

Supply to Deny: The Benefits of Nuclear Assistance for Nuclear Nonproliferation

Rebecca Davis Gibbons 

University of Southern Maine/Harvard Kennedy School

Abstract

Recent scholarship on nuclear proliferation finds that many forms of nuclear assistance increase the odds that recipient states pursue nuclear weapons programs. While these studies may help us understand select cases of proliferation, they overshadow the role of nuclear supply in bolstering global nonproliferation efforts. After the risks of nuclear assistance became well-known following India's nuclear explosion in 1974, most major suppliers conditioned their assistance on recipients joining nonproliferation agreements. Case studies of states' decision-making regarding these agreements illustrate how the provision of nuclear technology has been an effective tool in persuading states to join such agreements, the most important of which is the Treaty on the Non-Proliferation of Nuclear Weapons (NPT). By joining the NPT, states strengthen the global nonproliferation regime and increase the costs of any potential future decision to proliferate. The offer of nuclear assistance has done far more to bolster global nuclear nonproliferation efforts than recent research suggests.

Keywords: nuclear proliferation, nuclear weapons, NPT, nuclear assistance, nuclear supply, global governance

In the summer of 1974, Italy had not yet forsworn nuclear weapons and joined the Treaty on the Non-Proliferation of Nuclear Weapons (NPT). The Indian nuclear explosion conducted in May of that year bolstered Italian hardliners who argued that Italy should forgo NPT ratification and maintain the option to develop nuclear weapons. But Italy needed materials from foreign suppliers for its planned civilian nuclear energy program. In particular, Italy sought nuclear assistance from Canada and the United States. Leaders in both governments made clear that nuclear supply would be unlikely unless Italy joined the NPT. In a meeting in Rome with Italian leaders, "Canadians promised only that serious consideration would be given to Italian request [for nuclear supply] after NPT and safeguards agreement ratified" (O'Mahoney 2018). The Americans said that supply would be forthcoming with the NPT in place (O'Mahoney 2018). Finally capitulating, the Italian government joined the NPT

in April 1975. After ratifying the treaty, the Italian Prime Minister explained why: "Western countries [that] supply our uranium have unmistakably conditioned their deliveries to our ratification of the NPT. Only by doing so, therefore, is it possible to ensure for Italy the development of an advanced know-how and technology, and to avoid being left in a dangerous rearguard position" (Nuti 2017, 138). Without the offer of nuclear supply contingent on joining the NPT, it is unlikely Italy would have joined the treaty in 1975.

The study of the causes of nuclear weapons proliferation has blossomed in recent years with the renewed interest in scholarship focused on the *supply-side* of the proliferation equation. Whereas many scholars have examined the reasons why leaders sought or *demand*ed nuclear weapons (e.g., Sagan 1996/1997, 2011; Debs and Monteiro 2016), the supply-side literature focuses on how the abilities of these leaders to secure

nuclear-related information, materials, and technology increases their propensity to explore, pursue, and acquire nuclear weapons programs.

The introductory anecdote about Italy illustrates two important facts. First, that the United States and other suppliers changed their nuclear export policies after India's 1974 nuclear explosion. India harnessed "peaceful" nuclear assistance from both the United States and Canada to develop a nuclear explosive device. Second, in contrast to research emphasizing the negative implications of nuclear assistance, nuclear supply has benefited global nuclear nonproliferation efforts by bringing additional states into nonproliferation treaties and agreements. In particular, this example shows how, in the aftermath of the Indian explosion, Canada and the United States used the offer of nuclear supply as a tool to expand membership in the NPT and thus mitigate the risks of offering inherently dual-use technology. In other cases, suppliers may threaten to cut off existing nuclear assistance unless states join nonproliferation agreements. Conditioning nuclear assistance on participation in nonproliferation agreements means that supply may have become a less relevant factor in nuclear weapons proliferation since the risks of nuclear supply became apparent.

Historical cases of nuclear nonproliferation decision-making among states reveal that the promise of nuclear supply has been a significant factor in many states' decisions to commit to the nonproliferation regime. In other words, the NPT Article IV provision that promises the supply of peaceful nuclear technology to nonnuclear weapons states matters for bringing states into the nonproliferation regime. While practitioners of nonproliferation have long known about supply as a means to promote nonproliferation from their own personal experiences, this tool has not been studied systematically, nor have scholars examined how supply can discourage weapons proliferation. Exploring this tool more thoroughly is important because it provides a significant counterpoint to the current scholarly emphasis on the dangers of nuclear supply.

In developing this argument about the positive effects of nuclear supply, I begin with a brief review of recent nuclear weapons proliferation supply literature. Next, I theorize about how supply can be a tool to reduce nonproliferation risks and bolster the nuclear nonproliferation regime. In particular, I argue that two mechanisms—one direct and one indirect—promote nonproliferation when nuclear supply is used to expand membership in the nuclear nonproliferation regime. First, as a result of being in the NPT, the state customer will face several domestic and international obstacles if in the future it decides to pursue a nuclear weapons program. After all, state

interests are not fixed; an NPT member that later considers proliferation faces significant costs from the international community. Second, the addition of each new state to the NPT strengthens the regime, creating stronger normative pressure against nuclear proliferation. A state could decide not to proliferate without joining the NPT. If that were the case, the nonproliferation regime would be less universal and its normative strength weaker than it could have been. In other words, the strength of the nonproliferation regime depends in part on the number of countries in the NPT. Following the discussion of mechanisms, I move on to a medium-N assessment of the direct mechanism and follow with case illustrations of Japan, Indonesia, and Egypt. I conclude with implications for theory and policy.

Review of Recent Supply-Side Literature

Early in the nuclear age, leaders anticipated that many technologically capable states would develop nuclear weapons. In 1963, President Kennedy made his famous prediction that "by 1970, unless we are successful, there may be [ten] nuclear powers instead of four, and by 1975, [fifteen] or [twenty]" (Kennedy 1963). A 1966 National Intelligence Estimate listed twelve additional states that could seek nuclear weapons in the following ten years (NIE 4-66 as cited in Burr 2005). These expectations did not bear out, and scholars began to focus on why certain states sought nuclear weapons, while others did not. More recently, scholars have returned to the question of how the supply of information, material, and technology affects proliferation. Together, the majority of recent supply-side research on nuclear proliferation finds that all sources of nuclear assistance increase the risk that recipient states will pursue nuclear weapons.¹ This supply-side scholarship has led Erik Gartzke and Matthew Kroenig (2009, 152) to conclude, "the supply-side factors that enable nuclear development are among the most important determinants of nuclear proliferation."

One strand of the supply-side literature emphasizes the connection between the provision of "sensitive nuclear assistance" and nuclear weapons proliferation. Kroenig (2009b) finds that this type of assistance—sharing weapons design information, providing significant fissile material, or aiding in the construction of facilities to enrich uranium or reprocess plutonium—leads to an increased risk of nuclear weapons proliferation. Kroenig (2009a, 2010) argues that states decide to

1 One exception is Montgomery (2013), which argues that sometimes outside assistance is detrimental to a nuclear weapons program.

provide or not provide sensitive assistance for strategic reasons: to help rivals of their own rivals and to aid states in which they cannot project power.

In another contribution to the supply-side literature, Matthew Fuhrmann (2009a, 2012) finds that the provision of all nuclear assistance, not just sensitive assistance, increases the risk of nuclear weapons proliferation. Although most states that seek nuclear assistance do not develop nuclear weapons, having more Nuclear Cooperation Agreements (NCAs) with suppliers increases the likelihood that a state will proliferate. Fuhrmann theorizes that peaceful nuclear assistance reduces the expected costs of a weapons program and that proliferation is especially likely when states that have received assistance face security threats. Like Kroenig, Fuhrmann (2008, 2009b) finds suppliers provide assistance for strategic reasons.

Finally, Robert L. Brown and Jeffrey M. Kaplow (2014) find a third type of nuclear supply—International Atomic Energy Agency (IAEA) technical assistance related to the nuclear fuel cycle—is significantly correlated with the pursuit of a nuclear weapons program. Instead of state suppliers, the authors focus on assistance by an international organization, one founded to help promote peaceful nuclear technology. Brown and Kaplow argue that IAEA assistance both lowers the costs of pursuing a nuclear weapons program and increases the odds of a successful program.

Nuclear supply research is not without its detractors, though most disagreement occurs over the connection between peaceful nuclear assistance and nuclear weapons proliferation. In a comparative examination of all of the factors that scholars have claimed correlate with nuclear proliferation, Mark S. Bell (2016) finds that peaceful nuclear assistance is not a significant factor. Nicholas L. Miller (2017) observes that nuclear assistance in the form of nuclear energy programs rarely leads to nuclear weapons acquisition; he argues that suppliers recognize the dangers of providing dual-use technology and thus take steps to ensure it is not used for weapons purposes. Indeed, supply-side scholarship often employs statistical analyses that span the entire nuclear era without reflecting changes in suppliers' policies. As this article will illustrate, nuclear suppliers have changed the conditions of nuclear supply policies over time, precisely because of concerns over nuclear weapons proliferation. These changes in policy, such as requiring full-scope safeguards or NPT membership as conditions of supply or using supply as an inducement to broaden participation in nonproliferation treaties, suggest that supply may have become a less relevant factor in explaining proliferation over the course of the nuclear

age. Future studies on the effects of nuclear assistance should account for the changes in suppliers' policies over time.²

Though a systematic study of nuclear supply as a tool to promote nuclear nonproliferation has not been conducted to date, some scholars have made this connection when critiquing the existing supply literature. For example, to explain Fuhrmann's findings that peaceful nuclear assistance increases the risk of proliferation, Kroenig (as cited in Bluth et al. 2010, 188–90) argues "nuclear proliferators are likely to attract NCAs because the international community often uses nonsensitive nuclear cooperation as a tool to dissuade countries from working on more sensitive technologies." Similarly, Scott D. Sagan (2011, 232) has argued that, in some cases, "NCAs were offered to a state that was known to be exploring a nuclear weapons option in an attempt to provide economic carrots to keep the state from pursuing nuclear weapons to completion." Kroenig and Sagan highlight the importance of supply as a tool to stop states suspected of having an interest in weapons proliferation, but nuclear supply can also benefit nonproliferation more broadly by expanding membership in nonproliferation agreements such as the NPT and creating significant obstacles to proliferation were NPT states to decide to proliferate down the road. Exploring this first mechanism, how supply is used to expand treaty membership, requires assessing how the offer of supply affects governments' calculations about joining nuclear nonproliferation treaties. As such, detailed process-tracing of governmental decisions is best suited to demonstrating that supply can benefit nuclear nonproliferation efforts.

How Nuclear Supply Bolsters Nuclear Nonproliferation

Recent literature connecting nuclear assistance to the proliferation of nuclear weapons suggests that supply leads to proliferation by easing the path to building nuclear weapons. But nuclear supply also has an underappreciated positive side. Because states that provide nuclear technology are aware of the risks of selling dual-use technology, they have often required their state customers to be members of nuclear nonproliferation treaties. If potential customers are not already members, their

- 2 In *Atomic Assistance*, Fuhrmann tests the differences in NCA supplier behavior pre- and post-1974 and finds no significant differences (2012, 73). This test does not, however, indicate if supplying states added requirements for supply after this date.

interest in nuclear technology provides an opportunity to pressure these states into joining nuclear nonproliferation agreements in exchange for assistance. Thus, supply is an inducement—an offered benefit for a specific concession—used to broaden participation in the nuclear nonproliferation regime (Drezner 1999, 189). In addition, suppliers can threaten to curtail existing supply if a state is suspected of engaging in proliferation activities. In these cases, instead of a supplier offering an inducement to attain a desired outcome, the supplier issues a compelling threat to curtail existing nuclear assistance if an outcome is not achieved. The following section chronicles how the United States has used nuclear supply as a nonproliferation tool and then explains the ways in which the use of this tool strengthens the nuclear nonproliferation regime.

The United States, one of the most important suppliers of nuclear technology for most of the nuclear age, understands the potential detriments of nuclear assistance and has pursued policies to reduce its risks. But this was not always the case. US leaders were slow to fully appreciate the hazards of nuclear assistance because, in the early nuclear age, they anticipated that only highly developed states could build nuclear weapons. This assumption in part explains why President Eisenhower was willing to provide nuclear technology, training, and technical information to dozens of states through the 1950s Atoms for Peace program. Though the Eisenhower administration proposed establishing the IAEA and required nuclear safeguards on exports, the Atoms for Peace program resulted in the United States inadvertently aiding nuclear weapons programs in Israel, South Africa, India, and Pakistan. It was not until India exploded a nuclear device with US and Canadian materials and technology in May 1974 that the United States changed its policies and made it more difficult for states to purchase technology without participation in the nuclear nonproliferation regime.³

First, in 1975, the United States founded the Nuclear Suppliers Group (NSG) to establish guidelines for all suppliers of nuclear technology and material. In 1976, Canada established a policy that it would only supply nonnuclear states that joined the NPT or had full-scope, NPT-like nuclear safeguards (Government of Canada 1985, 13). Congress' Nuclear Non-Proliferation Act of 1978 required more stringent safeguards requirements for US nuclear exports: to be eligible for nuclear cooperation with the United States, states had to accept IAEA full-scope safeguards on all nuclear facilities and not manufacture or acquire any nuclear explosive devices. The United States also preferred that states were

members of the NPT. If existing contracts and NCAs with the United States did not comport with these new rules, they had to be renegotiated or terminated. US leaders encouraged their allies to condition their supply in similar ways. In sum, a country seeking peaceful nuclear technology after the mid-1970s would see that its chances were much higher if it joined the NPT and concluded the NPT-required safeguards agreement with the IAEA.

In more recent years, as the NPT has become almost universal, the United States and many other suppliers have encouraged customers seeking nuclear technology to conclude the 1997 Model Additional Protocol. The Model Additional Protocol is a more stringent safeguards agreement allowing international inspectors broad access to a country's civilian nuclear program. During the presidency of George W. Bush, the United States made the adoption of the Additional Protocol a requirement for those seeking US nuclear technology and material. Within the forty-eight-member Nuclear Suppliers Group, the Obama administration succeeded in making the Additional Protocol (or a regional alternative) a requirement for supply of the most sensitive nuclear technologies. In the past two decades, the offer of nuclear supply has increased states' embeddedness within the broader nuclear nonproliferation regime.

When a state has an interest in nuclear technology, diplomats from supplier countries have an opportunity to encourage ascension to nuclear nonproliferation agreements. These conversations are rarely public, as the appearance of a quid pro quo would weaken the legitimacy of the nonproliferation regime. Declassified US archival documents, however, provide many examples of US leaders seeking to offer nuclear assistance for increased involvement within the nuclear nonproliferation regime. For example, in 1975, a memo for President Ford on US nuclear nonproliferation goals stated, "Support the Non-Proliferation Treaty . . . by working with other Treaty proponents to gain the adherence of nonparties, such as Japan and Italy, and by adding to the benefits [that] adherence bestows (e.g., improved credit terms for the purchase of nuclear materials and equipment)" (Memorandum for S 1973, 2–3). In 1977, the Argentine government told US officials that it would join the Treaty of Tlatelolco (which, like the NPT, prohibits nuclear weapons development) and establish full-scope nuclear safeguards in exchange for greater nuclear cooperation with the United States, presumably based on a US offer for such a deal (Tudda and Howard 2015). In May 1978, the US embassy in Chile reported the following to Washington: "Chile might be willing to sign the NPT, accept total safeguards on all Chilean nuclear facilities . . . in exchange for an assured nuclear fuel supply and

3 This history is detailed in Miller (2018, 69–94).

technical assistance from the USG” (Tudda and Howard 2015). This response was heralded as a “breakthrough” in US efforts to encourage Chile to join the NPT (Tudda and Howard 2015). In the latter two cases, the deals did not go through for political reasons; nonetheless, they illustrate how the United States attempted to use supply as an inducement to bring about additional nonproliferation commitments from states that had not yet forsworn nuclear weapons development.

Declassified documents with more recent examples are not yet available, but it is likely that the desire for nuclear supply has helped the United States persuade states to conclude an Additional Protocol safeguards agreement. For example, Vietnam announced its plan for a civilian nuclear energy program in 2006 and, during the course of negotiations with the United States over nuclear cooperation, concluded an Additional Protocol safeguards agreement in 2012. Vietnam also joined the Global Initiative to Combat Nuclear Terrorism and ratified the Amendment to the Convention on the Physical Protection of Nuclear Material during this period (Countryman 2014). The US-Vietnam Nuclear Cooperation Agreement was finalized in 2014. Similarly, the United Arab Emirates (UAE) developed a national plan for nuclear energy in 2008. It concluded an Additional Protocol in April 2009, and the United States finalized a Nuclear Cooperation Agreement with the state in December of 2009 (United States State Department Bureau of Public Affairs 2009).

Supply as a nonproliferation tool is not always possible, and thus scope conditions apply. Some states had already secured nuclear assistance before the establishment of the NPT or other regime agreements; other states have been uninterested in nuclear technology. Indeed, the number of states seeking civilian nuclear technology has ebbed and flowed over time as perceptions of nuclear power have shifted. In using supply as a tool to promote nuclear nonproliferation, suppliers benefitted in the 1970s and, more recently, by an uptick in interest in producing nuclear energy. In the 1970s and into the 1980s until the 1986 Chernobyl disaster, the global oil crisis led many states to consider nuclear energy as an alternative to fossil fuels. More recently, the nuclear renaissance can be in part attributed to the desire to reduce carbon output amid concerns about climate change. Despite a dampening of enthusiasm following the 2011 Fukushima disaster, today approximately thirty states are seeking nuclear energy programs (World Nuclear Association 2018a). The 1970s, early 1980s, and 2000–present are periods when we would expect this tool to be employed most effectively. Furthermore, nuclear supply can only bring about deeper participation in the nuclear nonproliferation

regime when a state is seeking to build or grow a civilian nuclear program *and* the state is not yet fully embedded in the regime. For these reasons—variation in interest in nuclear technology over time and variation in states’ regime embeddedness—the use of nuclear supply as an incentive for greater treaty participation is less likely to show up in systematic quantitative analysis of the entire nuclear era; again, this is another reason why research on the benefits of nuclear supply is better suited to qualitative evidence.

Using supply to persuade states to join nuclear nonproliferation agreements mitigates against nuclear weapons proliferation via two primary mechanisms, one direct and one indirect. Once a state customer has joined the NPT in exchange for nuclear assistance, it will face several domestic and international obstacles if it later decides to pursue a nuclear weapons program. In a less direct mechanism, the addition of another state in a particular treaty or agreement strengthens the nonproliferation regime as a whole by creating greater global normative pressure against nuclear proliferation. Each of these mechanisms will be described in turn below.

When a state joins the NPT and concludes a safeguards agreement with the IAEA as a way to receive nuclear assistance, it faces at least three domestic and international obstacles if it subsequently considers nuclear weapons proliferation: overcoming domestic stakeholders; building a deeply hidden program; and the potential detection of the clandestine program and the negative repercussions that would likely follow. Together, these obstacles deter potential considerations of proliferation.

First, a leader considering a nuclear program while a member of the NPT will likely contend with domestic factions who take their states’ nonproliferation commitments seriously. NPT members send diplomats to meetings four of every five years to assess the treaty. In these meetings, diplomats meet with other treaty members and make public statements about their commitments to nuclear nonproliferation. Over time, participation in these meetings has a socializing effect and ultimately creates NPT stakeholders within a government.⁴ States seeking nuclear weapons will have to overcome these pro-NPT individuals within their foreign ministries. Another set of stakeholders is the civilian nuclear industry within the country. Pro-nuclear energy interests would likely realize that cheating on the NPT could lead suppliers to cut off their assistance. This cutoff would harm government and industry officials on a financial and reputational level,

4 On the socializing effect of participating in international arms control and nuclear nonproliferation meetings, see Johnston (2007).

but it would also harm the country's energy program. If the civilian program is creating or is on track to create a source of energy for the state, it would pose a great risk to be caught cheating on NPT and safeguards commitments. These stakeholders are likely to oppose a clandestine nuclear weapons program.

A second obstacle to an NPT member considering a nuclear weapons program is the challenge of creating a deeply secretive nuclear weapons program that avoids detection by outsiders. Because the supplier state is likely to cut off nuclear assistance (and encourage other suppliers to do the same) if it believes its customer is using the technology for weapons, the only way to proliferate and continue receiving nuclear technology is by developing a clandestine program. The level of secrecy and compartmentalization required would increase the cost and efficacy of the program. The lengths Saddam Hussein went to in order to hide his program from international inspectors is a case in point (Kay 2005). While it is true that states such as Iraq were able to hide their nuclear weapons programs, the increasingly sophisticated detection methods and intelligence-gathering surrounding proliferation make this a perilous route for any leader today. The supplier is likely to maintain some oversight of the nuclear program and thus may detect clandestine activity. In addition, because safeguards agreements require states to submit to regular inspections from the IAEA, these international inspectors may detect banned nuclear activity. If a state has concluded an Additional Protocol safeguards agreement, it faces a greater risk of detection due to the agreement's provision for short-term inspections at any location connected to any part of the state's nuclear program. Moreover, the presence of international inspectors can make cheating more obvious to the international community. If a state expels IAEA inspectors, for example, as North Korea did in 2002 and 2009, or refuses to respond to questions from the IAEA about its nuclear activities, as Iran did throughout the 2000s, these actions send a strong message to the international community to pay more attention to what is transpiring in that state. IAEA safeguards thus provide a warning bell to the international community about potential proliferation. The difficulty and high cost of a secret program have dampening effects on illegal proliferation.

A final obstacle for a state that considers proliferating after joining the NPT is the punishment that would occur after detection. The state would likely lose access to additional nuclear supply for peaceful purposes. This would be a high risk for a state that had invested time and human and material resources into developing a peaceful nuclear program. Nuclear programs are large and expensive projects for any government to undertake.

Often announcements about civilian nuclear programs are major public declarations. If leaders have invested political capital into a new civilian nuclear program, it would be a risk to their leadership if they were unable to continue the program due to proliferation concerns. Punishment may also come after a state is referred by the IAEA Board of Governors to the UN Security Council for noncompliance with NPT commitments. This high-profile action creates a focal point to develop a global response to noncompliance, such as economic sanctions (Miller 2014). The international response to Iranian nuclear activities since 2002, including Iran's referral to the UN Security Council, exemplifies how punishing it can be for a state that is suspected of cheating on its NPT commitment. Knowing that detection is likely to lead to significant punishment, as it did for Iraq and Iran, is another factor inhibiting interest in pursuing nuclear weapons.

The second, and indirect, mechanism by which supply in exchange for regime commitments dampens nuclear weapons proliferation is by strengthening the overall nuclear nonproliferation regime. Increasing membership in nonproliferation agreements by even one state strengthens global nonproliferation norms, and isolates those who remain nonmembers. This mechanism is one of the reasons why the United States has promoted global membership in nuclear nonproliferation agreements, even to states that seemingly have no risk of proliferating. As a 1980 US Government Accountability Office report on the NPT explains, "countries with little or no nuclear capability or potential are not ignored, as adherence by just one additional state increases by two the difference between the number of parties and nonparties and thereby serves to further isolate the nonparty states" ("[Evaluation of the US Efforts to Promote Nuclear Non-Proliferation Treaty](#)" 1980, 20). Though the mechanism is indirect, each new member of a nonproliferation treaty or agreement brings attention to the regime and inches it closer to universalization. Once states are members of the NPT and other nonproliferation treaties, all of the other direct mechanisms that inhibit proliferation operate.

Observers of the NPT will note that some states joined the treaty only to cheat on their commitments and pursue nuclear weapons. In this case, it may seem as though inducing or compelling NPT membership did not benefit global nuclear nonproliferation efforts, as nuclear assistance may have aided a clandestine nuclear weapons program. While cheating harms the legitimacy of the regime, it is notable that the majority of cheaters remained in the regime after ending their secret weapons programs. Iraq, South Korea, Libya, Iran, and Romania stayed in the NPT after pursuing weapons-related research; NPT membership meant their efforts to build a

program were hindered as they had to go to great lengths to avoid detection. Had they not been treaty members, their proliferation would have been more legitimate—they would not be cheating on a treaty, after all—and addressing the proliferation challenges posed by these states would have been more difficult. In the case of Iran, for example, perceptions of cheating facilitated a coordinated response from the international community.

Medium-N Analysis

To illustrate the utility of supply as a nonproliferation tool, the following section provides a medium-N analysis of the pool of states that have raised proliferation concerns in the nuclear age. Using Philipp Bleek's (2017) coding of nuclear weapons programs, there are thirty states (including Taiwan) that have explored, pursued, and/or acquired nuclear weapons. These states are listed in Table 1 below.⁵ Five of these states acquired nuclear weapons before the NPT was under negotiation in the mid-1960s, leaving twenty-five possible states where supply could be used as a tool to threaten or induce NPT adherence. Of those remaining states, qualitative evidence indicates that the offer of nuclear supply or the threat of its removal were key factors in ten states' decisions to join the NPT. This number represents more than double the number of states that used nuclear energy assistance to acquire nuclear weapons and more than the number of states that used a nuclear energy program to pursue a weapons program according to Miller's (2017, 61) assessment. Five of the ten states engaged in some level of cheating on the NPT, though only one, North Korea, built nuclear weapons and left the treaty. The other former cheaters now appear to be in good standing with their NPT commitments.

Case Studies

The three case studies below chronicle Indonesian, Japanese, and Egyptian decision-making surrounding ratification of the NPT. These cases illustrate in detail how nuclear supply can be used to broaden participation

in the nuclear nonproliferation regime. The three cases are substantively important for nuclear nonproliferation, as all three states have a history of high-level interest in nuclear weapons and have been regional and global leaders on nonproliferation and disarmament at various points in the nuclear age.

Indonesia

In the mid-1960s, after China's successful nuclear test, Indonesia's leader, President Sukarno, began publicly discussing an Indonesian nuclear weapon. In a July 1965 speech, Sukarno proclaimed the following: "God willing, Indonesia will shortly produce its own atom bomb" (cited in Cornejo 2000, 35). With little nuclear infrastructure beyond a US-supplied research reactor, the US intelligence community did not think Indonesia had an indigenous weapons program of significance. Indonesia's alignment with China, however, led some to speculate that the Chinese government would give Indonesia a nuclear weapon (Cornejo 2000). This concern was alleviated in October 1965 when Major General Suharto took control of the Indonesian government after a botched coup attempt. He would lead Indonesia until 1998. Suharto's government agreed to international safeguards and, at times, assured the international community that Indonesia was not seeking nuclear weapons.

Similar to many other states during the 1970s oil crisis, Indonesia began to plan for a civilian nuclear power program as an alternative to reliance on fossil fuels. In 1972, the National Nuclear Agency of Indonesia, BATAN, established a commission to explore the construction of nuclear power plants. In 1974, the Director General of BATAN, Professor Achmad Baiquni, announced that his organization's five-year plan called for the development of an Indonesian nuclear energy program, with the first reactor set to generate power by 1985 ("Indonesia Plans to Develop Nuclear Industry" 1974). In the following month, Indonesian Foreign Minister Adam Malik announced that Jakarta would seek nuclear cooperation agreements with the USSR, Canada, France, and the United States. BATAN and the National Electric Authority subsequently conducted a study in 1976, with the IAEA determining that between eight and eighteen reactors could be built on the island of Java by 1992 (Poneman 1981).

Problems with this ambitious nuclear energy plan soon arose, however, delaying the program until the late 1970s. First, prospectors were unable to find indigenous sources of uranium in Indonesia. Then, in 1975, the state oil company, Pertamina, almost went bankrupt, costing the government funds that could have paid for

5 Future research should also examine all of the other states where supply may have influenced the decision to join the NPT. More than twenty additional states announced plans for nuclear programs between the 1950s and the early 2000s. By 2002, all current members were in the NPT. Additional research could also explore whether the offer of nuclear supply played a role in bringing about participation in other nonproliferation treaties and agreements.

Table 1. Nuclear supply and the NPT

<i>State</i>	<i>Nuclear program</i>	<i>Supply a factor in joining NPT?</i>	<i>Brief summary</i>
1. USA	1939–	No	Acquired before NPT era
2. Germany	1939–1945	No	Program ended before NPT era
3. Russia	1942–	No	Acquired before NPT era
4. UK	1940–	No	Acquired before NPT era
5. France	1945–	No	Acquired before NPT era
6. China	1956–	No	Acquired before NPT era
7. Israel	1949–	No	Not an NPT member
8. South Africa	1969–91	No	South Africa joined the NPT in July 1991 as a nonnuclear weapons state after dismantling its nuclear weapons program ¹
9. Pakistan	1972–	No	Not an NPT member
10. India	1948–	No	Not an NPT member
11. North Korea	1962–	Yes	The Soviets engaged in pressuring the North Koreans to join the NPT (Solingen 2007, 118). The USSR “lobbied the Soviet government to supply it with a nuclear power reactor on concessionary terms. The USSR finally agreed but on the condition that the DPRK first join the NPT.” (cited in Mansourov 1995). After the DPRK deposited its instruments of ratification, Soviet and North Korean leaders signed an agreement whereby the Soviets would supply four nuclear reactors.
12. Yugoslavia	1949–1962, 1974–1987	No	Yugoslavia joined the NPT in 1970 and restarted a nuclear weapons program after India’s nuclear explosion in 1974. There is no available evidence of supply used as an inducement in this case. ²
13. South Korea	1969–1981	Yes	South Korea joined the NPT in April 1975 after the United States threatened to cancel all current economic and nuclear contracts if the state did not join the NPT. These threats were brought about by concerns over South Korean proliferation (Solingen 2007, 91).
14. Libya	1970–2003	Yes	The United States and France would not sell technology to Libya the 1970s due to proliferation concerns. The Soviets were willing to sell Gadhafi a 10 megawatt nuclear reactor, but Moscow demanded Libya ratify the NPT. Gadhafi obliged and ratified the treaty in 1975. Additionally, the Soviets required Libya to sign a full-scope safeguards agreement with the IAEA. By July 1980 the safeguards were in force. ³
15. Brazil	1966–1990	No	Brazil acceded to the NPT in 1998 after developing nuclear technology, including enrichment capabilities. ⁴
16. Iraq	1975–1991	Yes	There is little available evidence about Iraq’s decision to join the NPT. The most comprehensive account of the Iraqi nuclear program implies a connection between Iraq’s NPT commitment and seeking nuclear assistance from international suppliers: “The turbulence of this period did not affect the Bakr regime’s commitment to ensure continued access to foreign nuclear assistance. Iraq signed the Nuclear Non-Proliferation Treaty in Moscow on July 1, 1968, fewer than three weeks before the Bakr coup, and ratified it in late October 1969. Three years later Iraq signed an additional safeguards agreement to facilitate IAEA inspections of declared nuclear facilities. This paved the way for further assistance and development” (Braut-Hegghammer 2016, 41).
17. Iran	1974–1979, 1984–	No	Iran signed the NPT at the earliest opportunity on July 1, 1968, ratified the treaty in February 1970, and concluded a safeguards agreement with the IAEA in June 1973. The Shah signed quickly “to keep Washington happy” and because the Shah saw it as a way to show the West that Iran was an “honorable” country (Patrikarakos 2012, 54–56). Although the Shah sought a vast nuclear energy program, there is no evidence this desire was tied to joining the NPT.

Table 1. Continued

<i>State</i>	<i>Nuclear program</i>	<i>Supply a factor in joining NPT?</i>	<i>Brief summary</i>
18. Syria	2000–2007	No	Syria ratified the NPT in 1969, but it did not complete its nuclear safeguards agreement with the IAEA until 1992. It began considering a civilian nuclear program in the 1970s, but was unable to fulfill these ambitions due to financial problems and proliferation concerns of Western powers. Finally, in 1991, the Chinese began building a nuclear reactor in Syria. Concerns about this reactor led the IAEA to delay approval of the transfer of nuclear material for the reactor. A year later, Syria concluded a safeguards agreement, indicating that supply was a factor in deepening Syria's involvement in the nuclear nonproliferation regime. ⁵ Nonetheless, this case is coded "no" because supply appears unrelated to Syria's NPT ratification.
19. Japan	1941–1945, 1967–1972	Yes	See case study.
20. Switzerland	1945–1969	No	Switzerland signed the NPT in 1969 and ratified the treaty in 1977. There is little evidence nuclear supply played a role in this decision. ⁶
21. Sweden	1945–1970	No	Sweden ratified the NPT in 1970. Scholars cite multiple nonsupply related reasons for Swedish adherence to the NPT. First, some argue the Swedish government made a secret deal by which the United States would extend its nuclear umbrella to Sweden. Another common argument is that Sweden decided to forgo the nuclear option because it concluded the country would become a target of the Soviet Union. Others argue the Swedes were overwhelmingly antinuclear by the late 1960s when the NPT was established. ⁷
22. Norway	1947–1962	No	There is no evidence of outside pressure influencing Norway's decision to join the NPT. The government of Norway announced in 1962 that it would not seek nuclear weapons and it ratified the treaty in 1969. ⁸
23. Egypt	1955–19980	Yes	See case study.
24. Italy	1955–1958	Yes	The Italian government joined the NPT in April 1975, after US and Canadian officials made clear that joining the treaty would facilitate the transfer of material and technology for Italy's nuclear energy program (O'Mahoney 2018; Nuti 2017, 138).
25. Australia	1956–1973	Yes	According to a declassified Australian government document on the February 1970 decision to sign the treaty, "Cabinet (or at least a section of it) in deciding that Australia should sign the NPT recognised that signature would enhance prospects for assistance from others (e.g., Britain, Canada, [United States]) for our nuclear programme for peaceful purposes (and that signature would still enable us to develop considerably our capability in nuclear technology without breaching the treaty)" (Reynolds and Lee 2013).
26. Indonesia	1964–1967	Yes	See case study.
27. Taiwan	1967–1976, 1987–1988	No	There is no evidence of supply being a factor in Taiwan's ratification in 1970.
28. Romania	1978–1989	Yes	Supply was a factor in Romania signing the NPT in 1968 and ratifying the treaty in 1970. Romania had nuclear weapons ambitions (Lanoszka 2018), but wanted Western nations to supply the country with nuclear technology and so it joined the NPT. ⁹
29. Argentina	1978–1990	No	The United States attempted to use the supply of heavy water to induce Argentina to join the Treaty of Tlatelolco (The Latin American Weapons Free Zone Treaty) in the late 1970s after it was clear Argentina would not join the NPT. Both treaties commit members to forgo nuclear weapons. At one point during these discussions, the government of Argentina agreed to join Tlatelolco in exchange for US nuclear supply, but ultimately it did not. Argentina joined the Treaty Tlatelolco in 1994 and the NPT in 1995. ¹⁰

Table 1. Continued

State	Nuclear program	Supply a factor in joining NPT?	Brief summary
30. Algeria	1983–1991	No	Algeria acceded to the NPT in 1995. International pressure, mainly from the United States, is the commonly stated reason for Algeria's adherence to the treaty. Pressure stemmed from concerns about Algerian nuclear intentions after a Chinese supplied reactor was discovered by US satellite surveillance in 1991. ¹¹

Notes:

¹See, for example, Liberman (2001).

²On the Yugoslavian bomb program, see Potter, Miljanic, and Slaus (2000).

³International Institute for Strategic Studies (2008); see also Braut-Hegghammer (2016, 162) and Rublee (2009a, 1520).

⁴See, for example, Spektor (2016).

⁵Hibbs and Bonn (1991).

⁶Stussi (1996).

⁷See, for example, Cole (1997) and Jonter (2012, 237). Rublee argues the Swedes were overwhelmingly antinuclear by late 1960s (2009a, 171).

⁸See Forland (1997).

⁹Gheorghie writes, "State Secretary Rusk reminded the Romanians that unless Bucharest endorsed the NPT, Washington would veto the transfer of technology, which the Romanians needed for their atomic energy program. The communist leadership in Bucharest did not wish to scare away its potential Western suppliers, by seeming too keen on acquiring nuclear weapons. Therefore, Bucharest used its signing of the NPT in July 1968 to show its potential Western nuclear suppliers that Romania was not a proliferation risk." As Gheorghie recounts, Romania then cheated on these commitments, though it never developed a nuclear weapon. See Eliza Gheorghie, "Flash in the Pan: Romania and the NPT, 1968–1975" (unpublished).

¹⁰The relevant document reads, "Aden stated that Argentina never attached much importance to the Tlatelolco Treaty as a device to prevent nonproliferation since they (Argentina) never had the intentions to proliferate. However, primarily because the [United States] felt this was an important move followed by international safeguards as discussed during the Vance visit last November, the GOA decided to ratify the Treaty accompanied by international safeguards and was under the impression the [United States] would follow up with discussions on the transfer of heavy water technology" (Tudda and Howard 2015).

¹¹See, for example, Albright and Hinderstein (2001).

the nascent nuclear program. Moreover, Indonesia experienced a recession in the mid-1970s that further tapped its limited resources. It was not until the late 1970s that the economy began to improve and a nuclear energy program again appeared viable (Poneman 1981, 577–78). In March of 1978, the head of BATAN said that Indonesia would "hopefully" have nuclear power by 1985 ("Country Hopes to Have Nuclear Power station by 1985" 1974). In November 1978, Indonesian President Suharto announced his desire for a 30-megawatt nuclear reactor ("Minister Says Larger Nuclear Reactor Needed for Research" 1978). At this point, Indonesia faced a more constrained international environment as an inexperienced nuclear state seeking nuclear technology from global suppliers. The establishment of the NSG in 1975 and the passing of the US Nuclear Non-Proliferation Act of 1978 restricted US and international nuclear exports to non-NPT states. As a nuclear-power aspirant in the late 1970s, Indonesian leaders soon began discussing the NPT and finally opted to join the NPT in 1979.

The history of Indonesia's desire for nuclear technology provides compelling evidence that an offer of nuclear assistance is a useful tool to achieve states' commitments to the nuclear nonproliferation regime. Indonesia's ratification of the NPT in 1979 reflects the newly constrained

supply environment created by the NSG and US domestic policies and how the offer of nuclear supply incentivized joining the treaty. The statements of Indonesian leaders during the period of NPT ratification indicate how Indonesia's desire for nuclear technology intersected with US efforts to link nuclear nonproliferation commitments to nuclear assistance. In August 1978, the State Minister for Research and Technology, Dr. B.J. Habibie, stated that the time had come to ratify the NPT because of Indonesia's need for foreign aid, including nuclear aid ("Government Faces Ratification of the Nuclear Non-proliferation Treaty" 1978). In explaining the importance of NPT ratification to parliament, Habibie stated, "it is necessary to ratify at this time the NPT . . . as this will lead to talks on foreign aid, especially for nuclear technology cooperation." He continued,

the government . . . considers the current international situation as unfavorable for non-NPT countries to obtain aid for the development of nuclear projects. This . . . can lead to undesirable political effects. Considering the development of politics within and outside the country, Indonesia has come to the conclusion that the time has come for her to ratify the bill ("Government Faces Ratification of the Nuclear Non-proliferation Treaty" 1978).

Habibie was almost certainly referring to the constraints the NSG and the United States were placing on nuclear supply for non-NPT members during this period. In order to receive nuclear supply, Indonesia must join the NPT, Habibie determined—an action his country had resisted for the previous eleven years.

When Indonesia deposited its instruments of ratification for the NPT in July 1979, it included a declaration emphasizing the need for nuclear technology:

Indonesia today is actively carrying out its national development. With a view to supporting and accelerating the development process, including the economic and social development, Indonesia has decided from the outset to make use of the nuclear energy [sic] for peaceful purposes. Indonesia's efforts in developing nuclear energy for peaceful purposes in its national development require the assistance and cooperation of technologically advanced nuclear countries (UNODA 1979).

Within a year of NPT ratification, Indonesia concluded its Comprehensive Safeguards Agreement with the IAEA (IAEA 1980). The swiftness with which Indonesia concluded this agreement suggests that having the safeguards required by the NPT—and newly required for nuclear trade with the United States and other suppliers—was an important factor in ratification.⁶ Soon after ratification, the Indonesian government signed nuclear cooperation deals with a number of foreign suppliers (Feldman 1997, 59).

In 1981, Indonesia awarded a contract for a research reactor to a West German company. The United States, Russia, France, and the United Kingdom supplied other technologies and materials for the reactor. The research reactor began operating in 1987 (IAEA 2009). By ratifying the NPT in 1979, Indonesia was able to secure international agreements for the supply of civilian nuclear technology its leaders were seeking.⁷

Japan

Six years passed from Japan's signature of the NPT in 1970 to its ratification in 1976. This gap was in part

- 6 States are supposed conclude their CSA within eighteen months, but the average time among NPTs states is much longer.
- 7 Nonetheless, the Indonesian nuclear program languished during the 1980s and much of the 1990s. Today the government is still assessing plans for civilian nuclear energy but has faced domestic protests related to safety concerns over the placement of nuclear reactors in earthquake-prone locations.

caused by the desire of some in the Japanese government to maintain a nuclear weapons option. In fact, the Japanese government has studied the nuclear option at least four times since the mid-1960s (Ruble 2009b). The six-year gap to ratification was also related to concerns that the treaty could hurt Japan's indigenous nuclear energy industry; when Japan signed the NPT in 1970, one of the conditions for future ratification was equality in the field of civilian nuclear energy for peaceful purposes (Endicott 1977, 277). Due to its limited domestic natural energy resources, nuclear power was recognized as a promising option for Japan early in the nuclear age: Japan was one of the first nations to join the IAEA after the Agency's founding in 1957, showing an early commitment to nuclear energy research.

The Japanese nuclear industry and some government officials thought that the NPT and its safeguards could hurt their nascent industry. In a 1967 conversation between Japanese Foreign Minister Miki and US Secretary of State Dean Rusk, Miki reminded the Secretary that Japan required 100 million tons of oil annually, almost all of which was imported. As a result, Japan planned to become a "great power in the peaceful use of nuclear energy, and the NPT must not prevent this" (State Department Memorandum 1967, 2). In meetings to discuss Japanese reservations surrounding the proposed treaty in November 1967, American officials reported that many in the Japanese government and industry "wish[ed] that NPT would go away" (Department of State Telegram 1967). Japanese officials expressed concerns about the potential negative effects of the NPT on their nuclear industry, including industrial espionage, lost time due to compliance with safeguards, and the need to build new nuclear infrastructure (Department of State Telegram 1967). US officials reported that there were some in Japan who wanted to reserve the nuclear option, but that most critiques of the NPT stemmed from the nuclear industry.

In the summer of 1973, Japanese government representatives began to meet with the IAEA to discuss safeguards, a requirement of NPT membership. In 1975, Japan and the IAEA finally concluded a safeguards agreement. Overcoming this hurdle was a necessary factor in the Japanese consideration of NPT ratification. Also, in 1975, the United States began communicating to the Japanese government that the NPT was needed for US supply to continue. A US Deputy Secretary of State told the Japanese ambassador to the United States that ratification of the NPT would help Japan in seeking "cooperation on the peaceful uses of nuclear energy" (as cited by O'Mahoney 2018). In the same vein, later the same year, Henry Kissinger communicated to Japanese officials that joining the NPT would "simplify" the "US

export of certain nuclear-related materials and equipment to Japan” (as cited by O’Mahoney 2018). That summer, the United States also helped those promoting NPT ratification against hardliners in Japan by reiterating its security commitment to Japan. The NPT’s cause was bolstered further in 1975 when Yoshitake Sasaki, the Chairman of the Japanese Atomic Energy Commission and Director of the Science and Technology Agency, and Hiromi Arisawa, Chairman of the Japan Atomic Industrial Forum, came out in support of the treaty (Endicott 1977, 293).

US pressure regarding nuclear supply and reassurance as to its security commitments finally allowed those in Japan who favored NPT ratification to overcome domestic opposition, and Japan ratified the treaty in June 1976. After ratification, Prime Minister Miki met with President Ford and emphasized Japan’s interest in nuclear assistance: “Now that Japan has ratified the NPT, Mr. President, I wish to request the continued cooperation of the United States in Japan’s development of the peaceful use of nuclear energy, on which we will have to rely increasingly in the future as a source of power” (Memorandum of Conversation 1976).

Despite its membership in the NPT, the Japanese government has explored the implications of a Japanese nuclear weapons program since ratifying the treaty in 1976. In reaction to North Korea’s nuclear and missile programs, the Japanese government secretly studied a nuclear option in 1995. In concluding against a weapons program, one of the study’s three considerations was “fears it would violate the Nonproliferation Treaty” (quoted in Rublee 2009a, 70). Following North Korea’s first nuclear test in 2006, some Japanese leaders again explored the feasibility of a small Japanese nuclear arsenal (Watanabe 2006). This exploration of a potential nuclear program was notable, but it did not change Japanese policy and the public showed little interest in the development of a Japanese nuclear weapons program (Izumi and Furukawa 2007). The announcement of the 2006 study led one Japanese ambassador to reflect on the effects of pursuing a nuclear weapons program: “We might be sanctioned by the IAEA and the United States. We would face severe international criticism and isolation. We would never try to do that, because it would lead us back to the 1930s, when Japan withdrew from the League of Nations” (quoted in Rublee 2008, 437). While many factors contribute to Japan’s continued nonnuclear status—historical antinuclear sentiment, the US security guarantee, and an active peace culture—its obligation to the nuclear nonproliferation regime and the detrimental effects of breaking this commitment are significant considerations.

Egypt

Like Indonesia and Japan, Egypt once considered nuclear weapons, albeit not aggressively or persistently. The USSR successfully pressured the Egyptians to sign the NPT after Egyptian President Gamal Abdel Nasser requested nuclear weapons from the Chinese and the Soviets following significant losses in the 1967 Six-Day War (Rublee 2009a, 110–15). Though Egypt signed the treaty, it did not ratify for over a decade—not until it sought a nuclear energy program.

Egypt’s aspiration for a nuclear energy program in the 1970s and early 1980s was a major factor in President Anwar Sadat’s 1980 decision that Egypt would move forward with NPT ratification. After the 1973 Arab-Israeli War and the subsequent warming of relations with the United States, Egypt sought to develop a civilian nuclear program. Like Indonesia, Egypt was motivated by the 1973 oil crisis to seek alternative energy sources. Egyptian leaders discussed the purchase of nuclear reactors with a number of supplier states. On a visit to Cairo in 1974, President Richard Nixon offered to sell Egypt two 600-megawatt power reactors and to supply the reactors with nuclear fuel (Feldman 1997, 59). Nixon also offered a similar deal to Israel; under these agreements, both states were supposed to vow that future nuclear technology would be put under safeguards. A year later, Sadat initialed the deal in Washington (Feldman 1997, 59). In a September 1976 memorandum, National Security Advisor Brent Scowcroft explained to President Ford that the provisions were “similar” to those in other US NCAs at the time, but also included, “several special restrictions [that] are intended to ensure that the introduction of nuclear power into Israel and Egypt will occur under exceptionally safeguarded and controlled conditions” (Ahlberg, Kim, and Tudda 2015).

The Egyptian reactor sale languished amid negotiations over nuclear safeguards on the reactors. The increased emphasis on nonproliferation in the Carter White House and within Congress in the late 1970s further delayed the deal, as the Carter administration required safeguards on all US-supplied reactors. Without these safeguards, a requirement for NPT parties, Egypt was unlikely to receive the two US-supplied reactors.

In February 1980, following the successful Camp David Accords, President Carter refused to make an exception for Egypt on the policy that only NPT members could access special financing on the sale of US nuclear power reactors (Einhorn 2004, 50). According to Robert Einhorn (2004, 50–51), it was at this point that Egyptian leaders realized they would have to accede to the NPT to access the nuclear technology they sought. Sadat announced in December 1980 that Egypt would

ratify the NPT (Walsh 2001, 182). During discussions over ratification in February 1981, the Egyptian Foreign Minister told members of the legislature, “Egypt found itself unable to develop its electric power through access to nuclear energy unless it ratified the Non-Proliferation Treaty” (Einhorn 2004, 50–51). Soon after ratification, Egypt signed a deal to buy two reactors from the French. Egypt also began discussing a deal with the British and West Germans for reactors and sought to reopen the reactor deal with the United States. In June 1981, seven years after Nixon’s offer and four months after Egypt’s NPT ratification, Washington signed a deal to supply Egypt with two reactors (Feldman 1982, 72). The flurry of activity in seeking nuclear reactor deals right after NPT ascension suggests that Egypt’s ratification was motivated by a desire for civilian nuclear technology—a goal that was made more difficult by the restrictions on nuclear sales promoted by the United States.⁸

At the time of Egypt’s consideration of the NPT, there were those in the government who wanted to maintain a nuclear weapons option (Einhorn 2004, 50). Without the obstacles created by NPT membership—international inspections, the need for a deeply secret program, and the prospect of punishment from the international community—it is possible that these voices could have been able to gain traction within Egypt at some point in the future. In fact, some in the Egyptian nuclear establishment went on to conduct secret experiments with plutonium after Cairo ratified the NPT. Per Egypt’s safeguards agreement with the IAEA, these sensitive experiments should have been declared. Though there was a delay in the IAEA’s discovery of these experiments, their inspectorate eventually learned of the experiments and conducted a deeper investigation into Egypt’s nuclear activities (Kerr 2005). This episode serves to reveal the challenges of conducting clandestine nuclear activities while a member of the NPT.

8 The Egyptian nuclear energy program envisioned by Anwar Sadat did not come to fruition. Though Egypt maintains one of the most developed nuclear infrastructures in its region with a regulatory agency and a number of nuclear-related sites for medical and research purposes, it does not have large-scale electricity-generating capabilities. The plan for the one reactor under construction, at El Dabaa, was abandoned following the 1986 Chernobyl disaster (World Nuclear Association 2019). In 2006, President Mubarak’s son announced that Egypt was again pursuing a nuclear energy program (Slackman and El-naggar 2006). President Abdel Fattah el-Sisi has continued the drive for indigenous nuclear power (Markey and Tsvetkova 2017).

Conclusion and Implications

The case sketches above illustrate how nuclear assistance has been used to bring states into the nuclear nonproliferation regime. Contrary to the implications of recent research on the supply-side of nuclear proliferation, offers of nuclear assistance can support nuclear nonproliferation goals. While the dual-use nature of nuclear information, materials, and technology means there is always an inherent risk in aiding states with civilian nuclear programs, without the ability to offer nuclear technology, it would be less likely that some states would have joined nuclear nonproliferation agreements in the first place.

In the future, scholarship on nuclear supply should account for the fact that nuclear assistance can both encourage and discourage nuclear weapons proliferation. Furthermore, scholars must pay more attention to differences in nuclear supply across the nuclear age; those seeking nuclear technology in the 2000s face a much different environment than that of the 1950s and 1960s, and even the 1980s.

This research suggests that supply-side factors may become less relevant to nuclear weapons proliferation in the current era, as the majority of states have joined the NPT, and suppliers are supposed to follow more rigid supply standards as members of the Nuclear Suppliers Group.⁹ This is a good-news story for nonproliferation, but one that is contingent on the maintenance of nonproliferation agreements. Thus, the first and most obvious policy implication of this research is for the United States and its allies to sustain their commitment to promoting the health of the nuclear nonproliferation regime.

The positive effects of nuclear assistance on nonproliferation suggest a second important policy lesson for the United States and its allies: attempt to regain and maintain a competitive nuclear industry. When US and allied technology is desirable, the nonproliferation regime benefits. Indonesia, Japan, Egypt, and several other states joined the NPT in part to receive nuclear technology from Western suppliers. Today, Egypt is purchasing its nuclear technology from Russia and China and has not agreed to the most stringent IAEA safeguards agreement, the Additional Protocol. If suppliers less concerned with nonproliferation have better technology or offer more favorable agreements than the United States and its allies, the nuclear nonproliferation regime could be weakened.

Unfortunately, the US nuclear industry has stagnated for a number of reasons, including cheaper fossil fuels,

9 An additional reason why foreign supply may be less relevant today is the ability of states to build indigenous nuclear technology, a worrying prospect for nuclear nonproliferation explored by Kemp (2014).

high operating costs, the persistent problem of waste disposal, and a complicated export process. The United States operates more domestic nuclear power plants than any other country in the world, but its reactor fleet is aging, and there are few new plants in the pipeline. In 2014, the Organisation for Economic Co-operation and Development's International Energy Agency wrote that the US nuclear industry was at a "critical juncture as a consequence of its declining economic competitiveness, and existing market mechanisms do not favour investment in high capital-intensive nuclear technology" (as cited in [Schneider and Frogatt 2015](#)). A stagnating domestic industry hurts innovation in the long-term and undermines the appeal of US nuclear exports.

Those knowledgeable of the US nuclear industry have a number of suggestions for increasing American competitiveness, including improving financing for nuclear projects and reforming and streamlining export regulations.¹⁰ Evaluating those proposals is beyond the scope of this article, but this research has shown that exporting civilian nuclear technology has been a beneficial nuclear nonproliferation tool for the United States. Absent a strong indigenous industry, the United States must work with US allies and partners to maintain strong nonproliferation standards for selling nuclear technology.

Russia is a major competitor in supplying nuclear energy technology and may not require the same safeguards standards as the United States. At present, Russia is focused on fostering its nuclear export business and is building or is slated to build twenty reactors globally ([World Nuclear Association 2018b](#)). Russia's state-owned Rosatom firm provides favorable financing and has less government oversight than comparable Western suppliers. US companies are limited to selling reactors to the forty-six states where the United States has NCAs, agreements that support US nonproliferation goals. Russia has no such restrictions; the nation's current dominance in the nuclear supply market is particularly worrisome as Russia is becoming less cooperative in nuclear nonproliferation matters, especially since its annexation of Crimea ([Einhorn 2016](#)). Building nuclear reactors in foreign states is a complicated and complex business, but the United States and its allies are in a better position to promote nuclear nonproliferation with competitive nuclear industries.

Acknowledgements

The author would like to thank the following people for providing helpful comments on earlier drafts of this

article: Molly Berkemeier, Matthew Fuhrmann, Eliza Gheorghe, Sidra Hamidi, Jeffrey Kaplow, Jooeun Kim, Matthew Kroenig, Carrie Lee, Martin Malin, Eleonora Mattiacci, Rupal Mehta, Nicholas Miller, Paige Price, Abigail Post, Megan Stewart, Luciana Storelli-Castro, Rachel Whitlark, Benjamin Zala, and the two anonymous reviewers.

References

- Ahlberg, Kristin L., Bonnie Sue Kim and Chris Tudda, eds. 2015. *Foreign Relations of the United States, Documents on Arms Control and Nonproliferation, 1973–1976*, Document 209. Washington, DC: United States Government Printing Office.
- Albright, David, and Corey Hinderstein. 2001. "Algeria: Big Deal in the Desert?" *Bulletin of the Atomic Scientists* 57 (3): 45–52.
- Bell, Mark S. 2016. "Examining Explanations for Nuclear Proliferation." *International Studies Quarterly* 60 (3): 520–29.
- Bleek, Philipp C. 2017. "When Did (and Didn't) States Proliferate? Chronicling the Spread of Nuclear Weapons." Discussion Paper. Cambridge, MA: Project on Managing the Atom, Belfer Center for Science and International Affairs, Harvard Kennedy School and the James Martin Center for Nonproliferation Studies, Middlebury Institute of International Studies, Monterey, CA.
- Bluth, Christoph, Matthew Kroenig, Rensselaer Lee, and William Sailor 2010. "Correspondence: Civilian Nuclear Cooperation and the Proliferation of Nuclear Weapons." *International Security* 35 (1): 184–200.
- Braut-Hegghammer, Målfrid. 2016. *Unclear Physics Why Iraq and Libya Failed to Build Nuclear Weapons*. Ithaca, NY: Cornell University Press.
- Brown, Robert L., and Jeffrey M. Kaplow. 2014. "Talking Peace, Making Weapons: IAEA Technical Cooperation and Nuclear Proliferation." *Journal of Conflict Resolution* 58 (3): 402–28.
- Burr, William. 2005. "National Intelligence Estimates of the Nuclear Proliferation Problem: The First Ten Years, 1957–1967." National Security Archive Electronic Briefing Book No. 155, Accessed June 3, 2018. <https://nsarchive2.gwu.edu/NSAEBB/NSAEBB155/prolif-12.pdf>.
- Cole, Paul M. 1997. "Atomic Bombast: Nuclear Weapon Decision-Making in Sweden, 1946–72." *Washington Quarterly* 20 (2): 233–51.
- Cornejo, Robert M. 2000. "When Sukarno Sought the Bomb: Indonesian Nuclear Aspirations in the Mid-1960s." *Nonproliferation Review* 7 (2): 31–43.
- "Country Hopes to Have Nuclear Power station by 1985." 1974. Daily Report (Jakarta), March 4. FBIS: Asia & Pacific: N1.
- Countryman, Thomas. 2014. "Section 123: Civilian Nuclear Cooperation Agreements." *Committee on Foreign Relations, United States Senate*, Washington, DC, January 30. Accessed August 20, 2018. <https://www.gpo.gov/fdsys/pkg/CHRG-113shrg93467/html/CHRG-113shrg93467.htm>.
- Debs, Alexandre, and Nuno P. Monteiro. 2016. *Nuclear Politics: The Strategic Causes of Proliferation*. Cambridge: Cambridge University Press.

10 For example, see [Daniel S. Lipman \(2014\)](#).

- “Department of State Telegram from Ambassador to Japan to Secretary of State Dean Rusk.” 1967. US-Japan NPT Experts meeting (Secret), NPT Japan 1966 & 1967 (folder), Director’s Office NPT Files (383/77/043), Box 4 of 9, National Archives, College Park, Maryland.
- Drezner, Daniel W. 1999. “The Trouble with Carrots: Transition Costs, Conflict Expectations, and Economic Inducements.” *Security Studies* 9 (1/2): 188–218.
- Einhorn, Robert J. 2004. “Egypt: Frustrated But Still on a Non-Nuclear Course.” In *The Nuclear Tipping Point*, edited by Kurt M. Campbell, Robert J. Einhorn and Mitchell B. Reiss, 43–82. Washington, DC: Brookings Institution Press.
- . 2016. “Prospects for U.S.-Russian Nonproliferation Cooperation.” Washington, DC: Brookings Institution.
- Endicott, John E. 1977. “The 1975–76 Debate Over Ratification of the NPT in Japan.” *Asian Survey* 17 (3): 275–92.
- “Evaluation of the U.S. Efforts to Promote Nuclear Non-Proliferation Treaty.” 1980. Report to Congress by the Comptroller General to the United States, Washington DC, July 31.
- Feldman, Shai. 1982. *Israel’s Nuclear Deterrence: A Strategy for the 1980s*. New York: Columbia University Press.
- . 1997. *Nuclear Weapons and Arms Control in the Middle East*. Cambridge, MA: MIT Press.
- Forland, Astrid. 1997. “Norway’s Nuclear Odyssey: From Optimistic Proponent to Nonproliferator.” *Nonproliferation Review* 4 (2): 1–16.
- Fuhrmann, Matthew. 2008. “Exporting Mass Destruction? The Determinants of Dual Use Trade.” *Journal of Peace Research* 45 (5): 633–52.
- . 2009a. “Spreading Temptation: Proliferation and Peaceful Nuclear Cooperation Agreements.” *International Security* 34 (1): 7–41.
- . 2009b. “Taking a Walk on the Supply Side: The Determinants of Civilian Nuclear Cooperation.” *Journal of Conflict Resolution* 53 (2): 181–208.
- . 2012. *Atomic Assistance: How “Atoms for Peace” Programs Cause Nuclear Insecurity*. Ithaca, NY: Cornell University Press.
- Gartzke, Erik, and Matthew Kroenig. 2009. “A Strategic Approach to Nuclear Proliferation.” *Journal of Conflict Resolution* 53 (2): 151–60.
- “Government Faces Ratification of the Nuclear Non-proliferation Treaty.” 1978. Daily Report (Jakarta), August 19. FBIS: Asia & Pacific: N1.
- Government of Canada. 1985. “Canada’s Nuclear Nonproliferation Policy.” External Information Programs Division, Department of External Affairs, Government of Canada. Accessed July 22, 2018. https://inis.iaea.org/collection/NCLCollectionStore/_Public/21/020/21020770.pdf.
- Hibbs, Mark, and Neal Sandler Bonn. 1991. “Safeguards Concerns Delay IAEA Approval of Syrian Reactor.” *Platts Nuclear Week* 32 (50): 1.
- IAEA. 1980. “The Text of the Agreement of 14 July 1980 Between Indonesia and the Agency for the Applications of Safeguards in Connections with the Treaty on the non-proliferation of Nuclear Weapons.” *International Atomic Energy Agency*. Accessed November 4, 2019. <https://www.iaea.org/publications/documents/infcircs/text-agreement-14-july-1980-between-indonesia-and-agency-application-safeguards-connection-treaty-non-proliferation-nuclear-weapons>.
- . 2009. “Research Reactor Details - GA Siwabessy MPR.” International Atomic Energy Agency. Accessed June 22, 2018. http://www-naweb.iaea.org/Napc/Physics/Research_Reactors/Database/Rr%20data%20base/Datasets/Report/Indonesia,%20Republic%20of%20%20Research%20Reactor%20Details%20-%20GA%20SIWABESSY%20MPR.Htm.
- “Indonesia Plans to Develop Nuclear Industry.” 1974. Daily Report (Jakarta Domestic Service), July 4. FBIS: Asia & Pacific: N1.
- International Institute for Strategic Studies. 2008. *Nuclear Programmes in the Middle East: In the Shadow of Iran*. London: IISS.
- Izumi, Hajime, and Katusuhisa Furukawa. 2007. “Not Going Nuclear: Japan’s Response to North Korea’s Nuclear Test.” *Arms Control Today* 37 (6): 51–6.
- Johnston, Alastair Iain. 2007. *Social States: China in International Institutions, 1980–2000*. Princeton, NJ: Princeton University Press.
- Jonter, Thomas. 2012. “The United States and Swedish Plans to Build the Bomb.” In *Security Assurances and Nuclear Non-proliferation*, edited by Jeffrey W. Knopf, 219–345. Stanford, CA: Stanford University Press.
- Kay, David. 2005. “Denial and Deception Practices of WMD Proliferators: Iraq and Beyond.” *Washington Quarterly* 18 (1): 85–105.
- Kemp, R. Scott. 2014. “The Nonproliferation Emperor Has No Clothes: The Gas Centrifuge, Supply-Side Controls, and the Future of Nuclear Proliferation.” *International Security* 38 (4): 39–78.
- Kennedy, John F. 1963. “Press Conference 52, State Department Auditorium, March 21, 1963.” *John F. Kennedy Presidential Library and Museum*. Accessed June 15, 2018. <https://www.jfklibrary.org/archives/other-resources/john-f-kennedy-press-conferences/news-conference-52>.
- Kerr, Paul. 2005. “IAEA: Egypt’s Reporting Failures ‘Matter of Concern.’” *Arms Control Today*, March 1. Accessed July 22, 2018. <https://www.armscontrol.org/print/1753>.
- Kroenig, Matthew. 2009a. “Exporting the Bomb: Why States Provide Sensitive Nuclear Assistance.” *American Political Science Review* 103 (1): 113–33.
- . 2009b. “Importing the Bomb: Sensitive Nuclear Assistance and Nuclear Proliferation.” *Journal of Conflict Resolution* 53 (2): 161–80.
- . 2010. *Exporting the Bomb: Technology Transfer and the Spread of Nuclear Weapons*. Ithaca, NY: Cornell University Press.
- Lanoszka, Alexander. 2018. “Nuclear Proliferation and Nonproliferation Among Soviet Allies.” *Journal of Global Security Studies* 3 (2): 217–33.

- Liberman, Peter. 2001. "The Rise and Fall of the South African Bomb." *International Security* 26 (2): 45–86.
- Lipman, Daniel S. 2014. "Statement for the Record, Space and Technology Subcommittee on Energy, US House of Representatives." Last modified December 11, 2014. Accessed April 14, 2016. <http://www.nei.org/CorporateSite/media/filefolder/Federal-State-Local-Policy/Testimony/NEItestimonyHouseScienceDec2014.pdf?ext=.pdf>.
- Mansourov, Alexandre Y. 1995. "The Origins, Evolution, and Current Politics of the North Korean Nuclear Program." *Nonproliferation Review* 2 (3): 25–38.
- Markey, Patrick, and Maria Tsvetkova. 2017. "Putin, Egypt's Sisi Discuss Restart of Flights, Pen Nuclear Deal." *Reuters*, December 11. <https://www.reuters.com/article/us-egypt-russia/putin-egypts-sisi-discuss-restart-of-flights-sign-nuclear-deal-idUSKBN1E51BR>.
- "Memorandum for S – The Secretary, Analytical Staff Meeting, (Secret) July 11, 1973." 1973. NSA Presidential Transition File, Box 1 (digitized), Gerald R. Ford Presidential Library. Accessed June 15, 2018. <http://www.fordlibrarymuseum.gov/library/document/0353/1555879.pdf>.
- "Memorandum of Conversation, Ford-Miki Luncheon Conversation." 1976. *State Dining Room*, White House, Washington, DC. Accessed July 15, 2015. <http://www.fordlibrarymuseum.gov/library/document/0314/1553489.pdf>.
- Miller, Nicholas L. 2014. "The Secret Success of Nonproliferation Sanctions." *International Organization* 68 (4): 913–44.
- . 2017. "Why Nuclear Energy Rarely Leads to Proliferation." *International Security* 42 (2): 40–77.
- . 2018. *Stopping the Bomb: The Sources and Effectiveness of US Nonproliferation Policy*. Ithaca, NY: Cornell University Press.
- "Minister Says Larger Nuclear Reactor Needed for Research." 1978. Daily Report (Jakarta), November 17. FBIS: Asia & Pacific: N2.
- Montgomery, Alexander H. 2013. "Stop Helping Me: When Nuclear Assistance Impedes Nuclear Programs." In *The Nuclear Renaissance and International Security*, edited by Adam Stulberg and Matthew Fuhrmann, 177–202. Stanford, CA: Stanford University Press.
- Nuti, Leopoldo. 2017. "Italy as a Hedging State? The Problematic Ratification of the Non-Proliferation Treaty." In *Nuclear Italy. An International History of Italian Nuclear Policies during the Cold War*, edited by Elisabetta Bini and Igor Londero, 119–39. Trieste, EUT Edizioni Università di Trieste.
- O'Mahoney, Joseph. 2018. "When Breaking the Norm Strengthens the Norm: India's 1974 Nuclear Explosion and the Nuclear Nonproliferation Treaty." Presented at the American Political Science Association Annual Meeting, Boston, Massachusetts.
- Patrikarakos, David. 2012. *Nuclear Iran: The Birth of an Atomic State*. New York: I.B. Tauris & Co. Ltd.
- Poneman, Daniel. 1981. "Nuclear Policies in Developing Countries." *International Affairs* 57 (4): 568–58.
- Potter, William, Djuro Miljanic, and Ivo Slaus. 2000. "Tito's Nuclear Legacy." *Bulletin of the Atomic Scientists* 56 (2): 63–70.
- Reynolds, Wayne and David Lee, eds. 2013. "Australia and the Nuclear Non-Proliferation Treaty, 1945–74." Australian Department of Foreign Affairs and Trade. Accessed June 22, 2018. <https://dfat.gov.au/about-us/publications/historical-documents/Documents/australia-and-the-nuclear-non-proliferation-treaty.pdf>.
- Rublee, Maria Rost. 2008. "Taking Stock of the Nuclear Nonproliferation Regime: Using Social Psychology to Understand Regime Effectiveness." *International Studies Review* 10 (3): 420–50.
- . 2009a. *Nonproliferation Norms: Why States Choose Nuclear Restraint*. Athens: University of Georgia Press.
- . 2009b. "The Future of Japanese Nuclear Policy" Strategic Insights, 8. <http://edocs.nps.edu/npspubs/institutional/newsletters/strategic%20insight/2009/rubleApr09.pdf>.
- Sagan, Scott D. 1996/1997. "Why Do States Build Nuclear Weapons?: Three Models in Search of a Bomb." *International Security* 21 (3): 54–86.
- . 2011. "The Causes of Nuclear Weapons Proliferation." *Annual Review of Political Science* 14 (1): 225–44.
- Schneider, Mycle, and Antony Froggatt. 2015. World Nuclear Industry Status Report 2015. <http://www.worldnuclearreport.org/IMG/pdf/20151023MSC-WNISR2015-V4-LR.pdf>.
- Slackman, Michael, and Mona El-naggar. 2006. "Mubarak's Son Proposes Nuclear Program." *New York Times*, September 20. <https://www.nytimes.com/2006/09/20/world/africa/20egypt.html>.
- Solingen, Etel. 2007. *Nuclear Logics: Contrasting Paths in East Asia and the Middle East*. Princeton, NJ, Princeton University Press.
- Spektor, Matias. 2016. "The Evolution of Brazil's Nuclear Intentions." *Nonproliferation Review* 23 (5–6): 635–52.
- "State Department, Memorandum of Conversation between Takeo Miki, Foreign Minister of Japan and the Secretary of State, Non-proliferation Treaty (Part II of II) (Secret)." 1967. NPT Japan 1966 & 1967 (folder), Director's Office NPT Files (383/77/043), Box 4 of 9, National Archives, College Park, Maryland.
- Stussi, Jürg. 1996. "Historical Outline on the Question of Swiss Nuclear Armament." Accessed July 22, 2018. <http://www.alexandria.admin.ch/bv001147186.pdf>.
- Tudda, Chris and Adam M. Howard, eds. 2015. *Foreign Relations of the United States, 1977–1980, Volume XXVI, Arms Control and Nonproliferation, Document 426*. Washington, DC: United States Government Printing Office.
- United States State Department Bureau of Public Affairs. 2009. "UAE Agreement for Peaceful Nuclear Cooperation (123 Agreement)." Last modified May 21, 2009. Accessed June 22, 2018. <http://www.state.gov/r/pa/prs/ps/2009/05/123747.htm>.
- UN Office for Disarmament Affairs (UNODA). 1979. "Indonesia: Ratification of Treaty on the Non-Proliferation of Nuclear Weapons (NPT)." Accessed June 3, 2018. <https://disarmament.un.org/treaties/a/npt/indonesia/rat/washington>.
- Walsh, James Joseph. "Bombs Unbuilt: Power, Ideas, and Institutions in International Politics." PhD dissertation, MIT, 2001.

- Watanabe, Chisaki. 2006. "Report: Japan Looked At Nuke Development." *Associated Press*, December 25. http://www.washingtonpost.com/wp-dyn/content/article/2006/12/25/AR2006122500059_pf.html.
- World Nuclear Association. 2018a. "Emerging Nuclear Energy Countries." Accessed October 5, 2018. <http://www.world-nuclear.org/information-library/country-profiles/others/emerging-nuclear-energy-countries.aspx>.
- . 2018b. "Nuclear Power in Russia." Accessed October 5, 2018. <http://www.world-nuclear.org/information-library/country-profiles/countries-o-s/russia-nuclear-power.aspx>.
- . 2019. "Nuclear Power in Egypt." Accessed November 4, 2019. <https://www.world-nuclear.org/information-library/country-profiles/countries-a-f/egypt.aspx>.