Legalizing Nuclear Abandonment:
The Determinants of Nuclear Weapon Free Zone Treaty Ratification

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ABSTRACT

This study seeks to explain when and why states ratify regional nuclear weapons free zone (NWFZ) treaties. When states ratify these treaties they legalize commitments not to manufacture, acquire, test, or possess nuclear weapons and receive assurances from the nuclear powers that nuclear weapons will not be used against them. Integrating insights from the literatures on legal commitment and nuclear proliferation, this paper argues that variation in the costs and benefits of the treaty's provisions is important to understanding NWFZ ratification. This broad assertion leads to several hypotheses that are tested using event history analysis and a sample of all 109 states that are eligible to join NWFZs. The results indicate that expectations of future conflict with the nuclear powers make states more likely to ratify NWFZ treaties and factors that might compel states to pursue nuclear weapons—such as militarized conflict and the presence of nuclear-related resources—make states less likely to do so. Only limited support for the argument that normative or reputation-based benefits influence states' decisions to join NWFZs is found.

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INTRODUCTION

Since 1967, more than 100 countries have joined regional nuclear weapons free zones (NWFZs). By ratifying NWFZ treaties, nations commit not to manufacture, acquire, test, or possess nuclear weapons. As part of the bargain, they receive negative security assurances from the five nuclear Nonproliferation Treaty's (NPTs) nuclear weapon states that they will not use or threaten to use nuclear weapons against countries in the zones. Currently, NWFZs exist in Latin America (the 1967 Treaty of Tlatelolco), the South Pacific (the 1986 Treaty of Rarotonga), Southeast Asia (the 1997 Treaty of Bangkok), and Antarctica (the 1961 Treaty of Antarctica). African countries pledged to sign-on to a nuclear free zone in 1996, but the Treaty of Pelindaba has yet to enter into force because a number of states have not ratified it. Similarly, the five Central Asian states have agreed to a zone but several countries have yet to complete the ratification process.[1] Efforts are underway to establish NWFZs in the Middle East, South Asia, and East Asia.

The appeal of NWFZs suggests that they may play an important role in international politics. Scholars have devoted considerable attention to understanding the processes of states' acquiring nuclear weapons.[2] However, the issue of legalizing commitments to forgo nuclear weapons has been largely ignored.[3] Some important case-specific studies have considered issues relating to NWFZs but scholars have yet to systematically identify the determinants of NWFZ membership.[4] In this study, we attempt to address this shortcoming.

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[1] At the time of this writing, Kyrgyzstan and Uzbekistan had ratified the treaty but Kazakhstan, Tajikistan, and Turkmenistan had not. As a result, the treaty has yet to enter into force.

[2] George Quester. 1973. *The politics of nuclear proliferation.* Baltimore: Johns Hopkins University Press; Zachary Davis and Benjamin Frankel, eds. 1993. *The proliferation puzzle: Why nuclear weapons spread (and what results).* Portland, OR: Frank Cass; Etel Solingen. 1994. "The political economy of nuclear restraint." *International Security* 19(2): 126-169; Scott Sagan. 1996/97. "Why do states build nuclear weapons." *International Security* 21: 54-86; Sonali Singh and Christopher R. Way. 2004. The correlates of nuclear proliferation: A quantitative test. *Journal of Conflict Resolution* 48(6):859-885; Dong-Joon Jo and Eric Gartzke. 2007. "The determinants of nuclear proliferation: A quantitative model." *Journal of Conflict Resolution* 51(1): 167-194; Matthew Kroenig. 2008. "Importing the bomb: Sensitive nuclear assistance and nuclear proliferation." Cambridge, MA: Harvard University. Available at:
 http://belfercenter.ksg.harvard.edu/files/uploads/Kroenig_Importing_the_Bomb.pdf

[3] For an important exception see Christopher Way and Karthika Sasikumar. 2004. "Leaders and laggards: Why and why do countries sign the NPT." *Note de Recherche Working Paper 16.* The literature on why states abandon the pursuit of nuclear weapons does not explicitly address legalization, but it also sheds some light on this issue. See, for example: T.V. Paul. 2000. *Power versus prudence: Why nations forgo nuclear weapons.* Montreal: McGill-Queen's University Press; Etel Sonlingen. 2007. *Nuclear logics: contrasting paths in East Asia and the Middle East.* Princeton, NJ: Princeton University Press.

[4] John Redick. 1981. "The Tlatelolco regime and nonproliferation in Latin America." *International Organization* 35(1): 103-134; Etel Solingen. 1994. "The domestic sources of regional regimes: The evolution of nuclear ambiguity in the Middle East." *International Studies Quarterly* 38(2): 305-337; Toshiki Mogami. 1988. "The south pacific nuclear free zone: A fettered leap forward." *Journal of Peace Research* 25(4): 411-430; Xia Liping. 1999. "Nuclear-weapon-free zones: Lessons for nonproliferation in Northeast Asia." *Nonproliferation Review* 6(4): 83-92; Scott Parrish. 2001. "Prospects for a Central Asian nuclear weapon-free zone;" Claudia Baumgart and Harald Muller. 2004. "A nuclear weapons-free zone in the Middle East: A pie in the sky?" *Washington Quarterly*

We seek to explain why some states ratify NWFZ treaties and others do not—and more importantly when do they decide to do so. Some countries refuse to officially join NWFZs (e.g. Egypt and Somalia) or join years after they are established (e.g. Argentina and Cuba) even when other countries in the region choose to do so without hesitation. Explaining this type of variation can advance our understanding of international law since treaties have no legally binding power until states ratify them, as the case of the African NWFZ illustrates.[5]

In this study we integrate insights from the literatures on legal commitment[6] and nuclear proliferation[7] to identify the determinants of NWFZ treaty ratification. We argue that variation in the costs and benefits of commitment explains when states enter NWFZs. We find that states are less likely to make commitments when doing so requires significant policy changes, which is consistent with the findings in the extant literature.[8] This means that states are less likely to enter NWFZs if they have not already made nonproliferation commitments or if they have incentives to acquire, test, or possess nuclear weapons in the future. We also find that states are more likely to enter NWFZs when they highly value the negative security assurances provided by the nuclear powers. These assurances are especially important for states that expect to be engaged in militarized conflict with the nuclear powers in the future (e.g. the possibility exists for nuclear weapons to be used against them). We find only limited empirical support for the argument that legal commitments are made to extract normative benefits, although our results indicate that liberalizing states are more likely to enter NWFZs.

Our argument speaks to an important debate taking place in policy circles. Policymakers are currently considering whether establishing NWFZs in the Middle East or other conflict prone regions is "a pie in the sky."[9] They are grappling with whether NWFZs can be introduced to promote peace and avert nuclear crises, or whether peace is a necessary

28(1): 45-58. In this article we use the phrasing "NWFZ membership" and "NWFZ treaty ratification" interchangeably. Membership is assumed to occur only once states ratify the treaty.

[5] Oona Hathaway. 2007. "Why do states commit to human rights treaties?" *Journal of Conflict Resolution* 51(4): 588-621. 28 of the 53 African states must ratify the Pelindaba Treaty before it enters into force.

[6] Martha Finnemore and Kathryn Sikkink. 1998. "International norm dynamics and political change." *International Organization* 52: 887-917; Beth Simmons. 2000. "International law and state behavior: commitment and compliance in international monetary affairs." *American Political Science Review* 94(4): 819-835; Andrew Moravcsik. 2000. "The origins of human rights regimes: Democratic delegation in postwar Europe." *International Organization* 54 (2): 217-52; Todd Landman. 2005. "Protecting human rights: A comparative study." Washington, DC: Georgetown University Press; Hathaway. "Why do states commit to human rights treaties;" Jay Goodliffe and Darren Hawkins. 2006. "Explaining commitment: States and the convention against torture." *Journal of Politics:* 68(2): 358-371.

[7] Quester, *The politics of nuclear proliferation*; Davis and Frankel, *The proliferation puzzle*; Solingen, "The political economy of nuclear restraint;" Sagan, "Why do states build nuclear weapons;" Singh and Way, "The correlates of nuclear proliferation;" Jo and Gartzke, "The determinants of nuclear proliferation."

[8] George Downs, David Rocke and Peter Barsoom. 1996. "Is the good news about compliance good news about cooperation?" *International Organization* 50(3): 379-406; Hathaway, "Why do states commit to human rights treaties;" Goodliffe and Hawkins, "Explaining commitment;" James Vreeland. 2003. "CAT selection: Why governments enter into the UN convention against torture." Working paper. Available at http://pantheon.yale.edu/~jrv9/cat.pdf.

[9] George Perkovich, Jessica Matthews, Joseph Cirincione, Rose Gottemoeller, and Jon Wolfsthal. 2005. *Universal compliance: A strategy for nuclear security.* Washington, D.C.: Carnegie Endowment for International Peace; Baumgart and Muller, "A nuclear weapons-free zone in the Middle East;" Rebecca Johnson. 2007. "Rethinking security interests for a nuclear weapon free zone in the Middle East," *Disarmament Diplomacy* 86.

prerequisite for these zones to function properly. Our results suggest that states engaged in militarized conflict are unlikely to enter NWFZs because the costs of doing so are high. This casts some doubt on the prospect of establishing a Middle East NWFZ (MENWFZ) under present conditions and suggests that a settlement of existing conflicts will need to precede negotiation of a MENWFZ. However, our finding that states will join NWFZs when they value negative security assurances suggests that states in other regions can be enticed by this incentive under the right circumstances.

We contribute to the literature on legalization by demonstrating that variation in the costs and benefits of treaty provisions is important to understanding commitment. While a number of studies have considered whether treaty commitments change state behavior, much less attention has been devoted to understanding when and why states legalize commitments in the first place.[10] We also contribute to this literature by applying many of its insights to commitment in the area of "high politics." By enhancing scholarly understanding of when states legalize their nonproliferation commitments, we contribute to the literature on nuclear proliferation. Interestingly, our results reveal that the determinants of nuclear proliferation and nuclear nonproliferation are not identical. For example, while an alliance with a nuclear power reduces states' incentives to pursue nuclear weapons[11] our results reveal that it does not make states more likely to enter a NWFZ. This suggests that these phenomena are not simply two sides of the same coin.

We proceed by describing NWFZs in more detail and what commitment to such treaties entails. Next, we draw from the extant literature to put forth hypotheses regarding when states will join NWFZs and then outline our methodological approach to testing these hypotheses. Subsequently, we describe our findings and conclude by summarizing their implications and offering directions for future research.

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[10] Important exceptions include Hathaway, "Why do states commit to human rights treaties;" Goodliffe and Hawkins, "Explaining commitment;" Vreeland, "CAT selection."
[11] Singh and Way, "The correlates of nuclear proliferation;" Jo and Gartzke, "The determinants of nuclear proliferation."

NWFZs AND COMMITMENT

NWFZ treaties are an important part of the nuclear nonproliferation regime.[12] NWFZs compliment the NPT in that both arrangements promote nonproliferation and disarmament while allowing the peaceful use of nuclear energy. But NWFZs are unique in three ways. First, NWFZ arrangements are more comprehensive from a nonproliferation standpoint than the NPT. In addition to banning the acquisition and stockpiling of nuclear weapons, NWFZs prohibit states from conducting any type of research on nuclear explosive devices, stationing any nuclear explosive device on their soil, and testing nuclear explosive devices. Further, most NWFZ treaties include more stringent safeguards requirements with regional mechanisms for verification.[13] Second, they are regional, rather than global, in scope. This means that NWFZs can be tailored to the needs of states in a particular region and lead to incremental advances in arms control and disarmament.[14] Third, NWFZ treaties require nuclear weapon states to provide negative security assurances, meaning that they pledge not to use or threaten to use nuclear weapons against any country in the zone.

Given these features, we can identify the costs and benefits of NWFZ membership. Many scholars have observed that legalization is costly.[15] States sacrifice a degree of national discretion by legalizing commitments not to develop, manufacture, control, possess, test, station, or transport nuclear weapons. For those states that ratify NWFZ treaties prior to ratifying the NPT, the commitments not to develop, manufacture, or control nuclear weapons are new.[16] These are significant pledges given that nuclear weapons can be a relatively cheap and security-maximizing deterrent.[17] For states that have already signed the NPT, these commitments are reaffirmations of previous pledges. Even these reaffirmations can be costly since they subject the state to further losses vis-à-vis non-compliant states[18] and make it more difficult to exit the NPT regime if such a need arises.[19] This is evident in

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[12] NWFZs have been labeled by some as "the most promising disarmament mechanisms," especially in light of the problems with the cornerstones of the regime, the NPT and the Comprehensive Test Ban Treaty. See Adam Shapiro. 2004. "Nuclear weapons free zones: The future of nuclear disarmament," *UN Chronicle* 41(3): http://www.un.org/Pubs/chronicle/2004/webArticles/081204_nwfz.asp. Recent research casts doubt on the effectiveness of the NPT by illustrating that signatories of the treaty are statistically no more likely than non-signatories to receive peaceful nuclear assistance. This suggests that one of the "grand bargains" of the NPT has not been fulfilled. See Matthew Fuhrmann. 2008. "Taking a walk on the supply side: The determinants of civilian nuclear cooperation." Cambridge, MA: Harvard University. Available at:
 http://belfercenter.ksg.harvard.edu/files/uploads/Fuhrmann_Taking_A_Walk_on_the_Supply_Side.pdf.

[13] For example, the Treaty of Tlatelolco established the Agency for the Prohibition of Nuclear Weapons in Latin America and the Caribbean (OPANAL) to ensure that all treaty obligations are met.

[14] Policymakers have recognized these advantages of regional arms control for decades. See Hubert Humphrey. 1963. "Regional arms control agreements." *Journal of Conflict Resolution* 7(3): 265-271.

[15] See, for example, Kenneth Abbott and Duncan Snidal. 2000. "Hard and soft law in international governance." *International Organization* 54(3): 421-456.

[16] Article II of the NPT states that non-nuclear weapons states will not manufacture, acquire, or control nuclear weapons. Of the 115 states eligible to enter NWFZs, 28 (24%) ratified the NWFZ treaty prior to ratifying the NPT. It is worth noting that the Latin American NWFZ was signed by many states in 1967, the year before the NPT was opened for signature.

[17] Quester, *The politics of nuclear proliferation*; Ashok Kapur. 2001. *Pokhran and beyond: India's nuclear behaviour*. New Delhi: Oxford University Press; Singh and Way, "The correlates of nuclear proliferation."

[18] Kenneth Waltz. 1979. *Theory of international politics*. Reading, MA: Addison-Wesley; Joseph Grieco. 1988. "Anarchy and the limits of cooperation: A realist critique of the newest liberal institutionalism." *International Organization* 42(3): 485-507.

[19] Article X of the NPT states that countries can exit the treaty if the provide 90 days advanced notice.

Egypt's position towards NWFZ ratification. Although Cairo ratified the NPT in 1981 it has refused to ratify the African NWFZ unless the nuclear powers make further strides towards disarmament and establish a NWFZ in the Middle East that includes Israel.[20]

There are several benefits states may reap as a result of entering NWFZs. In addition to furthering the cause of nonproliferation and making progress towards nuclear disarmament, NWFZs also provide the negative security assurances described above.[21] The desire of non-nuclear weapons states to obtain legally binding security assurances from the nuclear powers has been "a perennial subject of contention" at NPT review conferences.[22] Obtaining these security assurances lessens a non-nuclear weapons state's fear that nuclear weapons will be used against it and makes it feel more secure. There are also several indirect benefits of NWFZ commitment. Joining NWFZs allows states to signal their commitment to nonproliferation norms and their intention to play by the rules, which enhances their credibility. This in turn may lead to a host of psychological or material rewards such as increased economic aid, trade, and investment.[23]

THEORY AND HYPOTHESES

Since we assume that states are rational, utility-maximizing actors, they are likely to enter NWFZs when the costs are minimal or when the benefits are sufficiently high. Like recent work on legalization, we expect that the weight attached to the costs *and* benefits of NWFZ membership will vary from state-to-state (Goodliffe and Hawkins, 2006). Identifying the states that have the most to gain and the least to lose will help us explain the variation in NWFZ commitments. What follows is a description of factors that are likely to influence how states weigh the costs and benefits of NWFZ commitments. Based on these variables, we identify and test specific hypotheses regarding which states are likely to ratify NWFZ treaties and when they are likely to do so.

Variable Costs

Downs, Rocke, and Barsoom argue that governments commit to international agreements only when they have already made the particular policy change.[24] This suggests that the more compatible a state's policies are with the provisions of a treaty, the lower the costs of commitment.[25] For example, Goodliffe and Hawkins find that states are more likely to ratify a human rights treaty when they already have a good human rights record.[26] Building on this logic, we expect that the more costly it is for states to forgo nuclear weapons-related activities, the less likely they are to join a NWFZ. Since the NPT requires signatories to forgo the acquisition or possession of nuclear weapons, states that have

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[20] Leonard Spector and Aubrie Ohide. 2005. "Negative security assurances: Revisiting the nuclear weapon free zone option." *Arms Control Today* 35(3).

[21] Negative security assurances may also be attainable through bilateral provisions outside of a NWFZ framework.

[22] NPT review conferences are held every five years to examine the implementation of the treaty. See: Spector and Ohide, Negative security assurances.

[23] Simmons, "International law and state behavior;" Finnemore and Sikkink, "International norm dynamics and political change."

[24] Downs, Rocke and Barsoom, "Is the good news about compliance good news about cooperation."

[25] Hathaway, "Why do states commit to human rights treaties;" Goodliffe and Hawkins, "Explaining commitment;" Vreeland, "CAT selection."

[26] Goodliffe and Hawkins, "Explaining commitment."

already ratified the NPT should have less to lose by reaffirming these commitments. States that have not ratified the NPT make the legal commitment not to pursue or control nuclear weapons for the first time.

H1: States that have already ratified the NPT are more likely to ratify NWFZ treaties than states that have not ratified the NPT.

States may pursue nuclear weapons even when they are party to the NPT.[27] For example, even though Libya signed the NPT in 1975, it continued to pursue nuclear weapons until 2003. This suggests that we also need to look at state behavior in order to understand the costs of NWFZ commitments. Based on the logic advanced above, states that are considering the pursuit of nuclear weapons have to give up more than other states in order to ratify NWFZs. Even if a state is already a NPT member, deepening its commitment to nonproliferation and subjecting itself to further safeguards and verification measures could be costly. This leads us to our next hypothesis:

H2: States that are at least exploring nuclear weapons are less likely to ratify NWFZ treaties than states that are not exploring nuclear weapons.

A state's current level of satisfaction with global nonproliferation efforts might also have an affect on its willingness to enter a NWFZ. States may be unwilling to make further nonproliferation commitments if they perceive that other states are not abiding by nonproliferation norms. This perception could exacerbate the problem of relative gains and make regional cooperation extremely difficult.[28] For example, many states in the non-aligned movement are reluctant to make further nonproliferation commitments because they perceive that the nuclear powers are not abiding by their obligations to work towards nuclear disarmament and share nuclear technology for peaceful purposes.[29] For example, the northern African states voiced concern about ratifying the NWFZ when Israel possess nuclear weapons and has not signed the NPT.

H3: States that are not satisfied with global nonproliferation efforts are less likely to ratify NWFZ treaties.

Making legal commitments can be costly because it limits future flexibility.[30] Thus, states that have strong incentives to pursue nuclear weapons might be unwilling to make nonproliferation commitments in the face of uncertainty—regardless of whether they are currently pursuing nuclear weapons or not. The literature on nuclear proliferation identifies a number a variables that affect states' willingness to pursue nuclear weapons. The most salient factor is a state's security environment.[31] States prone to experience conflict feel

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[27]Jeffrey Berejikian and Matthew Fuhrmann. 2007. "Cheating honestly: Exit vs. predation in the nonproliferation regime." Paper presented at the 48th Annual Meeting of the International Studies Association, Chicago, IL, February 28-March 3, 2007. For example, we now know that Iran and North Korea pursued nuclear weapons programs while members of the NPT.

[28] Waltz, *Theory of international politics*; Grieco, "Anarchy and the limits of cooperation."

[29] These commitments are mandated by Article VI and Article IV of the NPT, respectively.

[30] Goodliffe and Hawkins, "Explaining commitment."

[31] Quester., *The politics of nuclear proliferation*; Sagan, "Why do states build nuclear weapons;" Singh and Way, "The correlates of nuclear proliferation;" Jo and Gartzke, "The determinants of nuclear proliferation."

compelled to fortify their military capabilities to prepare for or deter possible attacks. Since nuclear weapons are an effective deterrent, it is unlikely that states will give up this potential capability under these circumstances. Alternatively, states that are free from militarized conflict will have less incentive to acquire nuclear weapons for security reasons. Consequently, the costs associated with NWFZ membership are lower. This logic leads to our next hypothesis:

> *H4: States involved in violent militarized conflict are less likely to ratify NWFZ treaties than states that are not involved in violent militarized conflict.*

Hypothesis 4 is motivated by the expectation that the costs of entering NWFZs are mitigated when states have little incentive to pursue nuclear weapons to begin with. There are other ways that the costs of NWFZ membership can be marginalized. Even if states have an incentive to pursue nuclear weapons, they may choose to enter a NWFZ if they share an alliance with a state possessing nuclear weapons. Under these circumstances, they may be able to "free ride" on the protection provided by their ally's nuclear umbrella.[32] Relying on an ally's nuclear deterrent allows a state to enter a NWFZ without undermining its own security interests. It also minimizes fears of foreclosing policy options in the face of uncertainty and threat. Thus, a state is free to reap the benefits of joining a NWFZ while suffering very few costs. This assumes that the nuclear weapon state would come to the aid of its non-nuclear ally in the event of a crisis. Thus, the alliance must be strong and stable for this logic to hold. For this reason, we hypothesize the following:[33]

> *H5: A state sharing a formal defense pact with a state possessing nuclear weapons is more likely to ratify a NWFZ treaty than a state that does not share such an alliance.*

A state's nuclear-related resources have an important effect on the costs and benefits of NWFZ membership. Since states with significant nuclear resources have the potential to acquire nuclear weapons in the future and often are eventually impelled to do so,[34] they are foreclosing a policy option by making a NWFZ commitment. Conversely, the costs of NWFZ entrance are diminished for states that do not have the capability or knowledge (i.e. the opportunity) to develop nuclear weapons and are unlikely to develop such a capability in the future. Since countries without the appropriate resources have little prospect of acquiring nuclear weapons—even if they desired them—it is unlikely that NWFZ membership will force them to change their policies in the future.

> *H6: States with more nuclear-related resources are less likely to ratify NWFZ treaties.*

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[32] Josef Joffe. 1984. "Europe's American pacifier." *Foreign Policy* 14: 64-82.

[33] For more on this distinction see Long's discussion of the impact of alliances on international trade: Andrew Long. 2003. "Defense pacts and international trade." *Journal of Peace Research* 40(5): 537-552.

[34] Matthew Fuhrmann. 2008. *Grand Strategy and the Nuclear Marketplace: Civilian Nuclear Cooperation, the Balance of Power, and the Bomb.* PhD diss. Athens, GA: The University of Georgia; Peter Lavoy. 1993. Nuclear myths and the causes of nuclear proliferation, in Zachary Davis and Benjamin Frankel, eds., *The proliferation puzzle.* London: Frank Cass: 192-212; Stephen Meyer. 1984. *The dynamics of nuclear proliferation.* Chicago: University of Chicago Press.

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Variable Benefits

We also expect that the benefits of NWFZ commitments will vary from state to state. Recall that one of the major benefits of NWFZ membership is the negative security assurances provided by the nuclear powers. These assurances state that nuclear powers will not use nuclear weapons against members of the NWFZ. The extent that a state will see this as important varies based on its relationship with the nuclear powers. Specifically, countries that feel threatened by nuclear weapons states or believe that the likelihood of future conflict is high are likely to value this pledge more than countries that share a warm relationship with them. A state that is on friendly terms with the nuclear powers may not fear the use of nuclear weapons against it, which makes a negative security assurance pledge fairly meaningless. On the other hand, states that face the possibility of future conflict with the nuclear powers might perceive that nuclear weapons could be used against them. Under these circumstances, states have strong incentives to acquire negative security assurances. For example, Libya and Cuba—two states that historically have not been on good terms with United States—have more to gain from a U.S. negative security pledge than friends of the United States. This logic leads us to this hypothesis:

> *H7: States that have incompatible foreign policy interests with the nuclear powers are more likely to ratify NWFZ treaties.[35]*

The logic motivating Hypothesis 7 is that states value negative security assurances more when they perceive that future conflict with the nuclear powers is possible. Factors other than the compatibility of foreign policy interests can influence this expectation. Previous studies have concluded that powerful states are more likely to be involved in violent militarized conflict.[36] The logic driving this finding is that more powerful states are able to pursue more active (and possibly aggressive) foreign policies. This increases the interactions a state will have with others and increases the opportunity for militarized conflict. Further, a preponderance of power between two states reduces the likelihood of war because the clearly weaker party would not get involved in a war that it could not win.[37] Even if a weak state were to get involved in a war with a nuclear power, it is highly unlikely that nuclear weapons would be used against it given that the powerful state could easily achieve victory through other means. All of this logic suggests a relationship between state power and the value states place on the negative security assurances:

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[35] This hypothesis assumes that the compatibility of foreign policy interests is a proxy for the likelihood of future conflict. See: James Morrow, Randolph Siverson and Tressa Tabares. 1998. "The political determinants of international trade: The major powers, 1907-1990." *American Political Science Review* 92(3): 649-661. Of course, incompatible foreign policy interests with the nuclear powers could also discourage NWFZ membership because the incentives to pursue nuclear weapons are greater. This is an issue that we can address through our empirical tests. Results indicating a negative relationship between foreign policy interests and NWFZ entry would support this competing logic.

[36] Melvin Small and J. David Singer. 1982. International and civil wars, 1916-1980. Beverly Hills, CA: Sage; Stuart Bremer. 1992. "Dangerous dyads: Conditions affecting the likelihood of interstate war, 1816-1965." *The Journal of Conflict Resolution* 36(2): 309-341.

[37] Bremer, Dangerous dyads; Zeev Maoz and Bruce Russett. 1993. "Normative and structural causes of democratic peace, 1946-1986." *American Political Science Review* 87(3): 624-638; Jacek Kugler and Douglas Lemke. 1996. Parity and war: Evaluations and extensions of the war ledger. Ann Arbor, MI: University of Michigan Press.

H8: More powerful states are more likely to ratify NWFZ treaties than weaker states.

States also care about the non-material benefits of NWFZ status—such as enhanced image and reputation—to varying extents. Scholars from both the constructivist and neo-liberal camps posit that states may comply with norms to signal that they are responsible players in the international system. There is considerable variation, however, in the extent that states care about their image within international community. The countries that are most likely to comply with norms because of these considerations are those that are in a period of economic or political transition. As Glen Chefetz argues, states attempting to undergo an identity transformation and integrate into the liberal community will need to demonstration a robust commitment to liberal ideals in order to "join the club."[38] Indeed, this explains China's integration with the nonproliferation regime beginning in the 1980s.[39]

Based on this logic, states are likely to enter NWFZs when they are attempting to liberalize their economy or democratize. Under these circumstances, states have little to gain by maintaining ambiguous nuclear stances.[40] By committing to NWFZs, states can signal that they are committed to acting responsibly and are worthy of integration in the liberal community. Demonstrating these commitments may also allow states to attract foreign direct investment (FDI), land lucrative economic pacts such as free trade agreements (FTAs), or gain membership in coveted regional regimes (e.g. the Association of Southeast Asian Nations). Two hypotheses flow from this discussion.

H9: Democratizing states are more likely to ratify NWFZ treaties than non-democratizing states.

H10: States experiencing a period of increased economic interdependence are more likely to ratify NWFZ treaties than states that are not experiencing a period of increased economic interdependence.

Whether other states have made NWFZ commitments might also influence the extent that states care about the normative benefits of NWFZs. Finnemore and Sikkink argue that as more states commit to norms, other states feel pressure to do so as well.[41] The opportunity costs of remaining outside NWFZs (e.g. the benefits of joining) should increase as more states enter these zones. As this happens, those that do not commit stand out and could suffer greater costs.[42] This logic leads to two related hypotheses:

H11: States are more likely to ratify NWFZ treaties once other states in the region make the same commitment.

H12: States are more likely to ratify NWFZ treaties once the nuclear powers sign the NWFZ protocol.

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[38] Glen Chafetz. 1993. "The end of the cold war and the future of nuclear proliferation: An alternative to the neorealist perspective," in Z. Davis and B. Frankel, eds., *The proliferation puzzle: Why nuclear weapons spread.* Portland, OR: Frank Cass.

[39] Wendy Frieman. 2004. *China, arms control, and nonproliferation.* London: RoutledgeCurzon, 2004.

[40] Solingen, "The political economy of nuclear restraint."

[41] Finnemore and Sikkink, "International norm dynamics and political change."

[42] Simmons, "International law and state behavior."

DATA AND METHODS

We employ an event history model to test the hypotheses articulated above. Event history models typically include a dependent variable that measures the duration of time that units spend in a state before experiencing some event. The independent variables are theoretically assumed to exert effects on that observed duration. Since the events examined in this study entails time or history (the number of years) and change or event (ratifying a treaty), the event history model is preferred to the traditional regression models.[43]

The notion of failure and survival in the event history model is connected by the hazard rate, which gives the rate at which units fail (or duration ends) by the time t given that the unit has survived until t. Two widely used event history models are the parametric models (mainly the Weibull Model and the Gompertz model) and the Cox proportional hazard models.[44] In this study, since we are more interested in the effects of both time-invariant and time-varying covariates on the state's likelihood to ratify a NWFZ treaty than the shape of the hazard rate, the Cox model is preferred to the parametric ones. Mathematically, the Cox model can be written as $h_i(t) = h_0(t)\exp(\beta x)$, where $h_0(t)$ is the baseline hazard function and βx are the covariates and regression parameters. In scalar form, the Cox model can be expressed as $\log\left(\dfrac{h_i(t)}{h_0(t)}\right) = \beta_1 x_{i1} + \beta_2 x_{i2} + ... + \beta_n x_{in}$

The unit of analysis is yearly observation for all eligible countries in the existing four NWFZs from the years the respective NWFZs are established until 2002.[45] The dependent variable is the time between the year when the NWFZ is established and the year when the state enters/ratifies the NWFZ. Data on NWFZ ratification are obtained from lists compiled by the Center for Nonproliferation Studies.[46] Table I lists all states that are eligible to join NWFZs and the date that each ratified the relevant treaty. As Figure I reveals, the dependant variable has a positive skew, meaning that the lower half of the data are more concentrated than the upper half. It has a maximum value of 36 (Cuba), and the mean is 5.88.[47]

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[43] Janet Box-Steffensmeier and Bradford S. Jones. 2004. *Event history modeling: A guide for social scientists.* Cambridge: New York: Cambridge University Press.

[44] The parametric models are used when there is theoretically driven speculation about the shape of the hazard rate (increasing or decreasing) and are useful in making predictions beyond the scope of the sample data (because of the known baseline hazard rate). The Cox model relaxes the assumption on the baseline hazard rate and focuses more on the relationship between covariates and the hazard rate.

[45] The Central Asian NWFZ is not included since none of the eligible countries has yet ratified the treaty. There are in total 665 country-year observations in the dataset. Once missing data are accounted for, we are left with 461 observations.

[46] Center for Nonproliferation Studies. 2006. *Inventory of International Nonproliferation Organizations and Regimes.*

[47] Many of the relatively small duration cases are from the African NWFZ which was established in 1996.

Table I: List of Countries in the Four Eligible NWFZ and Their Year of Ratification.

Treaty of Tlatelolco (Latin America)	Treaty of Pelindaba (Africa)		Treaty of Rarotonga (South Pacific)	Treaty of Bangkok (Southeast Asia)
Antigua and Barbuda (1983)	Algeria (1997)	Mozambique (-)	Australia (1986)	Brunei Darussalam (1996)
Argentina (1994)	Angola (-)	Namibia (-)	Cook Islands (1985)	Cambodia (1997)
Bahamas (1977)	Benin (-)	Niger (-)	Fiji (1985)	Indonesia (1997)
Barbados (1969)	Botswana (1999)	Nigeria (2000)	Kiribati (1986)	Laos (1996)
Belize (1994)	Burkina Faso (1998)	Rwanda (-)	Marshall Islands (-)	Malaysia (1996)
Bolivia (1969)	Burundi (-)	Sao Tome (-)	Micronesia (-)	Myanmar (1996)
Brazil (1968)	Cameroon (-)	Senegal (-)	Nauru (1987)	Philippines (2001)
Chile (1974)	Cape Verde (-)	Seychelles (-)	New Zealand (1986)	Singapore (1997)
Colombia (1972)	Central African Republic (-)	Sierra Leone (-)	Niue (1986)	Thailand (1997)
Costa Rica (1969)	Chad (-)	Somalia (-)	Palau (-)	Vietnam (1996)
Cuba (2002)	Comoros (-)	South Africa (1998)	Papua New Guinea (1989)	--
Dominica (1993)	Congo (-)	Sudan (-)	Samoa (1986)	--
Dominican Republic (1968)	Democratic Republic of the Congo (-)	Swaziland (1996)	Solomon Islands (1989)	--
Ecuador (1969)	Cote d'Ivoire (1999)	Tanzania (1998)	Tonga (2000)	--
El Salvador (1968)	Djibouti (-)	Togo (2000)	Tuvalu (1986)	--
Grenada (1975)	Egypt (-)	Tunisia (-)	Vanuatu (1996)	--
Guatemala (1970)	Equatorial Guinea (2002)	Uganda (-)	--	--
Guyana (1995)	Eritrea (-)	United Republic of Tanzania (1998)	--	--
Haiti (1969)	Ethiopia (-)	Zambia (-)	--	--
Honduras (1968)	Gabon (-)	Zimbabwe (1998)	--	--
Jamaica (1969)	Gambia (1996)	--	--	--
Mexico (1967)	Ghana (-)	--	--	--
Nicaragua (1968)	Guinea-Bissau (-)	--	--	--
Panama (1971)	Guinea (1999)	--	--	--
Paraguay (1969)	Kenya (2000)	--	--	--
Peru (1969)	Lesotho (2002)	--	--	--
St. Kitts and Nevis (1995)	Liberia (-)	--	--	--
St. Lucia (1995)	Libya (2005)	--	--	--
St. Vincent (1992)	Madagascar (2003)	--	--	--
Suriname (1977)	Malawi (-)	--	--	--
Trinidad and Tobago (1970)	Mauritania (1998)	--	--	--
Uruguay (1968)	Mauritius (1996)	--	--	--
Venezuela (1970)	Morocco (-)	--	--	--

Notes: Ratification dates are in parentheses; a dash indicates that the treaty has yet to be ratified. Source: Center for Nonproliferation Studies. 2006. *Inventory of International Nonproliferation Organizations and Regimes.*

The explanatory variables are defined below. Summary statistics of these variables are provided in Table II. We begin by operationalizing the "cost" variables.

Nuclear Weapons. We include a dummy variable that is coded as 1 if a state is exploring nuclear weapons in year t and 0 otherwise.[48]

NPT membership. We include a dummy variable that equals 1 if a state is party to the NPT in year t, and zero otherwise.[49]

Militarized Conflict. We include a dummy variable that is coded as 1 if a state was involved in a militarized interstate dispute (MID) that resulted in at least one fatality in year t, and 0 otherwise.[50]

Rivalry. We include an additional variable to operationalize violent militarized conflict. We define a rivalry as a minimum of five militarized disputes between two states over a twenty year period.[51] We include a dummy variable that is coded as 1 if a state is involved in a rivalry in year t, and 0 otherwise.

Defense Pact. We include a dummy variable that is coded as 1 if a state shares a defense pact with a nuclear power and 0 otherwise.[52]

Nuclear Resources. To measure a state's nuclear-specific development capabilities we include a variable that measures the resources states have to produce nuclear weapons based on seven indicators.[53]

Nuclear Neighbor. To opeationalize a state's satisfaction with global nonproliferation efforts we include a dummy variable that equals 1 if there is a state within 150 miles that is pursuing nuclear weapons and 0 otherwise.[54]

The "benefit" variables are defined as follows:

Relations with Nuclear Powers. As a proxy for a state's relations with the nuclear powers, we use the s-score, which measures the similarity of alliance portfolios between states and computes

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[48] These data are taken from Singh and Way, The correlates of nuclear proliferation.

[49] Data on NPT membership are obtained from Center for Nonproliferation Studies, *Inventory of International Nonproliferation Organizations and Regimes.*

[50] Zeev Maoz. 2005. Dyadic Militarized Interstate Disputes Dataset (version 2.0). http://psfaculty.ucdavis.edu/zmaoz/dyadmid.html.

[51] This definition of a rivalry is taken from Gary Goertz and Paul Diehl. 1993. "Enduring rivalries: Theoretical constructs and empirical patterns." *International Studies Quarterly* 37(2): 147-171. For the militarized dispute data, we consult Maoz, Dyadic Militarized Interstate Disputes Dataset.

[52] Nuclear powers include: China, France, Russia, the United Kingdom, and the United States. These data are also obtained from Maoz, Dyadic Militarized Interstate Disputes Dataset.

[53] This measure is obtained from Jo and Gartzke, The determinants of nuclear proliferation.

[54] This, of course, is just one way to operationalize a state's satisfaction with nonproliferation efforts. For example, states may also be unhappy with the regime if they perceive that the nuclear powers are not abiding by their Article IV or Article VI commitments under the NPT. To construct this measure, we consult Singh and Way, "The correlates of nuclear proliferation," and Maoz, Dyadic Militarized Interstate Disputes Dataset.

a score between -1 and 1.[55] Lower scores indicate more dissimilar portfolios. We include a variable that measures a state's average s-score with all five nuclear weapons states in year t.[56]

State Power. To operationalize state power we measure the state's score on the Composite Index of National Capabilities (CINC).[57] This index, which ranges from 0 to 1, measures the share of a state's power in the international system based on its total population, urban population, iron and steel production, energy consumption, military personnel, and military expenditure.

Democratization. To measure democratization we use the Polity IV data.[58] These data use a 21-point scale (-10 to 10) to measure the level of democracy. States are considered to be democratizing if they experience a three-point increase in the Polity IV scale over a period of not more than five years. We construct a dummy variable that equals one if the state is democratizing and zero otherwise.

Trade Liberalization. Economic liberalization is measured as the difference between a state's exports plus imports as a share of GDP in year t and the same value in year t-1.[59]

Average Commitment. We follow Beth Simmons and measure the strength of the NWFZ norm by examining the extent that other states in the region have committed to it.[60] We utilize a 0-2 scale, where 0 indicates no action, 1 means that a state has signed the treaty, and 2 indicates signature and ratification. We then calculate the average commitment score for all states in the region for each year in our dataset.

Protocol. A state's willingness to enter a NWFZ may also depend on whether the nuclear powers have ratified the protocol pledging not to attack states in the zone with nuclear weapons. We include a variable measuring the percentage of the five nuclear powers that have ratified the negative security assurance protocol in year t.[61]

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[55] Curtis Signorino and Jeffrey Ritter. 1999. "Tau-b or not tau-b: Measuring the similarity of foreign policy positions." *International Studies Quarterly* 43(1): 115-144.

[56] These data and the CINC data were generated using EUGene. See D. Scott Bennett and Allan Stam. 2000. "EUGene: A conceptual manual." *International Interactions*, 26:179-204.

[57] J. David Singer, Stuart Bremer, and John Stuckey. 1972. Capability distribution, uncertainty, and major power war, 1820-1965, in Bruce Russett (ed) *Peace, war, and numbers*, Beverly Hills: Sage, 19-48.

[58] Monty Marshall and Keith Jaggers, 2002. .Polity IV Project. http://www.cidcm.umd.edu/polity/

[59] The trade data are taken from Kristian Gleditsch. 2002. "Expanded trade and GDP data." *Journal of Conflict Resolution* 46(5):712-24.

[60] Simmons, International law and state behavior:.

[61] Data on ratification are obtained from Center for Nonproliferation Studies, *Inventory of International Nonproliferation Organizations and Regimes*.

Table II: Summary of Explanatory Variables and Theoretical Expectations.

Variable	Mean	Std. Dev.	Min	Max	Anticipated Direction of Effect
Variable Costs					
Nuclear Weapon	0.04	0.20	0.00	1.00	Negative
NPT Membership	0.71	0.45	0.00	1.00	Positive
Militarized Conflict	0.31	0.48	0.00	4.00	Negative
Rivalry	0.22	0.41	0.00	1.00	Negative
Defense Pact	0.31	0.46	0.00	1.00	Positive
Nuclear Resources	1.86	2.38	0.00	7.00	Negative
Nuclear Neighbor	0.06	0.25	0.00	1.00	Negative
Variable Benefits					
Average S-score	0.67	0.10	0.50	0.80	Negative
State Power	0.001	0.003	0.00	0.008	Positive
Democratization	0.14	0.35	0.00	1.00	Positive
Trade Liberalization	3.5e-4	6.9e-4	0.2e-4	8.7e-3	Positive
Average Commitment	1.35	0.27	0.8	2	Positive
Protocol	0.50	0.33	0.00	1.00	Positive

RESULTS

Table III shows the results from the Cox proportional hazards model for the data specified above.[62] Positive coefficient suggests that an increase in the independent variable will increase the hazard and hence reduce the survival time. In other words, positive coefficients mean that an increase in the value of the independent variable makes it *more* likely that states will ratify NWFZ treaties. On the other hand, negative coefficients suggest that an increase in the covariate will decrease the hazard and increase the survival time. Thus, negative coefficients imply that an increase in the value of the independent variable makes it *less* likely that a state will ratify the treaty. The exponentiation of the coefficients are the hazard ratios, with values above 1 indicating that they make failure (NWFZ entry) more likely and values below 1 indicating that they make failure less likely. Table IV shows the substantive roles played by the variables that reached statistical significance. The entries represent the percentage change in the baseline hazard rate for a given change in the explanatory variable while holding other variables at the mean.

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[62] Several robustness checks were performed with respect to model specification and measurement. Alternative models using Weibull and exponential distributions are analyzed and they yield only marginally different coefficients. We then experimented with a series of different measurements for key variables. First, like Singh and Way, we estimated the Cox model using the 5-year moving average of the number of militarized interstates per year in which a state is involved as an alternate measure of the intensity of the security threat. Second, we added variables measuring GDP, democracy, percentage of democratic states in the region as well as the same variables drawn from the World Development Index. Third, we substituted the variable for S-score with the average s-scores with all states in the region and s-score with regional leader to measure foreign policy similarity. Finally, we employed the measurement of economic liberalization as the change of total trade volume over a 5-year period as used by Singh and Way. The corresponding results were not significantly different.

TABLE III: The Correlates of NWFZ Entry.

Independent Variables	Coefficients
Variable Costs	
Exploring Nuclear Weapons	-1.27
	(1.15)
NPT membership	**0.88****
	(0.4)
Involvement in Militarized Interstate Disputes	**-0.90 ****
	(0.48)
Involvement in enduring rivalry	-0.09
	(0.49)
Defense pact with nuclear states	0.70
	(0.48)
Nuclear resources	**-0.18****
	(0.09)
Nuclear neighbor within 150 miles	-0.24
	(0.56)
Variable Benefits	
Relationship with Nuclear Powers (Average S-score with all five NPT signatory states)	**-5.99*****
	(2.04)
State power (CINC score)	**148.6****
	(62.21)
Democratizing	-0.79
	(0.55)
Trade liberalization	**0.33***
	(0.19)
Average commitment in the region	-0.11
	(0.76)
Percentage of NPT signatory states that have ratified Protocol II of the NWFZ	**-6.56*****
	(0.83)
Number of Countries	109
Number of Observations	461
Log Likelihood	-245.09608

Notes: Cox model estimated by the averaged likelihood approximation of the partial likelihood function. Absolute value of z statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Efron method is used for ties.[63]

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[63] Since the data include quite a few ties, different methods of handling ties were employed, but all of them yield similar results.

Starting with the variables measuring "costs," we see that NPT membership is positive and the coefficient covers twice its standard error, suggesting that states that have ratified the NPT are more likely to ratify NWFZs. From a substantive standpoint, NPT status is the most salient factor in explaining NWFZ ratification. As Table IV indicates, being a NPT member increases the hazard rate of NWFZ entry by 141% compared to a state which has not ratified NPT. This lends support to the argument that states commit to international agreements when they have already adopted the relevant policies.[64]

Involvement in militarized disputes is also statistically significant and is linked with lower hazard rates as hypothesized. Militarized conflict also has a substantively significant effect on NWFZ commitments. A state involved in a violent MID has a hazard rate for entering the NWFZ that is 60% lower than a similar state not involved in a violent MID. This supports our argument that states will be reluctant to enter NWFZs when they have incentives to pursue nuclear weapons in the future. As for nuclear resources, the statistically significant coefficient lends support to the theoretic anticipation that states with significant nuclear resources are reluctant to forego the option of pursuing nuclear weapons and hence are less likely to make NWFZ commitments. A one point increase in the nuclear resources index yields a 13% drop in the hazard rate. In other words, the predicted hazard rate for a country with no nuclear resources is 91% lower than a fully nuclear capable country. These latter two findings reveal that some variables that are salient in explaining nuclear proliferation are also important for understanding nonproliferation commitments. Taken together, the statistical and substantive significance of the NPT, violent conflict, and nuclear resources variables lends support to the argument that variation in the costs of commitment is important in explaining a country's decision to ratify a treaty.[65]

The coefficients on the other variables operationalizing the future costs of treaty ratification did not cross the conventional statistical significance level. While involvement in an enduring rivalry, whether a state has a nuclear neighbor, and whether a state has a defense pact with a nuclear power are important in explaining nuclear proliferation[66] our results suggest that they are less salient in explaining nonproliferation commitments. This is a noteworthy finding. It indicates that the absence of factors that compel states to pursue nuclear weapons does not necessarily lead states to make nonproliferation commitments. Finally, the coefficient on the variable measuring exploration of nuclear weapons is negative as anticipated; however, it also falls short of the conventional statistical significance level, indicating no relationship between the variable and entry into NWFZ.[67] This suggests that whether a state has already made nonproliferation commitments (via NPT ratification) is a better indicator of the costs of policy change. As we stated above, NPT ratification is highly salient in explaining NWFZ ratification.

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[64] Downs, Rocke and Barsoom, "Is the good news about compliance good news about cooperation."

[65] Hathaway, "Why do states commit to human rights treaties;" Goodliffe and Hawkins, "Explaining commitment;" Vreeland. 2003. "CAT selection."

[66] Singh and Way, "The correlates of nuclear proliferation;" Jo and Gartzke, "The determinants of nuclear proliferation."

[67] This may be because only four states (Algeria, 1983-2002; Argentina, 1968-1990; Brazil, 1953-1990; Libya, 1970-2002) were exploring nuclear weapons during the domains under analysis here.

TABLE IV: Substantive Effects of the Explanatory Variables on the Likelihood of Entering Nuclear Weapons Free Zone.

Independent Variable	Percentage Change from Baseline Hazard
NPT membership	+141
Involvement in Militarized Interstate Disputes	-60
One point increase in nuclear resources	-13
Increase of 0.1 in the average S-score with all five NPT signatory states	-10
0.01 increase in CINC score	+16
One standard deviation increase in trade liberalization	+28
Increase of one NPT signatory state that has ratified Protocol II of the NWFZ	-20

Moving on to the variables measuring "benefits," we first see that the coefficient of the variable measuring a state's relations with the nuclear powers is negative, as expected, and is statistically significant. States that have incompatible foreign policy interests with the nuclear powers are more likely to enter NWFZs. This variable is substantively significant as well, but it is less salient than some of the other variables in explaining NWFZ treaty ratification. An increase of 0.1 (or one standard deviation) in a country's average S-score with all five NPT signatory states yields a 9.8% decrease in the hazard rate that a country will enter the NWFZ. The likelihood of making a NWFZ commitment for a country that has exact opposite foreign policy interests with the NPT states is almost twice as high as that of a country whose foreign policy interests is perfectly compatible with the NPT states. The coefficient of the variable state power is positive and significant, suggesting that more powerful states are more likely to make NWFZ commitments than weaker states. From a substantive standpoint, increasing the CINC score by 0.01 will raise the hazard rate by 16%. We believe that these two results are both counterintuitive and practically important. They indicate that negative security assurances have value and are a useful instrument for disarmament and arms control. While this argument has been advanced in the policy-oriented literature,[68] it was empirically untested until now. That the perception of possible future conflict with the nuclear powers makes security assurances more enticing suggests that these mechanisms can offset motivations to pursue nuclear weapons.

Of the normative/reputation-based variables, economic liberalization and protocol ratification achieve statistical significance. Economic liberalization has a positive and statistically significant effect on survival time, as hypothesized. This variable is also quite salient in explaining NWFZ treaty ratification. A one standard deviation increase in the value of the economic liberalization variable produces a 28% increase in the hazard rate. This lends some support to the argument that variation in the normative-based benefits is important in explaining treaty ratification.[69] It suggests that liberalizing states are especially willing to demonstrate that they are responsible and forgo the opportunity to pursue nuclear

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[68] Spector and Ohide,"Negative security assurances."
[69] Simmons, "International law and state behavior;" Finnemore and Sikkink, "International norm dynamics and political change."

weapons for the opportunity to make money.[70] Collectively, these results reveal that variation in the benefits of NWFZ ratification is important.

Protocol ratification by the nuclear powers is negatively correlated with NWFZ ratification. From a substantive standpoint our results reveal that each additional NPT signatory state that ratifies the protocol reduces the hazard rate by 20%. This is our most unexpected finding.[71] It suggests that states will ratify NWFZs quickly when they find the negative security assurances attractive, regardless of whether the nuclear powers ratify the protocols expeditiously or not. This may be because states ratify NWFZs with the expectation that the nuclear powers will ratify the protocol at some point in the future. Future research should explore this further and consider whether states' expectations about how others will behave in the future are more salient in explaining treaty ratification than how others behave in the present time.

None of the remaining two variables approaches minimum statistical significance, showing that neither democratization nor average commitment score affects the likelihood of NWFZ entry. Especially telling is the insignificance of average commitment score which fails to support the normative argument that states will be pressured to follow the majority as more states commit to norms.[72] It seems that when survival is at stake, normative benefits matter less in states' cost-benefit calculation.

CONCLUSION

This paper examines how likely a country is to join a nuclear weapon free zone once one has been established in its region. This is an important question because a failure to ratify NWFZ treaties delays their entry into force, as the Treaty of Pelindaba illustrates. The findings of our study offer some important conclusions. From a policy standpoint our study reveals that negative security assurances can entice states to make nonproliferation commitments, suggesting that they are a useful tool for arms control and disarmament. Our results suggest that the region that has the best chance of establishing a NWFZ in the near future is Northeast Asia. For several years, practitioners and scholars have considered the possibility of creating a NWFZ that includes Japan, North Korea, South Korea, and Mongolia. North Korean resistance to such a zone has stymied previous efforts.[73] At the moment, the prospects for such zone appear good since North Korea has recently pledged to give up its small nuclear arsenal and abandon the future pursuit of nuclear weapons. But more importantly, Pyongyang is likely to value the negative security assurances from the nuclear powers—especially from the United States. It is clearly concerned about a nuclear attack from the United States[74] and the prospect of reducing these fears could lure North Korea in to a NWFZ. The prospects for such a zone in the Middle East are not so bright. Ultimately, whether states join a Middle Eastern NWFZ will depend on the extent that they value the negative security assurances from the nuclear powers and the extent that making the relevant nonproliferation pledges will impose policy costs.

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[70] Solingen, "The political economy of nuclear restraint;" Chafetz, "The end of the cold war and the future of nuclear proliferation."

[71] It is worth reiterating that this finding is consistent across alternate model specifications.

[72] Simmons, "International law and state behavior."

[73] Liping, "Nuclear-weapon-free zones."

[74] James Laney and Jason Shaplen, 2003. "How to deal with North Korea." *Foreign Affairs* 82(2).

Our study also offers several theoretical contributions. First, it reveals that some of the same factors leading states to pursue nuclear weapons make them less likely to legalize nonproliferation commitments. Especially salient in explaining commitment are militarized conflict and nuclear resources, which the extant literature on nuclear proliferation also identifies as important.[75] We also find that economically liberalizing states are more likely to ratify NWFZ treaties, which is consistent with proliferation arguments advanced by Solingen.[76] However, other variables that explain proliferation do not appear to influence legalization. For example, we find that whether a state has an alliance with a nuclear power and whether a state is involved in a rivalry have no statistically significant effect on a state's willingness to legalize nonproliferation commitments. These results suggest that nonproliferation and proliferation are related but are not two sides of the same coin. As we highlight below, this is an issue that future research should explore further.

Second, we find that the costs and benefits of NWFZ commitments vary from state-to-state. Like some previous work on legalization,[77] our study suggests that it is incorrect to assume that costs are either constant or randomly distributed. Further, recognizing the variation in these costs and benefits is the key to understanding legalization. This suggests that states rationally calculate the costs and benefits of making legal commitments and are especially likely to do so when the treaty provisions are attractive or when its policies are already consistent with the treaty's requirements (e.g. the costs are low). This finding has important implications for the compliance debate.[78] Recent work has concluded that states self-select in to treaties and that they have no independent effect on state behavior. In other words, the states that are most likely to comply with treaties are those that are more likely to enter them in the first place.[79] We do not directly challenge this assertion, but our study suggests that if it is self selection that is important, this literature must account for the variable costs and benefits states experience when it comes to legalization.

Third, our study is one of the few we are aware of that attempts to apply the logic of legalization—which typically focuses on human rights or economic domains—to the area of "high politics." We find that the insight of variable costs[80] does translate to legalization in the domain of nuclear nonproliferation. However, we do not find much support for the notion that variation in normative costs/benefits explains legalization. While we do find that liberalizing states may care more about their reputations, we do not find support for the argument that states are more likely to ratify a treaty when their neighbors do so.[81] When it comes to issues that affect state survival, it appears that security-based costs and benefits are

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[75] Sagan, "Why do states build nuclear weapons;" Singh and Way, "The correlates of nuclear proliferation;" Jo and Gartzke, "The determinants of nuclear proliferation."

[76] Solingen, "The political economy of nuclear restraint;" Solingen, *Nuclear logics*.

[77] Hathaway, "Why do states commit to human rights treaties;" Goodliffe and Hawkins, "Explaining commitment;" Vreeland, "CAT selection."

[78] Abram Chayes and Antonia Handler Chayes. 1993. "On compliance." *International Organization* 47(2): 175-205; Downs, Rocke and Barsoom, "Is the good news about compliance good news about cooperation."

[79] Jana von Stein. 2005. "Do treaties constrain or screen? Selection bias and treaty compliance." *American Political Science Review* 99:611.

[80] Hathaway, "Why do states commit to human rights treaties;" Goodliffe and Hawkins, "Explaining commitment: States and the convention against torture;" Vreeland, "CAT selection."

[81] Simmons, "International law and state behavior."

more salient than normative-based costs and benefits.

There are a number of questions related to NWFZs that warrant further scholarly attention. This paper focuses on a state's decision to join a NWFZ once one exists in its region, but it is also important to understand when and why a particular region becomes a nuclear-free zone. For example, why has South East Asia decided to establish itself as a NWFZ but North East Asia has not? This type of research would provide a greater sense of whether proliferation and nonproliferation are not two sides of the same coin, which is a claim we advance in this article. Additionally, it is worthwhile to further explore the effectiveness of NWFZ treaties. The policy-oriented literature suggests that NWFZs are an effective component to the nonproliferation regime because they are more comprehensive than other arrangements such as the NPT and provide additional mechanisms for verification. The ultimate effectiveness of these treaties, however, remains an open empirical question.

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