

Challenges to the Nuclear Non-Proliferation Treaty

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Abstract

The effectiveness of a given treaty hinges on states acknowledging the necessity of membership in that treaty, its functioning as intended, and its members preferring the treaty's continued existence. A number of challenges threaten the effectiveness of the Nuclear Non-Proliferation Treaty (NPT). These include continuing proliferation efforts, nationalism, great power competition, the spread of nuclear technology, the increasing burden on the International Atomic Energy Agency (IAEA), and polarization among NPT member states. This article models the mechanism that underpins the NPT and then assesses the effects of the identified challenges. When the various challenges work together within the NPT mechanism, effectiveness is likely to decrease in the foreseeable future unless the international community adopts specific measures. We conclude by offering policy recommendations intended to strengthen the NPT.

The Treaty on the Non-Proliferation of Nuclear Weapons (NPT) is an international framework designed to uphold the nuclear non-proliferation regime. It opened for signatures in 1968 and entered into force in 1970. As a result of the obligations enshrined within the NPT, the nuclear weapons states (NWS) agree not to assist the nonnuclear weapons states (NNWS) to either develop or acquire nuclear weapons, while the NNWSs are required to refrain from developing and/or acquiring nuclear weapons (Articles I and II).¹ To verify the NNWSs' compliance with the principles of the NPT, they accept the imposition of safeguarding measures, including inspections and monitoring by the International Atomic Energy Agency (IAEA), in relation to all the nuclear materials held within their territories (Article III). In exchange, all the signatories to the NPT pledge to facilitate the peaceful use of nuclear energy through the exchange of nuclear materials, equipment, and technology (Article IV). Finally, the NWSs are required to engage in negotiations

concerning the cessation of the nuclear arms race and the pursuance of nuclear disarmament (Article VI).²

Critics of the NPT have alleged it has exhibited only a relatively limited correlation with nuclear nonproliferation to date.³ However, we consider the treaty largely effective because states acknowledge the necessity of NPT membership, the treaty's framework is functioning as intended, and its members prefer its continued existence. While the number of signatories to the NPT has grown since 1968, only five states are now nonsignatories, including one case of withdrawal from the treaty.⁴ The NPT has prevented the majority of signatories from shirking their nonproliferation obligations by offering combinations of positive and negative incentives, applying stringent safeguards, and enhancing the international consensus and norms against the acquisition of nuclear weapons.⁵ Member states agreed to indefinitely extend the treaty in 1995, and more than 130 member states have now ratified the additional protocol to the NPT. This protocol strengthened safeguards that allow IAEA inspectors to access all parts of a state's nuclear fuel cycle, all buildings on an inspection site on short notice, all manufacturing and import locations in the state, and all environmental samples beyond declared locations.⁶

The prior success of the NPT and the apparent firmness of member states' agreement as to its importance, however, are not sufficient to guarantee its effectiveness in the future. In fact, history tells us that an international treaty can lose its effectiveness and eventually even collapse. International law scholars consider two pathways to be of particular relevance to the threshold at which an international treaty is deemed to be ineffective and defunct.⁷ First, if some or all of the signatories to a given treaty officially end their membership without supplanting any rules, then that treaty would be rendered severely weakened or even defunct (e.g., the 1987 Intermediate-Range Nuclear Forces [INF] Treaty). Second, even if the signatories do not officially withdraw from a given treaty, some states might cease to comply with that treaty if they consider its framework to not be working (e.g., the 1994 Budapest Memorandum). These two cases emphasize the key role played by state behavior in relation to the rise and fall of international treaties. Thus, a sound understanding of why states choose to adopt a nonproliferation policy and then continue to comply with the principles of the NPT is important when investigating whether or not the NPT will continue to be effective in the future.

Among the various challenges associated with contemporary international security, five are particularly relevant to the effectiveness of the NPT. These five challenges are continuing proliferation efforts of states

such as North Korea and Iran, global resurgence of nationalism, intensified competition among the great nuclear powers, increasing burdens faced by the IAEA, and growing polarization among NPT member states. While denuclearization of North Korea and Iran remains undecided, the novel coronavirus (COVID-19) pandemic will likely accelerate the resurgence of nationalism, the competition among the great powers, and the burdens on the IAEA.⁸

Without an adequate model of the mechanism that underpins states' choices with regard to the NPT, we are limited when it comes to assessing the potential impact of the challenges currently facing the treaty. In general, a *mechanism* can be defined as a set of statements that provides a plausible account of how certain variables are linked to one another.⁹ The mechanism underpinning states' choices with regard to the NPT represents a set of statements that provides a plausible account of why a state chooses to sign the NPT and then to continue complying with the treaty. Here, we explore the mechanism behind the NPT using a rational choice approach with a focus on the interactions that occur among the various international and domestic actors involved. These international and domestic actors include a state's government, which decides whether or not to comply with the requirements of the NPT; domestic groups, which either support or oppose the state's adoption of, and compliance with, a nonproliferation policy; rival states, which might pose security threats; and the international community, which comprises states and international institutions that support the existing nuclear control order and which provides incentives, generates norms, and monitors noncompliant behavior.¹⁰

The article begins by explaining the actors within the mechanism that underpin the NPT. Each actor alone is inadequate when it comes to predicting the potential impact of the five identified security challenges, as each is based on a particular perspective. Next, we present our model of the strategic choices available, which is intended to supplement the work of prior studies as well as to help overcome their limitations. Building on the presented mechanism, the article then assesses the potential impact of the challenges on the effectiveness of the NPT. The results show that an increasing number of NNWSs may deviate from the requirements of the NPT by ignoring the relevant principles or by withdrawing from the treaty. If this occurs, the effectiveness of the nonproliferation regime will decrease. We conclude by offering policy recommendations intended to strengthen the NPT and achieve a more robust nonproliferation regime.

Understanding the Mechanism behind the NPT

How exactly does the NPT work, and what explanations of the treaty have been, or could be, offered by the major theoretical approaches in the field of international relations? The neoliberal institutional theory considers the NPT to resolve two collective action problems because, as an institutional framework, it can “provide information, reduce transaction costs, make commitments more credible, establish focal points for coordination, and in general facilitate the operation of reciprocity.”¹¹ In particular, the principles enshrined within the NPT involve a commitment on the part of the NWS to the nontransfer of nuclear weapons technology to the NNWS. Thus, the nuclear powers consider the treaty to be useful for preventing rival nuclear powers from providing nuclear weapons technology to their allies. For the NNWS, the NPT framework is also a useful tool for monitoring potential proliferation behavior, forcing NNWS rivals to remain nonnuclear and thereby mitigating a security dilemma.¹²

A more strategic perspective regarding the NPT framework interprets it as a grand bargain struck between the nuclear haves and the have-nots, with the aim of ensuring the nonproliferation of nuclear weapons and moving toward complete nuclear disarmament.¹³ That is, the NWS provides the NNWS with both security and economic benefits, while in return, the NNWS complies with the principles of the NPT and accepts international safeguards. Key to the whole agreement are the nuclear powers’ commitment to the obligations contained within the NPT and the institutions’ capacity for screening and constraining noncompliant behavior.¹⁴ Within the broader nuclear nonproliferation regime, the NPT facilitates states’ commitments to, and coordination with, other institutional bodies—including the IAEA, the Comprehensive Test Ban Treaty (CTBT), supplier mechanisms that control the export of materials and equipment that could potentially be diverted for nuclear weapons development (i.e., the Nuclear Suppliers Group), and other United Nations resolutions (i.e., UN Security Council Resolution 1540 and 1673) and disarmament treaties.

A realist view, also known as the “cartel” theory of the NPT, sees the treaty as a way for the five NWSs to maintain their nuclear oligopoly and preeminence.¹⁵ Initially, the nuclear powers considered their allies’ nuclear weapons proliferation to be a means of strengthening their side’s influence against the opposing side. Later, however, the nuclear powers realized that the spread of nuclear weapons would actually reduce their influence over their allies, as those allies could substitute the availability of nuclear weapons for the nuclear powers’ security assurance and subsequently gain au-

tonomy.¹⁶ Therefore, the NWSs collectively bribed and coerced the NNWSs to comply with the principles of nonproliferation through a combination of multilateral and bilateral agreements.¹⁷ According to this theory, the NPT resulted from the NWSs' joint action to stop nuclear proliferation, and it now serves as a framework for coordinating the NNWSs' expectations concerning the benefits of compliance and bolstering the monitoring of noncompliant behavior.

The fourth relevant strand of theory is a normative explanation. Constructivists define a *norm* as "a standard of appropriate behavior for actors with a given identity."¹⁸ Such scholars argue that states shift from following "a logic of consequences" to following "a logic of appropriateness" as norms diffuse among them and alter their belief systems.¹⁹ In the field of nuclear politics, the prominent norm is nuclear nonproliferation, conveying a very clear meaning: "nuclear weapons are not acceptable weapons of war, . . . no new states should be allowed to obtain them, and . . . states with nuclear weapons should work to reduce and eventually eliminate them."²⁰ The nuclear nonproliferation norm is the core idea embodied within the NPT.²¹ Thus, when a state signs the NPT, its membership does not solely involve material terms but also means that it must abide by the associated ideas and rules in exchange for enjoying the rewards offered through the treaty framework.²²

As Maria Rost Rublee and Avner Cohen note, "Norms as an analytical framework provide great insight to understand the current roiling in nuclear politics."²³ In particular, this normative approach sheds light on the behavior of states that cannot be explained by material factors alone. First, the normative approach explains why the number of NPT member states has gradually increased over the years as well as why many states willingly abide by the nonproliferation principles enshrined within the treaty. Since the introduction of the NPT, leading states have sought to promote the nonproliferation norm. In fact, during the early 1990s, a norm cascade occurred that resulted in almost all states worldwide adopting the nonproliferation norm.²⁴ Through the process of international socialization, the majority of states gradually recognized the importance of becoming responsible and respected members of the international community, and it was their desire for membership that motivated them to willingly comply with the nonproliferation principles.²⁵ Second, the concept of norm contestation (i.e., the conflict between old and new norms) serves to explain why states' behavior can result in different outcomes under similar material situations.²⁶ The nonproliferation norm is an idea and a standard imposed by international actors, and it arguably conflicts with the NNWS's

sovereign right to develop nuclear weapons. Therefore, when there is a growing sense of nationalism within a given state, the conflict between new and old norms will be more intense. In particular, nationalistic coalitions “thrive on popular resentment over adjustment policies they regard as externally imposed, reliance on foreign investment, and the ‘Western’ principles and norms embodied in most international regimes.”²⁷ When facing real or perceived national security threats, these nationalistic coalitions, which oppose compliance with the nonproliferation norm, could choose the nuclear weapons option as a means of achieving greater self-reliance.

Although the above-mentioned theoretical approaches offer valuable insights with regard to exploring the mechanism behind the NPT, no single theory is sufficient to explain the net effects of such challenges when they work together through one mechanism. For instance, the bargaining theory would be useful in terms of explaining the impact of the IAEA’s capacity for monitoring noncompliant behavior on the effectiveness of the NPT. However, the effect of the growing competition among the great nuclear powers is not clearly explained by this theory. Rather, we could better understand the potential outcomes of the competition among the great powers using the cartel theory because it focuses on the coalition formed by the NWSs. Meanwhile, the normative theory would prove valuable in relation to assessing the likely impact of the rise of nationalism and the decline of globalization, although such an approach might be less effective in explaining the impact of the other highlighted challenges. To extend this line of research, our model of the mechanism underpinning the NPT is intended to supplement the work of prior studies and to help address our research question.

A New Model of the Mechanism behind the NPT

We model the mechanism behind the NPT using a rational choice approach and focusing on the interactions that occur among the associated international and domestic actors rather than on the actions of any one of them (table 1). There are four actors involved in our model. First, a state government decides whether or not to comply with the requirements of the NPT. Second, the *international community* (IC) is defined as a network of governments that prefers the current nuclear control order and nonproliferation regime, which are capable of providing incentives, generating norms, and monitoring noncompliant behavior. Third, if they exist, rival states pose security threats to the state government. Finally, the state government’s decision in this regard is also influenced by certain domestic groups that either support or oppose the adoption of, and compliance with, a policy of nonpro-

liferation. A state’s behavior in relation to the NPT is shaped by the process of strategic interactions that occur among these actors.

		NPT membership	
		Yes	No
Nonproliferation	Yes	Full compliance	Nonmembership / Nonproliferation
	No	Cheating	Nonmembership / Proliferation

Table 1. A state government’s possible choices with regard to the NPT

The interactions begin with the IC offering the benefits of NPT membership, contriving disadvantages for non-NPT member states, and possibly imposing sanctions on cheating states. We assume that all the states are originally nonmembers of the NPT. When interacting with the associated actors, a state government chooses one of the following three policy options. First is *full compliance* (upper left, table 1), which implies that a state signs the NPT and then genuinely upholds the rules and principles enshrined within it. Second is *nonmembership/proliferation* (bottom right, table 1), which implies that a state either fails to sign or withdraws from the NPT and develops or acquires nuclear weapons. The second policy option is relevant to both those states that have never signed the NPT (e.g., Israel, India, and Pakistan) and states that initially signed but later withdrew from the NPT (e.g., North Korea). Third is *cheating* (bottom left, table 1), which implies that a state clandestinely develops nuclear weapons despite remaining a signatory to the NPT, as seen in the cases of Iran (prior to the Joint Comprehensive Plan of Action [JCPOA]) and North Korea (prior to its withdrawal from the NPT). Thus, a cheating state is able to enjoy the benefits of NPT membership awarded by the IC while continuing to pursue the development of nuclear weapons, unless (or until) its clandestine activities are uncovered. We focus on these three policy options and do not consider the final option, namely *nonmembership/nonproliferation* (upper right, table 1), for two key reasons. First, logically, if a state does not have any intention of developing and/or acquiring nuclear weapons, it is better off choosing *full compliance*, as doing so results in positive and non-zero benefits.²⁸ Second, historically, all states except for South Sudan—only founded in 2011—have chosen one of the three policy options. No state has remained a nonmember/nonproliferator.

If a state government decides to choose *full compliance*, then the game ends with compliance equilibrium (see fig. 1). The IC does not change its strategy profile (i.e., the provision of rewards and disadvantages) during the subsequent period.²⁹ If a state government decides to choose *nonmembership*,

disadvantages will be imposed on it. The IC will change its strategy profile during the subsequent period based on updated beliefs and understandings regarding the situation. If a state government decides to choose *cheating*, there exists a certain probability (i.e., p) that its cheating will not be detected and that the IC will not change its strategy profile during the following period. Yet there also exists a probability (i.e., $1 - p$) that the cheating will be revealed and that sanctions will be imposed on the state government. During the next round, the IC will change its strategy profile based on its updated beliefs and understandings. In the remainder of this section, we will examine the costs and benefits associated with each strategic choice during one period of the game.

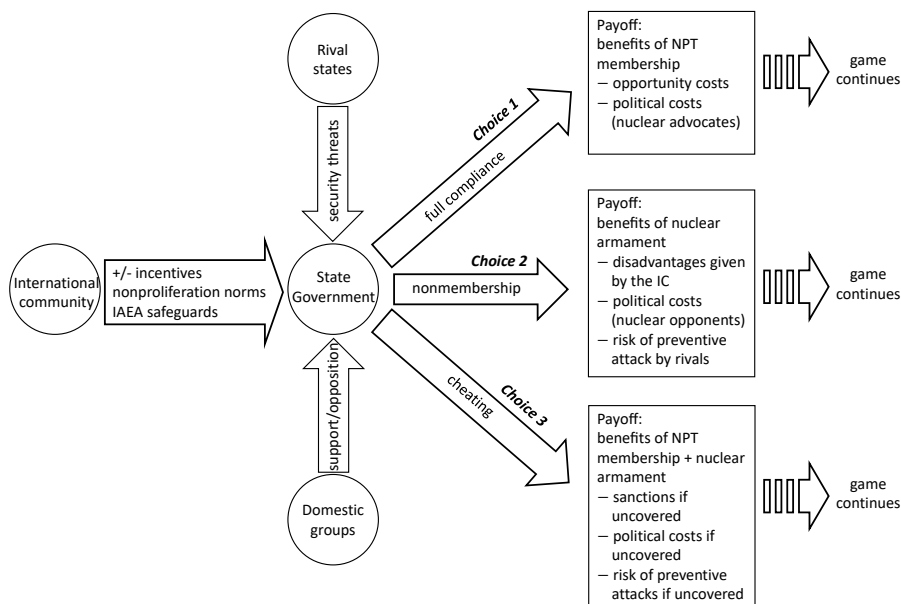


Figure 1. Strategic interactions in a state government's choice of a policy with regard to the NPT. The outcome of a state government's policy choice returns back to the beginning and affects subsequent behavior of the IC, rivals, and domestic groups in the next period.

Strategic Choice 1: Full Compliance

For the NPT compliers, the IC provides a set of rewards involving both security and economic benefits. First, although the text of the NPT does not specify any explicit security guarantees for the NPT states, NPT membership provides certain security benefits to signatories.³⁰ Some NWSs have provided assurances that they will never use nuclear weapons against signatories to the NPT.³¹ For instance, the 2018 US *Nuclear Posture Review* states that the United States will not use nuclear weapons against nonnu-

clear states in full compliance with the NPT.³² In addition, some NWSs also promised to assist its NNWS allies if they were threatened with nuclear attack.³³ Second, on the economic front, the NPT provides explicit economic benefits in terms of nuclear technology transfers and assistance with nuclear energy programs. Furthermore, being a member of the NPT and becoming part of the global community may catalyze foreign investment and better integration into the international economy.³⁴ However, such economic and security benefits may incentivize states differently depending on the situations in which those states live. That is, for states rich in energy sources, the promise of assistance with nuclear energy programs is likely to have only little attraction, while states with scarce resources may be more incentivized by the offer of nuclear energy assistance.

On the cost side, a state government choosing to comply with the treaty pays certain opportunity costs.³⁵ The costs are twofold since security and economic aspects are involved. In the case of the NPT, the most significant cost is security, which arises due to the loss of strategic freedom in the long term. Nuclear weapons are often seen as an effective means by which weaker states can strike a balance with powerful rivals at a relatively low cost. States with developed industrial and scientific infrastructure may regard nuclear armament as a more attractive policy option. Therefore, giving up the nuclear weapons option would limit a state's strategic flexibility and thereby require it to pay a higher price when signing the NPT.³⁶ This also implies that compliance with the NPT would incur economic costs, which would be required to build and operate larger conventional forces. However, such opportunity costs would differ according to the state's material situation. A state would face higher opportunity costs if it had stronger military rivals. A state facing powerful military rivals requires more investment in conventional forces for effective deterrence.³⁷

When a state government decides to join the NPT, the nonproliferation norm embedded within the treaty is also introduced into the state, possibly prompting a clash between the proponents and opponents of those new norms while generating the political costs. That is, if the state government accepts the rewards offered by the IC for engaging in norm-conforming behavior, some groups would lose the benefit they derived from existing norms. For instance, if Pyongyang complied with the nonproliferation norm, it would gain the rewards associated with the receipt of economic support from the IC. At the same time, however, it would no longer benefit from the self-help security effects associated with the possession of nuclear weapons. Thus, a group of people who believe *Juche*, a

self-reliance ideology, to be the foremost theory of survival would lose their normative foundation in domestic politics.³⁸ State leaders may well be concerned about such clashes since opposition to new norms on the part of the public or elite could lead to domestic turmoil or even a coup against the ruling elite.

Strategic Choice 2: Nonmembership

The greatest benefit associated with this policy option is that a state's national security could be significantly enhanced by nuclear armament. Indeed, the state could compensate for military weakness relative to its rivals through the development and acquisition of nuclear weapons. Further, the acquisition of nuclear weapons allows the proliferator to rely less on its allies. Thus, the state may improve its ability to make autonomous decisions.³⁹

The flip side of choosing such a policy is that both the state's rivals and the IC would launch countermeasures intended to thwart the state's nuclearization, as the proliferator's nuclear possession could alter the current balance of power. First, the IC could bring about punishment for the proliferator.⁴⁰ The text of the NPT does not specify the penalties that can be applied to nonmembers. However, it should be expected that economic punishments, both bilateral and multilateral, would be used as a tool to induce states to join and comply with the requirements of the NPT.⁴¹ Furthermore, the state's rivals may seek to prevent its nuclear development by launching different countermeasures, such as a preventive war (i.e., Israel's attack on the Osirak reactor in Iraq in 1981 and the al-Kibar reactor in Syria in 2007). Thus, the state government needs to consider both the disadvantages and risks from the IC and rivals.

Additionally, noncompliance with the nonproliferation norm can result in political costs for a state government. In particular, compliance with the nonproliferation norm may signal that the signatory state intends to adhere to international standards and to promote international peace.⁴² Further, signing the NPT can also be a costly signal that the state is taking action to become a legitimate member of the IC. Such action implies that domestic coalitions may recognize the importance of becoming a signatory to the NPT, not only for the associated economic benefits but also for status and normative reasons. Therefore, if the state government decides not to sign the NPT and instead pursues nuclearization, the government may expect both marginalization on the part of the IC and political costs from domestic groups supporting the nonproliferation norm and international peace.

Strategic Choice 3: Cheating

Not all state governments genuinely comply with the requirements of the NPT. Why do such state governments seek to deceive the IC and to covertly develop nuclear weapons, while at the same time claiming that they desire a security guarantee from the IC? One reason is related to security benefits, as such states may want to buy the time necessary to clandestinely build nuclear weapons while still seeking to alleviate tensions with their stronger rivals. The NPT can serve as a tool for signaling peaceful intentions. By pretending to eschew the nuclear option, a state government can seemingly demonstrate its commitment to de-escalating tensions and avoiding a costly arms race with its rivals. In response to the cheater's signal, rivals of that state may slow down their military buildup. If the cheating state government continues to develop nuclear weapons in covert ways, it could narrow the military power gap relative to its enduring rivals, or even possibly outpace its rivals by possessing nuclear forces. Such an approach could prove effective for a state that requires both time and resources to develop nuclear weapons so that it can stand on an equal footing to militarily and economically stronger rivals.

The other type of perceived benefit concerns the economic gains associated with compliance that a cheater can access in terms of nuclear assistance and foreign investment. In a self-help and anarchic international order, reaping the incentives for compliance with the NPT and then going back on one's pledge could represent a promising strategy. Although most states that have signed the NPT have not behaved in such a way, some states have appeared to do so. For example, in 1984, the Soviet Union reportedly agreed to provide four light-water reactors (LWR) to North Korea contingent upon Pyongyang's compliance with the obligations set out within the NPT.⁴³ Furthermore, in 1994, the United States and an international consortium agreed to provide political and economic assistance to North Korea in exchange for the freezing of its nuclear weapons program.⁴⁴ Yet Pyongyang declared its withdrawal from the NPT in 2003 in the face of receiving the benefits offered by the Soviet Union and the United States.

In terms of implications, however, if the clandestine activities are uncovered, the cheater must expect heavy costs due to strong economic and military sanctions imposed by the IC. Economic sanctions, such as the freezing of funds and trade embargos, have often been imposed on cheaters. One case of economic sanctions was the international restrictions on Iranian financial assets and economic resources in response to Tehran's refusal to halt its uranium enrichment program.⁴⁵ In some cases, military

measures have been used to punish cheating. Baghdad's alleged development of nuclear weapons, for example, was met with the invasion of Iraq by the United States and its allies in 2003.⁴⁶ Sanctions for cheating behavior tend to be stronger than the disadvantages imposed for nonmembership because cheating may signal to other states that they could deceive the IC as well.⁴⁷ A state government therefore decides to cheat the IC only if it expects the probability of detection to be sufficiently low and the potential sanctions to be weak, and the benefits of cheating substantially greater than for noncheating.

The Strategic Choice of Noncompliance

We have defined the costs and benefits that a state government considers when it chooses one of the three strategic choices. However, the payoff associated with each outcome does not tell us which strategic choice is preferred over the others. This means that we must compare the utility of each choice and then determine which choice offers greater utility than the others as well as under what conditions. In particular, the economic rationality assumption upon which this study is founded implies that a state government will choose a specific strategic choice if the utility of that choice is greater than the utilities of the other options.⁴⁸ Given the three choices, under what conditions will a state prefer a policy of noncompliance (either nonmembership or cheating) over one of compliance?

First, when choosing between full compliance and nonmembership policy, a state government will choose the nonmembership policy if its utility is greater than that of compliance. When compared, the likelihood of a state government's choice of nonmembership decreases when non-nuclear states are more sensitive to the benefits of compliance, when domestic coalitions' support of nonproliferation policy is strong, and when the disadvantages to nonmember states are great. For instance, if a state has an open economy and limited energy resources, its government and domestic groups may be concerned with economic assistance from the NPT framework and with meeting international standards and will therefore be more sensitive to the benefits of NPT membership.⁴⁹ In such a case, the state government is less likely to choose the nonmembership policy. A relevant example of this case can be seen in the South African government's decision to dismantle its nuclear arsenal. Along with the improvement in South Africa's security environment seen during the late 1980s, its rollback was driven by Pretoria's growing sensitivity to the benefits of NPT membership and by domestic coalitions' desire to escape

isolation from the international community through the dismantling of its nuclear arsenal.⁵⁰

The likelihood of choosing nonmembership, on the other hand, would increase when domestic opposition to compliance with NPT requirements and the opportunity costs of giving up a nuclear option increase. Then the IC must be able to provide sufficient incentives through the NPT framework to incentivize the state to remain a member and abide by the nonproliferation policy. For instance, when Japan ratified the NPT membership in 1976, it had already developed industrial and technological infrastructure and faced nuclear-armed China. A group of politicians had also openly discussed Japan's desire to develop nuclear weapons.⁵¹ The greater opportunity costs and domestic opposition that Tokyo faced led the IC to provide greater incentives, such as US extended nuclear deterrence and latent nuclear capability, so as to induce Japan to comply with the NPT.⁵²

Second, when choosing between full compliance and cheating policy, a state government will also choose the cheating policy if its utility is greater than that of compliance. When compared, the likelihood of choosing the cheating policy increases when the IC cannot impose effective sanctions on cheating states, when the probability of discovery of cheating actions is sufficiently low, and when a state government needs nuclear weapons due to security threats but also needs the benefits of NPT membership. Of particular importance is the IAEA's ability to inspect and monitor nuclear sites belonging to NNWSs.⁵³ If the IAEA's monitoring capacity is low, more states are likely to pursue clandestine nuclear development.⁵⁴ Iraq's and North Korea's covert nuclear programs suggest a correlation between monitoring inefficiency and cheating, as those states relied on their knowledge of the IAEA's limited inspection measures to hide nuclear materials and facilities.⁵⁵ The IC's lack of success in imposing sanctions on nuclear proliferators may also lead state governments to consider cheating a viable option. For instance, the UN sanctions against North Korea were weakened by surrounding states' worries about the regime's possible collapse. Pyongyang's belief that the IC cannot levy heavy sanctions against it might have prompted it to continue violating the principles of nonproliferation.⁵⁶

Nonmembership and cheating represent the main pathways that could negatively impact the effectiveness of the NPT. When aggregated, as more states choose either cheating or nonmembership, the likelihood that the NPT will become ineffective increases. Next we examine how the identified challenges are linked to these two potentially harmful pathways.

Assessing Potential Challenges to NPT Effectiveness

Five distinct trends could challenge the future effectiveness of the NPT. These are states' proliferation efforts, the global resurgence of nationalism, the increasing competition between the great nuclear powers, the spread of nuclear technology and the increasing burden on the IAEA, and the growing polarization among NPT member states. Assessing the potential impact of each challenge based on the mechanism defined above is instructive.

Challenge 1: States' Continuing Proliferation Efforts

Although the international community has tried to reduce the potential dangers associated with the spread of nuclear weapons, some states increased rather than decreased their efforts with regard to nuclear proliferation. First, while North Korea has not tested nuclear warheads since the failed negotiations with the United States at Hanoi and Stockholm in 2019, Pyongyang has continued its development of delivery vehicles, such as submarine-launched ballistic missiles and short-range missiles.⁵⁷ Second, since the United States withdrew from the JCPOA in May 2018 and later imposed new unilateral sanctions against Iran, Tehran has resumed its uranium enrichment program, restarted research and development on advanced centrifuges, and expanded its stockpile of nuclear fuel—thereby halving the time it would need to produce enough weapons-grade fuel to build a nuclear weapon.⁵⁸ As Richard Nephew, a US negotiator on the JCPOA, states, “Iran is manifestly closer to being able to produce a nuclear weapon than they were two years ago.”⁵⁹ Lastly, in South Asia, both Pakistan and India are continuing to produce nuclear weapons-related materials, develop delivery systems such as sea-based missiles (India) and short-range ballistic missiles (Pakistan), and deploy nuclear weapons in the midst of their nuclear competition.⁶⁰

The continuing proliferation efforts of these states and possible acquisition of nuclear weapons would increase the security and economic opportunity costs of regional rivals in the mechanism. For instance, in East Asia, a nuclear-armed North Korea would pose a threat to South Korea and Japan. These states count on the United States' extended deterrence to tackle the nuclear threat posed by North Korea. Yet, although the credibility of the United States' commitment to its allies' security is believed to be high, it is impossible to be certain that the United States will always be willing to sacrifice its people and territory for its allies. This uncertainty is a risk the protected states endure. In economic terms, the nuclear threat

posed by North Korea forces its regional rivals to commit more resources to the buildup of conventional forces. South Korea, for example, plans to spend 58.8 billion dollars from 2019 to 2023 to build a counter-nuclear system comprising radars, stealth fighter aircraft, and air-defense and ground-to-ground missiles.⁶¹ Similarly, Iran's latent nuclear capability is likely to prompt its rivals in the Middle East to consider deploying similar systems. Such security and economic costs could exceed the cost of nuclear weapons development, while also placing additional pressure on rival states' leaders to consider nuclear-armed options.

Challenge 2: Global Resurgence of Nationalism

Nationalism is defined as an ideology and a movement with the aim of gaining and maintaining a state's sovereignty, implying the belief that each state should be free from outside interference.⁶² Today, nationalism is seemingly on the increase in every continent.⁶³ In the United States, President Trump has called for a wall to be constructed along the border with Mexico as well as for a ban on Muslim immigrants. In Europe, the United Kingdom ended its membership of the European Union. In Asia, China is still pushing hard with regard to the South China Sea, and as political scientist Minxin Pei stated, Beijing would likely "beat the drums of Chinese nationalism to counter the United States."⁶⁴ Recently, South Korean courts ruled that citizens can sue Japanese civilian firms for reparations stemming from the use of forced labor during the Second World War. In retaliation, the Japanese government imposed export controls on materials of significant importance to the South Korean economy, including materials that are critical to the production of semiconductors.⁶⁵ Elsewhere, nationalist leaders have been elected or reelected on a mandate of seeking independence from foreign influence.

The global resurgence of nationalism would increase the political costs in two possible scenarios. First, opposition to nonproliferation obligations would increase when a rival state has nuclear weapons. Adherence to the nonproliferation regime means that a state needs to rely on extended deterrence from a security patron, even when facing a nuclear threat. Such a condition might not be acceptable to nationalistic leaders, meaning that they might decide to pursue nuclear weapons development.⁶⁶ Second, even in the absence of nuclear-armed rivals, nationalists may consider the NPT framework to be unfair and hence seek the renegotiation of its NPT benefits. Such resistance might stem not only from the perceived unfairness between NWSs and NNWSs but also from the unbalanced conditions among NNWSs.

Challenge 3: Competition among the Great Powers

One key trend in international politics is the return of competition among the great nuclear powers: the United States, Russia, and China. In Asia, the United States has been engaged in a “trade war” against China since early in the Trump presidency. Disputes over the South China Sea continue. In Europe, the US government issued a new national defense strategy in 2018 that cited Russia (as well as China) as the main threats to the United States. Soon afterward, the United States declared its withdrawal from the Intermediate-Range Nuclear Forces (INF) Treaty after accusing Russia of violating the treaty, which required the United States and Russia to forswear ground-launched ballistic and cruise missiles with ranges between 500 and 5,500 kilometers. In addition, the 2018 NPR indicated that the United States will acquire new nonstrategic nuclear weapons to address perceived threats from Russia and China. Furthermore, experts predict the US-China competition will be intense after the COVID-19 crisis in the areas of the military, the economy, technology, information, and the future order.⁶⁷

The increased competition between the great nuclear powers allows for incongruence to develop in the international cooperation against nuclear proliferation efforts, thereby weakening the effectiveness of sanctions. While the major nuclear powers remain likely to cooperate on nonproliferation issues, possible mismatches between their intentions and their efforts would render the sanctions approach less effective. In practice, such a scenario is not just likely but has in fact already occurred. For example, in the nuclear agreement with Iran, the United States pressured other states to leave the Iranian market and to not import Iranian oil. However, many Chinese and Russian firms remain active in the Iranian market while also taking over business sectors once dominated by European companies. Iran is relying on these states to remain afloat in the face of US-led sanctions. Consequently, the willingness on the part of both China and Russia to continue to engage with Iran will render the sanctions less effective.⁶⁸ Similarly, in terms of North Korea’s denuclearization project, China is weakening the efficiency of international sanctions. Although China participates in the international sanction regime against North Korea’s nuclear proliferation, a UN report revealed that there have been at least 148 incidents of North Korea smuggling illicit oil between January and August 2018, which mostly occurred in the Chinese-administered Yellow Sea and South China Sea. Some experts argue that these actions indicate that China has adopted a “posture of tacit consent” to the lifting of sanctions.⁶⁹

Challenge 4: The Spread of Nuclear Technology and Burdens on the IAEA Safeguards

Another key challenge to the effectiveness of the NPT is the spread of nuclear technology worldwide and thereby the increasing burden on the IAEA safeguard. According to IAEA statistics, the number of nuclear facilities subject to IAEA safeguards has increased by 12 percent to over 1,300 since 2010. During the same period, the number of significant quantities of nuclear material held under IAEA safeguards rose by 24 percent to over 200,000 significant quantities.⁷⁰ Further, the number of nuclear material accounting reports submitted by member states has increased by more than 30 percent. In addition, as more nuclear facilities are decommissioned, the demand for safeguards is also increasing, alongside additional requirements to verify the packaging, movement, and disposition of nuclear materials.⁷¹ All these growing burdens with regard to the IAEA safeguards on nuclear facilities and materials could reduce the effectiveness of its monitoring of cheating activities unless the IAEA is able to expand its capabilities.

Despite the growing need for safeguards, member states' support for the IAEA has not increased to a comparable level. The IAEA's safeguard budget has risen by around six percent since 2010. This means that IAEA inspectors and analysts need to bear increasing burdens and take on increasing workloads, consequently reducing the effectiveness of their monitoring activities. Although the IAEA is seeking more cost-effective means of safeguarding, such as remote monitoring through surveillance cameras, the burden will not decrease anytime soon as the number of nuclear facilities and decommission cases continues to increase.

Challenge 5: Growing Polarization among NPT Member States

As pointed out by Lewis Dunn, a former assistant director of the US Arms Control and Disarmament Agency and NPT review conference ambassador, "the polarization among NPT parties is greater today than it ever has been."⁷² First, this polarization is partly the result of many NNWSs' frustration with the lack of progress toward nuclear disarmament as set out in Article VI of the NPT. This frustration is reinforced by some NWSs modernizing their nuclear arsenals with low-yield warheads and high-precision, hyperspeed delivery vehicles. Second, the polarization among NPT member states, in part, reflects the NNWSs' growing concern about the risk of nuclear weapons use. While the salience of nuclear weapons is growing in the security policies of both the United States and

Russia, other states are expressing their concerns regarding the possible humanitarian disaster that would be caused by the use of nuclear weapons in the so-called Humanitarian Pledge and in the Treaty on the Prohibition of Nuclear Weapons (TPNW).⁷³ Lastly, the polarization is also partly based on the increasing demand for fairness within the existing nuclear order by the middle-ground states (e.g., Argentina, Brazil, and South Korea), which maintain advanced nuclear technology and actively participate in the governance of the nonproliferation regime. These middle-ground states require access to nuclear technology for peaceful purposes as well as the freedom to share such technology with other states, as guaranteed by the NPT, because exercising this right is seen as critical to their economic growth and their status within the nuclear order.⁷⁴

Among the five challenges highlighted, this polarization problem could pose a structural threat to the NPT, as it fundamentally counters both the existing nuclear order and the NPT's incentive system.⁷⁵ For the most part, the NPT framework has remained stable because the NNWSs have preferred the current system over the potential insecurity they would face if they violated the nonproliferation rules and principles. At the same time, the strong nonproliferation norm and the incentive system have induced the NNWSs to tolerate the inequalities inherent within the NPT framework. However, if the sense of injustice and unfairness is growing among certain NPT member states, then the dissatisfied parties might not agree with the treaty framework. Consequently, the international community's capability to offer collective incentives to other NNWSs could be hindered. This is not merely a hypothetical postulation. Indeed, the 2015 NPT Review Conference showed symptoms of this tension, as the conference failed to reach a consensus and was considered an "accurate reflection of the profound inadequacies and disagreement permeating the global nuclear disarmament regime."⁷⁶

Conclusion and Recommendations

Although each individual challenge might not appreciably influence the effectiveness of the NPT framework, working together their net effects should not be underestimated. Domestically, rival states' nuclear proliferation and the rise of nationalism could give state governments reasons to consider nuclear weapons as a means to achieve security goals. Internationally, while the growing competition between great nuclear powers and the polarization among NPT member states would weaken the work of the NPT's incentive system, increasing burdens on the IAEA safeguards might lead states to miscalculate that their clandestine activities could be intact. If

this situation were to occur, NPT effectiveness would certainly decrease, and the treaty would possibly become defunct. This potential development has a number of implications for both policy and research.

First, we suggest that the international community—including NWSs, NNWSs, and international institutions—implement measures to promote cooperation among the NPT member states. The United States and the other NWSs should demonstrate a genuine commitment to nuclear disarmament. While the INF Treaty collapsed in 2019, a particular concern in this regard is the potential expiration of New START in 2021. The end of the INF Treaty has already raised concerns among the NNWSs about the risk of the use of nuclear weapons, and there is no doubt that the failure to renew or extend New START would heighten the divisions within the NPT member states, erode the legitimacy and credibility of the NPT framework, and weaken the collaboration among member states. Additionally, NWSs and NNWSs should renegotiate and redefine the goal of disarmament as set out in Article VI of the NPT. As long as the United States, Russia, and China are all increasing the salience of nuclear forces in their national security policies, the pursuit of the complete elimination of nuclear weapons is neither practical nor realistic. Rather, it serves as a potential flash point between NWSs and NNWSs. Also, the NPT member states should conclude the TPNW and then work toward rebuilding cooperation. While critics of the TPNW have framed it as a radical and destabilizing move that undermines the existing order, it is important to acknowledge that some states consider it to be a potential alternative to the NPT. This debate is related to both economic growth and national prestige. If the member states do not overcome these issues, the NPT's incentive system would be rendered less effective because it works through close cooperation among the states.

Second, the international community should strengthen the nuclear nonproliferation norm. As we have demonstrated, one major reason why the NPT framework has proved effective thus far is the spread of the nonproliferation norm. The norm plays a role as a restraint on domestic support in favor of nuclear armament. In particular, the nonproliferation norm could represent a means of salvaging the NPT framework from the resurgence of nationalism. One way of strengthening the nonproliferation norm is to increase the role of a network of professionals with recognized expertise that can help decision-makers define problems and identify and evaluate various policy options.⁷⁷ Although their role might be soft, or relegated to track-two diplomatic status, the members of this community could help to more persistently and deeply advance the norm.

Third, the international community should collaborate to expand the IAEA's safeguards capacity. As our model indicates, the efficacy of the inspection and monitoring of nuclear-related activities on the part of member states is vital to maintaining the effectiveness of the NPT regime. In particular, such a capability is critical to preventing states from deviating from the principles of the NPT through cheating. Unfortunately, the IAEA's budget has risen by only 6.3 percent since 2010. As the secretary general of the IAEA points out, insufficient funding will result in a reduction in the number of inspectors and, consequently, a decrease in monitoring efficiency.⁷⁸ In addition, around 60 states have not yet ratified the additional protocol. International support is required both politically and financially to have more states comply with the additional protocol and to maintain the efficacy of the IAEA's safeguarding measures.

Lastly, the international community should be prepared for the potential impact of the COVID-19 pandemic. On the one hand, the enormous damage done to the global economy could significantly reduce budgetary resources devoted to the development and deployment of nuclear weapons. On the other hand, however, the spread of the virus could result in the limitation or suspension of IAEA inspections of various nuclear facilities, including Iran's enrichment and centrifuge development sites.⁷⁹ Moreover, states are raising questions about the credibility and the ability of international organizations in dealing with global issues appropriately and fairly. Indeed, states with a damaged economy due to the coronavirus crisis might reduce their financial support to the IAEA. Lastly, as Philippe Legrain notes in *Foreign Policy*, the coronavirus crisis highlighted the downside of globalization while legitimatizing nationalism.⁸⁰ Such a trend is not expected to directly affect international cooperation on nuclear non-proliferation, but it may restrict the flow of people and information and reduce the effectiveness of cooperation.

Given the discussed challenges as well as the varied perspectives among the NPT member states that are so evident today, maintaining the effectiveness of the NPT will be difficult. At the heart of such efforts should be a credible vision of the future in terms of a desirable nuclear order. Thus, all member states and other associated actors need to genuinely support the NPT even if not fully comfortable with the overall impact of the treaty. **SSQ**

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Notes

1. Only the five permanent members of the United Nations Security Council (the United States, Russia, the United Kingdom, France, and China, as listed according to the order of their nuclear test dates) are permitted to possess nuclear weapons.

2. Daryl Kimball, "The Nuclear Nonproliferation Treaty (NPT) at a Glance," fact sheet, Arms Control Association, accessed 23 June 2020, <https://www.armscontrol.org/>.

3. A common argument in this regard draws on the notion that only those states with little or no intention of pursuing the development of nuclear weapons signed the treaty. Refer to John J. Mearsheimer, "The Case for a Ukrainian Nuclear Deterrent," *Foreign Affairs* 72, no. 3 (Summer 1993), <https://www.foreignaffairs.com/>; Richard K. Betts, "Universal Deterrence or Conceptual Collapse? Liberal Pessimism and Utopian Realism," in *The Coming Crisis: Nuclear Proliferation, US Interests, and World Order*, ed. Victor A. Utgoff (Cambridge, MA: MIT Press, 2000); Jacques E. C. Hymans, *The Psychology of Nuclear Proliferation: Identity, Emotions and Foreign Policy* (Cambridge: Cambridge University Press, 2006), chap. 1; Matthew Fuhrmann, "Spreading Temptation: Proliferation and Peaceful Nuclear Cooperation Agreements," *International Security* 34, no. 1 (Summer 2009): 7–41, <https://www.belfercenter.org/>; and Matthew Kroenig, *Exporting the Bomb: Technology Transfer and the Spread of Nuclear Weapons* (Ithaca, NY: Cornell University Press, 2010).

4. These five non-NPT states are Israel, India, Pakistan, South Sudan, and North Korea. North Korea was a member of the NPT and withdrew from the treaty in 2003.

5. See Trevor McMorris Tate, "Regime-Building in the Non-Proliferation System," *Journal of Peace Research* 27, no. 4 (1990): 399–414, <https://doi.org/10.1177/0022343390027004005>; Scott D. Sagan, "Why Do States Build Nuclear Weapons? Three Models in Search of a Bomb," *International Security* 21, no. 3 (Winter 1996/1997): 54–86, doi:10.2307/2539273; Maria Rost Rublee, *Nonproliferation Norms: Why States Choose Nuclear Restraint* (Athens, GA: University of Georgia Press, 2009); and Matthew Fuhrmann and Yonatan Lupu, "Do Arms Control Treaties Work? Assessing the Effectiveness of the Nuclear Nonproliferation Treaty," *International Studies Quarterly* 60, no. 3 (September 2016): 530–39, <https://doi.org/10.1093/isq/sqw013>.

6. See Model Protocol Additional to the Agreement(s) between State(s) and the International Atomic Energy Agency for the Application of Safeguards, IAEA INFCIRC/540, September 1997, <https://www.iaea.org/>; and IAEA, "Status of the Additional Protocol," March 2019, <https://www.iaea.org/>.

7. Michael J. Glennon, "How International Rules Die," *Georgetown Law Journal* 93, no. 3 (2005): 939–91, <https://papers.ssrn.com/>; and Laurence R. Helfer, "Exiting Treaties," *Virginia Law Review* 91, no. 7 (2005): 1579–1648, <https://www.virginialawreview.org/>.
8. John Allen et al., "How the World Will Look after the Coronavirus Pandemic," *Foreign Policy*, 20 March 2020, <https://foreignpolicy.com/>; see also Charles Edel and Mira Rapp-Hooper, "The 5 Ways U.S.-China Competition Is Hardening," *Foreign Policy*, 18 May 2020, <https://foreignpolicy.com/>.
9. Peter Hedström and Richard Swedberg, "Social Mechanisms," *Acta Sociologica* 39, no. 3 (1996): 281–308, <https://doi.org/10.1177/000169939603900302>.
10. In this article, *nuclear order* is defined as the prevailing set of ideas, institutions, and practices established to control, limit, and monitor nuclear weapons, technologies, and materials. See Nick Ritchie, "A Hegemonic Nuclear Order: Understanding the Ban Treaty and the Power Politics of Nuclear Weapons," *Contemporary Security Policy* 40, no. 4 (2019): 409, 412, DOI: 10.1080/13523260.2019.1571852.
11. Robert O. Keohane and Lisa L. Martin, "The Promise of Institutional Theory," *International Security* 20, no. 1 (Summer 1995): 42, <https://www.uio.no/>.
12. Scott D. Sagan, "Why Do States Build Nuclear Weapons? Three Models in Search of a Bomb," *International Security* 21, no. 3 (Winter 1996/1997): 54–86, <https://cisac.fsi.stanford.edu/>; and Liviu Horowitz, "Beyond Pessimism: Why the Treaty on the Non-Proliferation of Nuclear Weapons Will Not Collapse," *Journal of Strategic Studies* 38, no. 1–2 (2015): 126–58, DOI: 10.1080/01402390.2014.917971.
13. Jeffrey W. Knopf, "Nuclear Disarmament and Nonproliferation: Examining the Linkage Argument," *International Security* 37, no. 3 (Winter 2012/13): 92–132, https://doi.org/10.1162/ISEC_a_00109.
14. Beth A. Simmons and Daniel J. Hopkins, "The Constraining Power of International Treaties: Theories and Methods," *American Political Science Review* 99, no. 4 (November 2005): 623–31, <https://dash.harvard.edu/handle/1/3153315>.
15. Andrew J. Coe and Jane Vaynman, "Collusion and the Nuclear Nonproliferation Regime," *Journal of Politics* 77, no. 4 (October 2015): 983–97, <https://www.jstor.org/>; and Daniel Verdier, "Multilateralism, Bilateralism, and Exclusion in the Nuclear Proliferation Regime," *International Organization* 62, no. 3 (2008): 439–76, <https://polisci.osu.edu/>.
16. Coe and Vaynman, 983–84.
17. Verdier, "Multilateralism, Bilateralism, and Exclusion," 439–41.
18. Martha Finnemore and Kathryn Sikkink, "International Norm Dynamics and Political Change," *International Organization* 52, no. 4 (1998): 891, <https://home.gwu.edu/>. See also Rublee, *Nonproliferation Norms*, 40.
19. Jeffrey T. Checkel, "International Institutions and Socialization in Europe: Introduction and Framework," *International Organization* 59, no. 4 (2005): 804, doi:10.1017/S0020818305050289. For norm diffusion and states' behavior, see also Fabrizio Gilardi, "Transnational Diffusion: Norms, Ideas, and Policies," in Walter Carlsnaes, Thomas Risse, and Beth A. Simmons, eds., *Handbook of International Relations* (London: SAGE Publications Ltd, 2013); Alastair Iain Johnston, "Treating International Institutions as Social Environments," *International Studies Quarterly* 45, no. 4 (December 2001): 487–515, <https://www.jstor.org/stable/3096058>; Judith Kelley, "International Actors on the Domestic Scene: Membership Conditionality and Socialization by International Institutions," *International Organization* 58, no. 3 (2004), <https://www.jstor.org/stable/3877839>; Frank Schimmelfennig, "Strategic Calculation and International Socialization: Mem-

bership Incentives, Party Constellations, and Sustained Compliance in Central and Eastern Europe,” *International Organization* 59, no. 4 (2005): 827–60, DOI: <https://doi.org/10.1017/S0020818305050290>; and Beth A. Simmons, Frank Dobbin, and Geoffrey Garrett, “Introduction: The International Diffusion of Liberalism,” *International Organization* 60, no. 4 (2006): 781–810, <http://nrs.harvard.edu/>.

20. Rublee, *Nonproliferation Norms*, 39.

21. The two components of the nuclear nonproliferation norm are nuclear disarmament and nonproliferation. These components are reflected in the three pillars of the NPT (nonproliferation, peaceful use of nuclear energy, and nuclear disarmament). See Mario Carranza, “The Stability of the Nuclear Nonproliferation Norm: A Critique of Norm-Contestation Theory,” *Nonproliferation Review* 26, no. 1-2 (2019): 10, <https://doi.org/10.1080/10736700.2019.1587844>.

22. Etel Solingen, “The Political Economy of Nuclear Restraint,” *International Security* 19, no. 2 (Fall 1994): 140, <https://www.jstor.org/stable/2539198>.

23. Maris Rost Rublee and Avner Cohen, “Nuclear Norms in Global Governance: A Progressive Research Agenda,” *Contemporary Security Policy* 39, no. 3 (2018): 319, <https://doi.org/10.1080/13523260.2018.1451428>.

24. Carranza, “Stability of the Nuclear Nonproliferation Norm,” 9.

25. Rublee, *Nonproliferation Norms*, 47–49.

26. Finnemore and Sikkink, “International Norm Dynamics,” 897, 915. For further discussions on norm contestation, refer to Antje Wiener, *A Theory of Contestation* (Heidelberg: Springer, 2014); and for a critique of norm contestation, see Carranza, “Stability of the Nuclear Nonproliferation Norm.”

27. Solingen, “Political Economy of Nuclear Restraint,” 140.

28. One exceptional case could involve some states choosing the nonmembership/nonproliferation option because they believe that the current NPT system is unfair. Such a situation is possible, as many NNWSs have expressed their concerns regarding the unfairness and unevenness in terms of benefits and status structured in the NPT. Yet we opt to deal with this exceptional case in a separate paper, as the assessment of the potential impact of the growing sense of unfairness appears to require an in-depth investigation.

29. Our model is based on two core assumptions. First, we assume that all actors are rational and capable of conducting a cost-benefit analysis, and our model predicts that they will choose the policy option that is most likely to maximize their payoffs. Second, the IC has a significant interest in maintaining the current nonproliferation regime and preventing states from engaging in nuclear development. That is, the IC strictly prefers the full compliance outcome to the other outcomes. Between nonmembership and cheating, the IC weakly prefers nonmembership. In relation to a nonmember state, the IC could harness the coercive power of an international coalition so as to pressure the state government to abort its nuclear weapons program (i.e., South Africa). However, the IC could not take any action against a cheating state unless its clandestine actions were revealed.

30. For example, the positive security guarantees the United States has given to its NATO allies, Japan, and South Korea do not derive from the treaty. The same holds true for the security support extended to Israel and certain Arab states. Negative security guarantees also do not derive from the treaty directly but are an artifact of the NPT review process. The real security benefits that derive directly from the NPT are that member states can have confidence that their neighbors are not developing nuclear weapons.

31. Daryl Kimball, "U.S. Negative Security Assurances at a Glance," Arms Control Association, fact sheet, accessed 22 June 2020, <https://www.armscontrol.org/>.
32. Office of the Secretary of Defense, *Nuclear Posture Review* (Washington, DC: Department of Defense, February 2018), 21, <https://media.defense.gov/>.
33. George Bunn and Roland M. Timerbaev, "Security Assurances to Non-Nuclear-Weapon States," *Nonproliferation Review* 1, no. 1 (1993): 11–20, <https://www.nonproliferation.org/>; and Matthew Fuhrmann and Todd S. Sechser, "Nuclear Strategy, Nonproliferation, and the Causes of Foreign Nuclear Deployments," *Journal of Conflict Resolution* 58, no. 3 (2013): 455–80, <https://faculty.virginia.edu/>.
34. Anne-Marie Slaughter, *A New World Order* (Princeton, NJ: Princeton University Press, 2004), 200–203.
35. The *opportunity cost* is defined as "the loss of potential gain from other alternatives when one alternative is chosen." See Angus Stevenson and Christine A. Lindberg, eds., *New Oxford American Dictionary* (Oxford, UK: Oxford University Press, 2010). In simple terms, the opportunity cost here is the security and economic benefit not received as a result of not selecting the nuclear armament option.
36. Christopher Way and Karthika Sasikumar, "Leaders and Laggards: When and Why Do Countries Sign the NPT?" Research Group in International Security Working Paper (REGIS) Working Paper No. 16 (Montreal: University of Montreal/McGill University, November 2004), 7–8, <https://www.academia.edu/>.
37. Robert Powell, "Guns, Butter, and Anarchy," *American Political Science Review* 87, no. 1 (1993): 115, <https://www.jstor.org/stable/2938960>.
38. Kyung-Ae Park, "North Korea's Defensive Power and U.S.-North Korea Relations," *Pacific Affairs* 73, no. 4 (2000): 544–46, doi:10.2307/2672443.
39. Nuno P. Monteiro and Alexandre Debs, "The Strategic Logic of Nuclear Proliferation," *International Security* 39, no. 2 (2014): 12, <https://www.mitpressjournals.org/>.
40. Coe and Vaynman, "Collusion and the Nuclear Nonproliferation Regime"; and Verdier, "Multilateralism, Bilateralism, and Exclusion."
41. For instance, during the mid-1990s, the United States halted economic assistance to Pakistan to compel the country to adhere to the nonproliferation regime. See Samina Ahmed, "Pakistan's Nuclear Weapons Program: Turning Points and Nuclear Choices," *International Security* 23, no. 4 (Spring 1999): 190, <https://www.jstor.org/>.
42. Solingen, "Political Economy of Nuclear Restraint," 140.
43. Alexander Zhebin, "A Political History of Soviet-North Korean Nuclear Cooperation," in Alexandre Y. Mansourov and James C. Moltz, eds., *The North Korean Nuclear Program: Security, Strategy, and New Perspectives from Russia* (New York: Routledge, 2000), 32–33.
44. Joel Wit, "The Korean Peninsula Energy Development Organization: Achievements and Challenges," *Nonproliferation Review* 6, no. 2 (Winter 1999): 59–69, <https://www.nonproliferation.org/>.
45. Paul Kerr, "UN Security Council Resolution 1737 on Iran," Arms Control Association, accessed 22 June 2020, <https://www.armscontrol.org/>.
46. Joint Resolution to Authorize the Use of United States Armed Forces against Iraq, Public Law 107–243, 107th Cong., 1st sess., 16 October 2002, <https://www.govinfo.gov/>.
47. Bradley A. Thayer, "The Causes of Nuclear Proliferation and the Utility of the Nuclear Non-Proliferation Regime," *Security Studies* 4, no. 3 (1995): 510–13, <https://doi.org/10.1080/09636419509347592>.

48. According to the definition suggested by DiRita, the *economic rationality principle* is “based on the postulate that people behave in rational ways and consider options and decisions within logical structures of thought, as opposed to involving emotional, moral, or psychological elements.” See Peter DiRita, “Economic Rationality Assumption,” in *Encyclopedia of Quality of Life and Well-Being Research*, ed. Alex C. Michalos (Dordrecht: Springer, 2014), DOI: https://doi.org/10.1007/978-94-007-0753-5_822

49. Solingen, “Political Economy of Nuclear Restraint.”

50. Peter Liberman, “The Rise and Fall of the South African Bomb,” *International Security* 26, no. 2 (Fall 2001): 71–82, <https://www.jstor.org/stable/3092122>.

51. Before signing the NPT, domestic response to the nuclear issue was mixed in Japan. Japan had adopted the “three nos”: no possession of nuclear weapons, no manufacturing of nuclear weapons, and no introduction of nuclear weapons on its territory. These were adopted in the late 1960s, before the NPT entered into force. In the meantime, a group of people supported Japan’s possession of nuclear force. For example, Prime Minister Eisaku Sato said, “If Chicoms [Chinese Communists] had nuclear weapons, the Japanese also should have them.” See Kurt M. Campbell and Tsuyoshi Sunohara, “Japan: Thinking the Unthinkable,” in Kurt M. Campbell, Robert J. Einhorn, and Mitchell B. Reiss, eds., *The Nuclear Tipping Point: Why States Reconsider Their Nuclear Choices* (Washington, D.C.: Brookings Institution Press, 2004), 222.

52. Fintan Hoey, “Japan and Extended Nuclear Deterrence: Security and Non-proliferation,” *Journal of Strategic Studies* 39, no. 4 (2016): 44–501, <https://doi.org/10.1080/01402390.2016.1168010>.

53. Laura Rockwood, “The Legal Framework for IAEA Safeguards,” *IAEA Brief for Policymakers*, February 2018, <https://www.iaea.org/>.

54. Based on the lessons learned in relation to Iraq and North Korea, the IAEA promoted the additional protocol that involves strengthening the IAEA’s safeguards implementation, such as access to all parts of a state’s nuclear fuel cycle. However, due to concerns about sovereignty, not all states agreed with the additional protocol; thus, the IAEA’s inspection of undeclared nuclear weapons programs remains incomplete. See Lawrence Scheinman, “Transcending Sovereignty: In the Management and Control of Nuclear Material,” *IAEA Bulletin* 43, no. 4 (April 2001): 33–38, <https://www.iaea.org/>.

55. Hans Blix, “Verification of Nuclear Nonproliferation: The Lesson of Iraq,” *Washington Quarterly* 15, no. 4 (1992): 58–61, <https://doi.org/10.1080/01636609209550118>.

56. Robert McMahon, “UN Sanctions: A Mixed Record,” Council on Foreign Relations, Backgrounder, 17 November 2006, <https://www.cfr.org/>.

57. Kelsey Davenport, “Chronology of U.S.–North Korean Nuclear and Missile Diplomacy,” Arms Control Association, fact sheet, accessed April 2020, <https://www.armscontrol.org/>.

58. We appreciate an anonymous reviewer’s comment about how the United States’ unilateral withdrawal from the JCPOA and the imposition of new sanctions would undermine the Iranian supreme leader Ayatollah Khamenei’s beliefs as to the United States’ intentions and the possible effect of the JCPOA on the lifting of international sanctions. Additionally, see Lewis A. Dunn, “The Strategic Elimination of Nuclear Weapons: An Alternative Global Agenda for Nuclear Disarmament,” *The Nonproliferation Review* 24, no. 5–6 (2017): 406–7, DOI: 10.1080/10736700.2018.1440733.

59. Colum Lynch, “Despite U.S. Sanctions, Iran Expands Its Nuclear Stockpile,” *Foreign Policy*, 8 May 2020, <https://foreignpolicy.com/>.

60. Dunn, "Strategic Elimination of Nuclear Weapons," 407.
61. Dagyum Ji, "ROK to Spend over \$84 Billion on New Military Capabilities over Five Years: MND," *NK News*, 11 January 2019, <https://www.nknews.org/>.
62. Anthony D. Smith, *Nationalism: Theory, Ideology, History* (Cambridge, MA: Polity, 2010), 9, 25–30.
63. Jack Snyder, "The Broken Bargain: How Nationalism Came Back," *Foreign Affairs* 98, no. 2 (2019): 54–60, <https://www.foreignaffairs.com/>.
64. Minxin Pei, "China's Coming Upheaval: Competition, the Coronavirus, and the Weakness of Xi Jinping," *Foreign Affairs*, May/June 2020, <https://www.foreignaffairs.com/>.
65. Lindsay Isaac, Sophie Jeong, and Junko Ogura, "A Feud between Japan and South Korea Is Threatening Global Supplies of Memory Chips," *CNN Business*, 10 July 2019, <https://edition.cnn.com/>.
66. Hymans, *Psychology of Nuclear Proliferation*, 16–46.
67. Edel and Rapp-Hooper, "5 Ways U.S.-China Competition Is Hardening."
68. Dina Esfandiary and Ariane M. Tabatabai, "Will China Undermine Trump's Iran Strategy? Tehran Is Hedging against International Isolation," *Foreign Affairs*, 20 July 2018, <https://www.foreignaffairs.com/>.
69. Yosuke Onchi, "North Korea's Oil Smuggling Blows Past Import Cap: UN Report," *Nikkei Asian Review*, 26 February 2019, <https://asia.nikkei.com/>.
70. One significant quantity is the approximate amount of nuclear material with which a state could manufacture a nuclear explosive device.
71. IAEA, "Safeguards in Practice," <https://www.iaea.org/>.
72. Dunn, "Strategic Elimination of Nuclear Weapons," 408.
73. Dunn, 408–9. For the TPNW, refer to Daryl Kimball, "The Treaty on the Prohibition of Nuclear Weapons at a Glance," fact sheet, Arms Control Association, accessed 23 June 2020, <https://www.armscontrol.org/>.
74. Toby Dalton, Togzhan Kassenova and Lauryn Williams, "Introduction," in *Perspectives on the Evolving Nuclear Order*, eds. Toby Dalton, Togzhan Kassenova, and Lauryn Williams (Washington DC: Carnegie Endowment for International Peace, 2016).
75. Ritchie, "Hegemonic Nuclear Order," 425–26.
76. Cesar Jaramillo, "NPT Review Conference: No Outcome Document Better than a Weak One," *Bulletin of the Atomic Scientists*, 3 June 2015, <https://thebulletin.org/>.
77. Peter M. Haas, "Introduction: Epistemic Communities and International Policy Coordination," *International Organization* 46, no. 1 (Winter 1992): 3, <https://fbau.unc.edu/>.
78. Yukiya Amano, "Challenges in Nuclear Verification," *IAEA*, 5 April 2019, <https://www.iaea.org/>.
79. George M. Moore, "One Potential Victim of Coronavirus? Nuclear Inspections in Iran," *Bulletin of the Atomic Scientists*, 17 March 2020, <https://thebulletin.org/>.
80. Philippe Legrain, "Will the Coronavirus Kill Globalization?" *Foreign Policy*, Spring 2020, 24.

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