

The Secret Success of Nonproliferation Sanctions

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Forthcoming, *International Organization*, Fall 2014

ABSTRACT: Building on the rationalist literature on sanctions, this article argues that economic and political sanctions are a successful tool of nonproliferation policy, but that selection effects have rendered this success largely hidden. Since the late 1970s—when the U.S. made the threat of sanctions credible through congressional legislation and began regularly employing sanctions against proliferating states—sanctions have been ineffective in halting ongoing nuclear weapons programs, but they have succeeded in deterring states from starting nuclear weapons programs in the first place and have thus contributed to a decline in the rate of nuclear pursuit. The logic of the argument is simple: rational leaders assess the risk of sanctions before initiating a nuclear weapons program, which produces a selection effect whereby states highly vulnerable to sanctions are deterred from starting nuclear weapons programs in the first place, so long as the threat is credible. Vulnerability is a function of a state's level of economic and security dependence on the U.S.—states with greater dependence have more to lose from U.S. sanctions and are more likely to be sensitive to U.S.-sponsored norms. The end result of this selection effect is that since the U.S. made the threat of sanctions credible in the late 1970s, only insulated, inward-looking regimes have pursued nuclear weapons and become the target of imposed sanctions, thus rendering the observed success rate of nonproliferation sanctions low. I find support for the argument based on statistical analysis of a global sample of countries from 1950-2000, an original dataset of U.S. nonproliferation sanctions episodes, and qualitative analysis of the South Korean and Taiwanese nuclear weapons programs.

Acknowledgements

The author thanks Daniel Altman, Mark Bell, Eugenie Carabatsos, Fotini Christia, Christopher Clary, Chad Hazlett, David Jae, Vipin Narang, Kai Quek, participants in the MIT International Relations Working Group, and the editor and two anonymous reviewers for comments and suggestions. Upon publication, the dataset and code necessary to replicate the analysis will be posted at <http://dvn.iq.harvard.edu/dvn/>.

Starting in the 1970s and continuing to sanctions against Iran in the present day, policymakers have long considered sanctions central to U.S. efforts to halt nuclear proliferation and have employed them regularly. Many scholars of nonproliferation are similarly optimistic about the role of sanctions, arguing they are an important component of the nonproliferation policy toolkit.¹ Despite their centrality to U.S. nonproliferation policy, the efficacy of these efforts—which include financial and trade restrictions, economic and military aid cutoffs, termination of peaceful nuclear cooperation, as well as threats to weaken military alliance relationships—remains hotly debated. This disagreement is reflected in policy debates over sanctions on Iran,² recent scholarly work on sanctions and nuclear proliferation,³ and an extensive literature that argues sanctions are generally ineffective.⁴

As in other policy realms, selection effects pose an obstacle to assessing the efficacy of sanctions in nonproliferation.⁵ As the editor of a recent volume on the topic observes, “selection effects entail the plausibility that sanctions are only applied in instances where targets estimate (correctly or incorrectly) that sanctions will not work in their own particular case.”⁶ In other words, if states expect that sanctions are likely and too costly to endure, they may abstain from nuclear proliferation in the first place, which may mean that sanctions succeed before they are even implemented—biasing downward our estimates of sanctions’ efficacy. However, much like early work on economic sanctions that focused on cases where sanctions were imposed rather

¹ Campbell and Einhorn 2004; Braun and Chyba 2004, 43-45; Montgomery 2005, 181-182; Sagan 1996-1997, 72; Solingen 2007, 289-299; and Levite 2002-2003, 78-80.

² Recent examples include Esfandiary and Fitzpatrick 2011; and Maloney 2010.

³ Solingen 2012.

⁴ See Galtung 1967; Lindsay 1986; Pape 1997; Morgan and Schwebach 1997; Drezner 1998; Drezner 2003; and Lacy and Niou 2004.

⁵ See Fearon 2002

⁶ Solingen 2012a, 8. Also see pages 299-301.

than threatened,⁷ the literature on nonproliferation has focused almost entirely on cases where sanctions were imposed.⁸ While this is an important topic of inquiry, on its own it cannot settle the issue of sanctions' efficacy as an overall policy.

Building on the rationalist literature on sanctions, this article incorporates the selection effects issue into the theoretical argument and systematically tests its observational implications. I argue that economic and political sanctions are indeed a successful nonproliferation tool, but that selection effects have rendered this success largely hidden. I provide evidence that since late 1970s—when the U.S. made clear through congressional legislation that positive economic and security relations with the United States were contingent on nonproliferation and began regularly employing sanctions against proliferating states—sanctions have been ineffective in halting *ongoing* nuclear weapons programs, but have succeeded in *detering* states from starting nuclear weapons programs in the first place and have thus contributed to a decline in the rate of nuclear pursuit.⁹ The logic is simple: rational leaders assess the risk of sanctions *before* initiating a nuclear weapons program, which produces a selection effect whereby states highly vulnerable to sanctions are deterred from starting nuclear weapons programs in the first place, so long as the threat is credible. Vulnerability is a function of a state's level of economic and security dependence on the U.S.—states with greater dependence have more to lose from U.S. sanctions and are more likely to be sensitive to U.S.-sponsored norms. The end result of this selection effect is that since the U.S. made the threat of sanctions credible in the late 1970s, only insulated, inward-looking regimes with few ties to the U.S. have pursued nuclear weapons and become the

⁷ Most prominently, Hufbauer, Scott, and Elliott 1990; and Pape 1997.

⁸ See Solingen 2012 for the most recent work in this tradition.

⁹ For a visualization of the decline, see Sagan 2011, c2.

target of imposed sanctions, rendering the observed success rate of nonproliferation sanctions low.¹⁰

To evaluate this argument, this article tests three key observable implications: (1) controlling for other predictors of proliferation, states dependent on the U.S. economically and militarily should be significantly less likely to pursue nuclear weapons, but only since the threat of sanctions became credible in the late 1970s, (2) the observed success rate of sanctions threatened or imposed against ongoing nuclear programs should be low, and (3) the rare cases of observed sanctions success should be largely confined to instances where states dependent on the U.S. underestimated the risk of sanctions when initiating their nuclear pursuit. Utilizing quantitative analysis on a global sample of countries from 1950-2000, an original dataset of all U.S. nonproliferation sanctions episodes, and historical analysis of South Korean and Taiwanese nuclear programs drawing on U.S. archival documents, this article finds strong support for the theoretical argument.

Existing Literature on Sanctions and Nuclear Proliferation

A large body of literature examines the efficacy of economic sanctions, and while some scholars are relatively optimistic about the efficacy of imposing sanctions,¹¹ the majority view is that sanctions are usually ineffective in securing the desired behavioral changes from the target state.¹² The arguments for why imposed sanctions are unsuccessful fall into three different

¹⁰ Although multilateral sanctions have been imposed against recent proliferators such as North Korea and Iran, I focus on the U.S. since they have taken the lead in virtually all nonproliferation sanctions campaigns, have been by far the most frequent imposer of nonproliferation sanctions and have the most longstanding and clearly articulated sanctions regime and policies. Based on data from Hufbauer, Schott, Elliott, and Oegg 2008, Of 21 cases of sanctions related to nuclear proliferation identified through 2006, 14 (67%) were imposed by the U.S.

¹¹ For example, see Baldwin 1985; Hufbauer, Schott, and Elliott 1990, and Baldwin 1999-2000.

¹² On measuring efficacy, see Baldwin 1999-2000.

camps, and suggest different policy implications. First are those who argue that nationalism and the possibility of substitution allow states to weather economic disruption.¹³ Second are those arguing that domestic political incentives or international conflict expectations lead sanctions to be poorly designed and targeted—thus, it is not that sanctions are inherently ineffective but rather that policymakers implement them in imperfect ways.¹⁴ Finally, and most relevant to this article’s argument, a third group of scholars focuses on the rational calculations of leaders and the incentives for reaching a bargain prior to the imposition of sanctions. Their intuition is that rational states consider the future costs of sanctions when weighing their options—the result is that those who are particularly vulnerable to the sanctions will concede at the mere threat rather than defying the sender and enduring the costs.¹⁵

Turning to the literature on nuclear proliferation, extant work has identified three classes of motivations for proliferation: security, domestic politics, and norms.¹⁶ More precisely, states pursue nuclear weapons in order to (1) ensure their security against nuclear or overwhelming conventional threats,¹⁷ (2) serve domestic bureaucratic or political interests,¹⁸ or (3) build international prestige or fulfill conceptions of national identity.¹⁹ Consequently, states may renounce nuclear weapons programs when they promise to harm rather than help their security, threaten domestic political or bureaucratic interests, or when nuclear proliferation is believed to violate an important international norm or contradict a state’s national identity. Apart from motivations for proliferation, recent work has examined how peaceful nuclear cooperation and

¹³ See Galtung 1967; Lindsay 1986; Pape 1997.

¹⁴ Kaempfer and Lowenberg 1988; Hiscox 2011; Lindsay 1986, 153-154; Whang 2011; and Drezner 1998, 710-711

¹⁵ Lacy and Niou 2004; Drezner 2003; Hovi, Huseby, and Sprinz 2005

¹⁶ This trinity of motivations was originally suggested in Sagan 1996-1997. Also see Paul 2000; Meyer 1984; Jo and Gartzke 2007; and Singh and Way 2004.

¹⁷ Thayer 1995.

¹⁸ Solingen 2007

¹⁹ Hymans 2006.

sensitive nuclear assistance provide a supply-side impetus for the pursuit and acquisition of nuclear weapons.²⁰ However, no extant work systematically examines how dependence on the U.S. deters nuclear pursuit by the threat of sanctions; indeed, the role of U.S. nonproliferation policy and strategic interaction between potential proliferators and opponents of proliferation is largely absent from the literature.

Argument and Methods

Building on the rationalist work on economic sanctions, I argue that the key to understanding the dynamics of sanctions in nonproliferation is that rational leaders consider the risk of sanctions *before* initiating a nuclear weapons program. If the probability and cost of sanctions are sufficiently high for a given state—in particular, if they are highly dependent on the U.S. and the threat of sanctions is credible—they will not pursue nuclear weapons at all and no explicit threat of sanctions will be needed. In other words, the selection effect is one step further removed than the rationalist work on economic sanctions suggests: states can be deterred even prior to an explicitly targeted threat. As Drezner notes, “It is quite likely that potential targets try to comply with U.S. demands before the articulation of a threat...There may...be instances in which a target refrains from acting against the sender’s preferences because of the anticipation of sanctions.”²¹

The threat of sanctions can help deter proliferation by states dependent on the U.S. through each of the three pathways of proliferation identified in the literature: security, domestic politics, and norms. First, in terms of security, states dependent on U.S. troops or military aid are likely to think twice about proliferating if it threatens to jeopardize these important relations with

²⁰ See Fuhrmann 2009 and Kroenig 2009.

²¹ Drezner 2003, 653-655.

the U.S. Thus, while states may desire nuclear weapons in order to ensure security against nuclear or conventional threats, they may be unwilling to accept the window of vulnerability that would occur if they started a nuclear weapons program and lost American troop commitments and military aid shortly thereafter—the average time to completing a nuclear weapons program (among those who succeeded in building the bomb) is not short: about 10 years.²²

Second, in terms of domestic politics, recent work by Solingen has highlighted how regimes whose political coalitions depend on the international economy are less likely to pursue nuclear weapons since it poses risks to their internationalist agenda.²³ The threat of sanctions is clearly relevant here: ruling coalitions relying on trade or foreign aid from the U.S. are likely to oppose a nuclear program in order to avoid costly trade embargos or aid cutoffs that may threaten their political survival. Alternately, domestic nuclear scientists and bureaucrats whose work is advanced through international nuclear cooperation may oppose the initiation of a nuclear weapons program since it jeopardizes international assistance.²⁴

Finally, in terms of norms, sanctions ought to be equally critical. While much of the international relations literature has focused on the moral, ideational, and sociological sources of norms,²⁵ there is an extensive literature in international relations and other disciplines that argues norms derive much of their power from sanctions that serve as enforcement mechanisms.²⁶ Finnemore and Sikkink note that socialization is the primary mechanism of a norm cascade, and that “in the context of international politics, socialization involves diplomatic praise or censure,

²² Data for this calculation are from Way 2011.

²³ Solingen 2007.

²⁴ Hymans 2011. It should be noted that other scholars, for example Fuhrmann 2009, argue that international nuclear cooperation may spur nuclear weapons programs.

²⁵ See Finnemore 1996; Nadelmann 1990; Barnett and Finnemore 1999; and Tannenwald 2006.

²⁶ See Axelrod 1986; Heckathorn, 1988; Goertz and Diehl 1992; and Fehr and Fischbacher 2004.

either bilateral or multilateral, which is reinforced by material sanctions and incentives.”²⁷ Goertz and Diehl observe that even if norms become internalized, the fact remains that “in virtually all cases of functioning norms, there seem to be some sanctions.”²⁸ Drawing on this research, we should expect that the credibility of and vulnerability to sanctions should strengthen norms against proliferation, helping to deter nuclear pursuit.

This argument suggests that a serious selection effect is at play. As Fearon explains, “selection effects occur when factors that influence the choices that produce cases also influence the outcome or dependent variable for each case.”²⁹ Thus, when the threat of sanctions is credible, dependence on the U.S. is likely to influence both (1) whether a state starts a nuclear weapons program (and thus becomes a possible observed case of nonproliferation sanctions) *and* (2) whether that state concedes in the face of sanctions that are ultimately threatened or imposed.³⁰ The result of this selection effect is that states vulnerable to sanctions are likely to be deterred from *initiating* nuclear weapons programs; meanwhile, those that choose to initiate them are likely to be precisely those states that are *least vulnerable* to sanctions (and therefore unlikely to make major concessions). A natural question arises: Why does the U.S. continue to impose sanctions in cases where it is likely to fail? The answer, simply, is that a reputation for imposing sanctions is necessary for future threats to successfully deter.³¹

In order to test this argument, I explore multiple observable implications using a variety

²⁷ Finnemore and Sikkink 1998, 902.

²⁸ Goertz and Diehl 1992, 638.

²⁹ Fearon 2002, 7.

³⁰ The target’s dependence on the U.S. is also likely to be correlated with the costs of the sanctions to the U.S. Imposing sanctions that are costly to the sender more effectively conveys resolve by sinking costs (see Schelling 1966, Fearon 1997, and Lektzian and Sprecher 2007). However, the *threat* to impose sanctions that are costly to the sender may be less credible because of the self-harm they would inflict if carried out. As I argue, the U.S. resolved this problem by adopting congressional legislation that tied the President’s hands—only beginning in the late 1970s, however.

³¹ On the importance of establishing a reputation for imposing sanctions, see Lacy and Niou 2004 and Peterson 2012.

of sources and methods. Despite their disagreements, both quantitative and qualitative methodologists agree that rigorous theory testing should explore as many observable implications of a theory as feasible.³² While no test is expected to be fully convincing on its own, in combination the tests shed considerable light on the theory's validity. Specifically, we should observe that states that are more vulnerable to U.S. sanctions (i.e. more dependent on the U.S. economically and militarily) should be less likely to pursue nuclear weapons, even controlling for other predictors of proliferation, but only after the threat of sanctions became credible in the late 1970s. Second, we should find that the observed success rate of sanctions threatened or imposed against proliferating states is low. Third, sanctions should be most likely to succeed at halting *existing nuclear weapons programs* when targeted at states that had reasons to miscalculate the probability or cost of sanctions when initiating their nuclear pursuit, particularly those with high economic and security dependence on the U.S.

The Deterrent Effect of Nonproliferation Sanctions

The argument I've elaborated suggests that dependence on the U.S. should be associated with nuclear forbearance, but *only when the threat of sanctions is credible*. As a proxy for the credibility of the threat of American sanctions, I exploit the shift in U.S. nonproliferation policy that occurred between 1975 and 1978. Before 1975, when the U.S. imposed sanctions on South Africa, the U.S. had never imposed sanctions in the context of nonproliferation. This policy was strengthened and formalized between 1976 and 1977, when Congress passed the Symington and Glenn amendments to the Foreign Assistance Act of 1961. These amendments, codified in the

³² See Van Evera, 1997, 35; and King, Keohane, and Verba 1994, 19-20.

Arms Export Control Act of 1976, banned all U.S. economic assistance, military aid, and export credits to states that export or import plutonium reprocessing technology or unsafeguarded, non-multilaterally managed uranium enrichment technology after August 4, 1977—significantly, these are the only two methods for producing the material needed to build a nuclear bomb—as well as to states that test a nuclear bomb. Only a presidential waiver, submitted to Congress, could exempt a country from these sanctions.³³ This policy was bolstered by the passage of the Nuclear Non-Proliferation Act (NNPA) in 1978, which mandated a cut-off in nuclear cooperation (absent a presidential exemption) with non-nuclear weapon states that did not conform to a set of strict nonproliferation criteria, including full-scope International Atomic Energy Agency (IAEA) safeguards on all their nuclear facilities, a commitment not to explode a nuclear device and not to enrich or reprocess U.S.-supplied nuclear materials without prior approval.³⁴ Between 1975 and 1978, the United States also spearheaded the establishment of the Nuclear Suppliers Group (NSG), an international cartel of nuclear suppliers devoted to preventing the export of sensitive nuclear materials to states without IAEA safeguards.³⁵ Importantly, however, since the NSG included the Soviet Union as well as Japan and European suppliers, its effect would not account for the decline in proliferation *only among countries dependent on the United States* that the theoretical argument predicts (and the evidence supports).

While the United States sponsored the Nuclear Non-Proliferation Treaty, which entered into force in 1970 and prohibited non-nuclear weapons states that ratified the treaty from developing nuclear weapons, the treaty did not include an explicit sanctioning mechanism.

Moreover, while U.S. policy stood in opposition to further proliferation, President Nixon himself

³³ U.S. Nuclear Regulatory Commission 2011, 1082-1086.

³⁴ Ibid, 1050-1052.

³⁵ Nye 1981. Also see Strulak 1993.

was not strongly opposed, at least among friendly states. Although he went through with ratification of the NPT upon taking office in 1969, Nixon insisted, “There should be no efforts by the U.S Government to pressure other nations, in particular the Federal Republic of Germany, to follow suit.”³⁶ Nixon considered the NPT an unwelcome product of the Johnson Administration—as he told Henry Kissinger in a meeting in June 1972, “I supported nonproliferation because we had to.” Instead, he believed that “Each nation should handle this problem in the light of its own circumstances.”³⁷ Overall, nonproliferation “remained on the periphery of the Nixon administration’s foreign policy agenda in light of other, more pressing Cold War concerns.”³⁸ When India exploded a nuclear device in May 1974, the U.S. initially responded calmly, increasing economic assistance in the short term and continuing nuclear fuel shipments, policies that continued into the Ford administration.³⁹

In the long run, however, the Indian nuclear test, along with the revelation of commercial deals that promised to transfer reprocessing and enrichment technology from European suppliers to Brazil, South Korea, and Pakistan, convinced many U.S. policymakers that (1) nonproliferation needed to be a higher priority, and (2) the NPT was insufficient to halt proliferation.⁴⁰ In other words, it was precisely the limitations of the NPT—its inability to influence states that chose to remain outside the treaty and lack of controls on the spread of

³⁶ National Security Decision Memorandum 6, Washington, February 5, 1969, Nixon-Ford Administrations, Volume E-2, Document 8, *Foreign Relations of the United States* (hereafter FRUS), <http://history.state.gov/historicaldocuments/frus1969-76ve02/d8>

³⁷ Conversation Between President Nixon and his Assistant for National Security Affairs (Kissinger), Washington, June 13, 1972, Nixon-Ford Administrations, Volume E-2, Document 58, FRUS, <http://history.state.gov/historicaldocuments/frus1969-76ve02/d58>

³⁸ Martinez 2002, 262.

³⁹ Reiss 1988, 232; and Perkovich 1999, 184.

⁴⁰ Lellouche, 1979, 337; Martinez 2002, 262; Nye 1981, 17-18

sensitive nuclear technology that could be used to build weapons as well as for peaceful purposes—that led to the firmer U.S. sanctions policies emerging between 1976 and 1978.⁴¹

The threat of sanctions developed between 1976 and 1978 meets the primary criteria for threat credibility identified in the deterrence literature: (1) the U.S. had both the interest and capability to carry out the threat,⁴² (2) communicated the threat clearly to the world,⁴³ and (3) signaled its commitment by adopting hand-tying mechanisms that generate domestic audience costs.⁴⁴ First, in terms of capability, it is clear that the U.S. had the power to employ sanctions against proliferating states if it desired. The U.S. also had an interest in doing so: as one of the few states with nuclear weapons, and the only state with truly global power projection capabilities, any additional nuclear state reduced American relative power and limited the American military's influence and freedom of action.⁴⁵ As a pivotal 1965 U.S. government report concluded, additional nuclear proliferation “will add complexity and instability to the deterrent balance between the U.S. and the Soviet Union, aggravate suspicions and hostility among states neighboring new nuclear powers...impede the vital tasks of controlling and reducing weapons around the world, and eventually constitute direct military threats to the U.S.”⁴⁶

Although it took about a decade until the U.S. developed enforcement mechanisms, this blanket policy of opposition to nuclear proliferation was ultimately applied to allies and enemies alike, and was largely driven by the belief in a nuclear domino theory—once one state got nuclear weapons, others would inevitably follow, further constraining U.S. power.⁴⁷ In fact, since

⁴¹ Nye 1981, 18-20.

⁴² Classic works include Schelling 1966; and George and Smoke 1974. More recently, see Press 2005 and Danilovic 2001.

⁴³ See Schelling 1966, 70-76; and George, Hall, and Simons 1971.

⁴⁴ See Schelling 1966, 35-125; Powell 1990; Fearon 1994; Fearon 1997; and Slantchev 2007.

⁴⁵ See Kroenig 2009.

⁴⁶ U.S. Department of State 1965.

⁴⁷ Gavin 2004-2005.

the Symington Amendment cut off military and economic aid to offending states, and the NNPA cut off U.S. nuclear energy cooperation, one might conclude that the policy was targeted *especially* at allies, since U.S. adversaries would not be receiving U.S. aid or nuclear cooperation in the first place.

The second criterion for credible threats, clear communication, is also met by the U.S. sanctions policy, which was publicly codified in U.S. law, reported on in the media,⁴⁸ and privately communicated to states that seemed in danger of violating it.⁴⁹ Finally, if American interests in nuclear nonproliferation were not clear enough, the U.S. sanctions legislation tied the president's hands, automatically cutting off aid to proliferating states absent a presidential waiver. By granting a waiver the president would incur audience costs, a nontrivial matter given the importance of nonproliferation as an American political issue starting with the 1976 presidential campaign.⁵⁰ In fact, the one case between 1976 and 2000 where the president did waive the Symington Amendment (sanctions against Pakistan were lifted after the Soviet invasion of Afghanistan convinced President Reagan that Pakistani support was crucial) was accompanied by significant congressional and public criticism and efforts by Congress to restrict the presidential waiver, namely the Pressler and Solarz amendments.⁵¹ While Israel is often mentioned as a case where U.S. nonproliferation law was sidestepped, Israel has in fact never triggered sanctions because “(1) it has not been documented to have received any un-safeguarded nuclear fuel since the enactment of the Symington Amendment and the NNPA, (2) it does not

⁴⁸ See, for instance, *New York Times*, 10 August, 1976, 1; *New York Times*, 12 November, 1976, 3; and *New York Times*, 8 May, 1977, 9.

⁴⁹ These include Pakistan, South Korea, and Taiwan. See U.S. Department of State 1976; U.S. Department of State 1976b; and Reiss 1988.

⁵⁰ See Martinez 2002; and Nye 1978.

⁵¹ On the Pressler and Solarz Amendments, see Reiss 1995, 183-231. For examples of domestic criticism, see *New York Times*, 15 May, 1981, 6; *New York Times*, 19 June, 1981, 26; *New York Times*, 1 July, 1981, 26; *New York Times*, 21 October, 1981, 9; and *New York Times*, 2 January, 1982, 9.

receive any U.S. nuclear assistance, and (3) it has never overtly tested a nuclear device.”⁵²

In order to test the hypothesized deterrent effect of U.S. sanctions, I analyze a country-year dataset from 1950-2000, adapted from Singh and Way and incorporating data from Fuhrmann on nuclear cooperation agreements.⁵³ Measuring the key causal variable, dependence on the U.S., requires the recognition that dependence is a multidimensional concept. Empirically, the U.S. maintains a variety of economic and security relationships with other states in the international system. As a parsimonious way of capturing these relationships, each of which may contribute to a state’s dependence on the U.S., and each of which could be endangered by U.S. sanctions, for every country-year I code a dependence score which sums together four binary indicators: (1) whether the state received economic aid from the U.S., (2) whether the state received military aid from the U.S.,⁵⁴ (3) whether the state stationed any U.S. troops,⁵⁵ and (4) whether the U.S. was a major trade partner for the state (more than the median in the full sample, or 1.67% of the state’s GDP involved in imports from or exports to the U.S.).⁵⁶ This five-point dependence score thus measures the extent to which a state relies on the U.S. economically and militarily, with economic aid and trade measuring economic dependence and troop presence and military aid measuring security dependence.⁵⁷ I expect that in the post-1976 period, greater dependence on the U.S. should reduce the likelihood that a state initiates a nuclear weapons

⁵² Thyagaraj and Thomas 2006, 360. The only nuclear cooperation agreement between the U.S. and Israel is strictly limited to sharing information on nuclear safety. See Haaretz, April 14, 2008.

⁵³ Singh and Way 2004; Fuhrmann 2009. 1950 is the starting date due to data limitations vis-à-vis trade and U.S. troops levels.

⁵⁴ U.S. aid data, originally from *U.S. Greenbook*, is from Bueno de Mesquita and Smith 2007.

⁵⁵ Data from Kane 2006. The results are also robust to 100 and 1000 troop thresholds.

⁵⁶ Trade dependence data, originally from Gleditsch 2002, is from Gartzke and Jo 2009. Trade data for Taiwan is from Barbieri, Keshk, and Pollins 2009. Results are robust to using Barbieri et al trade data. GDP data is from Penn World Tables.

⁵⁷ Adding whether a state has an alliance with the U.S. to the dependence score does not significantly alter the results, nor does only including the economic components of the dependence score or only the military components. The results are also robust to excluding the US troops indicator from the dependence score.

program—the greater the number of pathways through which a state is dependent on the U.S., the more likely it will be deterred by the threat of sanctions. In the pre-1976 period, meanwhile, dependence on the U.S. should have no effect on the probability of pursuing nuclear weapons.

As an initial, informal way of exploring this hypothesis, Tables 1 and 2 display each of the four dimensions of dependence for all states that have pursued nuclear weapons post-1950, divided by time period. I draw on Singh and Way’s coding of nuclear pursuit, which requires that a state “do more than simply explore the possibility of a weapons program. They have to take additional further steps aimed at acquiring nuclear weapons, such as a political decision by cabinet-level officials, movement toward weaponization, or development of single-use, dedicated technology.”⁵⁸ I utilize Way’s 2011 codings of nuclear program dates.⁵⁹ While proliferation is a fluid phenomenon, with many states hedging or exploring the nuclear option without formally authorizing a program,⁶⁰ for my purposes the explicit political decision to pursue nuclear weapons is most theoretically relevant, since at this pursuit stage it is most accurate to code deterrence as having failed.⁶¹ To mitigate reverse causality issues, the data displayed are from the year before the onset of a nuclear weapons program. As the tables illustrate, the average state that pursued nuclear weapons in the pre-1976 time period was significantly more dependent on the U.S. than in the post-1976 era.

Of course, this data selects on the dependent variable and does not control for alternate reasons that states may or may not pursue nuclear weapons so it is at best suggestive. In order to test the argument more systematically, I turn to a multivariate logit analysis on a global sample

⁵⁸ Singh and Way 2004, 866.

⁵⁹ Way 2011. These codings have since been updated (see Way 2012). The results are robust to utilizing the new codings.

⁶⁰ See, for example, Singh and Way 2004; and Levite 2002-2003.

⁶¹ The results are robust to using as dependent variables (1) exploration of nuclear weapons, (2) whether a state has an ongoing nuclear program, and (2) pursuit of nuclear weapons as defined by Jo and Gartzke 2007.

Table 1

Pre-1976	Year	Economic Aid	Military Aid	US Troops	High Trade	Dependence Score
France	1953	✓	✓	✓		3
China	1954					0
Israel	1957	✓		✓	✓	3
Australia	1961		✓	✓	✓	3
India	1963	✓	✓	✓		3
Egypt	1964	✓		✓	✓	3
Taiwan	1966	✓	✓	✓	✓	4
Libya	1969	✓	✓	✓	✓	4
South Korea	1969	✓	✓	✓	✓	4
Pakistan	1971	✓	✓	✓		3
South Africa	1973			✓	✓	2
Average		72.7%	63.6%	90.9%	63.6%	2.91

Table 2

Post-1976	Year	Economic Aid	Military Aid	US Troops	High Trade	Dependence Score
Brazil	1977	✓	✓	✓		3
Argentina	1978			✓		1
North Korea	1979					0
Iraq	1982				✓	1
Iran	1984					0
Average		20%	20%	40%	20%	1.0

of countries from 1950 to 2000.⁶² Following recent work by Singh and Way and Fuhrmann, the binary dependent variable measures whether a state decides to pursue nuclear weapons in a given year (states exit the dataset while nuclear programs are ongoing).⁶³ In order to test the theoretical argument, I include the dependence score for each country-year, a dummy variable for the post-1976 period, and create an interaction between these two variables (since dependence on the U.S. is expected to have an effect only after 1976).⁶⁴ Whereas the dependence score proxies the costs of sanctions for a given state, the dummy variable for time period proxies the expected probability of sanctions. Before 1976, when the U.S. lacked a sanctions policy, the expected probability was close to zero; after 1976, as a result of U.S. legislation, the expected probability was at least in theory close to 100% (because the sanctions were intended to be automatic). The interaction term can therefore be interpreted as the expected value of the cost of sanctions. I estimate three primary models: one that includes only the theoretical variables, one that includes all control variables employed in Fuhrmann (2009), excluding NPT variables out of concerns for post-treatment bias,⁶⁵ and one that includes the NPT variables as well. I use a leading dependent variable to mitigate reverse causality concerns and cluster standard errors by country.

⁶² The results are also robust to the use of probit, ReLogit, a linear probability model, and a linear probability model with country fixed effects.

⁶³ States reenter the dataset when they abandon nuclear weapons programs. The results are robust to accounting for temporal dependence by including as covariates the number of years since the last pursuit of nuclear weapons, as well as the squared and cubic terms of this variable (see Carter and Signorino 2010). The results are also robust to the exclusion of any individual country that pursued nuclear weapons.

⁶⁴ I also conducted several placebo tests with different cutoff years. If the argument advanced in this paper is correct, the results should attenuate as one moves the cutoff further back in time (it should not completely eliminate the results since the moving the cutoff back to say, 1973, includes only 3 years where one would expect no effect with 24 years where one would expect an effect). This is indeed what we find: the results are attenuated as the cutoff date is moved further back, with the results completely disappearing when a 1964 cutoff date is used. Indeed, if a model is estimated on the 1964-1976 period alone, dependence on the U.S. has an insignificant effect. Finally, the results are also robust to using a 1978 cutoff (when the Nuclear Suppliers Group was fully formed).

⁶⁵ Post-treatment bias occurs when a variable is included as a control that is partially a consequence of the key causal variable. Because states have often signed the NPT only when they have decided against

Table 3 displays the results of the primary models, and shows that regardless of whether controls are included or excluded, and whether variables measuring the NPT era and NPT membership are included, significance and signs on the variables of interest remain largely stable. Because the coefficient and statistical significance of the interaction term cannot be interpreted directly,⁶⁶ and because logit coefficients do not represent the marginal effects that are of substantive interest, I use Clarify to estimate first differences based on model 2.⁶⁷ These first differences tell us how much the yearly probability of pursuing nuclear weapons changes in the pre- and post-1976 era as dependence on the U.S. increases, holding all control variables at their median.

Table 4 displays the estimates and compares them to the substantive effects of the statistically significant control variables. Supporting the theoretical argument, they suggest that increases in dependence score significantly reduce the probability of proliferation, but only in the post-1976 era. In the pre-1976 era, dependence score has an insignificant, *positive* effect. Specifically, the first differences suggest that an increase in the dependence score from 0 to 1 reduces the yearly probability of proliferation in the post-1976 era by .0018, with this difference significant at the 95% level. While this sounds small, proliferation is a rare outcome, and this first difference represents an approximately 536% decrease from the median yearly predicted probability of proliferation generated by the model. An increase to 2, 3, or 4 in dependence score

proliferation and because this can be a response to U.S. pressure and sanctions threats, including it as a control may bias the results of dependence on the U.S. toward zero. See King and Zeng 2007, 201-202. It is also possible that dependence on the U.S. in the post-1976 era caused states to be more secure vis-à-vis shared rivals, producing a spurious result. To account for this, I ran a model where I controlled for (1) the average number of MIDs a state experienced with the USSR/Russia over the past 5 years and (2) the same variable vis-à-vis China. The results are robust to the inclusion of these variables.

⁶⁶ Braumoeller 2004.

⁶⁷ King, Tomz, and Wittenberg 2000. The results remain significant if model 1 or model 3 are used.

Table 3

	(1) Simple	(2) +Controls	(3) + NPT Variables
Dependence Score	0.398	0.553	0.457
	(0.279)	(0.302)‡	(0.294)
Post-1976 Dummy	2.113	2.579	2.489
	(1.124)‡	(1.514)‡	(1.714)
Dependence Score * Post 76	-1.591	-1.643	-1.359
	(0.616)*	(0.575)**	(0.587)*
No. of Nuclear Cooperation Agreements (NCA)		0.048	.030
		(0.042)	(.044)
NCA * Average # of MIDS in Past 5 Years		0.038	0.063
		(0.020)‡	(0.018)**
Average # of MIDS in Past 5 Years		0.339	0.355
		(0.089)**	(0.090)**
GDP per Capita		0.000	0.000
		(0.000)‡	(0.000)
Industrial Capacity Threshold		1.641	1.977
		(0.670)*	(.767)*
GDP per Capita Squared		-0.000	-0.000
		(0.000)*	(0.000)*
Polity Score		0.003	0.005
		(0.048)	(0.051)
Nuclear Ally		-0.144	0.246
		(0.701)	(0.803)
Interstate Rivalry		1.683	1.314
		(0.866)‡	(0.825)
Trade Openness		-0.003	0.002
		(0.011)	(0.010)
Change in Polity Score in Past 5 Years		-0.101	-0.103
		(0.080)	(0.071)
Change in Trade Openness in Past 5 Years		0.024	0.022
		(0.013)‡	(0.012)‡
NPT Member			-3.468
			(1.499)*
NPT Era (Post-1970)			0.704
			(1.065)
No Proliferation Years		0.004	0.032
		(0.023)	(0.024)
Constant	-6.556	-10.028	-10.376
	(0.863)**	(1.372)**	(1.476)**
<i>N</i>	5,835	5,156	5,156
Pseudo R ²	.0611	.3288	.3761

‡ $p < 0.10$ * $p < 0.05$; ** $p < 0.01$ (two-tailed tests)

Clustered standard errors in parentheses

reduces the probability of proliferation by .0023 to .0025—between a 685% to 745% reduction from the median; all of these first differences are significant at the 95% level.

Figure 1 displays these first differences graphically. The figure shows that in the pre-sanctions era, there is an insignificant, positive effect of changes in dependence score (the 95% confidence interval always includes zero). In the post-sanctions era, however, the first differences are always negative and significant (never crossing zero), as theoretically expected, with the biggest change in simply moving from 0 to 1 in the dependence score. While the first differences of moving from 1 to 2, 2 to 3, and 3 to 4 in the dependence score are still negative and statistically significant, they are much smaller in magnitude, suggesting that moving from 0 to 1 is most important. Although it is hard to tell from the figures, the 95% confidence intervals for first differences in the two eras never overlap. This means that we can infer with 95% confidence that the effect of dependence on the U.S. was different in the two eras.

Figure 2 shows the first differences of moving from the pre- to post-sanctions era at different levels of dependence score. This treats dependence as the conditioning variable in the interaction term rather than era (as in Figure 1).⁶⁸ The results suggest that for states with relatively low dependence on the U.S., (scores of 0 or 1) moving to the post-sanctions era is associated with an insignificant *increase* in the probability of pursuing nuclear weapons. For those with high dependence (scores of 3 or 4), moving to the post-sanctions era is associated with a significant decrease in the probability of pursuing nuclear weapons, as theoretically

⁶⁸ Berry et al (2012) note that interaction terms are inherently symmetric (meaning that each component variable conditions the other) and therefore recommend constructing plots both ways.

Table 4

	FD Estimate	95% CI	%Δ Relative to Median Prob.
Dependence Score, 0 to 1, Post-76 era	-.0018*	-.0075, -.0001	-536%
Dependence Score, 0 to 2, Post-76 era	-.0023*	-.0092, -.0001	-685%
Dependence Score, 0 to 3, Post-76 era	-.0024*	-.0095, -.0001	-715%
Dependence Score, 0 to 4, Post-76 era	-.0025*	-.0096, -.0001	-745%
Dependence Score, 0 to 1, Pre-76 era	.0001	-.0000, .0006	+30%
Dependence Score, 0 to 2, Pre-76 era	.0003	-.0001, .0016	+89%
Dependence Score, 0 to 3, Pre-76 era	.0008	-.0001, .0037	+238%
Dependence Score, 0 to 4, Pre-76 era	.0017	-.0001, .0082	+507%

* Significant at the 95% confidence level.

Figure 1

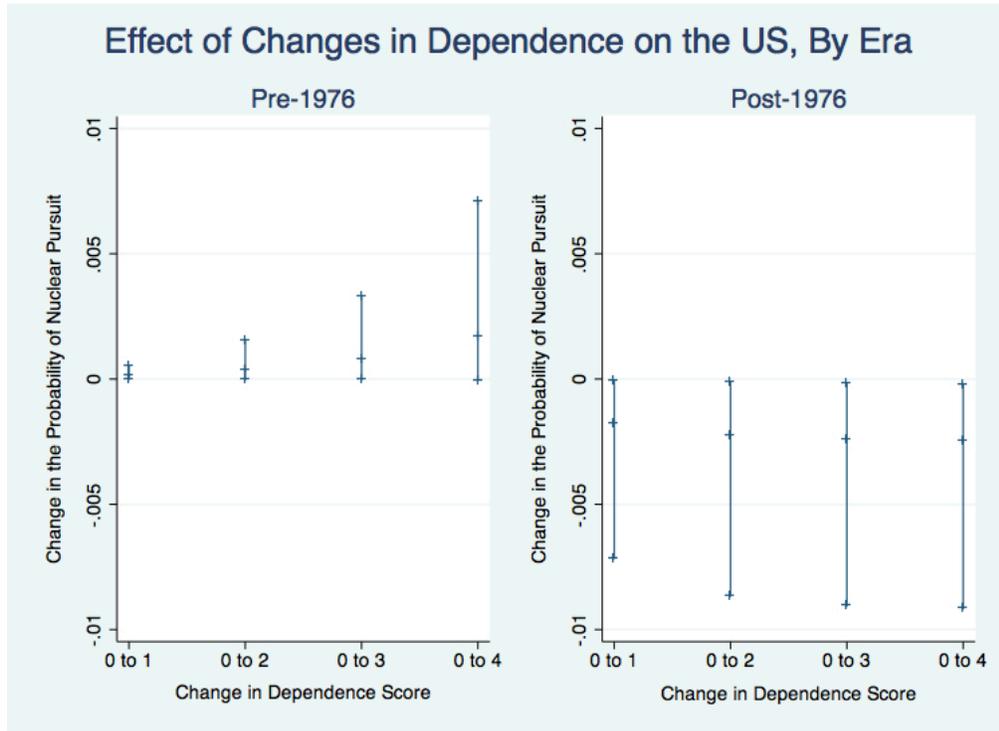
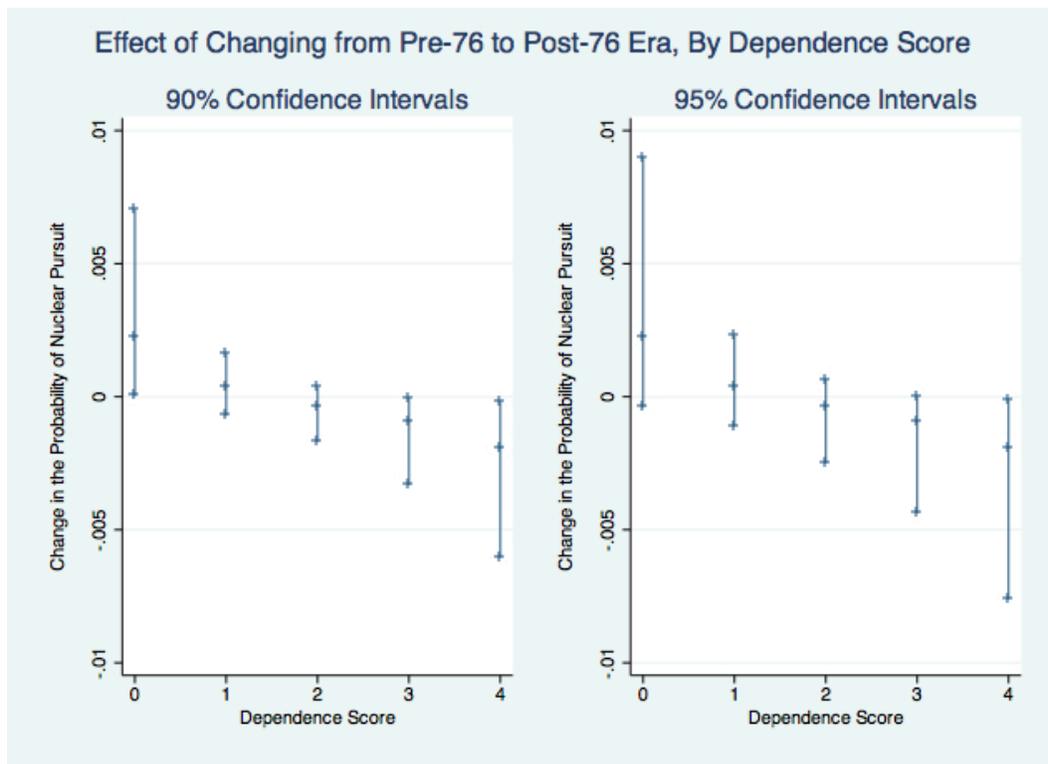


Figure 2



expected.⁶⁹ Taken together, these results suggest that in the post-sanctions era, the biggest dampening effect is moving from no dependence to some dependence. However, moving from the pre to post-sanctions era has the biggest negative effect on states with the highest levels of dependence.

Finally, although the effect of dependence is insignificant in the pre-1976 era, the fact that it is positive in sign suggests a shift not just in magnitude but in direction: before the U.S. sanctions policy, states dependent on the U.S. were actually marginally *more* likely to pursue nuclear weapons, *ceteris paribus*, perhaps due to greater access to nuclear technology and know-how before the U.S. tightened its nonproliferation policy. This cuts against an important counterargument—that states dependent on the U.S. do not pursue nuclear weapons simply because they feel more secure—since before 1976 and the U.S. sanctions regime, states dependent on the U.S. were actually somewhat *more* likely to proliferate.

The Inefficacy of Imposed Sanctions

The argument suggests that starting in the late 1970s, states dependent on the U.S. have been deterred from proliferation, an assertion supported by the empirical evidence. This causes a selection effect: because only states with low dependence on the U.S. are likely to pursue nuclear weapons in this time period, the observed success rate for sanctions should be low—the U.S. will not have the leverage necessary to succeed.

⁶⁹ The estimates are statistically significant at the 90% confidence interval for dependence scores of 1, 3 and 4 and significant at the 95% level only for dependence scores of 4. For a list of country-years that the models suggest would have had a high risk of proliferation in the absence of the sanctions policy, see the online appendix.

In order to test this prediction, I built a dataset of all nonproliferation sanctions episodes involving the U.S from 1975 to the present.⁷⁰ The data builds on previous datasets on economic sanctions collected by Hufbauer, Schott, Elliott, and Oegg,⁷¹ the Threat and Imposition of Sanctions Dataset compiled by Morgan, Krustev, and Bapat,⁷² and is supplemented by my own research. In order to qualify for the dataset, the U.S. must have threatened or imposed some cutoff in its economic or security relationship (trade, economic or military aid, nuclear energy cooperation, U.S. troop commitments) with a state exploring or pursuing nuclear weapons, and the resumption of normal relations must have been linked to some form of nuclear restraint on the part of the target state. A case is coded as successful if the target state halted its development of nuclear weapons shortly following the threat or during the imposition of sanctions. Cases where existing sanctions are tightened or expanded are not counted as separate observations; including them would make the success rate lower.⁷³

The cases are presented in Table 5 below, and the evidence strongly confirms the theoretical prediction—that the overall success rate of sanctions should be low. Only one of eight cases of sanctions imposition has succeeded (Libya 2004), for a success rate of 12.5%. Similarly, threats of sanctions have succeeded in only two of thirteen tries (South Korea and Taiwan), for a

⁷⁰ I use 1975 as the start date since this is when the U.S. first imposed sanctions in the context of nonproliferation. Sources for sanctions episodes are listed in the online appendix.

⁷¹ Hufbauer, Schott, Elliott, and Oegg 2007. Full list available from <http://www.piie.com/research/topics/sanctions/sanctions-timeline.cfm>

⁷² Morgan, Krustev, and Bapat 2006.

⁷³ While the U.S. imposed nonproliferation sanctions against Iraq following the Gulf War, Iraq did not have an active nuclear weapons program in this period and thus is not included in the dataset. It is possible, however, that the threat of further sanctions may have been responsible for the halting of the Iraqi program (see Brands and Palkki 2001, 162-3). The U.S. also imposed nonproliferation sanctions against India from 1978-1982; by this point, however, India had already tested a nuclear bomb. Coding Iraq as a successful case of imposition and India as a failed case of imposition would make the success rate for imposed sanctions 20%.

Table 5

	Type	Years	Outcome
South Africa	Threat	1975	Failure
South Africa	Imposition	1975-1982	Failure
South Korea	Threat	Early 1975	Failure
South Korea	Threat	Late 1975	Success
Taiwan	Threat	1976	Failure
Taiwan	Threat	1977	Success
Pakistan	Threat	1976	Failure
Pakistan	Imposition	1977-1978	Failure
Argentina	Threat	1978	Failure
Argentina	Imposition	1978-1982	Failure
Brazil	Threat	1977	Failure
Brazil	Imposition	1978-1982	Failure
Pakistan	Threat	1979	Failure
Pakistan	Imposition	1979-1980	Failure
Iran	Threat	1992	Failure
Iran	Imposition	1992-	Failure (So far) ⁷⁴
North Korea	Threat	1993-1994	Failure ⁷⁵
Libya	Threat	1996	Failure
Libya	Imposition	1996-2004	Success
North Korea	Threat	2002	Failure
North Korea	Imposition	2002-	Failure

⁷⁴ At the time of publication, Iran is engaged in negotiations with the United States and other world powers to limit its nuclear program in exchange for sanctions relief. If this effort is ultimately successful at halting Iran's nuclear weapons program, this case could be coded as a success.

⁷⁵ While a case could be made that the threat of sanctions succeeded because it was followed by the 1994 Agreed Framework that froze the North Korean plutonium program, North Korea did not actually end its nuclear weapons program, simply switching to the uranium enrichment route. Others have argued that by 1994, North Korea already possessed a virtual nuclear capability through plutonium reprocessing. See Richelson 2007, Nicksch 2006. For a dissenting view, see Hymans 2010.

success rate of 15.4%.⁷⁶ Overall, there are three cases of success out of 21 observations, a 14.3% rate of success. This is lower than the 34% success rate Hufbauer, Schott and Elliot identified in their analysis of 115 cases of economic sanctions, although higher than the 4.34% success rate Pape found after re-analyzing their data.⁷⁷

Of course, the prediction that the success rate of imposed sanctions should be low is not unique—it could also be explained by the inherent inefficacy of sanctions or poor design and implementation. In order to provide greater confidence in my argument, I test theoretical predictions about the rare cases of observed sanction success, predictions unique to this article’s argument.

Miscalculation and the Rare Cases of Observed Sanctions Success

The argument that states consider the risk of sanctions before pursuing nuclear weapons, and that this deters vulnerable states from starting nuclear weapons programs, holds only for states that are able to accurately assess the likelihood and costs of sanctions. To the extent that states underestimate the risk, there is room for vulnerable states to slip through and for explicitly targeted threats of sanctions to have an impact. This logic suggests two observable implications: states with identifiable reasons for underestimating the risk of sanctions when initiating nuclear weapons programs should (1) be surprised at the threat of sanctions, and (2) those vulnerable states that underestimated the risk of sanctions should be likely to concede to subsequent threats of sanctions, once they are made credible, for fear of jeopardizing relations with the U.S.

⁷⁶ In three cases where explicit evidence of a threat prior to imposition could not be found (South Africa 1975, Iran 1992, and Libya 1996), I assume a private threat was made. Omitting these cases would make the success rate of threats 20% and the overall success rate 16.7%.

⁷⁷ Pape 1997, 91-93.

As a measure of whether states had reason to underestimate the risk of sanctions when they initiated their nuclear programs, I again turn to the shift we would expect to see when the U.S. began imposing sanctions as nonproliferation policy after 1976. Countries that started nuclear weapons programs prior to 1977 would undoubtedly underestimate the future probability of sanctions from the outset. After 1976 and the new emphasis on sanctions in U.S. nonproliferation policy, we would expect precisely those states that started nuclear programs prior to 1977 *but had not yet completed them* to be most likely to fold in the face of sanctions, in particular those states with high dependence on the U.S.

The two countries that fit these criteria are South Korea and Taiwan. These represent two out of three successful cases of sanctions; there are no successes for sanctions against states that started programs post-1976 (and thus were more likely to accurately assess the risk of sanctions). While Libya likely underestimated the probability of sanctions (having started its nuclear weapons program in 1970) and ultimately conceded to U.S.-led sanctions, the mechanism in this case is different. By the time Qaddafi initiated a nuclear weapons program in 1970, Libya was no longer highly dependent on the U.S.; moreover, the literature suggests that a combination of military threats and/or a change in Qaddafi's general preferences about international engagement were most relevant.⁷⁸

Drawing on secondary sources and U.S. archival documents, I seek to confirm the theory's relevant observable implications in the South Korea and Taiwan cases: (1) that these states were surprised by the threat of sanctions and (2) that they subsequently ended their nuclear weapons programs due to the threat of sanctions, *once the threat was made credible*, because of their high dependence on the U.S.

⁷⁸ On Libya, see Solingen 2007, 213-228; Jentleson and Whytock 2005-2006, St. John 2004; and Bowen 2006.

Taiwan

Taiwan was undoubtedly surprised when the U.S. began threatening sanctions in 1976 and 1977. Although U.S. officials had opposed Taiwanese proliferation from the moment they recognized Taiwan was pursuing nuclear weapons in 1972,⁷⁹ sanctions were not clearly threatened until the introduction of the Symington Amendment in 1976. Instead, the U.S. initially focused on supply-side measures. In early 1973, for example, the U.S. successfully pressured Germany to reject the Taiwanese purchase of reprocessing equipment.⁸⁰ The first direct verbal warnings to Taiwan were vague and did not threaten sanctions. In October 1973, for example, a U.S. study team warned Taiwanese officials, “Should we have reason to believe that the ROC has moved from consideration of a nuclear weapons program to actual implementation, we would be forced to react. That reaction would be based upon the circumstances at the time.”⁸¹

Despite the Taiwanese foreign minister’s promise to drop efforts to acquire a reprocessing facility,⁸² the vague U.S. threats were insufficient to halt the Taiwanese nuclear weapons program. In 1975, Chiang Ching-kuo came to power following his father’s death, and by early 1976, “the IAEA suspected that Taiwan’s nuclear ambitions might stretch beyond power production.”⁸³ Reacting to growing concerns about the Taiwanese nuclear program, in September the State Department instructed the ambassador in Taipei to clearly threaten sanctions namely an end to nuclear cooperation and “legislative efforts by the US congress, such as the Symington Amendment, to deny US military and economic assistance to any country that acquires a national reprocessing capability. This reflects the growing sensitivity of congressional and public opinion

⁷⁹ U.S. Central Intelligence Agency 1972.

⁸⁰ Solingen 2007, 101.

⁸¹ U.S. Department of State 1973.

⁸² U.S. Department of State 1973a.

⁸³ Hersman and Peters 2006, 544.

on the issue of nuclear proliferation and the implications seem clear to my government—should the ROC [Republic of China] or any other government seek national reprocessing facilities, this would risk jeopardizing additional highly important relationships with the US.”⁸⁴

Superficially, these threats appeared to be successful, as Chiang Ching-kuo reiterated that Taiwan’s policy was “not to manufacture nuclear weapons” and that “all nuclear research on Taiwan would be directed toward peaceful uses.”⁸⁵ He pledged that Taiwan would cease all reprocessing activity and end attempts to purchase reprocessing technology abroad.⁸⁶ Nonetheless, by December the ambassador was forced to admit, “we have rather compelling evidence that in spite of solemn and public assurances given by the GROC and personally by Premier Chiang, the Chinese may not yet have given up their intentions of acquiring a capability for reprocessing nuclear fuels.”⁸⁷

A major problem was that the new U.S. nonproliferation policy was still inchoate. Although the Symington Amendment had been passed in Congress as of June 1976, it would not go into effect until August 1977 and it was still unclear exactly how far the U.S. would go to enforce congressional dictates. Thus, in January 1977 the Taiwanese Vice Foreign Minister Chien Fu complained that he had “seen a press report that U.S. would acquiesce in West German and French sales of reprocessing facilities to Brazil and Pakistan respectively” and “asked whether the U.S. was applying a ‘double standard’ with regard to its policy of opposing acquisition of reprocessing facilities.”⁸⁸ Even after being informed that the new American policy was “global, and that the U.S. would be ‘unstinting’ in its efforts to prevent proliferation of sensitive technology to Brazil and Pakistan,” the Vice Foreign Minister still felt the U.S policy

⁸⁴ U.S. Department of State 1976.

⁸⁵ U.S. Department of State 1976c.

⁸⁶ Albright and Gay 1998, 58.

⁸⁷ U.S. Department of State 1976a.

⁸⁸ U.S. Department of State 1977.

was sufficiently vague that he asked, “out of ‘curiosity,’ what the penalties would be in the event a nation did not follow U.S. non-proliferation guidelines.”⁸⁹ The response was clear and to the point: “the sanctions would not be confined to nuclear matters but would also affect a wide range of relations, including military cooperation...Levin [the U.S. official] dwelt on the adverse consequences that questionable ROC nuclear activities would have on weapons supply and cited the Symington Amendment as an example of the increasingly restrictive U.S. attitude toward proliferation risks.”⁹⁰ In March, the U.S. continued to pressure Taiwan, directing the American ambassador to emphasize to Taiwanese officials, “President Carter’s determination to do everything in his power to prevent nuclear proliferation...Our non-proliferation policy is global in scope and must be based on long-term considerations.”⁹¹

With the Symington Amendment and the Nuclear Non-Proliferation Act coming down the pike and the increased credibility of American threats, Taiwan complied with the tough American conditions, which went far beyond Taiwan’s obligations under the NPT.⁹² Both security and domestic political considerations deriving from the importance of the United States to the Taiwanese economy played a role in this decision. After all, “The U.S. was not only Taiwan’s main market, source of foreign investment, and provider of weapons and security guarantees, but also its principal supplier of low-enriched uranium for power reactors.”⁹³ As Solingen concludes, “The KMT and its successors’ military, political, and economic dependence on the U.S. are central to understanding Taiwan’s nuclear history. Nuclear decisions were embedded in a model of regime survival emphasizing economic growth, prosperity, stability, and the defeat of internal subversion, which explains widespread receptivity to U.S. demands and

⁸⁹ Ibid.

⁹⁰ Ibid.

⁹¹ U.S. Department of State 1977a

⁹² Mitchell 2004, 301.

⁹³ Solingen 2007, 112.

inducements.”⁹⁴ Evidence from U.S. government documents supports this conclusion. For example, in January 1977, a cable from the U.S. embassy in Taipei noted that high-ranking Taiwanese officials “gave the impression that they believe it would be folly for ROC to endanger its nuclear power program by conducting nuclear activities of questionable nature. We were particularly struck by Chien’s question about penalties that would result from defiance of U.S. nuclear policies. It seemed as if he might have been seeking ammunition—which we supplied—to use within ROC policy counsels.”⁹⁵

Although evidence of small-scale uranium enrichment and plutonium reprocessing emerged again in 1978 and 1987-88, respectively, there is no indication that Taiwan ever made the political decision to pursue nuclear weapons again post-1977. Moreover, in both instances, the threat of U.S. sanctions succeeded in bringing the Taiwanese program under control.⁹⁶

South Korea

When South Korea initiated its nuclear weapons program in 1970, the U.S. was five years from its first application of sanctions in nonproliferation policy. Predictably, then, South Korea was not expecting sanctions and was surprised when confronted with threats of American sanctions in 1975. This fact was explicitly noted by a 1978 CIA report:

What patchwork attempts were made to assess the political implications of the nuclear weapons program in 1974-75 led [Park Chung-Hee] and some of his senior advisers to conclude that Washington would tolerate this work. Blue House staffers at that time drew an analogy between the cases of South Korea and Israel. The U.S., they reasoned, provided Israel with billions of dollars in defense assistance, including the most modern weapons in its inventory, even while Washington suspected Tel Aviv of developing a nuclear weapons program. The Koreans went on from there to conclude that the U.S.—while opposing

⁹⁴ Ibid, 116.

⁹⁵ U.S. Department of State 1977.

⁹⁶ See Albright and Gay 1998, 59-60; and Burr 2007.

short-term weapons work in Korea—would eventually recognize and tolerate Korea’s need to have an independent nuclear capability.⁹⁷

The story of U.S. diplomacy vis-à-vis the South Korean nuclear program starts in early 1975, when U.S. officials ramped up nuclear intelligence gathering efforts following the 1974 Indian nuclear test and obtained evidence of the South Korean nuclear weapons efforts.⁹⁸ This evidence included a South Korean deal to purchase a nuclear reprocessing facility from a French firm—although this did not violate South Korea’s commitments under the NPT, the U.S. worried the facility could be used to extract weapons grade plutonium.⁹⁹ Despite their serious concern over the matter, U.S. officials initially decided to tread lightly to avoid another public crisis in Asia following the fall of Saigon and America’s ongoing diplomatic focus on improving relations with China.¹⁰⁰ Rather than explicitly confronting South Korea about ending its nuclear weapons program and canceling the reprocessing deal, the U.S. “first focused on South Korea’s NPT membership.”¹⁰¹ As part of this effort, in March 1975 Congress delayed US Export-Import Bank loans totaling \$236 million to South Korea’s nuclear energy industry; the U.S. informed South Korea that the loan was under review because of the Indian nuclear test and that “Korea’s very timely ratification of the NPT will be an important factor in Ex-Im eventually gaining congressional agreement to finance Kori-2.”¹⁰² This veiled threat was shortly followed by South Korea ratifying the NPT in March,¹⁰³ but it did not end the South Korean nuclear program.

In the summer of 1975, the U.S. finally confronted South Korea about the reprocessing deal; nonetheless, “despite possessing significant evidence that the South was indeed pursuing a

⁹⁷ U.S. Central Intelligence Agency 1978.

⁹⁸ Drezner 1999, 256.

⁹⁹ Ibid.

¹⁰⁰ Reardon 2010, 226.

¹⁰¹ Ibid, 227.

¹⁰² Ibid, fn 443.

¹⁰³ Drezner 1999, 258.

weapons program, the Americans refrained from any direct accusation. Nor did they reveal the extent of their intelligence. Instead, the US vigorously objected to the reprocessing deal on the grounds of ‘the appearances of things’ and the ‘difficulties it would cause.’”¹⁰⁴ Starting in August 1975, however, “The Americans’ threats became progressively costlier and increasingly explicit.”¹⁰⁵ The U.S. reportedly threatened to cut off \$275 million in annual military assistance.¹⁰⁶ Even more broadly, according to the U.S. ambassador in Seoul, South Korean leaders were asked, “whether Korea (is) prepared (to) jeopardize availability of best technology and largest financing capability which only US could offer, as well as vital partnership with US, not only in nuclear and scientific areas but in broad political and security areas.”¹⁰⁷ By the end of the year, “the US had threatened to cease civilian nuclear cooperation, including the training of scientists, and to withdraw US security guarantees, including the nuclear umbrella.”¹⁰⁸ In January 1976, South Korea canceled the reprocessing deal under the mounting pressure, and by December 1976 the broader nuclear weapons program was canceled, a decision “based both on U.S. threats and the failure of the program to make any significant technical progress.”¹⁰⁹

Although the U.S. Congress had not yet passed the Symington Amendment, these threats were credible due to a variety of signals the U.S. government had sent in recent years, including the U.S. rapprochement with China and withdrawal from Vietnam, both of which communicated to South Korea that anti-Communism was no longer sufficient to merit unwavering military and political support from the U.S.¹¹⁰ Bringing matters closer to home, in 1973 the U.S. withdrew 24,000 of the 70,000 American troops from Korea and was subsequently late in delivering a

¹⁰⁴ Reardon 2010, 230.

¹⁰⁵ Ibid.

¹⁰⁶ Drezner 1999, 258.

¹⁰⁷ Quoted in Drezner 1999, 257.

¹⁰⁸ Reardon 2010, 231.

¹⁰⁹ Ibid, 232. Also see Hayes and Moon 2011.

¹¹⁰ Reiss 1988, 80.

promised \$1.5 billion military aid package.¹¹¹ In 1974, Congress reduced the level of military aid to South Korea due to human rights concerns.¹¹² Taken together, these signals made clear to South Korea that the U.S. was willing and able to withdraw its military and economic support.

Once President Jimmy Carter entered office in 1977, however, the nuclear weapons issue surfaced once again. Echoing a pledge he had made while campaigning, in March Carter announced his intent to withdraw almost all U.S. troops from Korea, asserting that U.S. air and naval forces could provide adequate security for South Korea.¹¹³ Moreover, Carter announced plans to remove approximately one thousand tactical nuclear weapons from the peninsula.¹¹⁴ South Korean officials declared in May that they would have to develop their own nuclear weapons if the U.S. went through with their plans and in August claimed they would build their own indigenous reprocessing plant.¹¹⁵ Importantly, however, South Korea did not fully revive its nuclear weapons program, instead focusing on “keeping the option open” by developing dual-use missile, explosive, and heavy water reactor technology.¹¹⁶ As Pollack and Reiss put it, “American officials never found convincing evidence of a revived covert program.”¹¹⁷ Indeed, the aforementioned 1978 CIA report found “No evidence that any nuclear weapons design work is under way at present...No evidence that the South Koreans are trying to acquire a uranium enrichment capability...No evidence of any current activity related to the acquisition of a reprocessing capability...No evidence of stockpiling of fissile material...[and] No evidence of work on weapons fabrication.”¹¹⁸

¹¹¹ Reiss, 1988, 81; and Englehardt 1996, 32.

¹¹² Yager 1985, 199.

¹¹³ Drezner 1999, 257.

¹¹⁴ Paul 2000, 121.

¹¹⁵ Englehardt 1996, 32.

¹¹⁶ Hayes and Moon 2011

¹¹⁷ Pollack and Reiss 2004, 263.

¹¹⁸ U.S. Central Intelligence Agency 1978.

After President Park was assassinated in 1979, successor Chun Doohwan ended these nuclear hedging efforts.¹¹⁹ This occurred after Carter had scrapped the troop withdrawal plan and was reinforced by the incoming Reagan administration's promise to increase the American economic and security commitment to South Korea, coupled with the threat of removing these benefits if South Korean nuclear weapons activities continued.¹²⁰ However, these reassurances occurred *after* South Korea had canceled its nuclear weapons program, suggesting that it was the threat of sanctions rather than the reassurance that played the key causal role. Drezner reaches the same conclusions about the primacy of threats over assurances in his analysis of the 1975-1976 period.¹²¹ Thus, while the reassurance may have been important for ending the nuclear hedging, the evidence suggests the sanctions threats were sufficient to halt the active nuclear weapons effort.

Like Taiwan, South Korea conceded to U.S. threats only because of its high dependence on the U.S. Both security and economic considerations played a role in the success of the sanctions threats. The U.S. was South Korea's largest trading partner,¹²² purchasing 26% of South Korean exports at the time, and the U.S. held much of South Korea's \$20 billion foreign debt.¹²³ Drezner observes that, "the threat to suspend all trade in nuclear materials would have completely devastated ROK plans for energy autonomy,"¹²⁴ while Solingen notes, "without U.S. equipment and fuel supplies for South Korea's first nuclear plant, still under construction in 1975, the economy might have stalled at an already critical period following the oil crisis."¹²⁵ Meyer similarly observes that, "The United States government took advantage of South Korea's

¹¹⁹ Pollack and Reiss 2004, 263.

¹²⁰ Siler 1998, 75-76.

¹²¹ Drezner 1999, 269-275.

¹²² Hersman and Peters 2006, 541.

¹²³ Englehardt 1996, 32.

¹²⁴ Drezner 1999, 262.

¹²⁵ Solingen 2007, 92.

political, military, and economic dependence to compel the South Korean government to cancel its nuclear weapons project...the threat of an economic cutoff was particularly potent.”¹²⁶

In terms of security, as Reiss notes, South Korea was simply unwilling to take the risk of placing itself “in a position where it had neither nuclear arms nor the American commitment,”¹²⁷ an eventuality that would have been realized—at least for several years—had the U.S. acted on its threats. In other words, even though part of South Korea’s motivation for pursuing nuclear weapons was uncertainty about the long-term American security commitment,¹²⁸ the short-term loss of American support was simply too costly, both in economic and security terms. Overall, then, the South Korean case is in line with theoretical expectations. South Korea conceded to U.S. threats after miscalculating, but only because of its high dependence on the U.S. politically, economically, and militarily.

Conclusion

The argument and evidence presented here suggest that U.S. sanctions have indeed been an effective tool of nonproliferation policy, but that selection effects have rendered this success largely hidden. Because states consider the probability and cost of sanctions *before* initiating nuclear weapons programs, those that are highly vulnerable to U.S. sanctions are likely to be deterred from starting nuclear weapons programs in the first place, so long as the threat of sanctions is credible. Meanwhile, those that choose to pursue nuclear weapons are likely to be highly insulated and able to weather the threat and imposition of sanctions. Thus, while observed sanctions campaigns are unlikely to succeed in halting ongoing nuclear programs, they do deter less insulated states that might otherwise have pursued nuclear weapons.

¹²⁶ Meyer 1984, 126.

¹²⁷ Reiss 1988, 99.

¹²⁸ See Pollack and Reiss 2004; Hersman and Peters 2006.

On the causes of proliferation, the findings suggest we should move beyond focusing on the incentives and capacity to build nuclear weapons and pay more attention to disincentives. While important theoretical works have emphasized the disincentives in terms of negative economic and security externalities,¹²⁹ sanctions have been largely ignored and systematic empirical testing has been rare. Moreover, the findings help resolve a puzzle in the nuclear proliferation literature: namely the disconnect between theoretical and qualitative empirical works that emphasize the role of allied security commitments and international trade openness in reducing motivations for nuclear proliferation¹³⁰ and quantitative studies that find these variables to be insignificant.¹³¹ The findings suggest that international integration and security commitments may inhibit proliferation only to the extent that their continuation is contingent on nuclear abstinence, a condition that arguably did not exist until the advent of U.S. sanctions policies in the late 1970s. The key point is that many states quite rationally may prefer an independent nuclear arsenal, a nuclear ally, *and* an internationally integrated economy. Only when well-established sanctions policies make states choose between a nuclear arsenal and the latter two luxuries should international integration and allied security commitments significantly inhibit proliferation. More broadly, the results suggest the importance of historicizing the study of nuclear proliferation; for example, the disincentives to pursue nuclear weapons have not been constant over time and nuclear cascades may have failed to materialize partially because of determined efforts to prevent their occurrence by the United States.¹³²

¹²⁹ See Solingen 2007 and Paul 2000.

¹³⁰ On the role of security commitments, see Betts 1977; Frankel 1993; and Sagan 1996-1997. On the importance of international integration, see Solingen 2007.

¹³¹ See Singh and Way 2004; Jo and Gartzke 2007; as well as Muller and Schmidt 2010. For an exception on security commitments, see Bleek 2010.

¹³² For an argument of this flavor, see Miller 2014. On the lack of support for nuclear domino predictions, see Bleek 2010a; Gavin 2009-2010 and Mueller 2009.

In terms of theoretical implications for the study of sanctions, the findings suggest that sanctions can be effective even in the realm of national security, contrary to popular realist arguments. Thus, while the field has known since Drezner (2003) that selection effects understate the true efficacy of sanctions with regard to trade and environmental issues, we can now extend this argument to cases where security is more directly at stake.

In terms of policy implications, three in particular stand out. First, nonproliferation sanctions should continue to be employed by the United States, even though they are unlikely to halt active nuclear weapons programs. After all, the threat of sanctions is credible only to the extent that the U.S. actually employs them. The importance of credible signals also suggests that recent U.S. decisions to waive sanctions against India and Pakistan in 2001 and sign a major civilian nuclear deal with India in 2006 may reduce the efficacy of sanctions in the future—it should be harder to deter states to the extent that the actual imposition of sanctions is less automatic. On the other hand, both India and Pakistan suffered under years of sanctions prior to reaching this point, and most states cannot count on an exception being made for them. Depending on the importance of relations with the U.S., the ‘threat that leaves something to chance’ may be enough. Moreover, although I’ve focused on the U.S. because they have the most extensive nonproliferation sanctions track record, the findings should be generalizable to other important bilateral relations. For example, if China and Russia had credible sanctions policies in the early 1980s, Iran may not have pursued nuclear weapons in the first place.

Second, U.S. international engagement provides critical leverage in the realm of nonproliferation—sanctions deter only states that are dependent on the U.S. economically and/or militarily. In other words, to the extent that the U.S. reduces its global economic and security commitments, a position that has become more attractive in recent years due to budget crisis and

recent experiences in Afghanistan and Iraq, it should expect a corresponding lack of nonproliferation leverage. This would be particularly problematic given recent research that suggests nuclear weapons may not be a reliable or consistent deterrent to conflict.¹³³

Third and finally, gauging the success of sanctions solely by studying cases where they were imposed against states like Iran and North Korea is theoretically misguided; success should not be expected in such cases. In these “adversary” cases where the U.S. had little relationship with the proliferating state to begin with, multilateral sanctions involving important partners of the proliferating state or inducements (whether in the form of economic assistance or security assurances) are likely to be more effective since the U.S. has little to threaten in the way of sanctions on its own.¹³⁴

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¹³³ See Narang 2013 and Bell and Miller, n.d.

¹³⁴ Some have advocated the threat and use of military force to prevent adversaries from acquiring nuclear weapons (e.g. Ellis 2003) and this is largely the policy Israel has adopted since 1981. While the efficacy of the use of military force as a deterrent to proliferation is outside the scope of this paper, see Kreps and Fuhrmann 2011 on preventive strikes against nuclear programs.

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