

State Compliance and the Track Record of International Institutions^{*}

Jeffrey M. Kaplow[†]

Abstract

This paper examines how the past performance of an international institution—its track record of compliance—affects the decisions of states to comply with the institution in the future. A substantial IR literature sees institutions as rationally designed to achieve outcomes desired by member states, and so struggles to explain why compliance varies even as an institution's design remains fixed. I propose an informational theory of state compliance that fills the gap between rational design and actual institutional performance, showing how an international organization may persist with low levels of compliance even as states do not attempt to revise the institution's design. This theory suggests that an institution's track record should affect future compliance in settings where the underlying strategic problem is characterized by the need for reciprocity among member states. I test the influence of institutional track record on state compliance using data on violations of the nuclear nonproliferation regime, finding strong empirical support for the track record mechanism. This finding has important implications both for our understanding of the constraining power of international institutions and for the ongoing policy debate about the credibility of the nuclear nonproliferation regime.

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[†] University of California, San Diego; Department of Political Science; jkaplow@ucsd.edu

A large and influential literature in international relations sees international institutions as rationally designed to achieve the goals of member states. In many institutions, however, a significant number of member states violate their commitments. The extent of violations varies widely across different institutions and over time within a single institution, even when the design of the international organization (IO) remains the same. This paper proposes a new theory to explain this variation and answer research questions central to international relations theory: Why do states comply with international institutions? Why do some institutions see greater compliance than others, and how can the same institution, at different times, experience varying levels of compliance by member states?

In many substantive domains, from arms control to international trade, the decision of a state to comply with an international institution hinges on whether it expects a substantial number of other states to comply as well. I argue that, in strategic settings characterized by this kind of reciprocity, the track record of an international institution provides states with a valuable signal about the IO's future performance. States are likely to adjust their compliance behavior in response to this signal. The effect of an institution's track record on compliance, however, is likely to be moderated or amplified by institution- and state-level factors.

This paper makes several important contributions to our understanding of international institutions. First, it fills an important gap between the design of an institution and the actual level of compliance that the institution experiences. In some cases compliance exceeds state expectations, and in some cases compliance falls short; my theory explains why. Second, I expand on the classical view of information as contributing to international cooperation. When it comes to the track record of institutions, information is a double-edged sword: when the track record shows stronger than expected IO performance, this information does lead to more compliance by others, but information about a negative institutional track record makes violations of an international agreement more likely. Finally, I identify the level of reciprocity in an institution—the extent to which a state's payoff in the underlying strategic game depends on the compliance of others—as an important determinant of states' compliance behavior. When reciprocity is high, the

track record of the regime will have greater influence on the decisions of states to comply with or violate an international agreement.

I proceed in three parts. First, I present a new theory of state compliance, in which the track record of the institution provides member states with information about future institutional performance, and derive several testable hypotheses. Next, I apply this theory to the case of the nuclear nonproliferation regime, explain my empirical approach, and discuss the results of a quantitative analysis. Finally, I conclude with a discussion of the implications of my findings for theory and policy.

The track record mechanism of state compliance

There is a bargain at the core of many international agreements: states forego some action in exchange for similar forbearance on the part of other member states. This might be an agreement not to develop nuclear, chemical, biological, or anti-satellite weapons; to refrain from protectionist trade policies; or to enforce minimum labor standards. When a particular state's willingness to comply depends on the compliance of others, and when the compliance of others is uncertain, new information about the overall level of compliance with an international agreement should make states more or less likely to abide by the agreement themselves. The track record of the IO is the best source of such information: as time passes with few violations overall, states should in turn be more likely to comply themselves, while evidence of rampant noncompliance should make states more likely to cheat.

In this section, I lay out the logic of the track record mechanism for state compliance, first by highlighting the reciprocity underlying many institutions, then explaining how information about the performance of an institution affects future compliance, and finally by deriving hypotheses for how system- and state-level factors moderate the effect of IO track record on compliance.

Reciprocity and the strategic setting of international institutions

Reciprocity is central to an international institution when the compliance of others factors into the benefit a state realizes in abiding by its commitments; compliance becomes more attractive when others comply, and less desirable when others violate.¹ This basic reciprocity is frequently a key element of the collective action problems that IOs endeavor to solve (Fearon 1998; Keohane 1984; Oye 1985). In the prisoner's dilemma, for example, each player's payoff is greater when the other chooses to cooperate. In iterated games, strategies that rely on punishing non-cooperative behavior, such as tit-for-tat, further emphasize reciprocity—the player that chooses to defect invites punishment in future rounds (Axelrod 1984; Oye 1985).²

The prisoner's dilemma is not the only strategic setting with this characteristic; in many of the other familiar two-by-two games, the decision of one party to cooperate rather than defect can change the payoffs for other parties (Oye 1985; Snidal 1985). This is true of most n -player versions of the stag hunt and other coordination games (Kim 1996), the related critical mass game (Granovetter 1978; Schelling 1978), and the volunteer's dilemma game (an n -player version of the familiar chicken game with collective interaction) (Diekmann 1985), to name a few. Each of these strategic settings calls on an actor to make some judgment about the level of cooperation by all other actors.

¹ In this paper, I use the term “reciprocity” to refer to the idea that the compliance of one state is contingent upon the compliance of other states. A state will reciprocate the compliance of others by complying itself, and the violations of others by cheating itself. I do not intend reciprocity to suggest conceptions of fairness or kindness (as does, for example, Falk and Fischbacher (2006)), although these richer definitions of reciprocity from behavioral economics are not inconsistent with my theory. For a full discussion of the concept of reciprocity in formal and informal theory, see Keohane (1986).

² The underlying game type for many IOs is probably closer to an n -player iterated prisoner's dilemma or a public goods game, where each player's payoff is a function of the number of other players that choose to cooperate or defect. See Yao and Darwen (1994) for a description of the n -player prisoner's dilemma and a discussion of successful strategies. For discussions of the added complexity of the n -player version of the prisoner's dilemma, see Axelrod and Dion (1988); Molander (1992); and Seo, Cho, and Yao (2000).

There are many examples of international agreements in which one party's compliance is contingent on the compliance of others. In arms control and nonproliferation treaties, states give up the right to develop new weapons systems in exchange for the same concession from others. The more member states that are discovered to have cheated by developing new weapons, the more other states will begin to doubt the underlying bargain and seek to violate the agreement themselves. International trade agreements can similarly break down when a substantial number of member states (or a few particularly influential states) fail to cooperate. Some international environmental agreements have this structure: states may agree to take costly steps to reduce greenhouse gas emissions, for example, only if other states do not try to realize a competitive advantage.

This reciprocal dynamic is common but not universal. In some strategic settings, actors will cooperate or not without regard to the behavior of other players, because that behavior does not affect the payoff structure of the game (or perhaps does so in only a small or indirect way). Some human rights agreements seem to fit this description.³ Simmons (2010) points out that human rights “does not engage reciprocity in any significant way.” That a foreign country is mistreating its own citizens does not directly make a state more or less likely to do the same, at least not in the same way that a foreign country erecting trade barriers or developing nuclear weapons might make others more likely to follow suit.⁴ Environmental agreements designed to protect endangered species or conserve natural resources may also lack a reciprocal dynamic. One state's failure to safeguard its natural resources may have little effect on another state's propensity to do so.

³ But not all human rights treaties lack direct reciprocity. Restrictions on child labor, for example, engage reciprocity in the same way as some international environmental regulations. States may be willing to set minimum labor standards as long as other countries are not able to exploit this for competitive advantage. For international labor standards modeled as a stag hunt, see Hyde (2009).

⁴ Normative theories, however, do provide for a more indirect kind of reciprocity. If a norm against torture is violated by one state, for example, the weakened norm may do less to constrain the behavior of other states, leading to more torture generally.

Resolving compliance uncertainty

States will comply with international agreements when the benefits of compliance outweigh the benefits of violation. In strategic settings characterized by reciprocity, in which the benefits of abiding by international commitments are a function of the compliance of others, we can simplify member states' payoffs such that each requires a particular level of overall compliance with the international agreement in order to make its own continued cooperation worthwhile.⁵

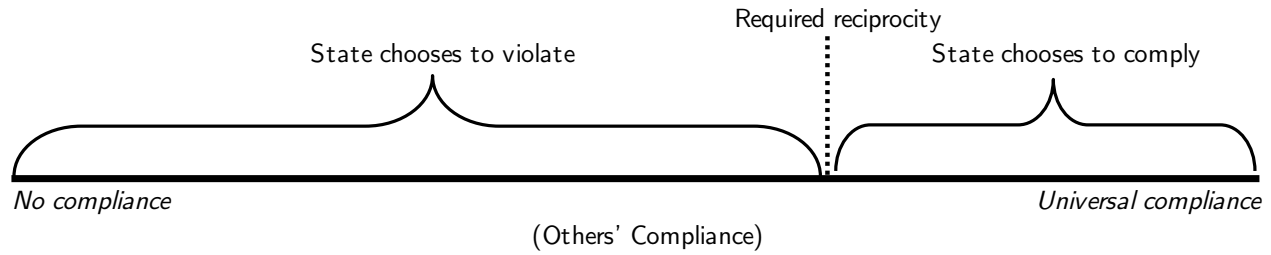
Figure 1 illustrates this simple relationship between the requirement for reciprocity and the state's own compliance. The horizontal line represents the range of possible compliance with the international agreement, from no compliance on the left to compliance by all member states on the right. Each state can be thought of as having a particular level of reciprocity that it requires for its own compliance, shown here with a dotted vertical line. When the compliance of others is above this level, the benefits to the state of abiding by its commitments outweigh the benefits of violating the agreement, and it chooses to comply. When the compliance of others is below this level, the benefits to the state of violating the agreement outweigh the benefits of abiding by its commitments, and it chooses to violate.

The overall level of compliance, however, is almost never clear in advance; other states may or may not be cheating on their international commitments or may choose to do so in the future. In the face of this compliance uncertainty, states must take their best guess about the behavior of others when making their own decisions about whether to abide by their commitments. IOs provide two primary pieces of information that can resolve compliance uncertainty and shape perceptions of member state behavior: the design of the institution and the IO's track record over time.

Design features of an international institution, particularly monitoring, verification, and enforcement measures, send an important signal about the likely extent of member state

⁵ The importance of this threshold point was emphasized by Schelling (1978) and expanded in the realm of international cooperation by Molander (1992). "Different players may have very different requirements about the frequency of cooperation in order to cooperate..." (Molander 1992). See Molander (1992) for a formal proof.

Figure 1: Required reciprocity and compliance with international agreements



compliance even before an international agreement has come into force. A substantial theoretical literature points to the provision of information as a principal function of international institutions (Keohane 1984; Oye 1985), and to verification and monitoring measures as the mechanism by which IOs increase transparency (Dai 2002; Keohane 1984; Mitchell 1998; Snidal 1985). When a country commits to declarations, surveillance, inspections, or other measures, it increases the likelihood that its noncompliance will be discovered and that it will bear some reputational cost or other form of punishment, reducing its incentive to defect in the first place.

When states' compliance decisions are contingent on the compliance of others, there is an additional indirect effect. The increased costs to noncompliance for each individual country as a result of verification and monitoring measures reassure other states that treaty violations will be less likely overall, making these states themselves less likely to cheat on their commitments. In this way, states take into account the design features of an international institution to form a baseline assessment of the overall likelihood of compliance. Stronger verification and monitoring measures suggest greater compliance in general, which makes states correspondingly less likely to cheat. Weaker measures, in turn, suggest noncompliance is more likely, making states more likely to violate the agreement themselves.

The verification or enforcement measures necessary to affect perceptions of overall compliance will vary across institutions. In strategic settings where violations are easily detected, states may form very optimistic baseline assessments about the likelihood of overall compliance

even in the absence of strong verification measures.⁶ For example, trade agreements often rely on aggrieved commercial interests to sound the alarm about violations. The affected parties are incentivized to complain about possible violations to member states, and these states likewise have a strong incentive to pursue cases against violators. These “fire alarms” are likely to be even more effective than formal verification measures in this case, and so the absence of formal measures probably will not appreciably lower a member state’s expectations of overall compliance.⁷ In the security realm, however, where violations are often very difficult to detect, the lack of an intrusive inspection regime may lead states to draw quite pessimistic conclusions about the prospects for overall compliance. For example, during the 1999 debate over Senate ratification of the Comprehensive Test Ban Treaty, which seeks a global ban on nuclear weapons testing, senators opposed to the treaty cited technical barriers to verification when arguing that the treaty would do little to constrain its signatories.⁸

The design of an international institution allows states to form a baseline assessment of the likelihood of compliance overall, but this assessment probably will change over time as states acquire new information about the violations of others and further resolve their compliance uncertainty. The performance of the IO itself is the best source of this information. States learn from the track record of their IO: As noncompliance is discovered or as time passes without a violation, states update their assessments to reflect this new information. Revised assessments of overall compliance with an international institution can then be incorporated into each state’s decision about whether to comply or cheat. An IO’s track record of compliance should make states more confident that others are abiding by their agreements and thus more likely to comply

⁶ Violations also may be more easily detected when there are clear standards or metrics for compliance (Mitchell 1994; Urpelainen 2010).

⁷ On fire alarm and police patrol methods of oversight, see McCubbins and Schwartz (1984).

⁸ For a point-by-point critique of the Comprehensive Test Ban Treaty by a key participant in the debate, see Kyl (2000). The more recent debate over ratification has focused on the much stronger technical measures now in place to detect even low-yield nuclear tests (National Research Council 2012).

themselves, while a history of noncompliance should raise concerns about the compliance of others and lead to further cheating on international commitments.

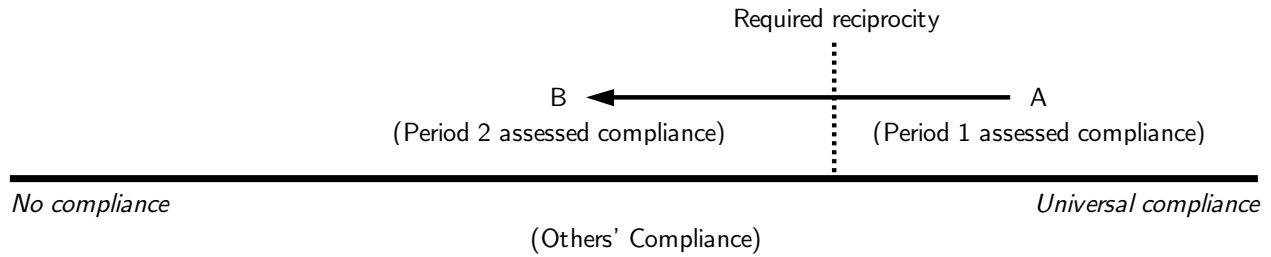
The track record of the IO also affects states' expectations for future compliance because it provides a signal, albeit in some cases a noisy signal, about the efficacy of the international agreement itself. An IO's poor track record may not just indicate that present compliance is worse than expected, but also that the IO, which may once have been seen as having significant constraining power, in fact is not up to the task of incentivizing state compliance. States may thus revise their assessments of future compliance upward or downward based on perceptions of IO effectiveness in addition to judgments about the likely behavior of other member states.

Figure 2 illustrates this logic in terms of a state's particular requirement for reciprocity. In period 1, perhaps based on the specific verification and monitoring measures built into the international agreement, the state assessed that others members would comply with their commitments at the high level represented by point *A*. Because point *A* exceeds the state's required level of reciprocity,⁹ the state's expected benefit from complying with the agreement given others' compliance at point *A* is greater than its expected benefit from violating. As a result, the state chooses to comply with the agreement in period 1. Prior to period 2, however, the state evaluates the track record of the IO, and sees more noncompliance than expected. It thus revises downward its assessment of the compliance of others to point *B*. Because point *B* falls short of the state's requirement for reciprocity, its expected benefit from violating the agreement outweighs its expected benefit from complying, and the state chooses to violate the agreement in period 2.¹⁰ In

⁹ The requirement for reciprocity is shown here in terms of the number of member states complying with the agreement. The track record mechanism, however, does not require that a state find the compliance of every other member state equally reassuring. The compliance or noncompliance of specific states might send a particularly strong signal about the overall performance of the institution. The requirement for reciprocity might be seen by some states, for example, in terms of the share of world exports that are in compliance with a trade agreement, rather than simply the number of other member states that comply.

¹⁰ The hypothetical could just as easily run in the opposite direction. If the state had previously assessed that few states would comply with the agreement, but the track record of the treaty suggested greater than expected cooperation, the state may choose to come back into compliance

Figure 2: An IO track record of non-compliance leads to further violations



this way, the track record of the IO can cause states to update their assessments of the compliance of others and alter their own compliance behavior accordingly.

This logic suggests the central hypothesis of this paper:

Track record hypothesis: In strategic settings characterized by reciprocity, states will be more likely to comply with international institutions when the IO's track record indicates increasing levels of compliance, and will be more likely to violate when the IO's track record indicates increasing levels of noncompliance.

Moderators of the track record mechanism

If the track record of an international institution matters, it is not clear that it should matter equally across all IOs and to all states. Under what circumstances, then, will the past performance of an IO affect state compliance? When is noncompliance so rampant that states will abandon their international commitments, and when is cooperation so pervasive that states will reconsider previous violations? I argue that the strength of an IO's verification and monitoring mechanisms and a state's ex ante propensity to violate the agreement moderate or amplify the effect of track record on compliance.

with the agreement after a period of violation. Another possibility is that the track record of the IO leads to no change in the state's behavior. This could be because the state's baseline assessment was borne out by the IO's track record, or because its assessment of others' compliance changed but did not cross the state's requirement for reciprocity.

The track record of the international institution may or may not contain useful information about overall compliance and the performance of an IO. If few incidences of noncompliance are discovered over a period of time, for example, this could suggest one of two scenarios: either noncompliance is rare, and states should be reassured that the IO's constraints are working, or else noncompliance is merely difficult to detect, and the fact that no violations have been discovered tells us little about the performance of the treaty.

The strength of the agreement's monitoring and verification measures can help distinguish between these two possibilities. To paraphrase and extend a quote from former Secretary of Defense Donald Rumsfeld (and others before him), "the absence of evidence is not evidence of absence," *unless we would expect to have seen such evidence*.¹¹ When monitoring and verification measures are strong, states will have more confidence that treaty violations will be detected and thus that the track record of the international organization carries useful information about the treaty's effectiveness. When these measures are weak, however, states learn little from the past performance of the treaty. Since member states' assessment of others' propensity to cheat does not change in this case, we would expect to see little or no effect from the institution's track record on the underlying level of compliance in the IO.

We might think of the IO's track record as providing a noisier signal about overall compliance when verification measures are weaker. At one extreme, verification is so ineffectual that the IO's track record provides member states with no information about the performance of the institution at all. At the other extreme, verification is so effective that the track record of the institution perfectly represents past compliance, and so provides a strong basis for assessing the future performance of the IO. In between these extremes, states are likely to discount the signal they receive from the institution's track record based on the strength of verification measures.

¹¹ At a Defense Department briefing on February 12, 2002, Secretary of Defense Rumsfeld responded to a question about Iraq's willingness to supply weapons of mass destruction to terrorists: "I could have said that the absence of evidence is not evidence of absence, or vice versa" (United States Department of Defense 2002).

The track record of the IO, then, allows a state to update its assessment of other states' behavior only to the extent that the past performance of the institution carries some useful information. This information may only be present when verification and monitoring is strong.¹² This logic suggests the following hypothesis:

Verification hypothesis: A change in the track record of an international institution will have a greater effect on compliance when monitoring and verification measures are strong.

To this point, we have treated all member states as equivalent, but there is reason to suspect that states will vary in the level of reciprocity they require from others in an international institution to ensure their own continued compliance. Some states, for example, might need to be confident that absolutely no other states are violating a treaty to feel comfortable abiding by the treaty themselves. Other states might be willing to put up with the occasional violator, while still others might be happy to comply with the treaty no matter how many of their fellow member states are cheating. Differences in states' requirements for reciprocity may lead to variation among states in the effect of new information—the track record of the IO—on treaty compliance. These differences may stem from states' varying willingness to violate treaties or from differences in state capabilities.

Many state parties to treaties would not violate their agreements even if this violation carried no international consequences. While we often treat international agreements as a prisoner's dilemma, some states may have payoff structures that do not reward defection. For example, states that do not face significant external threats see little need to develop nuclear weapons, regardless of the proliferation behavior of others. The United States will not be reneging on conventions governing child labor for reasons far removed from the continued compliance of other signatories. Several European states have domestic incentives to abide by environmental agreements even when compliance is costly. To the extent that international agreements screen, rather than constrain, member states, the compliance of others is not likely to matter much to the

¹² Recall that what constitutes strong verification is likely to vary across IOs, and depends in part on the inherent difficulty of detecting violations in a particular substantive domain.

decisions of states to violate treaties.¹³ These states can be thought of as having a lower requirement for reciprocity; many other parties to the agreement can cheat on their commitments without prompting these states to follow suit.

On the other hand, for some states the issues governed by the IO will be particularly salient. These states might feel more threatened by others, and so bear a higher cost to comply with arms control agreements. Or these states might have domestic incentives, rather than disincentives, to turn a blind-eye to child labor violations or to pollute in violation of an international commitment. The higher costs of compliance translate into a higher requirement for reciprocity; at the extreme, these states might demand close-to-universal compliance with a treaty as a condition for their own compliance.

Another factor that might affect the way a state responds to the track record of an IO is the state's capacity to violate the treaty. States that are lacking in financial or natural resources may ultimately be unable to violate a treaty, even if such violation would be desirable. For example, for some states implementing protectionist policies would tax their administrative capacity, and many states lack the resources to support an indigenous industry in violation of international commitments or have too small a fishing sector to overfish waters that are governed by international accords. States without significant domestic uranium stocks and a cadre of skilled engineers face a much tougher path to developing nuclear weapons than do states with richer endowments of natural and human resources. For states with little capability to violate, the opportunity cost of complying is low, and so many other states must fail to comply to prompt cheating. On the other end of the spectrum, the most capable states bear the greatest opportunity cost of complying, and so demand the highest level of reciprocity for their continued cooperation.

¹³ When a treaty fully screens rather than constrains—that is, when all member states would be in compliance even in the absence of the international agreement—this corresponds with the strategic setting, highlighted above, in which the compliance of others has no effect on the incentives of member states. On screening versus constraining agreements, see Downs, Rocke, and Barsoom (1996) and von Stein (2005).

It is also possible for states to be incapable of complying with an international agreement, or at least finding compliance to be extremely difficult or costly. Such states would have a very high requirement for reciprocity. Chayes and Chayes (1993) argue that lack of capacity explains some or even most incidences of noncompliance in cases where abiding by an agreement involves an affirmative obligation. One example is Indonesia's most recent participation in OPEC, despite its inability, as a net oil importer, to meet OPEC's prescribed output levels. Indonesia withdrew from the cartel in 2008 ("Indonesia to Withdraw from Opec" 2008).

The willingness of a state to violate an agreement and its capability to do so can be seen as the two major elements of the state's *ex ante* propensity to violate its international commitments. States that are otherwise more likely to cheat bear higher costs (or receive lower benefits) from compliance, and so require higher levels of reciprocity before they will comply. States that are unlikely to violate their agreement, before the past performance of the IO is considered, face lower opportunity costs for complying with their obligations and so will have a lower requirement for reciprocity.

The implications of differing requirements for reciprocity depend on the absolute level of compliance within the institution. Consider a case where overall compliance is very high. Here, states with a high *ex ante* propensity to violate, because they require high levels of overall compliance, will be more responsive to new information. Small changes in the track record of the institution may be enough to cause such states to reconsider their decision to comply or to violate. States with a low *ex ante* propensity to violate, on the other hand, will be largely unaffected by changes to the track record of the IO when overall compliance is high. It would take a truly dramatic decline in the institutional track record to change the compliance behavior of states with a low *ex ante* propensity to violate.

In the case of an institution where overall compliance is very low, the effects are reversed. Here, states with a high *ex ante* propensity to violate are unlikely to be affected by modest changes in the track record of the institution—such states will choose to violate regardless—while

the compliance behavior of states with a low ex ante propensity to violate may be influenced by small changes in the track record of the institution. This logic suggests the following hypothesis:

Ex ante propensity hypothesis: A change in the track record of an international institution will have a greater effect on compliance when the state has a high ex ante propensity to violate and there is high compliance overall, or when the state has a low ex ante propensity to violate and there is low compliance overall.

One implication of my theory is that a state may fluctuate in its compliance with an institution when its assessment of the extent to which other states are cheating is close to the minimum level it is willing to tolerate while staying in compliance. A discovery of a new violation may send a state's assessments below its minimum requirement, causing the state to drop out of compliance with the institution. Some period of success for the institution may then cause the state's assessment of overall compliance to rise, prompting the state to return to compliance. This effect may be particularly pronounced when there are still high levels of uncertainty around the true performance of the institution (for example, early in the life of the IO or when the information provided by the IO's track record has been contradictory). When uncertainty is greater, each piece of new information is likely to carry more weight and lead to greater adjustments in states' expectations of overall compliance.

These decisions by individual states to comply or not to comply with international agreements, when aggregated to the level of the IO, determine the overall effectiveness of international institutions. This theory suggests that IOs can settle into different equilibria based on the institution's design, the compliance and enforcement track record of the IO, and variation in member states' requirement for reciprocity. It is easy to see that these factors can lead to a spiral of IO decline. As violations of an agreement are discovered, states see others as less likely to comply and thus are less likely to do so themselves. This leads to additional violations, making states even less likely to comply, and so on. Ultimately, such IOs are reduced to zombie

institutions; they may continue to exist (IOs are very difficult to dispose of) but they no longer exert any constraining power on their members.

On the other hand, confidence in an institution can breed more confidence, leading to a virtuous cycle of self-reinforcing compliance. As time goes by without news of violations uncovered by strong verification mechanisms, states revise upward their assessments of the compliance of others, making states more likely to comply themselves. These IOs become constraining institutions, with high levels of compliance.

IOs may also find themselves in a third equilibrium in which states vacillate between compliance and noncompliance. This can be the result of a high level of compliance uncertainty caused by weak verification mechanisms or by either a very narrow or a bimodal distribution of state requirements for reciprocity. These wavering institutions can exhibit a very different constraining effect on member states depending on where we look in the cycle of compliance and noncompliance.

Track record and compliance in the nuclear nonproliferation regime

Some in the nuclear nonproliferation community have in recent years been sounding the alarm about the decline of the nuclear nonproliferation regime. These analysts argue that efforts by some states to circumvent the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), and the ongoing pursuit of nuclear weapons both within and outside of the treaty, make others less likely to comply with the regime in the future (Perkovich 2006; Sauer 2006; Williams and Wolfstahl 2005). Commonly cited harbingers of the regime's decline include the US-India nuclear cooperation agreement (Carranza 2006; Potter 2005; Wable 2007; Warburg 2012; Weiss 2007); the development of nuclear weapons outside the treaty by Israel, India, and Pakistan (Asculai 2004; Fahmy 2006); the pursuit of weapons inside the treaty by North Korea, Iran, and Iraq (Asculai 2004; Huntley 2007; Spies 2006); the withdrawal of North Korea from the treaty

(Asculai 2004); and the failure of the international community to punish these transgressions (Kittrie 2006).¹⁴

In the view of these analysts, the track record of the nuclear nonproliferation regime—in terms of past compliance and other factors—is an important element in the decisions of member states to comply with their obligations in the future. Belief in this argument, however, is not universal. Many analysts see the regime's health as independent of its past performance (Fields and Enia 2009; Potter 2010; Walsh 2005). The active policy debate surrounding the supposed decline of the nuclear nonproliferation regime makes it a useful test case for the track record mechanism of state compliance.

The security domain in general has been largely neglected by the recent quantitative literature on the drivers of compliance in international organizations, which has focused primarily on the case of multilateral economic institutions (Simmons and Hopkins 2005; Simmons 2000; von Stein 2005). The omission of arms control and nonproliferation regimes, in particular, is notable (Sagan 2011). Indeed, security institutions represent something of a hard case for advocates of regime effectiveness (Young 1992). Security is the issue area where we would expect states to most jealously guard their interests, where the relative lack of distributional effects from treaty membership make such interests more stark, and where the international consequences of compliance are most dramatic.

The strategic setting of nuclear nonproliferation is such that the benefits of complying with the rules of the regime and foregoing the development of nuclear weapons are tightly linked to the willingness of others to do so. States have historically been very wary of unilaterally giving up the right to any kind of defensive capability, particularly nuclear weapons. In 1962, for example, the UN Secretary General asked states about the conditions under which they would give up the right to develop nuclear weapons. Most of the 62 nations that responded said they would only agree to do so if their neighbors also forswore nuclear weapons (Sokolski 2010).

¹⁴ Potter's (2010) "short list" of challenges to the NPT includes 10 external and 9 internal factors.

We would expect, then, that the predictions of theory will hold: a track record of compliance should breed future compliance, and this effect should be greater when verification mechanisms within the treaty are strong. Because overall compliance with the regime is quite high (at worst, a handful of states have been in violation at any one point), states with a high ex ante propensity to violate the rules of the regime should be more sensitive to changes in the regime's track record.

A brief history of compliance and verification in the NPT

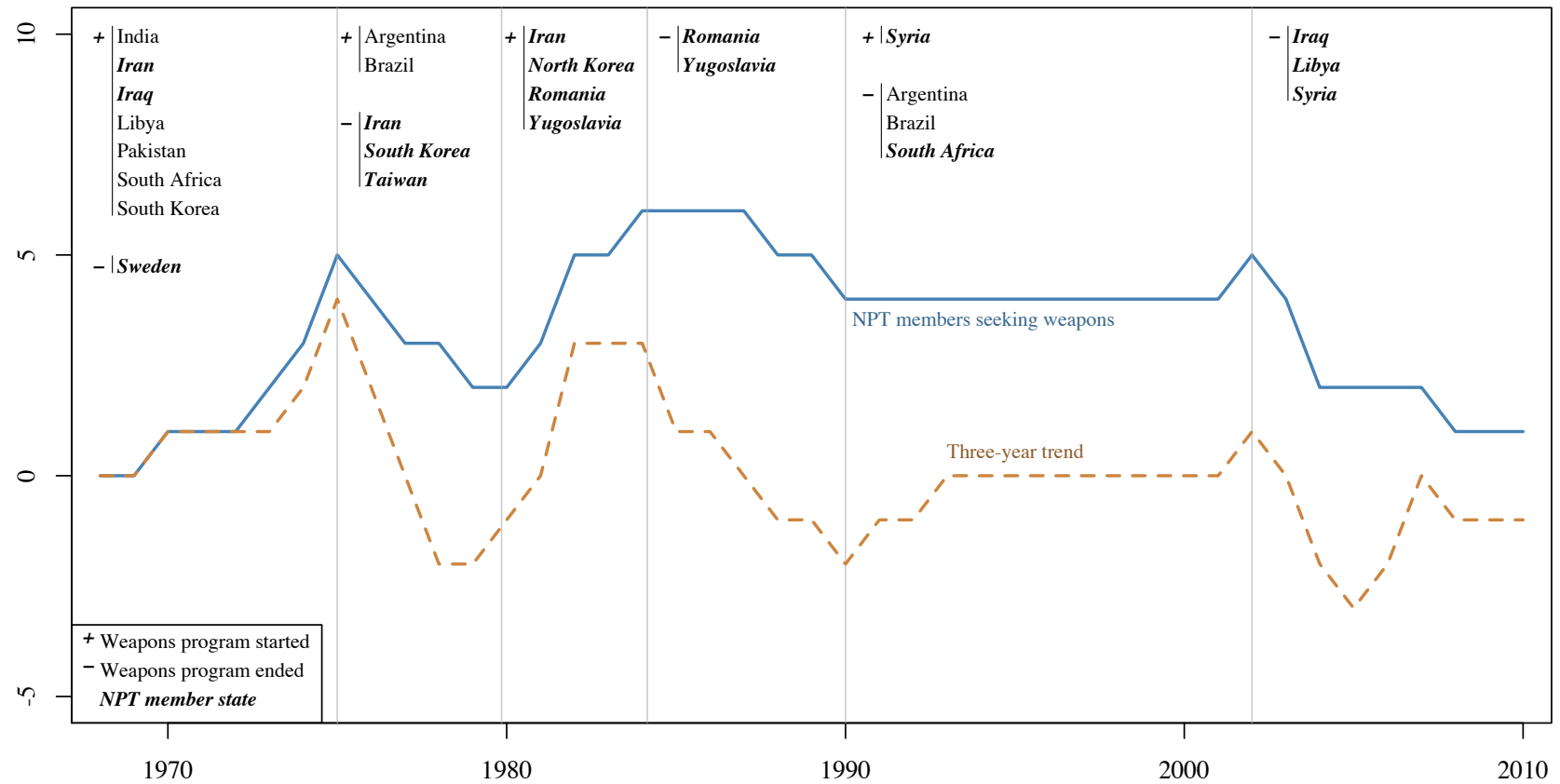
Iran and North Korea, despite their current prominence as nonproliferation hotspots, are not the first challenges to the nonproliferation regime. Figure 3 depicts violations of the nonproliferation regime over time.¹⁵ Since 1968, when the NPT first opened for signature, 16 states have had an active nuclear weapons program, nine of which were NPT members at some point during the program.¹⁶ Only one NPT member state has acquired nuclear weapons; North Korea withdrew from the treaty in 2003 and conducted its first nuclear test in 2006.

Two time periods in the NPT's history—the 1970s and the 1990s—are particularly instructive. In the early years of the treaty, the United States and the Soviet Union sought to convince their client states and the nonaligned to sign onto the NPT. Many states had reservations

¹⁵ I refer to an NPT member state as “in compliance” if it is not pursuing nuclear weapons, and “in violation” if it is seeking nuclear weapons. These definitions do not conform to those used in the nonproliferation policy arena, where a finding of noncompliance is a political decision reserved for the IAEA Board of Governors. A state can also be in technical noncompliance with its NPT commitments, because, for example, it did not provide the IAEA with adequate notice of the construction of a new facility, or because it did not implement a safeguards agreement in a timely way, or for any number of other reasons that fall short of having an actual nuclear weapons program. I do not consider such minor infractions here as NPT violations. For a discussion of the complications that attend to a legal finding of noncompliance, see Goldschmidt (2010).

¹⁶ This tally excludes the P-5 nuclear weapons states recognized by the treaty (the United States, the Soviet Union/Russia, the United Kingdom, China, and France). Country program dates are updated from Jo and Gartzke (2007).

Figure 3: Nuclear proliferation and NPT violations over time



about setting aside, at least for 25 years, their nuclear weapons ambitions.¹⁷ A number of key states in the US sphere, including Australia, Japan, South Korea, Taiwan, Israel, Iran, and West Germany, were considering or even pursuing nuclear weapons in this time period, along with other influential states like India, Pakistan, and South Africa. As a consequence, uncertainty in the viability of the treaty, let alone its effectiveness, ran high. The NPT member states developing a latent nuclear weapons capability in this timeframe—Taiwan, South Korea, Iraq, Iran, and Libya—may have been motivated in part by assessments that the NPT was unlikely to be successful in limiting the proliferation of others.¹⁸

In Japan, for example, China's 1964 nuclear test and the negotiations over the NPT prompted a reconsideration of its non-nuclear stance, with several secret commissions investigating nuclear contingency plans into the early 1970s. Japanese officials went so far as to caution US representatives that further nuclear tests by India or others, or a build-up in Chinese nuclear capabilities, could prompt Japan to seek its own nuclear deterrent (Green and Furukawa 2008). Even in the early days of the NPT, Japan recognized US concerns about maintaining the credibility of the fledgling nonproliferation regime. In a 1974 memo, defense officials argued that the United States would be inclined to provide a stronger nuclear guarantee to Japan in response to a latent Japanese nuclear capability, "because otherwise, the US would be afraid of a rapid deterioration of the stability in the international relations triggered by nuclear proliferation" (Green and Furukawa 2008). Japan ultimately concluded that its interests were best served by staying within the US nuclear umbrella, and it ratified the NPT in 1976.

In contrast to the 1970s, the early 1990s saw a series of very public successes for the regime. South Africa joined the NPT, having dismantled its small arsenal of nuclear weapons.

¹⁷ The NPT was conceived as a 25-year bargain, to be renegotiated, extended, or abolished after that timeframe. This was at least partly to alleviate the concerns of non-nuclear weapons states that the nuclear weapons states would have little incentive to work toward disarmament once the treaty was in place (Sokolski 2010). See Koremenos (2001) on the 25-year term as a flexibility mechanism.

¹⁸ This seems also to have been a factor in the cases of Argentina and Brazil, two non-NPT states that began nuclear weapons efforts in the 1970s (Doyle 2008).

Brazil and Argentina put an end to long-standing nuclear weapons efforts. The newly independent states of Belarus, Ukraine, and Kazakhstan renounced the nuclear weapons they had inherited from the Soviet Union and joined the NPT. Two long-time NPT holdouts, China and France, finally acceded. The nuclear crisis with North Korea was at least temporarily addressed with the 1994 Agreed Framework. And all of this good news culminated in the decision of the international community at the 1995 NPT Review Conference to extend the treaty indefinitely without condition.

It seems that the regime's positive track record in the early part of the decade bred further success, as theory suggests it would. The 1990s was the only decade since the start of the nuclear age in which no new nations launched a nuclear weapons program. While several countries seemed to take stock of their nuclear options around this time period, all chose to remain in compliance with the regime. Japan's defense policy study of 1994-1995, for example, concluded that nuclear weapons would not serve Japan's strategic goals, citing, among several costs, the potential harm from a breakdown in the nonproliferation regime (Green and Furukawa 2008; Kurosawa 2004; Mochizuki 2007). NPT accession also increased dramatically in the 1990s, perhaps in part because of increasing compliance with the treaty. Fifty-one countries became NPT members over the course of the decade, the highest rate of accession since the first years the treaty was open for signature, transforming the NPT into a near-universal regime.

In parallel to these cycles of compliance and violation among NPT members, efforts to monitor and verify compliance were evolving and expanding, often in direct response to major proliferation events. Before the NPT came into force, International Atomic Energy Agency (IAEA) safeguards were generally implemented piecemeal on select nuclear facilities within a country, usually as a condition of sale specified by the nuclear supplier (Jennekens 1990). Under the NPT, member states were required to implement comprehensive safeguards agreements with the IAEA,

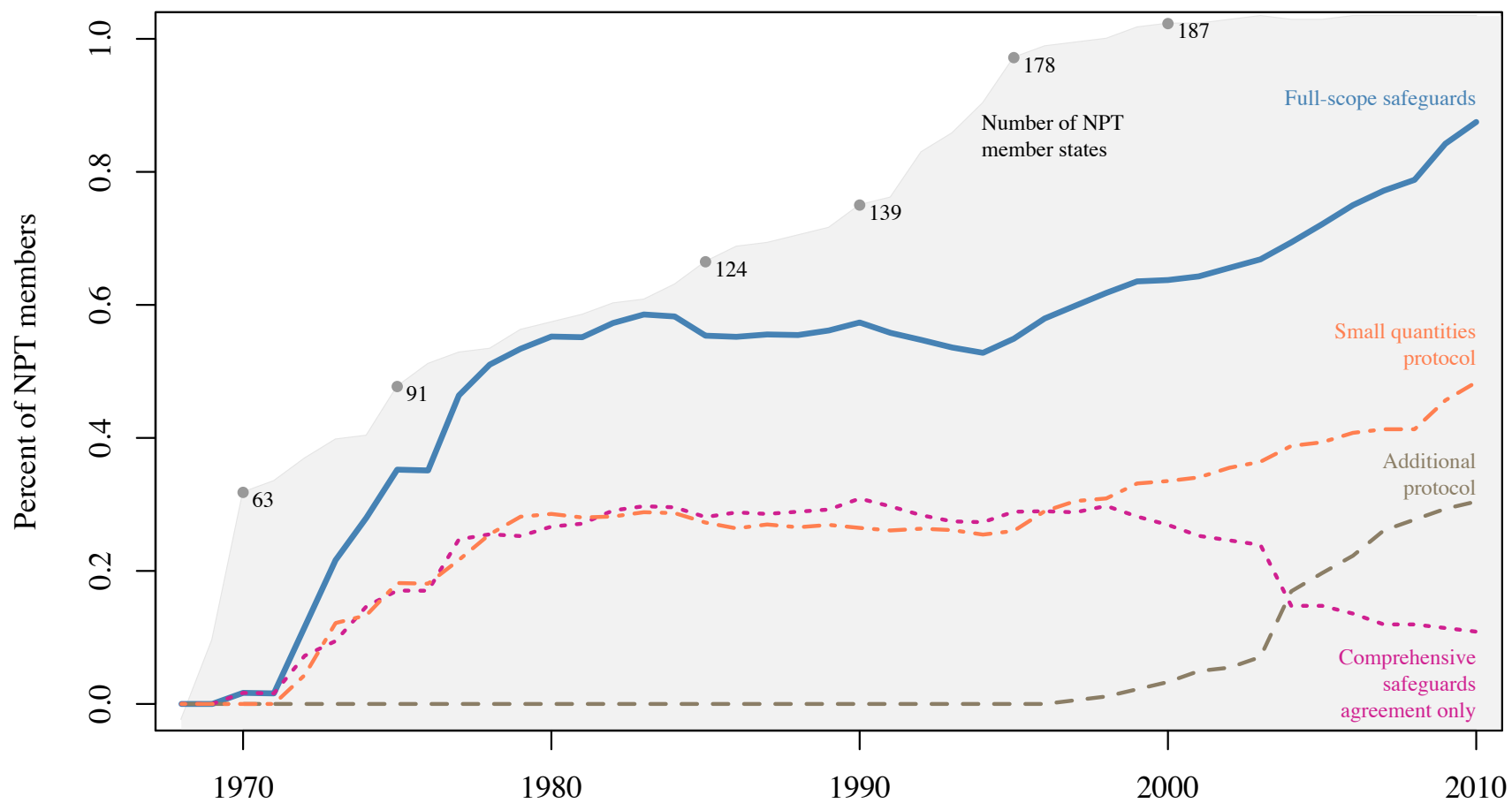
placing all nuclear material in the country under IAEA purview.¹⁹ The NPT stipulates that these agreements enter into force within 18 months of accession, but the actual performance of member states in this area has been far worse. Figure 4 shows safeguards adoption over time as a percentage of NPT member states in a given year. The solid line indicates the presence of a comprehensive safeguards agreement of any type. As recently as 1995, only 55 percent of NPT member states had a comprehensive safeguards agreement in force, although total adoption had risen to 87 percent by 2010.

Figure 4 highlights three categories of comprehensive safeguards. A comprehensive safeguards agreement grants the IAEA access to nuclear facilities for the purposes of verifying state declarations about nuclear activities. Beginning in 1997, as a response to the undeclared nuclear activities in Iraq, member states were encouraged also to bring into force an Additional Protocol to their safeguards agreement that provides the IAEA with wider access to verify the completeness of state declarations. This includes the requirement to declare nuclear facilities and allow inspections there even when nuclear material is not present, and the wider use of environmental sampling techniques to provide assurances that nuclear material has not been introduced at undeclared sites (Hirsch 2004).

If the Additional Protocol represents a more stringent level of safeguards access than a standard comprehensive safeguards agreement, then the Small Quantities Protocol (SQP) is a significant step down. For states with quantities of nuclear material below a particular threshold, the SQP reduces declaration requirements and limits IAEA access to facilities within the state. Importantly, there is no mechanism by which the IAEA can seek to verify the state's assertion that it meets the requirements for the SQP in the first place. This represents an enormous loophole in the safeguards system; the IAEA must trust that a state is correctly characterizing its low level of nuclear development, and must rely on the state to notify the IAEA when these conditions no

¹⁹ This requirement applies only to non-nuclear weapons state parties to the NPT. While the P-5 nuclear weapons states have voluntarily implemented safeguards and allowed inspections at some facilities, these are not full-scope safeguards that cover every nuclear facility within the state.

Figure 4: Full-scope safeguards among NPT member states



longer apply.²⁰ The IAEA in 2005 took steps to close this loophole with a modified version of the SQP that allows the IAEA to verify state declarations and, if necessary, conduct in-country inspections (International Atomic Energy Agency 2005; Kerr 2005a, 2005b).

Overall, the trend in safeguards coverage has been toward stronger verification, especially since the mid-1990s. Almost all states now have some type of full-scope safeguards agreement in place. After a slow start, a substantial share of NPT members has signed the Additional Protocol, granting the IAEA new tools in its efforts to verify compliance. The introduction of a modified SQP effectively closes the largest remaining loophole in the safeguards system for states that bring the modifications into force. And this increase in safeguards coverage for NPT members has occurred at the same time as a spike in NPT membership (the shaded portion of Figure 4). The result is that the IAEA now has substantially more access to nuclear facilities in more states than at any point in the history of the regime.

Modeling compliance

A broader look at the overall trend in NPT violations, along with evolving efforts to detect noncompliance, reveals significant variation over time. Some periods, such as the early 1970s, saw a number of states violating the NPT amidst substantial uncertainty about the prospects for the treaty. By the 1990s, uncertainty had subsided, and with increased confidence in overall compliance came fewer violations. Verification measures, too, have been far from uniform, changing substantially in response first to the 1974 Indian nuclear test and then to the 1991 revelations of an undeclared Iraqi weapons program. This variation in two potentially important drivers of compliance—the track record of the treaty and the strength of verification measures in place to detect violations—may give us some leverage in answering important questions about state compliance. Does the past performance of the nuclear nonproliferation regime affect the decisions of states to comply with or to violate the rules of the regime in the future? More

²⁰ No state has been found to be using the SQP as part of a clandestine nuclear weapons effort. Still, the decision of states like Saudi Arabia to adopt the SQP rather than a standard comprehensive safeguards agreement has aroused suspicion (Kerr 2005b; Perkovich 2008).

generally, does the track records of an international institution exert some influence on state compliance? Answering these questions requires untangling the various other factors that affect the decision to violate a treaty.

I test hypotheses about the track record mechanism on the case of the nuclear nonproliferation regime, using a dataset of nuclear weapons efforts by NPT members from 1968, the year that the NPT opened for signature, to 2010. I exclude from the analysis the P-5 nuclear weapons states (the United States, United Kingdom, Russia, France, and China). Because the nuclear weapons programs in these states are permitted under the NPT, we would not expect their presence to color perceptions of regime effectiveness in the same way as the illicit weapons programs of other member states.²¹ My theory hypothesizes effects for state parties to an international institution, and so I limit the analysis to NPT member states. While many states outside the NPT have been associated with the nuclear nonproliferation regime in some way, the centrality of the NPT to the overall regime suggests that it is a useful cut-point in distinguishing regime members from non-members.²² That is, NPT member states can be thought of as members of the nonproliferation regime, while those outside the NPT cannot be meaningfully considered members of the regime.

The data are structured as a pooled time series, with the unit of analysis as the country-year. My analysis builds on a rich and growing quantitative literature in nuclear proliferation; to the extent that it is possible and theoretically justified, I employ similar explanatory variables to those commonly used in this literature to facilitate comparisons with existing models.

The dependent variable in this analysis is the pursuit of nuclear weapons, a dichotomous measure that takes on the value of one when a state has a nuclear weapons program in a given

²¹ The unwillingness of the P-5 states to engage in meaningful nuclear disarmament may affect perceptions of the strength of the treaty. This mechanism is distinct, however, from the mutual forbearance dynamic I investigate in this paper. On potential damage to the regime from nuclear weapons states' lack of disarmament, see Knopf (2012) and Perkovich (2006). For opposing views, see Ford (2009) and Kroenig (2012).

²² Such prominent NPT abstainers as Israel, India, and Pakistan, for example, are all members in good standing of the IAEA.

year.²³ I use nuclear weapons program dates from Jo and Gartzke (2007), updating their list of nuclear weapons pursuers with the addition of Libya from 1970 to 2003 and Syria from 2001 to 2007.²⁴ An alternative coding of nuclear weapons aspirants is available from Singh and Way (2004), and yields similar results.

The key explanatory variables in this analysis are the track record of the nonproliferation regime, to address the track record hypothesis, and the interaction of track record and strength of verification measures to address the verification hypothesis. There are a number of possible ways to operationalize the track record of the treaty. In this analysis, I employ one of the simplest such measures: the three-year trend in the number of NPT violators; that is, the number of NPT violators in the current year minus the number of violators three years ago.²⁵ If my track record hypothesis holds true, we would expect an increase in the three-year trend to be associated with an increase in an individual state's likelihood of pursuing nuclear weapons.

An alternative measure might be a simple count of treaty violators in a given year or years, but the trend in NPT violators seems a closer proxy for the track record of the regime than does the aggregate number of violators. My theory posits that states update their assessments of overall compliance and the treaty's performance using information provided by the track record of the IO. If the track record suggests that compliance is at the level previously anticipated by the state, no change in the assessment of overall compliance (and no change in proliferation behavior) is called for. It is the recent change in overall compliance, then, rather than the raw count of violators, that we would expect to drive changes in the compliance decisions of individual states. Of course, states

²³ Because my theory suggests that the track record of international institutions may affect both the initiation of new nuclear weapons programs and the decision to continue those programs, I include in my analysis country-years both before and during a nuclear weapons effort. Modeling only the initiation of nuclear weapons programs yields similar results.

²⁴ Given Libya's decision in 2003 to disclose and dismantle its nuclear infrastructure, it seems clear that a nuclear weapons program did exist there. The 1970 start date for the Libyan effort is from Singh and Way (2004). Israel's 2007 air strike on a nuclear reactor in Syria revealed a nascent nuclear weapons effort there. Construction at the site began in 2001 (Albright and Brannan 2008).

²⁵ The three-year trend in NPT violations is shown in Figure 3, above.

may consider trends longer or shorter than three years; alternative measures using the number of violators over one or five years does not affect my results.

I include two measures of the strength of the regime's verification mechanisms, representing two different levels of IAEA access to a state's nuclear facilities. The first is the percentage of NPT member states in a given year that have signed a small quantities protocol to their comprehensive safeguards agreement. As discussed above, the IAEA does not conduct on-site inspections or even verify that a state meets the criteria for the SQP.²⁶ The second measure is the percentage of NPT member states in a given year that have a comprehensive safeguards agreement in force, excluding those with a SQP. Included in this latter measure are states that have signed the Additional Protocol to their safeguards agreement.²⁷ States included in this second category have allowed the IAEA substantially greater access to nuclear facilities. To test the verification hypothesis, which posits a stronger effect for the IO track record when verification measures are strong, I interact the three-year trend in violations with the percentage of member states that have signed a comprehensive safeguards agreement (excluding SQP signatories).

I include in my analysis three additional categories of factors that have been found to affect states' propensity to proliferate: nuclear capability, nuclear willingness, and domestic politics. Recent quantitative literature has found a strong association between the nuclear capacities of states in terms of access to resources, nuclear material and infrastructure, and expertise, and their tendency to seek nuclear weapons (Brown and Kaplow Forthcoming; Fuhrmann 2009; Jo and Gartzke 2007; Kroenig 2009). I thus include in the models a measure of real GDP per capita, using data from K. Gleditsch (2002) and Heston, Summers, and Bettina

²⁶ I do not account here for the modified version of the SQP introduced in 2006, which provides for greater IAEA access, because of its relatively small overlap with the time period covered by my analysis.

²⁷ Because the Additional Protocol became available only in 1997, I do not break out the share of states with an Additional Protocol as its own variable, to avoid privileging the last ten years of my dataset. Robustness checks that include as an explanatory variable the percentage of NPT members that have signed an Additional Protocol yield similar results.

(2012).²⁸ To account for state access to nuclear technology, I include the count of the number of fuel-cycle related IAEA Technical Cooperation projects a state was involved in for a given year (Brown and Kaplow Forthcoming). In a recent analysis, Brown and Kaplow found that this measure is strongly associated with a state's pursuit of nuclear weapons, perhaps because this form of multilateral nuclear assistance reduces the cost for states to initiate and continue weapons efforts.

I include three variables that address a state's underlying interest in pursuing weapons. First, because a propensity for conflict may drive states to seek a nuclear deterrent, I employ a dichotomous variable that takes on the value of 1 if a state has been engaged in an interstate armed conflict in the previous five years, using data from the UCDP/PRIO Armed Conflict Dataset (N. P. Gleditsch et al. 2002). Second, to capture a state's response to the direct threat posed by a proliferating adversary, I use a dichotomous variable that takes on the value of 1 if a state's rival is pursuing or has already acquired nuclear weapons in a given year, using rivalry data from Thompson and Dreyer (2012). Third, the extension of a nuclear umbrella might help to alleviate states' security concerns and thus their willingness to proliferate. Following standard practice in this literature, I include a dichotomous measure that takes on the value of 1 if a state has a defense pact with a nuclear weapons state, using alliance data from the Correlates of War project (Gibler and Sarkees 2004).

A number of analyses credit domestic politics in driving the pursuit of nuclear weapons (Jo and Gartzke 2007; Montgomery 2005; Singh and Way 2004; Solingen 1994; Way and Weeks Forthcoming). As an admittedly rough measure of the role that domestic interests may play in a state's proliferation decision-making, I include as an explanatory variable the Polity project's measure of domestic regime type, which runs from -10 (strong autocracy) to 10 (strong democracy) (Marshall, Jaggers, and Gurr 2010).

²⁸ Data from K. Gleditsch (2002) is available only through 2004. Additional country-years are filled in from Penn World Table data (Heston, Summers, and Bettina 2012). Robustness checks using only Gleditsch's data (limiting the time period of the analysis to 1968-2004) and using only Penn World Table data yield nearly identical results to the models shown here.

Finally, to address temporal dependence in the data, I include a simple count of the number of years that have passed without the state engaging in a nuclear weapons program, along with its squared and cubed terms (Carter and Signorino 2010). This measure is analogous to the peace-years variable commonly used for this purpose in studies of international conflict. Because my data include country-years in which a state is pursuing nuclear weapons, I also employ a cubic polynomial representing the number of years that have passed in the course of a state's nuclear program. While my dataset begins in 1968, counts of program years and non-program years incorporate the complete set of nuclear weapons efforts beginning in the late 1930s, and so do not suffer from bias due to left-truncation (Carter and Signorino 2012).

Findings

Table 1 shows the results of four logit models of nuclear proliferation. Model 1 tests the association between the regime's track record and a state's likelihood to violate the NPT, without regard for other drivers of nuclear weapons pursuit. Model 2 adds a measure of the strength of verification and a set of controls for nuclear capability and willingness. Model 3 adds a measure of state regime type, and Model 4 interacts the track record of the regime with a measure of the strength of verification mechanisms. I report robust standard errors, clustered by country.

Consistent with my track record hypothesis, I find a strong association between the track record of the regime, as measured by the three-year trend in NPT violators, and a state's likelihood of having a nuclear weapons program. As the regime's track record worsens, an NPT member state becomes more likely to pursue a nuclear weapon. As the track record improves, a state is less likely to violate the treaty. This association holds even when controlling for other theorized drivers of proliferation behavior, as in Models 2 and 3.

The two measures of the strength of verification are statistically significant in Models 2-4, but, as expected, they point in different directions. The coefficient on the percentage of states that allow robust inspector access is negative and significant in each model. The more states that allow such access within the regime, the less likely is an NPT member to seek nuclear weapons. The

Table 1: Logit Analysis of NPT Violations, 1968 – 2010

		Model 1	Model 2	Model 3	Model 4
Track Record	NPT violations (three-year trend)	0.697 (0.144)	0.735 (0.125)	0.640 (0.139)	-0.978 (0.678)
Verification	Safeguards agreement, excluding SQP (percent of NPT members)		-35.964 (14.060)	-43.586 (14.671)	-61.435 (14.777)
	Small Quantities Protocol (percent of NPT members)		30.378 (12.862)	38.543 (8.923)	49.939 (10.015)
	Safeguards agreement, excluding SQP × NPT violations (three-year trend)				6.217 (2.794)
Nuclear Capability	Real GDP per capita		0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
	Fuel cycle-related IAEA TC		0.507 (0.104)	0.598 (0.103)	0.593 (0.125)
Nuclear Willingness	Interstate conflict (previous five years)		2.629 (1.486)	3.625 (1.039)	3.607 (1.060)
	Rival with nuclear weapons program		1.240 (0.879)	0.709 (0.832)	0.842 (0.893)
	Defense pact with nuclear state		2.793 (1.046)	2.385 (1.097)	2.343 (1.131)
Domestic Politics	Regime type			-0.537 (0.175)	-0.575 (0.186)
	Constant	-2.404 (0.484)	-3.339 (1.701)	-6.321 (3.296)	-5.138 (3.025)
	N	5662	5530	4774	4774

Logit coefficients with robust standard errors, clustered on country, in parentheses. Bold values are statistically significant ($p < 0.05$). Cubic polynomials of the years without a nuclear weapons program and the years since a program was initiated are included in all models but not shown.

coefficient on the percentage of NPT member states that have an SQP in place is positive and significant in each model. The higher the proportion of states that could be taking advantage of this safeguards loophole, the more likely are member states to pursue nuclear weapons.

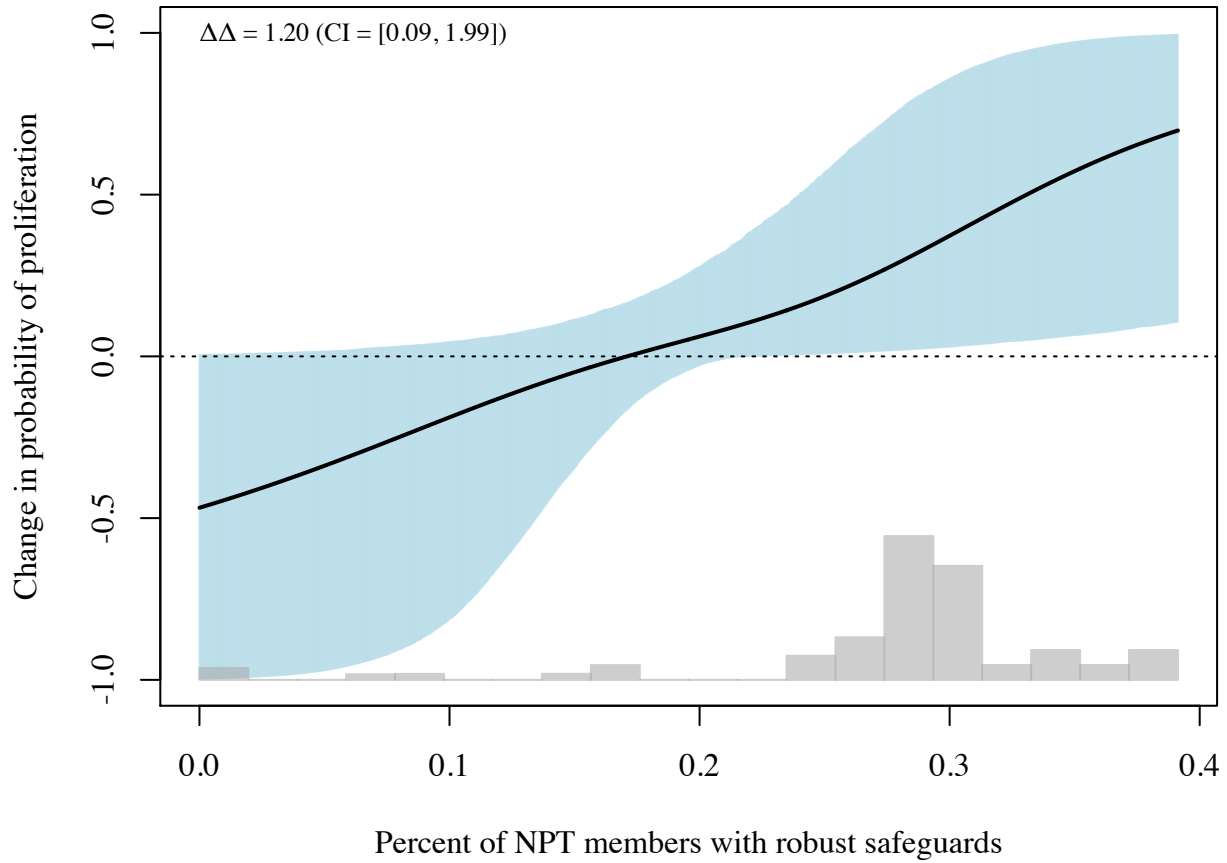
These results are consistent with my theory, which sees strong verification measures as providing valuable information to states about the prospects for overall compliance, but the finding is still perhaps surprising. If a climate of regime violations leads to an increase in the pressure exerted on states to allow IAEA inspectors greater access and to sign robust safeguards

agreements, then we might expect to find a statistical relationship in which violations increase with the strength of verification. This is analogous to the way in which an increase in the number of police on the street is associated with an uptick in crime. If such a dynamic is also present in the nonproliferation regime, it suggests that the link between stronger verification measures and a reduction in proliferation is even stronger than these results indicate. In fact, this finding provides new support for the view that the NPT exercises a constraining effect on states (Kaplow 2012). If the regime were ineffectual, verification measures would not matter to state decision-making, and we would expect to see no relationship (or a negative relationship) between strength of verification and compliance.

Model 4 tests the verification hypothesis by interacting regime track record and the percentage of NPT member states with robust safeguards. The coefficient on the interaction, although positive and significant, is more easily interpreted in graphical form (Brambor, Clark, and Golder 2006). In Figure 5, I plot the effect on proliferation of an increase in the three-year trend of violators from the minimum (-3) to the maximum (4). I set the percentage of states with an SQP to parallel the range of robust safeguards; other substantive variables are held at their mean, and the count of non-program years and program years is set to zero.²⁹ The shaded area in the figure represents a 95 percent confidence interval. Strength of verification is represented on the x-axis as the percentage of NPT member states that have a comprehensive safeguards agreement in force, excluding those with an SQP. The histogram below the plot represents the relative frequency of different values for strength of verification measures in the underlying data.

²⁹ Allowing the percentage of states with an SQP to vary with the percentage of states with robust safeguards makes this analysis more plausible. These variables are closely linked in the data. In the mean case, proliferation is very unlikely. By setting the count variables at zero, I approximate the case of a state that is new to the international system, and so more closely mimic a case with some proliferation risk.

Figure 5: Effect of poor regime track record by strength of verification



As the figure shows, when the strength of verification is low, the track record of the treaty has no significant effect on state decisions to pursue nuclear weapons. When a quarter of NPT member states or more allow IAEA inspections, however, the effect of the regime track record on proliferation can be quite large in substantive terms. The verification hypothesis posits a positive slope to this line. The second difference, calculated at the minimum and maximum for track record and verification strength and shown in the upper-left corner of Figure 5, is statistically significant, consistent with the hypothesis (Berry, DeMeritt, and Esarey 2010).

The ex ante propensity hypothesis suggests that, for agreements like the NPT where the number of violators is low, the track record of the IO will have a greater effect on states with a higher ex ante propensity to violate. I test this hypothesis by comparing the substantive effect of regime track record in a low-risk case to a case where violation is much more likely. Figure 6,

based on Model 3, plots the predicted probability of proliferation for both cases against the range of possible values for regime track record. In the high-risk case, all other variables are held at the median value for violating states. The low-risk case is plotted with variables set at the median values for NPT member states without a nuclear weapons program.³⁰ The shaded areas represent 95 percent confidence intervals. The histogram at the bottom of the plot shows the relative frequencies of different values for the regime track record in the underlying data.

It is clear from Figure 6 that the effect of regime track record on compliance is much greater for states that are otherwise more likely to violate the treaty, while states with a low ex ante propensity to violate are less likely to respond to changes in the track record of the regime. This provides support for the ex ante propensity hypothesis. Figure 6 also illustrates that the substantive significance of the track record variable is likely to be marginal for most NPT member states. For the minority of states with some real risk of proliferating, however, the track record of the regime is very strongly associated with the decision to pursue nuclear weapons. Moving from a slightly positive track record, for example, to a slightly negative one is associated with about a 25-percentage point increase in the probability of pursuing nuclear weapons.

Addressing Potential Objections

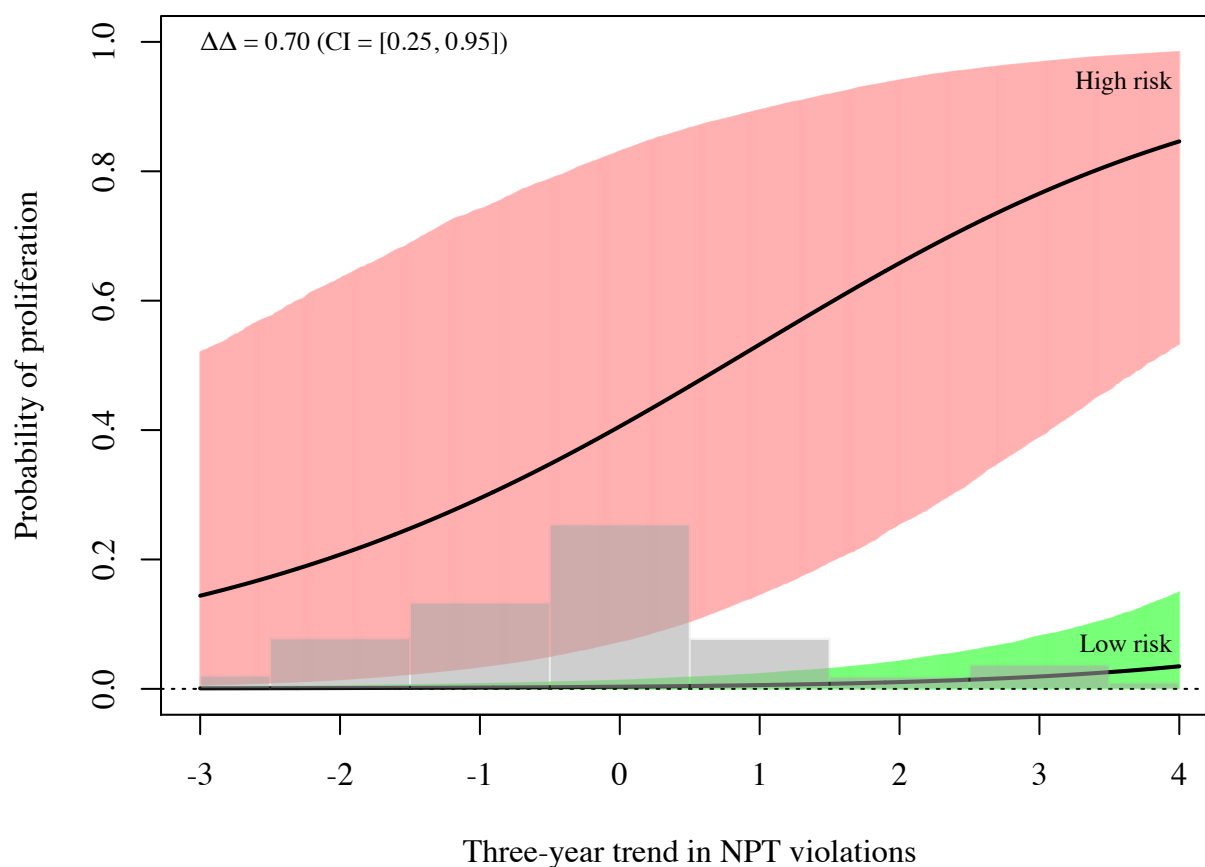
It is worth considering here several possible objections to this analysis, related to the choice of explanatory variable, the direct threat posed by others' proliferation, and the importance of the punishment of violations in shaping future compliance.

The problem of nuclear secrecy

My measure of the track record of the international regime, the three-year trend in NPT violations, is calculated with the benefit of hindsight. Even with decades to reflect, however, coding decisions about the particular years a nuclear weapons program was active are quite

³⁰ Beck, King, and Zeng (2000) adopt a similar approach when examining the ex ante probability of international conflict.

Figure 6: *Ex ante propensity to violate and the effect of regime track record*



uncertain, and reasonable analysts can disagree.³¹ One potential problem, then, with my measure of the track record of the regime, is that it assumes that all NPT member states are aware of others' transgressions, even though nuclear weapons programs are often among the best protected of national secrets.

We may take some comfort in the fact that any general bias created by nuclear weapons program secrecy would probably lead to an understating of the relationship between the overall level of noncompliance and the decisions of states to engage in a weapons effort. If states at the time were not aware of all the cheating reflected in the dataset, my results would be even stronger.

³¹ This uncertainty is evidenced by the coding differences in Jo and Gartzke (2007) and Singh and Way (2004). On the dangers of relying on a particular coding of nuclear weapons programs, see Montgomery and Sagan (2009).

On the other hand, if states believe there are more NPT violators than there actually are, my results may be overstated. This seems less likely; cases of nuclear false alarms are rare, although not unheard of. The most prominent case, of course, is the US assessment that Iraq was reconstituting its nuclear weapons program prior to the 2003 invasion.

It is also possible that some states are able to detect a secret weapons program where others are not. While this is certainly true when considering the full population of states, the states that exert the most effort in areas of nuclear intelligence, by far, are the P-5 nuclear states, and so are excluded from my analysis. India, Pakistan, and, in particular, Israel also have strong resources in this area, but they too are left out of this analysis because they have not joined the NPT.

There is likely still to be variation among the remaining states in the effort and resources they devote to ferreting out secret nuclear weapons programs. I test whether differential knowledge of nuclear efforts would alter my findings by recoding the explanatory variable of interest. I consider three major factors that might give some states unusual knowledge of others' nuclear efforts. First, the United States or another state with strong intelligence capabilities might provide this information to its allies. I examine this possibility by assuming that states that are part of a defense pact with a nuclear state have perfect knowledge of others' nuclear weapons programs, but that states that lack a nuclear ally will be unaware of nuclear weapons work in the first five years of those programs.³² Second, some states may simply have greater resources to devote to intelligence gathering. To consider this case, I give full knowledge of NPT violations to states with real GDP per capita above the global mean. States below the global mean are assumed to be unaware of weapons programs in the first five years of those programs. Finally, states may have greater knowledge of nuclear weapons programs undertaken in their region, because provocative or threatening behavior is a great deal more salient to neighboring states. Here I

³² Uncertainty about the existence of a nuclear weapons effort is likely to be highest in the program's early years, because the nuclear activity in this stage of development is primarily dual-use and so is less alerting to international observers. As weapons programs mature, they require more resources, larger facilities, and frequently foreign expertise, all of which may draw outside attention to the effort.

credit states with full knowledge of nuclear weapons programs within their region, but assume they are unaware of weapons programs elsewhere that have begun in the last five years.

Replicating my earlier analysis using each of these alternative explanatory variables does not change the result. In each case, the coefficient on the regime track record variable is positive and significant. The worse the trend in NPT violations, then, the more likely states are to seek nuclear weapons themselves, even accounting for the fact that some states may have more knowledge of nuclear weapons efforts than others. This reanalysis provides some support for the assertion that the secrecy of nuclear weapons programs does not substantially bias my results, or if it does so that it leads to understated findings.

Proliferation cascades versus the efficacy of the regime

In a proliferation cascade, State A's pursuit of nuclear weapons makes State B more likely to violate the treaty in turn, because State B is directly threatened by State A's behavior. This mechanism is distinct from the track record mechanism, in which the violations of others may lead a state to adjust its assessment of overall compliance with an international agreement and the efficacy of the IO, and ultimately cause changes in the state's compliance behavior. The distinction is of some importance, because proliferation cascades bypass the nuclear nonproliferation regime, while the track record mechanism works via the international institution. These mechanisms are separate in theory, but can be difficult to untangle empirically. It is worth considering, then, whether the empirical results provided above are really capturing the role the NPT plays in constraining state behavior, or whether states are simply made to feel less secure when others proliferate and so are more likely to do so themselves.

I attempt to distinguish proliferation cascades from the track record mechanism in three ways. First, I control in Models 2–4 for the pursuit of nuclear weapons by a state's rival. This variable would address the most straightforward cases of nuclear dominoes falling, such as South Korea's potential response to North Korea's nuclear program. The track record variable in these models remains a significant determinant of nuclear weapons pursuit, even when accounting for

the behavior of rivals, suggesting that the effect is not exclusively a response to the dangerous behavior of a single rival state.

Second, I compare the effect of the regime's track record on states within the NPT to the effect on states that have not joined the treaty. If these models were actually capturing the impact of a proliferation cascade, we would not expect to see any difference in the response of NPT members versus non-members. In fact, however, when the recent trend in NPT violations is one of increasing compliance, NPT members are less likely to violate the treaty than non-members by about 10 percentage points. When the trend in NPT violations is toward more violations, NPT membership is associated with a substantial increase—more than 25 percentage points—in the probability of a state seeking nuclear weapons. The interaction effect is strongly significant, with a min-max second difference of 0.45.³³ This result is consistent with the track record mechanism, but not with a direct proliferation cascade. In the latter case, we would expect to see no differential effect for NPT membership on the recent trend in NPT violators.

As a final check, I recode the explanatory variable of interest to include only NPT violations outside a state's home region. A proliferation cascade is likely to be most strongly felt among neighboring states. We worry about Japan's response to North Korea's nuclear weapons program, for example, and Saudi Arabia's response to Iranian proliferation, but not as much about Saudi Arabia's response to North Korea's weapons efforts. By considering only the NPT violations outside a state's region, we are more likely to be picking up the effect of these violations on state perceptions of the efficacy of the regime. The coefficient on regime track record remains positive and statistically significant, even when this variable is recast as the extra-regional trend in NPT violations. This finding provides strong support for the contention that my empirical analyses are capturing the dynamics of the international institutions of the nonproliferation regime, rather than the direct effect of a proliferation cascade.

³³ These findings come from replicating Model 2 using data on both NPT members and non-members, and adding variables representing NPT ratification and an interaction between track record and NPT ratification. The coefficient on the interaction term is positive and significant.

Uncertainty about the likelihood of punishment

A complementary theory might posit that the track record of international institutions provides information, not just about future compliance, but also about the prospects for the punishment of treaty violators. Such a mechanism may well be in play in the nuclear nonproliferation regime. Some argue, for example, that Libya's decision to give up its nuclear weapons efforts was prompted by the fear that the United States would conduct a preemptive attack against Libya as it had with Iraq. Or potential proliferators may currently be learning an important lesson from the international community's inability to stop Iran's nuclear development.

The findings presented in this paper, however, are unlikely to be confounded by this alternative mechanism. This is because harsh international responses to nuclear weapons programs are fairly rare, and they are most likely to attend to an incidence of NPT violation. If some small portion of NPT violators is strongly censured by the international community, then we might think of these violations as sending a constraining signal to other member states that encourages greater compliance. This is the equivalent of having fewer total NPT violators than are reflected in the data, and would cause my statistical models to underestimate the association between the regime track record and the decision to pursue nuclear weapons.

Conclusion

A large body of literature, from Keohane (1984) on, highlights the provision of information as an important mechanism by which international institutions can affect state behavior, and largely sees this information as providing an important benefit in terms of international cooperation. In this paper, I have presented a theory of IOs in which information—in the form of the track record of the international institution—is something of a double-edged sword, with the potential both to contribute to and to diminish the constraining power of IOs. The track record mechanism operates in strategic settings characterized by reciprocity, where the benefits members receive from compliance depends on whether others comply as well. The effect of

an institution's track record on state compliance is moderated or amplified by the strength of verification measures within the IO, and by the ex ante propensity of states to violate the treaty.

The theory is borne out in the case of nuclear nonproliferation regime. My analysis suggests that the track record of the nuclear nonproliferation regime influences future compliance. The impact of the track record varies based on the strength of verification mechanisms: the regime track record was found to have a stronger effect on compliance when international inspectors have more robust access to more states' nuclear facilities. States with a higher ex ante propensity to violate the NPT are much more affected by the track record of the regime than those that are ex ante less likely to cheat.

The finding that the nuclear nonproliferation regime's track record matters for future compliance points to a more dynamic view of international institutions than has generally been recognized in the literature. This result in the security realm is of particular interest, because this is an issue area where international enforcement mechanisms are weak or nonexistent, where states most jealously guard their national interests, and where, as a consequence, international institutions are commonly thought to be least constraining.

Policymakers face difficult tradeoffs between maintaining the credibility of the nuclear nonproliferation regime and achieving other foreign policy goals. My findings suggest that in many cases policies should emphasize support for the regime over these other interests. This can mean uncomfortable conversations between allies. The United States, for example, tolerated Saudi Arabia's refusal to sign and implement a comprehensive safeguards agreement with the IAEA for 20 years after signing the NPT, well beyond the 18 months permitted by the treaty. Saudi Arabia's safeguards agreement came into force in 2008, but even then only with limited inspector access. Clearly, the importance of the bilateral relationship was seen to outweigh the need to lend support to the regime. But if countries care about overall adherence to the rules of the NPT, as my analysis suggests, US pressure on its ally to implement the required safeguards agreement might have served its broader nonproliferation interests.

These findings also suggest that diplomatic efforts might effectively make use of the regime credibility argument to stave off weapons pursuit by some states. The strong link between the health of the regime and the decisions of states to seek weapons might help to convince important supplier states not send sensitive technologies to potential nuclear weapons aspirants, or even to convince states like Japan to remain in compliance with their NPT commitments.

In addition, these findings call for an all-out push to prevent South Korea, Japan, and others from seeking nuclear weapons in response to North Korean provocations. If these countries are thought to be pursuing a weapons capability, the credibility of the regime would be damaged, and other nations—even outside of East Asia—are more likely to follow suit. Strong security guarantees from the United States to Japan and South Korea, then, become an important policy tool not just in reassuring US allies in the region, but in preempting a breakdown of regime credibility.

South Korea has been pushing the United States to sign a nuclear cooperation agreement that would allow Seoul to use technology that could make a direct contribution to a nuclear weapons effort. South Korea maintains that this technology has nothing to do with nuclear weapons. But even the perception that an NPT member is seeking weapons can be harmful to the regime. Other member states might see such an agreement, particularly in the context of North Korea's behavior, as part of a nuclear hedging strategy by South Korea, allowing it to develop a latent nuclear weapons capability. The United States should prioritize the health of the nonproliferation regime over a fairly minor issue in bilateral relations between allies and refuse to sign this agreement.

Finally, and most fundamentally, the track record of the regime needs to be incorporated into policy thinking about future proliferation risks. Twenty years ago, identifying future proliferant states largely involved an assessment of which countries had enough economic and natural resources to make pursuing a weapon a reality. The nuclear landscape has shifted, and today a number of countries have a substantial latent nuclear capacity. Iran is perhaps the most visible example, but Japan, South Korea, Brazil, Egypt, Indonesia, and others either have or are

pursuing a civil nuclear infrastructure that could be repurposed for weapons work. The question for analysts thus has changed from which states could develop nuclear weapons to when nuclear-capable states may decide to make that final sprint to the finish line. A decline in the track record of the regime, in this context, could function as a kind of nuclear trigger, pushing states that had been on the verge of seeking weapons to proceed with the last stages of nuclear development. Considering the track record of the nonproliferation regime can help analysts assess the level of risk for individual countries at a particular time. Policymakers, as a result, can be better able to intervene to dissuade at-risk countries from pursuing weapons, using the full set of policy options at their disposal.

References

- Albright, David, and Paul Brannan. 2008. *The Al Kibar Reactor: Extraordinary Camouflage, Troubling Implications*. Institute for Science and International Security.
- Asculai, Ephraim. 2004. *Rethinking the Nuclear non-Proliferation Regime*. Jaffee Center for Strategic Studies, Tel Aviv University.
- Axelrod, Robert M. 1984. *The Evolution of Cooperation*. New York: Basic Books.
- Axelrod, Robert M., and Douglas Dion. 1988. "The Further Evolution of Cooperation." *Science* 242(4884): 1385–90.
- Beck, Nathaniel, Gary King, and Langche Zeng. 2000. "Improving Quantitative Studies of International Conflict: A Conjecture." *The American Political Science Review* 94(1): 21–35.
- Berry, William D., Jacqueline H. R. DeMeritt, and Justin Esarey. 2010. "Testing for Interaction in Binary Logit and Probit Models: Is a Product Term Essential?" *American Journal of Political Science* 54(1): 248–66.
- Brambor, Thomas, William Roberts Clark, and Matt Golder. 2006. "Understanding Interaction Models: Improving Empirical Analyses." *Political Analysis* 14(1): 63–82.
- Brown, Robert L., and Jeffrey M. Kaplow. Forthcoming. "Talking Peace, Making Weapons: IAEA Technical Cooperation and Nuclear Proliferation." *Journal of Conflict Resolution*.
- Carranza, Mario E. 2006. "Can the NPT Survive? The Theory and Practice of US Nuclear Non-proliferation Policy after September 11." *Contemporary Security Policy* 27(3): 489–525.
- Carter, David B., and Curtis S. Signorino. 2012. "What Just Happened? Left-Truncation in Grouped Binary Duration Data." Paper prepared for the 2012 Peace Science International Conference, Savannah, GA.

- Chayes, Abram, and Antonia Handler Chayes. 1993. "On Compliance." *International Organization* 47(02): 175–205.
- Dai, Xinyuan. 2002. "Information Systems in Treaty Regimes." *World Politics* 54(4): 405–36.
- Diekmann, Andreas. 1985. "Volunteer's Dilemma." *Journal of Conflict Resolution* 29(4): 605–10.
- Downs, George W., David M. Rocke, and Peter N. Barsoom. 1996. "Is the Good News About Compliance Good News About Cooperation?" *International Organization* 50(3): 379–406.
- Doyle, James E. 2008. "Argentina and Brazil." In *Nuclear Safeguards, Security, and Nonproliferation*, ed. James E. Doyle. Burlington, MA: Butterworth-Heinemann.
- Fahmy, Nabil. 2006. "An Assessment of International Nuclear Nonproliferation Efforts After 60 Years." *The Nonproliferation Review* 13(1): 81–87.
- Falk, Armin, and Urs Fischbacher. 2006. "A Theory of Reciprocity." *Games and Economic Behavior* 54(2): 293–315.
- Fearon, James D. 1998. "Bargaining, Enforcement, and International Cooperation." *International Organization* 52(02): 269–305.
- Fields, Jeffrey, and Jason S. Enia. 2009. "The Health of the Nuclear Nonproliferation Regime." *The Nonproliferation Review* 16(2): 173–96.
- Ford, Christopher. 2009. "Nuclear Disarmament, Nonproliferation, and the Credibility Thesis." *Hudson Institute Briefing Paper*.
- Fuhrmann, Matthew. 2009. "Spreading Temptation: Proliferation and Peaceful Nuclear Cooperation Agreements." *International Security* 34(1): 7–41.
- Gibler, Douglas M, and Meredith Reid Sarkees. 2004. "Measuring Alliances: The Correlates of War Formal Interstate Alliance Dataset, 1816–2000." *Journal of Peace Research* 41(2): 211–22.
- Gleditsch, Kristian Skrede. 2002. "Expanded Trade and GDP Data." *Journal of Conflict Resolution* 46(5): 712–24.
- Gleditsch, Nils Petter, Peter Wallensteen, Mikael Eriksson, Margareta Sollenberg, and Håvard Strand. 2002. "Armed Conflict 1946–2001: A New Dataset." *Journal of Peace Research* 39(5): 615–37.
- Goldschmidt, Pierre. 2010. "Safeguards Noncompliance: A Challenge for the IAEA and the UN Security Council." *Arms Control Today*.
- Granovetter, Mark. 1978. "Threshold Models of Collective Behavior." *American Journal of Sociology* 83(6): 1420–43.

- Green, Michael J., and Katsuhisa Furukawa. 2008. "Japan: New Nuclear Realism." In *The Long Shadow: Nuclear Weapons and Security in 21st Century Asia*, ed. Muthiah Alagappa. Stanford, CA: Stanford University Press.
- Heston, Alan, Robert Summers, and Aten Bettina. 2012. *Penn World Table Version 7.1*. Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania.
- Hirsch, Theodore. 2004. "The IAEA Additional Protocol: What It Is and Why It Matters." *The Nonproliferation Review* 11(3): 140–66.
- Huntley, Wade L. 2007. "U.S. Policy Toward North Korea in Strategic Context: Tempting Goliath's Fate." *Asian Survey* 47(3): 455–80.
- Hyde, Alan. 2009. "The International Labor Organization in the Stag Hunt for Global Labor Rights." *Law & Ethics of Human Rights* 3(2): 154–79.
- "Indonesia to Withdraw from Opec." 2008. *BBC*.
<http://news.bbc.co.uk/2/hi/business/7423008.htm>.
- International Atomic Energy Agency. 2005. *Strengthening the Effectiveness and Improving the Efficiency of the Safeguards System Including Implementation of Additional Protocols (GC(49)/1)*. Report to the IAEA General Conference.
http://iaea.org/About/Policy/GC/GC49/GC49Documents/English/gc49-9_en.pdf.
- Jennekens, Jon. 1990. "IAEA Safeguards: A Look at 1970-1990 and Future Prospects." *IAEA Bulletin* 32(1): 5–10.
- Jo, Dong-Joon, and Erik Gartzke. 2007. "Determinants of Nuclear Weapons Proliferation." *Journal of Conflict Resolution* 51(1): 167–94.
- Kaplow, Jeffrey M. 2012. "Does the Nuclear Non-Proliferation Treaty Matter?" Paper prepared for the 2012 ISA Annual Meeting, San Diego, CA.
- Keohane, Robert O. 1984. *After Hegemony: Cooperation and Discord in the World Political Economy*. Princeton, NJ: Princeton University Press.
- Keohane, Robert O. 1986. "Reciprocity in International Relations." *International Organization* 40(1): 1–27.
- Kerr, Paul. 2005a. "IAEA Board Closes Safeguards Loophole." *Arms Control Today*.
<http://www.armscontrol.org/print/1923>.
- . 2005b. "IAEA Board Seeks Strengthened Safeguards."
<http://www.armscontrol.org/print/1847>.
- Kim, Youngse. 1996. "Equilibrium Selection in n -Person Coordination Games." *Games and Economic Behavior* 15(2): 203–27.

- Kittrie, Orde F. 2006. "Averting Catastrophe: Why the Nuclear Nonproliferation Treaty Is Losing Its Deterrence Capacity and How to Restore It." *Mich. J. Int'l L.* 28: 337–430.
- Knopf, Jeffrey W. 2012. "Nuclear Disarmament and Nonproliferation: Examining the Linkage Argument." *International Security* 37(3): 92–132.
- Koremenos, Barbara. 2001. "Loosening the Ties That Bind: A Learning Model of Agreement Flexibility." *International Organization* 55(2): 289–325.
- Kroenig, Matthew. 2009. "Importing the Bomb: Sensitive Nuclear Assistance and Nuclear Proliferation." *Journal of Conflict Resolution* 53(2): 161–80.
- . 2012. "U.S. Nuclear Weapons and Nonproliferation: Is There a Link?" Working Paper.
- Kurosawa, Mitsuru. 2004. "Moving Beyond the Debate on a Nuclear Japan." *The Nonproliferation Review* 11(3): 110–37.
- Kyl, Jon. 2000. "Maintaining Peace through Strength: A Rejection of the Comprehensive Test Ban Treaty." *Harvard Journal on Legislation* 37: 325.
- Marshall, Monty G., Keith Jagers, and Ted Robert Gurr. 2010. *Polity IV Project: Political Regime Characteristics and Transitions, 1800-2010*. Vienna, VA: Center for Systemic Peace.
- McCubbins, Mathew D., and Thomas Schwartz. 1984. "Congressional Oversight Overlooked: Police Patrols Versus Fire Alarms." *American Journal of Political Science* 28(1): 165–79.
- Mitchell, Ronald B. 1994. "Regime Design Matters: Intentional Oil Pollution and Treaty Compliance." *International Organization* 48(03): 425–58.
- . 1998. "Sources of Transparency: Information Systems in International Regimes." *International Studies Quarterly* 42(1): 109–30.
- Mochizuki, Mike M. 2007. "Japan Tests the Nuclear Taboo." *The Nonproliferation Review* 14(2): 303–28.
- Molander, Per. 1992. "The Prevalence of Free Riding." *Journal of Conflict Resolution* 36(4): 756–71.
- Montgomery, Alexander H. 2005. "Ringling in Proliferation: How to Dismantle an Atomic Bomb Network." *International Security* 30(2): 153–87.
- Montgomery, Alexander H., and Scott D. Sagan. 2009. "The Perils of Predicting Proliferation." *Journal of Conflict Resolution* 53(2): 302–28.
- National Research Council. 2012. *The Comprehensive Nuclear Test Ban Treaty: Technical Issues for the United States*. Washington, D.C.: The National Academies Press.
- Oye, Kenneth A. 1985. "Explaining Cooperation Under Anarchy: Hypotheses and Strategies." *World Politics* 38(1): 1–24.

- Perkovich, George. 2006. "The End of the Nonproliferation Regime?" *Current History* 105(694): 355–62.
- . 2008. "Nuclear Developments in the GCC: Risks and Trends." In *Gulf Yearbook 2007-2008*, Dubai, UAE: Gulf Research Center.
https://www.carnegieendowment.org/files/perkovich_gcc.pdf.
- Potter, William C. 2005. "India and the New Look of U.S. Nonproliferation Policy." *The Nonproliferation Review* 12(2): 343–54.
- . 2010. "The NPT & the Sources of Nuclear Restraint." *Daedalus* 139(1): 68–81.
- Sagan, Scott D. 2011. "The Causes of Nuclear Weapons Proliferation." *Annual Review of Political Science* 14(1): 225–44.
- Sauer, Tom. 2006. "The Nuclear Nonproliferation Regime in Crisis." *Peace Review* 18(3): 333–40.
- Schelling, Thomas. 1978. *Micromotives and Macrobehavior*. New York, NY: W.W. Norton.
- Seo, Yeon-Gyu, Sung-Bae Cho, and Xin Yao. 2000. "The Impact of Payoff Function and Local Interaction on the N-Player Iterated Prisoner's Dilemma." *Knowledge and Information Systems* 2(4): 461–78.
- Simmons, Beth A. 2000. "International Law and State Behavior: Commitment and Compliance in International Monetary Affairs." *The American Political Science Review* 94(4): 819–35.
- . 2010. "Treaty Compliance and Violation." *Annual Review of Political Science* 13(1): 273–96.
- Simmons, Beth A., and Daniel J. Hopkins. 2005. "The Constraining Power of International Treaties: Theory and Methods." *The American Political Science Review* 99(4): 623–31.
- Singh, Sonali, and Christopher R. Way. 2004. "The Correlates of Nuclear Proliferation: A Quantitative Test." *Journal of Conflict Resolution* 48(6): 859–85.
- Snidal, Duncan. 1985. "Coordination Versus Prisoners' Dilemma: Implications for International Cooperation and Regimes." *The American Political Science Review* 79(4): 923–42.
- Sokolski, Henry. 2010. "What Does the History of the Nuclear Nonproliferation Treaty Tell Us About Its Future?" In *Reviewing the Nuclear Nonproliferation Treaty*, ed. Henry Sokolski. Carlisle, PA: US Army War College Strategic Studies Institute.
- Solingen, Etel. 1994. "The Political Economy of Nuclear Restraint." *International Security* 19(2): 126–69.
- Spies, Michael. 2006. "Iran and the Limits of the Nuclear Non-Proliferation Regime." *Am. U. Int'l L. Rev.* 22: 401–33.

- Von Stein, Jana. 2005. "Do Treaties Constrain or Screen? Selection Bias and Treaty Compliance." *The American Political Science Review* 99(4): 611–22.
- Thompson, William R., and David R. Dreyer. 2012. *Handbook of International Rivalries: 1494-2010*. SAGE/CQ Press.
- United States Department of Defense. 2002. "Defense.gov News Transcript: DoD News Briefing - Secretary Rumsfeld and Gen. Myers." <http://www.defense.gov/transcripts/transcript.aspx?transcriptid=2636>.
- Urpelainen, Johannes. 2010. "Enforcing International Environmental Cooperation: Technological Standards Can Help." *The Review of International Organizations* 5(4): 475–96.
- Wable, Kesav Murthy. 2007. "The U.S.-India Strategic Nuclear Partnership: A Debilitating Blow to the Non-Proliferation Regime." *Brooklyn Journal of International Law* 33: 719–59.
- Walsh, Jim. 2005. *The NPT and the Future of Non-proliferation*. Stockholm, Sweden: Weapons of Mass Destruction Commission.
- Warburg, Gerald Felix. 2012. "Nonproliferation Policy Crossroads: Lessons Learned from the US-India Nuclear Cooperation Agreement." *The Nonproliferation Review* 19(3): 451–71.
- Way, Christopher, and Jessica Weeks. Forthcoming. "Making It Personal: Regime Type and Nuclear Proliferation." *American Journal of Political Science*.
- Weiss, Leonard. 2007. "U.S.-India Nuclear Cooperation." *The Nonproliferation Review* 14(3): 429–57.
- Williams, Joshua, and Jon B. Wolfstahl. 2005. *The NPT at 35: A Crisis of Compliance or a Crisis of Confidence?* New York, NY: Carnegie Endowment for International Peace.
- Yao, Xin, and Paul J. Darwen. 1994. "An Experimental Study of n -person Iterated Prisoner's Dilemma Games." *Informatica* 18: 435–50.
- Young, Oran R. 1992. "The Effectiveness of International Institutions: Hard Cases and Critical Variables." In *Governance without government: order and change in world politics*, eds. James N. Rosenau and Ernst Otto-Czempiel. Cambridge, UK: Cambridge University Press, 160–94.