance with Japan and continue to provide a nuclear umbrella.”<sup>30</sup> Despite the long-term Japanese commitment to the “three nuclear principles” announced by Prime Minister Eisaku Sato in 1968 and formalized by the Diet in 1971 (banning the possession, production, or import of nuclear weapons) as well as provisions in the Japanese constitution that preclude the acquisition of a nuclear capability, senior Japanese officials have repeatedly indicated that these principles could be revised.<sup>31</sup> They have also stated that the constitution could be reinterpreted to permit Japanese possession of “defensive nuclear weapons.”<sup>32</sup> In fact, the three principles are carefully worded so as to allow the development of a standby

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29. “Japan May ‘Go Nuclear,’ Paper Says,” *Japan Times*, August 11, 1993, p. 4, cited in Paul, *Power versus Prudence*, p. 51.

30. See Morihiro Hosokawa, “Are U.S. Troops in Japan Needed? Reforming the Alliance,” *Foreign Affairs*, Vol. 77, No. 4 (July / August 1998), p. 5. This statement highlights the role that U.S. extended deterrence plays in restraining Japan’s nuclear ambitions and reveals Japan’s explicit preference for the U.S. nuclear umbrella over the development of an indigenous nuclear capability. It also demonstrates how Japan uses its advanced nuclear bomb-making potential both as leverage against the United States (lest it weaken its security commitment to Japan) and as a hedge should the United States do so. This case also underscores the limitations of the known universe of nuclear reversal cases, because it may include states that have all along pursued security offsets rather than nuclear weapons. See Yuri Kase, “The Costs and Benefits of Japan’s Nuclearization: An Insight into the 1968/70 Internal Report,” *Nonproliferation Review*, Vol. 8, No. 2 (Summer 2001), pp. 55–68.

31. For the most recent official formulation of this position, see comments made on May 30, 2002, by a “high-ranking [Japanese] government official,” later identified as Chief Cabinet Secretary Yasuo Fukuda, according to which Japan may reconsider its decade-long commitment to the three nuclear principles. See “Japan Official Hints at Review of Nonnuclear Policy,” Jiji Press Ticker Service (Tokyo), May 31, 2002; and Howard W. French, “Koizumi Aide Hints at Change to No Nuclear Policy,” *New York Times*, June 4, 2002, p. 10.

32. Paul, *Power versus Prudence*, p. 56.

nuclear capability that stops just short of actual weapons production—allowing Japan to remain within a few months of acquiring nuclear weapons. Under these circumstances, it is not surprising that South Korea has long referred to Japan as an “associate member of the nuclear club.”<sup>33</sup>

Nuclear hedging appears to have played a critical role in facilitating nuclear reversal in practically every case under examination in this article, especially early in the reversal process. Its influence begins to subside only gradually if at all and only after the reversal process has gained momentum. What is striking about nuclear hedging as a strategy is its elasticity. Hedging does not translate into a uniform formula for action but merely into a general choice of strategic posture. The time frame that a state deems acceptable to acquire nuclear weapons depends, in turn, on three principal factors: (1) how the state defines the desired “nuclear capability” (e.g., the number of weapons it would have to produce, assemble, and deploy); (2) the amount of advance warning it expects to have of adverse developments that might necessitate nuclear weapons acquisition; and (3) its assessment of the risks, opportunities, and costs of stepping up nuclear preparedness, especially in terms of domestic and foreign reaction to its nuclear hedging posture.

The appeal of nuclear hedging goes well beyond the nuclear weapons option that it facilitates politically as well as technically. Its greatest appeal is the “latent” or “virtual” deterrence posture it generates toward nuclear weapons aspirants or potential aggressors,<sup>34</sup> and the leverage it provides in reinforcing a state’s coercive diplomacy strategy, particularly against the United States.

A near-explicit endorsement of this logic found expression in a 1998 statement by President Mubarak of Egypt: “If the time comes when we need nuclear weapons, then we will not hesitate. I say if we have to, because this is the last thing we think about. We do not think now of joining the nuclear club.” Mubarak then implied that neither technical nor financial barriers held Egypt back from getting nuclear weapons: “Acquiring material for nuclear weapons has become very easy and it can be bought.”<sup>35</sup> Mubarak’s warning regarding the potential for (re)activation of Egypt’s nuclear weapons program was echoed by Nabil Fahmy, Egypt’s ambassador to the United States, who linked it

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33. *Ibid.*, p. 54.

34. *Ibid.*, p. 59.

35. Interview with the London-based newspaper *Al-Hayat*, quoted in “Egypt’s Mubarak Says Egypt Can Join Nuclear Club,” Reuters, October 5, 1998.

explicitly to weapons of mass destruction (WMD) proliferation trends in the Middle East.<sup>36</sup>

The Japanese and Egyptian cases underscore the complex relationship between the NPT and nuclear hedging. Contrary to widespread perceptions, the NPT appears to have had less to do with walking key states all the way back from nuclear weapons development to nuclear reversal and more to do with encouraging them (at least initially, and for some permanently) to trade nuclear development for nuclear hedging. This has resulted from a combination of flexibility implicit in NPT definitions of proscribed activities, the narrow focus on International Atomic Energy Agency (IAEA) safeguards as the core of its verification regime, and the NPT's provisions allowing members to engage in fuel-cycle activities. Their combined impact has been to convince many nations that it is easier to hedge and even push their nuclear weapons programs forward to a fairly advanced stage while being parties to the NPT. Both Iran and Iraq have been following this path for years, actively pursuing nuclear weapons while being members of the NPT.<sup>37</sup> All of these examples reaffirm Paul's observation that accession to the NPT is no more than a manifestation of a commitment to (rather than a practice of) nuclear nonproliferation, if that.<sup>38</sup>

#### CHARACTERISTICS OF THE NUCLEAR REVERSAL PROCESS

This analysis suggests that there is considerable variance in the motivations, direction, and pace governing nuclear reversal processes. The direction and speed of reversal are driven by complex motivations (not all of which may be explicit or widely shared among decisionmakers). Yet for all these differences,

36. Fahmy went on to write: "If this proliferation trend continues unabated, it will inevitably trigger a reevaluation on the part of regional states, prompting some to accelerate the development of their already existing WMD programmes, while forcing others to activate programmes that have so far remained dormant." Fahmy, "Special Comment," *Disarmament Forum*, No. 2 (2001), [http://www.unog.ch/unidir/1-02-eSpecial\\_com.pdf](http://www.unog.ch/unidir/1-02-eSpecial_com.pdf) (accessed January 4, 2003).

37. For authoritative assessments of the Iranian and Iraqi nuclear pursuits and ambitions, see the semiannual report submitted by the CIA to Congress on January 30, 2002, entitled *Unclassified Report to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions, 1 July through 31 December 2001*, at [http://www.cia.gov/cia/publications/bian/bian\\_jan\\_2003.htm#14](http://www.cia.gov/cia/publications/bian/bian_jan_2003.htm#14) (accessed January 14, 2003), as well as the U.S. Department of Defense's *Proliferation: Threat and Response* (Washington, D.C.: Department of Defense, January 2001), pp. 34–41. A comprehensive account of past Iraqi nuclear pursuits is also provided by the IAEA reports to the UN Security Council. See, for example, IAEA, *Report by the Director General of the International Atomic Energy Agency in Connection with the Panel on Disarmament and Current and Future Ongoing Monitoring and Verification Issues*, GOV/INF/1999/4 (Vienna, Austria: IAEA, February 24, 1999), pp. 17–21.

38. Paul, *Power versus Prudence*, p. 57.

there are some important underlying similarities across the cases. They all seem to reaffirm the CIA's assessment that "political rather than economic and technical factors restrain most of the nations which are capable of developing nuclear weapons from doing so."<sup>39</sup> Economic resource constraints, technical hurdles, organizational behavior and bureaucratic politics, and even regime change appear to have much lesser roles in the overall direction of a state's nuclear weapons program, but they do typically influence its scope, pace, cost, efficiency, and technical parameters. Among the political factors that play a dominant role, external security considerations—however defined by different leaders—stand out as having consistently had a profound impact on states' nuclear choices. Moreover, although a favorable external security outlook appears necessary to bring about nuclear reversal, it rarely if ever appears to be sufficient, by itself, to produce this outcome. This is where the combination of domestic regime change and the availability of external incentives may tilt the balance in one direction or another.

Reversal processes also seem to share one of three characteristics (and often all three). First, nuclear weapons programs typically fizzle out in a gradual and nonlinear way rather than shut down abruptly and completely. South Africa is the sole known exception to this rule due to the unique circumstances of the handover of power to the country's black majority. Second, states contemplating nuclear reversal do not begin with a clearly articulated objective. This may reflect uncertainty over what that goal ought to be, or it may be a tactic to avoid or deflect counterpressures (where a consensus can be forged on the interim step but not necessarily on the desired result). Third, states considering nuclear reversal rarely assume that it is permanent and irreversible.<sup>40</sup> Indeed, the reversal process allows states both in theory and in practice to switch course and restart their nuclear weapons programs should conditions warrant it. This is especially true early in the process, a point that has been underscored by the recent revelations concerning North Korea's nuclear enrichment project.

Because capping, let alone walking back, from a nuclear weapons program is a momentous decision, typically fraught with political risks and surrounded by domestic controversy, governments have a powerful incentive to devise a process that minimizes risks and friction (through hedging) and generates domestic consensus in support of such a decision. This kind of consensus,

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39. See Central Intelligence Agency, *Response to NSSM No. 9*, p. 1.

40. For a similar conclusion and an elaboration of the conditions that might result in such a reversal, see Paul, *Power versus Prudence*, pp. 147, 154–155.



whether cultivated entirely indigenously or, as is commonly the case, with some external support and (at times) prodding, typically requires the sophisticated use of offsets and incentives. These have to address the security, prestige, and bureaucratic appeal of a nuclear program. One prominent way in which this appears to have been done has been to offset, at least initially, a declining effort in acquiring nuclear weapons with an investment in peaceful nuclear activity, whether for power generation or further research. Notwithstanding any commercial or energy security rationales for building up the civilian nuclear infrastructure, in some of the countries of concern here, such investments—especially in enrichment and reprocessing technology and facilities—were designed at least in part to facilitate hedging at least for a while (Germany) or to this day (Japan and South Korea). For others, the construction of nuclear facilities could also have served to address issues of prestige and employment associated with nuclear activity, as was the case with Egypt and North Korea.<sup>41</sup> Civilian nuclear technology also underscores the important symbolic yet tangible benefits that accrue to a state for forswearing the nuclear option, of which access to modern reactors is tangible proof. Egypt and North Korea are once again cases in point.

### *The Role of the United States*

Earlier sections have noted the importance of nuclear hedging as well as nuclear restraint in explaining the nuclear behavior of specific states. This discussion has also drawn attention to the centrality of these phenomena for shedding light on the process and not merely the outcome of nuclear reversal. These phenomena in turn yield new insights into the influence that the United States has had on the nuclear choices of key states. The United States has played a unique role in helping to move nuclear aspirants away from nuclear pursuits toward more benign behavior, be it nuclear restraint or hedging if not outright nuclear reversal. Toward that end, it has energetically employed a range of techniques since the early days of the Cold War.

The role of the United States in influencing the nuclear choices of a number of states has long been recognized in the literature on nuclear nonproliferation.

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41. The United States, for example, promised to provide Egypt with a nuclear reactor in return for signing the NPT in 1981. North Korea was promised two light water reactors in return for signing the 1994 Agreed Framework, committing it to several verifiable steps of nuclear capping (freezing the reprocessing of plutonium and allowing inspections of nuclear waste storage sites).

James Doyle has provided the most comprehensive review of the efforts of successive U.S. administrations to stem the tide of nuclear proliferation and encourage would-be proliferants either to restrain or to abandon their programs altogether.<sup>42</sup> Some works have focused on specific initiatives taken by the United States either alone or with other states, the most recent example being the review by Robert Einhorn and Gary Samore, two former senior officials in President Bill Clinton's administration, of the U.S. effort to stem the tide of Russian nuclear assistance to Iran.<sup>43</sup> There is also extensive discussion of the traditional U.S. role in establishing and ultimately consolidating international nuclear nonproliferation norms and institutions and its efforts to persuade particular nuclear aspirants to desist from their pursuit of nuclear weapons.<sup>44</sup>

The nonproliferation literature, however, still lacks a systematic assessment of the vast array of nonproliferation instruments and assets employed by the United States across the cases of nuclear restraint and reversal. This is a glaring omission because the involvement of the United States in this area is unsurpassed in terms of the great quantity and diversity of resources that it has applied to an array of objectives—even if its policies have not always been consistently or coherently applied.

#### CHARACTERISTICS OF U.S. NONPROLIFERATION ACTIVITIES

U.S. nonproliferation efforts have four distinguishing characteristics, corresponding to the objectives, strategy, scope, and means of U.S. activity. First, the United States has sought to preserve its nuclear hegemony and diminish the appeal of nuclear weapons for others while improving overall international security. Second, although its stated goal in virtually all the cases has been to arrest or roll back nuclear proliferation, the United States has often settled for the more modest objective of nuclear restraint such as capping the production of fissionable material, banning nuclear testing, or preventing the deployment of nuclear capabilities (all of which it has attempted to apply in recent years to the Indian subcontinent). Third, the scope of U.S. efforts has been both global

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42. For a comprehensive review of U.S. nonproliferation policies and instruments, see Doyle, "Nuclear Rollback," pp. 23–24. In addition to assessing the efficacy of the U.S. efforts generally, Doyle evaluates their influence in five prominent cases of nuclear rollback: Argentina, Brazil, South Africa, Sweden, and Ukraine.

43. Robert J. Einhorn and Gary Samore, "Ending Russian Assistance to Iran's Nuclear Bomb," *Survival*, Vol. 44, No. 2 (Summer 2002), pp. 51–70.

44. Perhaps the most salient study of this genre is McGeorge Bundy's *Danger and Survival: Choices about the Bomb in the First Fifty Years* (New York: Random House, 1988).

and regional, aiming to mold a nonproliferation regime as well as to influence the local and regional conditions (conflicts, stability) that inspire nuclear aspirations and regulate international trade of nuclear materials. Fourth, U.S. nonproliferation efforts have employed many unilateral but also bilateral, trilateral, and multilateral instruments (from dialogues and treaties to supplier regimes); softer measures (norms and rewards) and more coercive ones; and universal as well as case-specific means.

These distinctions are evident in my survey of nuclear reversal and restraint cases. In the security realm, the United States has repeatedly engaged in diplomatic initiatives aimed at settling or at least defusing conflicts that could fuel proliferation. It has also provided nonnuclear security assistance to increase the recipient's confidence that it can address its security concerns without nuclear weapons.<sup>45</sup> This assistance has appeared in the form of conventional arms transfers and other types of military assistance (e.g., training and education and military-to-military ties), as well as security guarantees.

POSITIVE AND NEGATIVE INDUCEMENTS. Security guarantees extended by the United States have varied greatly in scope, degree of formality, and level of commitment. These guarantees have included both positive and negative security assurances,<sup>46</sup> and pertain not only to U.S. conduct but also to the behavior of third countries of particular concern to the country that the United States is trying to dissuade from acquiring nuclear arms (e.g., providing reassurances to Egypt regarding Israeli nuclear behavior). The security assurances that the United States has made concerning its own behavior have ranged from the soft (less explicit and/or binding) variety (extended, for example, to Ukraine) to bilateral and multilateral collective security arrangements (Australia, Japan, the North Atlantic Treaty Organization, and South Korea), which often are reinforced by the presence of U.S. troops. In NATO, these have been accompanied

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45. See Alexander Kelle, "Nonproliferation Decisions in Italy," paper prepared for the Workshop on Nonproliferation Decisions: Lessons from Lesser-Known Cases, Monterey Institute of International Studies, Monterey, California, August 19–20, 1996, p. 23; and Doyle, "Nuclear Rollback," p. 242. A good illustration of this point is Ukraine's attempts to procure security guarantees from both the United States and Russia in return for surrendering the nuclear weapons on its territory. This effort ultimately won it only modest guarantees. See James E. Goodby, *Europe Undivided: The New Logic of Peace in U.S.-Russian Relations* (Washington, D.C.: United States Institute of Peace, 1998), pp. 80–88. This case also illustrates the importance of most other incentives for securing nuclear reversal, including enhanced prestige and receipt of conventional arms and financial assistance.

46. Positive security assurances are commitments to extend help in the event of a nuclear attack; negative security assurances are reassurances against a first strike by a nuclear power.

by a promise not only to extend the U.S. nuclear umbrella to member states (and deploy nuclear weapons in some of them) but also to share information on these weapons. This has been coupled with some form of guaranteed formal (though, in practice, mostly symbolic other than as veto power) participation in nuclear weapons decisionmaking. In particular, such assurances have involved so-called dual-key arrangements,<sup>47</sup> bringing NATO countries into the process of U.S. nuclear contingency planning and providing them a veto right over certain pertinent scenarios for the employment of nuclear weapons. In the early 1960s, the United States considered (though never implemented) even more dramatic formulations of nuclear sharing, such as the 1960 proposal for the creation of a multilateral nuclear force.

The threat (or promise) of denying (or providing) economic and technological assistance, including the supply of civilian and nuclear weapons technology, has been another tool commonly (and successfully) used by the United States to encourage nuclear nonproliferation.<sup>48</sup> It has targeted suppliers, recipients, and developers of nuclear weapons-related capabilities, with special emphasis on denying the wherewithal to produce fissionable material.

In most cases, the United States has sought to downplay any explicit linkage between nuclear behavior and the provision (or denial) of economic assistance either unilaterally or through financial institutions such as the International Monetary Fund and the World Bank. Exceptions include the Argentinean case, in which the United States was widely suspected of linking external debt refinancing to Argentine nuclear reversal; energy assistance to North Korea by the Korean Peninsula Energy Development Organization; and bilateral and multilateral deals with Belarus, Kazakhstan, and Ukraine in the early to mid-1990s that facilitated the withdrawal of Russian nuclear weapons from their territory.<sup>49</sup> Most often, however, the quid pro quo is not as obvious, which sug-

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47. Leopoldo Nuti recounts the importance of such arrangements at the time for the Italians, who were wavering between developing an indigenous nuclear weapons capability through participation in a French-German nuclear (including weapons) program and seeking cover and prestige under an Atlantic nuclear umbrella. See Nuti, "Me Too, Please," pp. 120-132.

48. In addition to the more common U.S. offsets in the form of civilian nuclear technology (originally offered in its Atoms for Peace program of 1953), the United States has occasionally resorted to more direct forms of sharing nuclear weapons know-how and technology to induce the acceptance of nuclear restraints by Britain, France, and even China, most prominently in the domain of nuclear testing. For a reference to U.S. assistance to France, see Joseph S. Nye Jr., "New Approaches to Nuclear Proliferation Policy," *Science*, May 29, 1992, p. 1297. For the nature of the assistance, see Nicola Butler, "Sharing Secrets: Nuclear Weapons Information Exchange between France, Great Britain, and the United States," *Bulletin of the Atomic Scientists*, Vol. 53, No. 1 (January/February 1997), pp. 11-12.

49. In these cases, George H.W. Bush's administration and later the Clinton administration agreed to buy their supplies of highly enriched uranium. See Gilbert J. Brown, "From Nuclear Swords to

gests that a similar dynamic has been at work in many additional cases in which the extension of U.S. economic and security aid and/or other forms of U.S. engagement has coincided with nuclear reversal, or at least its formal codification (in the form of accession to a legally binding obligation prohibiting the production or purchase of nuclear weapons), with Argentina, Egypt, and Brazil being just three cases in point. In the Argentinean case, there appears to have been a linkage between the U.S. de-emphasis of the Carter administration's human rights initiative vis-à-vis Argentina and the (successful) U.S. effort to win the support of the military junta to terminate the country's nuclear weapons program.<sup>50</sup>

In 1976 President Gerald Ford's outgoing administration worked out a secret agreement with Brazil in which the latter agreed to annul a 1975 contract it had awarded to Germany for the purchase of reprocessing plants in return for U.S. security guarantees and promises of military sales. When the deal was leaked to the U.S. press by Jimmy Carter's incoming administration, Brazil's president backed out of the agreement and reverted to his earlier pronuclear stance, seriously straining U.S.-Brazil relations. Brazil canceled its mutual defense treaty with the United States and rejected \$50 million in military sales credits.<sup>51</sup>

The U.S.-Brazil deal sheds light on the key role of the United States in facilitating nuclear reversal, but it also illustrates the difficulty, in the absence of reliable information on secret deals as well as on the reasoning of the leadership, of establishing causality in nuclear reversal cases. In part, countries such as Brazil may have been thinking about adopting nuclear reversal anyway, and wanted only to extract a U.S. offset or payoff before carrying out that policy.<sup>52</sup>

Nuclear Plowshares," *Washington Post*, September 1, 1992, p. A17; and Thomas W. Lippman, "Two Nuclear Accords Expected: U.S.-Russia Pact Involves Uranium Buy," *Washington Post*, March 21, 1999, p. A25. In addition, Congress passed the so-called Nunn-Lugar Act, which provides economic aid to these former Soviet republics to guarantee that none of them reneges on its promise to abstain from nuclear proliferation. See Theodor Galdi, *The Nunn-Lugar Cooperative Nuclear Threat Reduction Program for Soviet Weapons Dismantlement*, Congressional Research Service, 94-985-F (Washington, D.C.: Government Printing Office, December 6, 1994), pp. 1-6.

50. For a summary of recently declassified official U.S. documents on the policy toward the Argentinean nuclear program, see Paul Richter, "U.S. Feared a Nuclear Argentina," *Los Angeles Times*, August 23, 2002, [http://www.latimes.com/news/printition/front/la-fg-dirty23aug\\_story?null](http://www.latimes.com/news/printition/front/la-fg-dirty23aug_story?null).

51. For information on the secret agreement, see A. David Rossin, "Plutonium," Stanford University, forthcoming. On the rejected mutual defense treaty and military sales credits, see Graham Hovey, "Carter Writes to Leader of Brazil," *New York Times*, March 31, 1977, p. 2. On the crisis in U.S.-Brazil relations, see, for instance, Hobart Rowen, "U.S. Shifted on Bonn-Brazil Nuclear Deal," *Washington Post*, May 9, 1977, p. A10. See also David Vidal, *New York Times*, Information Bank Abstract, June 14, 1977; and "Why Latin Americans Are Bitter about Carter," *Washington Post*, April 4, 1977, p. 33.

52. The Japanese case is a convincing example of extracting U.S. security guarantees as a condition for nuclear abstinence. Japan has repeatedly made it clear that the United States is a key player in

In addition, it is unclear whether these countries would have been able or willing to eschew nuclear weapons or to circumscribe their nuclear ambitions even if the United States had not responded to their demands. Moreover, there is evidence to suggest that at least some states (presently North Korea, but previously also Italy, Pakistan, South Korea, and Taiwan) may have deliberately moved ahead on the nuclear weapons path, by collecting information, conducting studies, procuring equipment, and constructing facilities, to attract or drive up the value of U.S. rewards offered to them in return for nuclear reversal.<sup>53</sup>

The extensive efforts by U.S. intelligence to track and analyze nuclear proliferation activities are relatively well documented, not in the least in scores of briefings, testimonies, and annual reports provided by the U.S. intelligence community to Congress. There have also been occasional references to some of the more creative and sophisticated means that U.S. intelligence agencies have employed to collect information, from using a civilian reconnaissance plane to fly over the South African nuclear test site in the Kalahari Desert in 1977 to planting an electronic monitoring device disguised as a rock near the Pakistani nuclear enrichment facility at Kahuta in the mid-1990s.<sup>54</sup>

CLANDESTINE TECHNIQUES. Clandestine techniques constitute additional U.S. tools employed to promote nuclear nonproliferation. Although they have been extensively used, and seem to be correlated with cases of nuclear restraint and even reversal, they have been neither well documented in the open literature nor systematically researched. Yet they merit serious consideration because they can help to put in perspective other explanations for the reversal phenomenon.

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its security (and specifically) nuclear policy, both by emphasizing the importance of the U.S. extended deterrence guarantee and by notifying the United States of a Japanese report investigating the costs and benefits of Japanese nuclearization. See Kase, "The Costs and Benefits of Japan's Nuclearization," especially pp. 56, 60.

53. There is a correlation between two occasions in which the United States announced its intent to scale back its military presence on the Korean Peninsula (by President Richard Nixon in 1970 and President Carter in 1977) and the intensification of South Korea's efforts to develop a nuclear bomb option. In both cases the United States ended up largely reversing course, as did South Korea. See Kang and Feiveson, "South Korea's Shifting and Controversial Interest in Spent Fuel Re-processing," pp. 71-72. A similar correlation is apparent between U.S. actions and Taiwan's nuclear weapons program, most prominently following the termination of diplomatic relations between the two countries on January 1, 1979. Then it culminated in a renewed U.S. commitment to the security of Taiwan in the form of the 1979 Taiwan Relations Act, public diplomacy to deter Chinese military invasion of the island, and massive conventional arms sales to Taiwan. For the ups and downs of Taiwan's nuclear program, see Albright and Gay, "Taiwan."

54. David Albright, "South Africa and the Affordable Bomb," *Bulletin of the Atomic Scientists*, Vol. 50, No. 4 (July-August 1994), <http://www.thebulletin.org/issues/1994/ja94/Albright.html>.

One cluster of U.S. clandestine activities to stop or slow foreign nuclear programs involves operations designed to recruit or trap foreign government agents engaged in procuring nuclear-related materials or foreign scientists engaged in nuclear research and development. Taiwan, for example, originally launched a secret nuclear weapons program in 1964 following China's first nuclear test earlier that year.<sup>55</sup> It abandoned the program in 1976 in response to extensive U.S. pressure. Taiwan restarted the program in 1987, however; and in violation of the 1976 agreement, its Institute for Nuclear Energy Research (INER) began construction of a hot cell facility. The United States apparently learned quickly of this development from Col. Chang Hsien-yi, the deputy director of INER and also a confirmed U.S. agent recruited by the CIA in the 1960s.<sup>56</sup> The United States proceeded to demand that Taiwan permanently disband this facility, which it did; Chang and his family were spirited to the United States shortly thereafter.<sup>57</sup>

Occasionally the U.S. government has also resorted to briefing foreign leaders about nuclear activities occurring in their own countries. The purpose has been to warn them that the United States is aware of the nuclear activity and to encourage them to terminate these activities or at least to scale them back. Perhaps the best-known case involves the June 1989 briefing provided by CIA Director William Webster to visiting Pakistani Prime Minister Benazir Bhutto. The briefing was meant to acquaint her with details of Pakistan's nuclear weapons program that the United States suspected were being withheld from her by the Pakistani military—in particular, Pakistan's transgression of its pledge to the United States concerning uranium enrichment. Although the briefing did not provide Bhutto with dramatic details of which she was previously unaware, it did impress her with the scope of U.S. knowledge of Pakistan's nuclear program, create a common base of knowledge between the U.S. government and the Pakistani premier on this delicate issue, and facilitate the establishment of a follow-up agenda for action. As a result of the meeting, Prime Minister Bhutto conceded her willingness to "work on any information or assessment" by the CIA of the Pakistani program.<sup>58</sup>

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55. Albright and Gay, "Taiwan," p. 55.

56. See Tim Weiner, "How a Spy Left Taiwan in the Cold," *New York Times*, December 20, 1997, p. A7. According to the article, the CIA refused to disclose more information about Colonel Chang.

57. See Albright and Gay, "Taiwan," pp. 59–60.

58. David B. Ottaway, "U.S. Relieves Pakistan of Pledge against Enriching Uranium," *Washington Post*, June 15, 1989, p. A38.

The United States has also used public leaks to try, first, to embarrass governments engaged in clandestine nuclear weapons activities and, second, to galvanize opposition against them within the United States, inside their own country, and internationally. News leaks have dogged nearly all nuclear aspirants at one time or another. On many occasions the source can be traced back to a U.S. origin. Yet even when it is possible to establish a U.S. connection, it is all but impossible to ascertain whether this is part of an officially sanctioned policy or just another aspect of “doing business” in Washington.

There have also been a number of other initiatives designed to press U.S. administrations to take more forceful action.<sup>59</sup> The U.S. Congress, at times to the chagrin of the administration, has pushed some of these initiatives. One case in point is the 1985 Pressler amendment, which expressed concern over Pakistan’s nuclear weapons development and required annual certification of its nuclear status as a condition of U.S. assistance. Another is former President Carter’s negotiations with North Korea in 1993, which yielded an agreement in 1994 on the capping of the North Korean nuclear program and eventually also inspections of its facilities in return for providing North Korea with heavy fuel and modern nuclear reactors.

Given the tremendous resources at its disposal and its position as global leader, the United States has been able to exert more influence than any other country over nuclear proliferants and would-be proliferants. Its capacity for influence has been reinforced by the willingness of virtually every administration since World War II to employ U.S. clout to promote the cause of nuclear nonproliferation. Behind this willingness has been the belief that such involvement best serves U.S. (and broader) interests—even if Washington’s policies were occasionally inconsistent (e.g., Pakistan), misguided (e.g., the Atoms for Peace initiative of Dwight Eisenhower’s administration, which sought to provide states with peaceful nuclear technologies as a means of dissuading their pursuit of nuclear weapons), or otherwise uneven (e.g., France and India).

An understanding with the United States is, in fact, a hallmark of many cases of nuclear slowdown or reversal.<sup>60</sup> Lively debates about the impact of in-

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59. One example is the consistent encouragement, and occasionally even direct financial assistance, provided in recent years by U.S. government agencies (primarily the Department of Energy, the Department of Defense, and the State Department) to bilateral and multilateral Middle East and South Asian track-two security and arms-control talks sponsored by several highly respected U.S. universities (e.g., Columbia, Stanford, and the University of California, Los Angeles) that do work in the field.

60. Some of the best-documented cases in point are those of Israel, North Korea, South Korea, and Taiwan.



digenous nuclear decisions on a country's relations with the United States have occurred within virtually every democratic nuclear aspirant, most prominently India and Israel. This has led Michael Siler to conclude that the actions of the United States can "make the critical difference," especially in dictating the particular course of a nuclear reversal process.<sup>61</sup> There is no evidence to suggest, however, that U.S. influence has ever been a sufficient factor for inducing nuclear reversal.<sup>62</sup>

#### U.S. INFLUENCE OVER DOMESTIC REGIMES

Some of the domestic calculations and forces affecting countries' nuclear ambitions have remained beyond the sphere of direct U.S. influence. As a result, although the United States has been able to encourage complete nuclear reversal in Europe and Latin America, and most saliently in South Africa, it has had more modest success in Egypt, Israel, Japan, South Korea, and Taiwan and much less success in India, North Korea, and Pakistan. In these cases, it has been able to limit their ambitions to some form of nuclear hedging and in the cases of India and Pakistan only to limited nuclear restraint. As for Iran, Iraq, and Libya, the United States has been unable to alter their nuclear aspirations, but it has been able to retard the progress of their nuclear programs, primarily by hindering access to fissionable materials and their production technologies and facilities.

The nature of domestic regimes is probably the most important factor affecting nuclear ambitions that remains largely outside the sphere of direct U.S. influence. It also provides some of the most fascinating illustrations of the delicate balance between the strength and limits of U.S. influence on foreign nuclear pursuits.

The studies of nuclear reversal and more broadly nuclear nonproliferation have been unable to establish a direct link between the nature of a regime and its nuclear orientation: Both democratic and totalitarian regimes have sought to produce or purchase nuclear weapons. Even changes in regime have not by themselves automatically yielded a reorientation of the state's nuclear pursuits.<sup>63</sup> Thus, even in those rare cases where the United States might be able to

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61. Siler, "Explaining Variation in Nuclear Outcomes among Southern States," p. 244.

62. Etel Solingen convincingly demonstrates that U.S. "hegemonic protection," for example, has been neither a sufficient nor a necessary condition for nuclear reversal. But her analysis refers merely to the U.S. role in providing security guarantees. See Solingen, "The Political Economy of Nuclear Restraint."

63. The cases of democracies maintaining or renouncing nuclear weapons after pursuing a nuclear program are numerous (e.g., the United States and Australia, respectively). As for totalitarian re-

encourage a regime change, this would not guarantee, by itself, nuclear reversal or restraint. Regime change can create new opportunities for external influence, however, because it can buy precious time and favorably transform the international or regional security environment, thereby diminishing the need for nuclear weapons. Leaders of a new regime might also be less personally or politically committed to pursuing nuclear weapons, or more amenable than their predecessors to external persuasion and inducements to forgo them. U.S. nonproliferation policy toward Argentina and Brazil underscores this dynamic.

The South African case illustrates the interplay between external influence and regime change in the context of nuclear reversal.<sup>64</sup> The 1989 election of F.W. de Klerk as president led to huge changes in South Africa's foreign and domestic policies, facilitating the end of apartheid and improved international acceptance. And with the end of the Cold War, concern over a communist liberation movement poised to overthrow the South African government dissolved. These developments created a domestic climate more favorable to disassembling South Africa's nuclear weapons program, as "in the transformed [South African] security environment, security threats were no longer crucial, and nuclear weapons seemed unnecessary symbols of a bygone era."<sup>65</sup> By themselves, however, these developments did not suffice to bring about nuclear reversal, at least not the rapid and decisive manner in which it came about. Driving this decision was the determination of the outgoing apartheid regime not to pass on to its successors South Africa's nuclear or ballistic missile capability. There is some evidence to suggest that this position was heavily supported by the United States, which feared the consequences of South Africa's long-range ballistic missiles or nuclear weapons falling into the hands of the new South African government led by the African National Congress (and

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gimes, Libya, Iraq, and North Korea continue to pursue a nuclear option. The issue of regime change is more intriguing and the effect more complex. Although some countries have reversed their nuclear policies after switching from military to civilian and more democratic rule, this change in policy often is directly linked to the more stable security situation accompanying the regime change. See the cases of Argentina and Brazil in Paul, *Power versus Prudence*, p. 111. Also, some states, such as India and Israel, have evolved to become more democratic while maintaining or intensifying their nuclear programs, but the changes in nuclear policy paralleled security changes rather than regime changes. Pakistan is a case in which a military coup could be associated with acceleration of its nuclear program, but security concerns are not the only factor that explains why other nations under military rule do not always seek to acquire nuclear weapons. See *ibid.*, p. 141.

64. See Peter Liberman, "The Rise and Fall of the South African Bomb," *International Security*, Vol. 26, No. 2 (Fall 2001), pp. 45–86.

65. Paul, *Power versus Prudence*, pp. 115, 116.

by extension possibly the communist regimes with which it was allied, such as Cuba<sup>66</sup>) or nationalist white extremist groups.<sup>67</sup>

Regime change might also affect the way security is achieved, creating a preference for either indigenous reliance or alliance guarantees, thereby influencing the requirement for an indigenous nuclear weapons capability or its renunciation. Both Germany and Japan seem to fall into this category.<sup>68</sup> And once again the United States was ready to extend security guarantees to both.

More broadly, regime change may affect a regime's nationalistic tendencies and the preference for autarky or interdependence, economic liberalization or closure to the outside world. Different regimes may assign higher or lower priority to security concerns versus economic or social progress, potentially influencing the course of their nuclear programs. In fact, Etel Solingen has suggested that the openness and economic liberalization associated with democratic governance is the only regime-based explanation for nuclear reversal that has withstood the test of time.<sup>69</sup> Yet even if this is the case (which is not borne out by the absence of nuclear reversal in economically liberalizing India and Israel), it is clear that formidable outside assistance has also been necessary to facilitate economic liberalization.

## Conclusion

The widely held fears of the 1960s of a world filled with dozens of nuclear weapons states grew out of a reality in which scores of countries were toying with, and in some cases actually pursuing, nuclear weapons capabilities. This nightmare scenario did not materialize, however, and since the mid-1960s the ranks of the nuclear powers have barely grown beyond the original five. Only India and Pakistan have tested their nuclear devices and proclaimed them-

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66. See, for example, "S. Africa to Abandon Missile Launching Programme," in Agence France-Presse, June 30, 1993.

67. See David Albright and Mark Hibbs, "South Africa: The ANC and the Atom Bomb," *Bulletin of the Atomic Scientists*, Vol. 49, No. 3 (April 1993), pp. 32-37.

68. Yuri Kase's "The Costs and Benefits of Japan's Nuclearization," pp. 55-68, is particularly insightful on Japan's investigation of the nuclear option as an alternative method for attaining security. Although the investigation was not brought on by a regime change per se, Prime Minister Eisaku Sato and his administration were behind the creation of the report, which was intended to determine if nuclear weapons were a viable option for Japan. The conclusion of the report has a distinct hedging edge, placing great importance on the U.S. umbrella of extended deterrence as a condition for Japan's maintenance of a nonnuclear policy. *Ibid.*, p. 60.

69. Solingen, "The Political Economy of Nuclear Restraint."

selves nuclear powers, while Israel and North Korea are widely suspected of having acquired the wherewithal to produce nuclear weapons.

This article has focused on nuclear reversal as a means of shedding new light on the gap between those expectations and the present reality. Nuclear reversal not only helps to explain why there are far fewer nuclear powers than once anticipated; it also generates fresh insight into the dynamics and patterns of proliferation, the factors that shape them, and the prospects for influencing them. In the process, this research has concluded that much of the success in curbing global nuclear proliferation has been attained by creating a favorable general as well as nation-specific political climate for restraining and even suppressing nuclear ambitions, as well as by converting many states' nuclear aspirations into a posture of nuclear hedging and, in a few other cases, nuclear restraint. Although this combination accounts for the considerable success in reversing proliferation trends, it also contains the seeds of its own undoing, should either of these conditions change for the worse. In fact, recent developments in both Asia and the Middle East attest to the highly precarious nature of the global order, as does the *U.S. National Strategy to Combat Weapons of Mass Destruction* report published in December 2002.

This leads us to consider the critical role that the United States has played in arresting nuclear proliferation. Obviously neither the United States by itself (or for that matter the Soviet Union at its peak) nor any group of powerful nations working together can impose nuclear reversal on a country that is adamantly opposed to it.<sup>70</sup> Nevertheless, the United States has been unique in its ability to create for most nations the favorable political climate necessary to encourage them to forgo the acquisition of nuclear weapons or, failing that, to transition toward nuclear hedging or at a minimum nuclear restraint. The opening for the United States to bring to bear its influence has been created by the acute demand facing virtually all nuclear programs for sustained, high-level domestic political support (to mobilize scarce resources, overcome bureaucratic and technical hurdles, and offset risks).

This study concludes that three factors have thus far combined to produce relative external success in bringing about nuclear reversal, hedging, or at a minimum restraint among the key nuclear aspirants: a change in the domestic

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70. As an elaborate CIA analysis put it as early as 1969, "Neither the U.S. nor the USSR, however, could dictate a decision on the NPT to these nations [referring to the five major holdouts, of which three—India, Pakistan, and Israel—remain]. Even if the major powers were willing to employ drastic sanctions, the results might be counterproductive." See Central Intelligence Agency, *Response to NSSM No. 9*, p. 5.

perceptions of the nuclear aspirants of the utility of acquiring nuclear weapons; sustained U.S. encouragement of such perceptions, made possible by tracking, understanding, and ultimately addressing the nuclear aspirant's concerns and requirements; and a conscious U.S.-led effort to complicate the road to nuclear weapons acquisition for those who embark on it. Building a global norm against nuclear proliferation (using scarce resources to reinforce it), establishing comprehensive safeguards on nuclear facilities, developing restraints on the transfer of nuclear technology, and exercising restraint in its nuclear strategy (especially employing its own nuclear arsenal) have all been part of this overall U.S. approach. This approach, however, is currently undergoing profound change that both reflects the fragility of the nuclear non-proliferation regime and might further accelerate its transformation.

The study also yields one more conclusion, namely that time stands out as the most important variable in any effort to bring about nuclear turnaround. The long lead time from the moment a state launches its nuclear program until the capability emerges (typically measured in a decade or more) is what creates the opportunity to influence the program's course from the outside. It leaves room for the emergence of domestic conditions (leadership, political orientation, security situation) as well as external ones that might be either less conducive to the continuation of the nuclear weapons program or more receptive to external inducements to change the state's nuclear course. This underscores Joseph Nye's conclusion that "history shows that buying time to manage destabilizing effects [that motivate nuclear proliferation] is a feasible policy objective" for attaining nuclear reversal.<sup>71</sup>

Even in the easiest cases, however, merely placing obstacles in a state's path to nuclear weapons acquisition cannot attain success. As the case of Pakistan amply demonstrates, external inducements by themselves cannot prevent a determined regime from acquiring a nuclear weapons capability, even at significant cost and risk to itself and its people. Success is within reach only to the extent that foreign influence and domestic conditions converge, and the foreign effort is closely tuned (in terms of both agenda and timing) to the domestic context. External players need to aim at the key factors affecting domestic nuclear choices: the external security environment, the availability of alternative means to deal with the threats that this environment poses or to attain the other goals that the nuclear program is meant to achieve, and the

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71. See Nye, "New Approaches to Nuclear Proliferation Policy," pp. 1293-1294.

balance between domestic proponents and opponents of nuclear weapons. They ought to seize on those opportunities in the nuclear program's evolution at which the program's proponents are either replaced, weakened, or otherwise undergo some transformation that may make them susceptible to external persuasion to consider at least nuclear restraint.

In closing, two suggestions for future research are in order. First, the concept of nuclear hedging, as well as the observations regarding the data limitations and their implications, should serve as a catalyst for a reexamination of nuclear reversal cases and further refinement of their theoretical findings. Second, it would be useful to broaden the scope of the empirical investigation of reversal processes beyond the nuclear domain, to compare the insights generated to date on nuclear reversal and restraint with similar processes in chemical and biological weapons programs and perhaps also ballistic missiles. The implementation in recent years of the Chemical Weapons Convention may well provide an opportunity and convenient platform for gaining new access into several such cases.