The Spread of Nuclear Weapons and International Conflict: Does Experience Matter?

Michael Horowitz[1]

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Abstract

This article evaluates whether the length of time states have nuclear weapons influences their behavior and the behavior of opponents in militarized disputes. Utilizing multiple statistical models and illustrative cases, the paper shows that while acquiring nuclear weapons makes states significantly more likely to reciprocate militarized challenges and have their challenges reciprocated, over time the effect reverses. In contrast to a static understanding of nuclear weapons, this variation in outcomes over time highlights the difficulties presented by nuclear proliferation.

Does the fact that new nuclear states lack experience in dealing with nuclear weapons influence they way they behave and the way they are treated by potential adversaries? This question is highly relevant for both academics and policy makers. In the United States, the proliferation of weapons of mass destruction (WMD), and especially nuclear weapons, has been at the top of the foreign policy agenda for decades.

Given that nuclear weapons have not been used in war since 1945, that modern biological weapons have arguably never been utilized in warfare, and that the risk of chemical weapons is often considered exaggerated, one might think preventing the proliferation of WMDs is not a critical policy issue. However, the proliferation of new weapons systems can have a profound impact on international politics even at levels short of war. The impact on the coercive power of states and the potential for actual use make nuclear weapons potentially destabilizing in the international security environment.

This paper presents a quantitative test of the belief in policy circles and one of the central arguments of the special issue (Gartzke and Kroenig, this issue) that nuclear weapons increase the coercive bargaining power of the states that possess them. While it is almost certainly true that nuclear weapons affect the balance of power between states, it is also possible that variations in experience with nuclear weapons are relevant for international politics. Specifically, the length of time countries have nuclear weapons may influence both the way they think about how to use their arsenal to achieve national goals and they way they are perceived by adversaries; nuclear learning may occur. The results of this project provide strong initial evidence that nuclear states and their opponents behave differently over time in dispute situations. New nuclear states, with a nascent arsenal and lack of experience in nuclearized disputes, play the "nuclear card"

significantly more often than their more experienced nuclear counterparts, making them more likely to reciprocate militarized disputes. Perhaps counter-intuitively, more experienced nuclear states also reciprocate disputes less frequently, suggesting perhaps that opponents learn over time about how to calibrate their challenges against nuclear powers.

The results have both academic and policy relevance. The successful coercion of a state in situations short of war becomes much more difficult in the years immediately following a state's acquisition of nuclear weapons. Nuclear proliferation therefore may risk either more dangerous militarized disputes or opponents of new nuclear states backing down and making concessions to avoid conflict.

International Relations Theory, Nuclear Weapons, and Time

Many scholars have written that, for reasons related to their magnitude relative to conventional weapons, nuclear weapons have changed the character of warfare (Betts 1987; Brodie and Brodie 1973; Jervis 1989a; Mueller 1989). Both Waltz and Sagan, for example, agree that nuclear weapons are unique in their destructive capacity, causing significant changes in the calculations of costs and benefits by nation-states – mostly for Waltz – and the way military organizations will develop routines and conduct planning – for Sagan (Sagan and Waltz 1995).

Slantchev focuses on actions like military maneuvers that he argues send clear but implicit signals to adversaries, even in the absence of explicit threats about what a state will do with the recently maneuvered forces. He also emphasizes that bluffing can be effective in conditions of incomplete information, but the logic of his argument applies to

inherent capabilities as well (Slantchev 2005). If bluffing works because the false nature of successful bluffs is never revealed, then inherent capabilities, to the extent they signal the ability to coerce at relatively lower cost, can deter action absent an explicit threat (Ikle 1964; Powell 1990).[2]

Betts argues that inherent nuclear capabilities played precisely this sort of coercive role during the Cold War influencing crisis situations (Betts 1987). It was something inherent to nuclear weapons given their destructive power, rather than the specificity of the threats involved, that mattered. As Betts writes "Any sort of nuclear threat in the midst of crisis, which is by definition an unstable situation, ought to be considered serious business. However indirect or tentative it may be, such a threat must be intended to raise by some degree the danger that disastrous escalation might result, and any degree is worrisome at that level of stakes" (Betts 1987, 9).

Some theoretical models focusing more directly on nuclear proliferation have come to relatively inconclusive outcomes (Brito and Intriligator 1996). However, empirical research on the causes of proliferation shows the importance of both security and economic factors in predicting proliferation (Singh and Way 2004; Gartzke and Jo 2007). More recently, scholars have investigated the role of civilian nuclear power and nuclear transfers in determining proliferation patterns, finding that civilian nuclear cooperation agreements are often made for strategic reasons and that the prominence of international nuclear transfers in many cases highlights the importance of approaching nuclear proliferation from a supply-side perspective (Kroenig, this issue; Fuhrmann, this issue).

Research by Huth and Russett (Huth and Russett 1984), Huth (Huth 1988; Huth 1990), Fearon (Fearon 1994), Danilovic (Danilovic 2002), and Signorino and Tarar (Signorino and Tarar 2006) has come to varying conclusions about the impact of nuclear weapons on deterrence failure. Other work on the effect of nuclear weapons on international politics suggests that nuclear weapons influence the success of states in international disputes as well as whether or not conflicts escalate (Simon, 1999). Recent work by Gartzke and Jo (this issue) endogenizes a model of the consequences of proliferation by substituting whether or not states have nuclear weapons for predicted values drawn from a model of proliferation. The endogenized model shows that, in general, nuclear weapons states are not necessarily more likely to either initiate disputes or face challenges. However, general estimation equation models of conflict involving nuclear states show that they do appear more likely to end up in low-level disputes, though those disputes are less likely to escalate and become major wars (Rauchhaus, this issue). Finally, examining behavior in international crisis, rather than militarized disputes, Beardsley and Asal (this issue) highlight how the asymmetric possession of nuclear weapons in a dispute dyad increases the probability of a favorable outcome.

However, little work to date has analyzed whether or not the length of time countries possess nuclear weapons influences their behavior and the way other states respond. Do the experiences states have over time change the way they behave in subsequent interactions? Most generally, learning is a process by which actors adapt (or do not adapt) their behavior over time as they gather more information from a variety of inputs; experiences, descriptions of experiences, and/or other sources (Levy 1994).

There is growing evidence that prior experiences influence why actors think about the international security environment (Khong 1992; Leng 2000; Reiter 1996). In some cases, through information diffusion, actors can also learn from events they did not directly experience. Multiple actors can also learn together if they have a shared interpretation of a key historical event. For example, Knopf shows how Argentina and Brazil developed a mutual understanding of risk and the link between bilateral tension and the failures of economic integration in the late 1980s, contributing to bilateral tension reduction in the early 1990s (Knopf 2003). Additionally, once a weapon or product or concept has existed for a while, late adopters may have a faster learning curve due to vicarious learning.

Theorizing the Relationship between Nuclear Weapons Possession and Time

The crux of the relationship between nuclear proliferation and international stability is whether nuclear weapons matter only because of the technologies involved – because a nuclear war would likely be so much more destructive than a conventional conflict – or whether there is something about proliferation that alters, perhaps temporarily, existing expectations about capabilities and resolve. The indeterminacy of much of the deterrence literature highlights the importance of rigorous testing (Downs 1989; George and Smoke 1989; Jervis 1989b). Scholars have disagreed, extensively, over how states in deterrence crises calculate the costs and benefits of different actions (Huth and Russett 1990, 466). Many scholars argue that nuclear proliferation is likely to lead to more international conflict, though some disagree. Waltz, for example, argues that nuclear weapons deter challengers and take escalation off the table, making disputes less likely. The balance of

threat from nuclear escalation outweighs issue-specific calculations of interests. According to Waltz, the risk of nuclear escalation trumps any uncertainty generated by nuclear acquisition, making post-proliferation conflicts less likely (Waltz 1995, 5-8).

A simple measurement problem limits existing research on nuclear war; all observations after 1945 are censored and end in a condition of no nuclear war. However, it is possible to empirically evaluate the relevance of nuclear weapons in military disputes short of war. In disputes like some of the US-Soviet clashes in the Cold War the issue of nuclear proliferation intersects with broader questions of learning and information.

Learning as states gain experience with nuclear weapons is complicated. While to some extent nuclear acquisition might provide information about resolve or capabilities, it also generates uncertainty about the way an actual conflict would go – given the new risk of nuclear escalation – and uncertainty about relative capabilities. Rapid proliferation may especially heighten uncertainty given the potential for reasonable states to disagree at times about the quality of the capabilities each possesses.[3] What follows is an attempt to describe the implications of inexperience and incomplete information on the behavior of nuclear states and their potential opponents *over time*. Since it is impossible to detail all possible lines of argumentation and possible responses, the following discussion is necessarily incomplete. This is a first step.

The acquisition of nuclear weapons increases the confidence of adopters in their ability to impose costs in the case of a conflict and the expectations of likely costs if war occurs by potential opponents. The key questions are whether nuclear states learn over time about how to leverage nuclear weapons and the implications of that learning, along with whether or not actions by nuclear states, over time, convey information that leads to

changes in the expectations of their behavior – shifts in uncertainty – on the part of potential adversaries.

Learning to Leverage?

When a new state acquires nuclear weapons, how does it influence the way the state behaves and how might that change over time? Though nuclear acquisition might be orthogonal to a particular dispute, it might be related to a particular security challenge, might signal revisionist aims with regard to an enduring dispute, or might signal the desire to reinforce the status quo.

This section focuses on how acquiring nuclear weapons influences both the new nuclear state and potential adversaries. In theory, system-wide perceptions of nuclear danger could allow new nuclear states to partially skip the early Cold War learning process concerning the risks of nuclear war and enter a proliferated world more cognizant of nuclear brinksmanship and bargaining than their predecessors. However, each new nuclear state has to resolve its own particular civil-military issues surrounding operational control and plan its national strategy in light of its new capabilities. Empirical research by Sagan, Feaver, and Blair suggests that viewing the behavior of other states does not create the necessary tacit knowledge; there is no substitute for experience when it comes to handling a nuclear arsenal, even if experience itself cannot totally prevent accidents (Blair 1993; Feaver 1992; Sagan 1993). Sagan contends that civil-military instability in many likely new proliferators and pressures generated by the requirements to handle the responsibility of dealing with nuclear weapons will skew decision-making towards more offensive strategies (Sagan 1995). The questions

surrounding Pakistan's nuclear command and control suggest there is no magic bullet when it comes to new nuclear powers making control and delegation decisions (Bowen and Wolvén 1999).

Sagan and others focus on inexperience on the part of new nuclear states as a key behavioral driver. Inexperienced operators, and the bureaucratic desire to "justify" the costs spent developing nuclear weapons, combined with organizational biases that may favor escalation to avoid decapitation, the "use it or lose it" mindset, may cause new nuclear states to adopt riskier launch postures, like launch on warning, or at least be perceived that way by other states (Blair 1993; Feaver 1992; Sagan 1995).[4]

Acquiring nuclear weapons could alter state preferences and make them more likely to escalate disputes once they start, given their new capabilities.[5] But their general lack of experience at leveraging their nuclear arsenal and effectively communicating nuclear threats could mean new nuclear states will be more likely to select adversaries poorly and find themselves in disputes with resolved adversaries that will reciprocate militarized challenges.

The "nuclear experience" logic also suggests that more experienced nuclear states should gain knowledge over time from nuclearized interactions that helps leaders effectively identify the situations in which their nuclear arsenal is likely to make a difference. Experienced nuclear states learn to select into cases where their comparative advantage, nuclear weapons, is more likely to be effective, increasing the probability that an adversary will not reciprocate.

Coming from a slightly different perspective, uncertainty about the consequences of proliferation on the balance of power and the behavior of new nuclear states on the

part of their potential adversaries could also shape behavior in similar ways (Schelling 1966; Blainey 1988). While a stable and credible nuclear arsenal communicates clear information about the likely costs of conflict, in the short-term nuclear proliferation is likely to increase uncertainty about the trajectory of a war, the balance of power, and the preferences of the adopter.

Through interactions over time, opponents learn what the new nuclear state is likely to do with its arsenal and the new nuclear state learns how to most efficiently leverage its capabilities. Interactions provide information that reduces uncertainty. Therefore, when states first acquire nuclear weapons, adversaries may reciprocate their challenges more often since there is still uncertainty about the implications. The results of dispute reciprocation provide important information. This logic also explains some of the selection problems that new nuclear states may face. Declining uncertainty about the likely behavior of a nuclear state over time may also help more experienced nuclear states credibly signal resolve in disputes. Adversaries have to take seriously the possibility of nuclear escalation because the experienced nuclear state has demonstrated a responsible pattern of behavior with nuclear weapons, meaning threats represent an accurate barometer of intentions. Moreover, non-nuclear states, initially on edge when dealing with new nuclear powers, may become less concerned with raw power grabs by experienced nuclear states, since they trust that the more experienced nuclear states will not shift the coercive goalposts. This makes reciprocation less likely.

Hypothesis 1: For initiators, newer nuclear states will have their militarized dispute initiations reciprocated *more* often than older nuclear states.

Both of these arguments, however, are mostly about nuclear-armed challengers. What about the flip side, when a state initiates a militarized dispute against a nuclear-armed actor? The reduction over time in uncertainty about the behavior of nuclear states should also affect nuclear-armed defenders. In defending situations, the inexperience of new nuclear states means it is possible that they will conceptualize their interests differently than more experienced nuclear states in ways that make reciprocation more likely. New nuclear states might place the highest emphasis on the importance of nuclear weapons, meaning they will reciprocate more than experienced nuclear states with a better idea of how nuclear bargaining works.[6] Basic deterrence logic would suggest nuclear states in general should experience fewer challenges since their new capabilities will deter many potential challengers from even initiating dispute. However, as Fearon argues, non-nuclear states that initiate against nuclear states are likely to be highly resolute, since they select into the conflict with knowledge of the nuclear capabilities of the defender, meaning those disputes should be more likely to escalate (Fearon 1994).

Learning could cut both ways, especially for defenders. Experience over time with nuclear weapons, combined with a more stable arsenal, could also cause a shift in how older nuclear states defend themselves. Older nuclear states might not reciprocate low-level military actions due to faith that their nuclear arsenal will function to deter escalation at higher levels, consistent with the findings of Rauchhaus (this issue). More experienced nuclear states learn that their nuclear arsenals represent a de facto guarantor of national survival. Nuclear states can make small-scale concessions with confidence, knowing their nuclear arsenal will always represent a credible threat in the case of a

challenge to core national interests. But this may be knowledge acquired over time, rather than something understood inherently upon possession.[7]

Hypothesis 2: For defenders, newer nuclear states will reciprocate militarized dispute initiations *more* often than older nuclear states.

Another plausible alternative worth mentioning is the idea that experienced nuclear states may be viewed as more responsible in dealing with nuclear issues – too responsible. Older nuclear states' safe experience with nuclear weapons may undermine their ability to credibly leverage nuclear capabilities in militarized disputes, especially in disputes involving non-vital areas of interest. Adversaries will discount the possibility of nuclear escalation if the issue does not impact the vital interests of the nuclear state. Nuclear experience could therefore lead to the opposite result as that hypothesized above.[8] However, the logic of experience drawn from Sagan and the information provided to all sides after dispute participation by new nuclear states would seem to suggest nuclear learning should help experienced nuclear powers more effectively leverage their weapons, which will also influence adversary perceptions, rather than undermine their credibility.

Finally, it is important to recognize that these concepts are somewhat indeterminate. The logics of experience and uncertainty are not the only way to think about nuclear learning and they could also be drawn out to come to very different conclusions. As a first cut at the question, the point of the empirical tests that follow is precisely to test these extrapolations of some of the deterrence literature and generate

initial insights about the relationship between the amount of time a state has nuclear weapons, its behavior, and the behavior of its potential opponents.

Research Design

This paper uses the Militarized Interstate Dispute (MIDs) 3.02 dataset created by the Correlates of War (COW) project to test the 1946-2002 period (Ghosn and Bennett 2003). The data is set up in directed dispute dyads, meaning it describes the interaction of pairs of states, where Side A refers to the challenger, the state that originally initiated the dispute by threatening, deploying, or using military force against another state, and Side B refers to the defender.[9] A directed dyads approach is necessary since the hypotheses depend on the specific capabilities of the challenger or the defender. The dependent variable is whether or not a defender reciprocates an initial militarized action by a challenger or if the defender backs down (Schultz 1999). The decision to respond to a militarized action with a militarized action – the joining of the dispute by the defender – moves a dispute beyond its initial stages, though there are still many other escalatory steps before a dispute reaches war. Given the specificity of the arguments to the way variations in nuclear capabilities impact the decisions by challengers and defenders, the actions taken by the defender in response to dispute initiation represent a valid way to operationalize the arguments above.[10]

Measuring the Independent Variables of Interest: Nuclear Weapons Acquisition and Possession over Time

The first set of independent variables of interest is whether or not each side in a dyad has nuclear weapons, *Side A nuclear* and *Side B nuclear*.[11] Each side in the dyad is coded a 0 if a state does not have nuclear weapons and 1 if it does. While often the possession of nuclear weapons is considered a relatively simple question – either a state has a nuclear weapon or does not – recent research by Singh and Way (Singh and Way 2004) points to the importance of being careful in nuclear weapons coding decisions. There are some differences in the way scholars have coded the nuclear arsenals of states over the last fifty years (Jo and Gartzke 2007; Singh and Way 2004). For example, while some have coded Israel as acquiring nuclear weapons in 1966, others say 1972 or even 1973. While some argue India acquired nuclear weapons capabilities in 1974 when it exploded a peaceful nuclear device, others say it was not until 1988, 1990, or even 1998 that it finally acquired nuclear weapons. To measure nuclear proliferation, I draw on the list of dates of nuclear proliferation provided by Gartzke and Kroenig (this issue).[12]

The second set of independent variables of interest is the number of years a country has possessed nuclear weapons, *Side A nuclear age* and *Side B nuclear age*. A counter measures the number of years since a country acquired nuclear weapons, with year 1 counted as the first year a country has had prior experience with nuclear weapons, or the second year in which a country possesses nuclear weapons.[13]

Other Factors That Influence Militarized Dispute Success

Isolating the relative importance of nuclear weapons requires differentiating the impact of nuclear weapons possession from the influence of other factors on the probability of militarized dispute reciprocation.[14] Given that the most prominent existing research on signaling and credibility focuses on domestic political regimes, *Side A democracy* and *Side B democracy* were created to measure domestic political regime type using the Polity IV dataset (Jaggers and Gurr 1995). Regimes with a combined polity score of eight or more, meaning their democracy score (-10 to 10) minus their autocracy score (-10 to 10) was equal to or greater than eight, were coded 1, with all other states defined as non-democracies and coded a 0.[15]

Two additional variables deal with the relationship between the two states in a dyad. The first, *Dyadic satisfaction*, generated using the Signorino and Ritter "S" score, measures the satisfaction of both states in the dyad based on their alliance portfolios. The variable, modified as suggested by Bennett and Stam, runs from 0 to 1 (as opposed to -1 to 1), with 0 indicating dissatisfaction and 1 showing satisfaction (Bennett and Stam 2004).[16] Since the paper starts from the theoretical position that military capabilities matter for international politics, a measure of the conventional balance of forces was also included, *Conventional balance of forces*. Using relative national power scores (combining measures of economic, demographic, and military power) as coded by the Correlates of War dataset, the balance of power control measures the gap between the relative power of Side A and Side B.[17]

Finally, the paper also includes controls for the particular issue involved in the dispute with three variables, Territory, Regime/Government change, and Policy (Bueno

de Mesquita and Siverson 1997; Schultz 1999). Issue type matters in this case because given the potentially existential threat posed by nuclear weapons, the stakes of the issue may be important in determining the credibility of a threat and therefore how to respond. Some issues, like territorial control, are often valued more than simple policy changes. The MID data for each dispute includes a four-tiered variable for both Side A and Side B measuring whether each state has revisionist demands and the type of demand: the issue categories are territory, regime/governmental change, policy, and other.[18]

Results

The hypotheses above are compared to a null hypothesis predicting no effect between time and behavior. Given the dichotomous nature of the dependent variable, the most appropriate statistical model is logistic regression.[19] These tests include Huber-White robust standard errors and control for the possibility of fixed time effects with peace year splines (Beck et al. 1998).[20] Table 1 presents initial statistical representations of the relationship between MID reciprocation and the possession of nuclear weapons, building from a simple model without any control variables to larger models including relevant controls. The results show a clear and consistent statistically significant impact to learning over time with nuclear weapons.

[Insert Table 1 about here]

The control variables behave in the predicted directions. As Schultz finds, reciprocation is less likely when a challenger is democratic. Interestingly, as the relative power of Side A in a dispute increases, reciprocation appears more likely. This suggests the general relationship between power and dispute reciprocation is not necessarily linear.

Neither the dyadic satisfaction variable, nor the joint nuclear possession variable, measuring whether both sides have nuclear weapons, are significant.[21] In general, the significance of the Side B nuclear weapons variable suggests there is something inherent about nuclear capabilities that influences militarized behavior, though the nuclear variable for Side A is not significant. However, the results show that nuclear experience matters as well. The Side A nuclear experience variable is –0.024 and significant at the .05 level. Given the caveats above about the indirect nature of these tests, the nuclear learning argument seems clearest in explaining the results for challengers. The negative and significant coefficient for Side A shows that the challenges of older nuclear states are reciprocated significantly less than the challenges of younger nuclear and non-nuclear states.

The results for defenders, though a bit less clear, are potentially even more interesting. The longer the defending side (Side B) possesses nuclear weapons, the more likely it is not to reciprocate a militarized dispute. This is the opposite of the coefficient for the possession of nuclear weapons by the defending state in general. Possession of nuclear weapons by the defending state, all other things being equal, makes the defending state more likely to reciprocate a militarized challenge with militarized activity of its own.[22]

The results for defenders could represent a reversion to the mean as nuclear states gain experience. There are other alternatives as well. It is possible other states learn about experienced nuclear powers and selectively challenge nuclear powers on issues where they are likely to succeed, which are often issues that do not involve the territory or regime of the nuclear power. Alternatively, it is also possible that threats by more

established nuclear powers lack credibility since attackers know the state is unlikely to escalate to the nuclear level. For example, North Korea is the classic example of a small, beleaguered state confronted by a large coalition of states led by a major nuclear power. Even before North Korea tested a nuclear weapon in 2006, analysts expected enormous costs if a conventional war on the Korean peninsula erupted. Knowledge that the United States did not want to pay those costs and was very unlikely to escalate to the nuclear level, the only way to eliminate the North Korean threat without paying the costs of conventional war, likely made it harder for the United States and its allies to influence North Korean behavior.[23]

However, there is some simple statistical evidence that suggests that nuclear defenders decide whether or not to reciprocate challenges on the basis of threats to core national security issues – they are more efficient in when they decide to respond to challenges. There are 136 cases in the data where Side B has nuclear weapons but Side A does not. When the issue involves policy or "other" demands, Side B backs down 75% of the time (75 of 100). However, when the issue involves territorial demands or regime change, the probabilities reverse; Side B reciprocates 75% of the time (27 of 36).[24] Side B backs down in only 25% of the cases. More evidence for this interpretation of the data is the average nuclear experience of nuclear-armed defenders in these situations. Older nuclear-armed defenders, those with nuclear experience levels above the 10th percentile of average ages for all nuclear-armed defenders, only reciprocate policy or "other" challenges 22% (22 of 100) of the time. In contrast, the probability that older nuclear-armed defenders will reciprocate on territorial or regime change issues is 56% (20 of 36). Moreover, nuclear-armed defenders facing regime change challenges, the most serious

possible threat, are extremely unlikely to make concessions, with 80% (4 of 5) reciprocating and an average nuclear experience age of 16.5. In comparison, in those cases where Side A possesses an asymmetric nuclear advantage (186 cases), Side B reciprocates 22% of the time in general and 26% of the time when the issue involves territorial or regime change issues.

This evidence is somewhat disconcerting since it suggests that experienced nuclear states may become targets. However, the effect might just represent a regression to the mean if new nuclear states feel more confident in their capabilities immediately after acquiring nuclear weapons and reciprocate challenges even if they are not over critical national security issues like territory or the regime. The combination of a fear that nuclear weapons might be "unusable" for a variety of international political and domestic reasons but knowledge that they are an important coercive chip may influence Side B, which shifts as Side B gains more experience with nuclear weapons.

In general, these results provide clear evidence demonstrating that nuclear experience matters, though the contours are a bit less clear. The experience countries have with nuclear weapons influences both the way they behave and the way states respond to them. Initial analysis shows fairly robustly the significance of the nuclear age variables. The models also reaffirm Schultz's conclusion that democratic challenges are significantly less likely to be reciprocated.

Marginal effects are generated to ensure the statistical results are not an artifice of the large number of non-nuclear states, meaning the negative sign on the nuclear experience coefficient refers to non-nuclear states rather than less experienced nuclear states. The marginal effects further highlight the way altering the balance of nuclear

capabilities within a dyad (both the possession of nuclear weapons by each state and the experience each side has with nuclear weapons) influences the probability of dispute reciprocation. Based on model 2 in Table 1, Figure 1 compares the probability of dispute reciprocation where Side A has asymmetrical possession of nuclear weapons within a dyad to a situation where Side B has asymmetrical possession of nuclear weapons within a dyad. In both cases, the longer a country has nuclear weapons, the lower the probability of dispute reciprocation. As Side A gains experience with nuclear weapons, the probability of dispute reciprocation by Side B drops from .30 the first year Side A has nuclear weapons to .11 in year fifty-six. In contrast, as Side B gains experience with nuclear weapons, it becomes increasingly likely to not reciprocate militarized challenges. The probability of reciprocation drops from .53 the first year Side B has nuclear weapons to .23 in year fifty-six. As noted above, on territorial and regime change issues, Side B is still likely to reciprocate even if it is an experienced nuclear state. While there is a decline in the probability of reciprocation over time, the predicted probability of reciprocation by Side B on regime change issues in year fifty-six is still .44 and it is .50 on territorial issues. This compares very favorably with a reciprocation probability of just .16 on policy issues in year fifty-six.[25]

[Insert Figure 1 about here]

A final comparison involves varying the experience both sides have with nuclear weapons to highlight the way risk calculations may shift as the experience each side has with nuclear weapons changes. A situation where neither side has nuclear weapons is compared to several "scenarios", or balances of nuclear capabilities between both sides. Table 2 shows the difference between the relative risk of MID reciprocation when a side

does not have nuclear weapons versus when it is a new nuclear state, meaning the nuclear age variable is 0, versus gradually increasing levels of nuclear experience based on averages for Side A and Side B described below. This setup also helps deal with the non-monotonic effect caused by the pooling of zeroes.

[Insert Table 2 about here]

The biggest relative risks are consistent with nuclear learning. If both sides have nuclear weapons but have had them for a relatively short period of time, Side A will not have built up credibility over time with its nuclear arsenal and Side B will not have learned to focus more on existential security risks. The nuclear experience theory would predict a higher relative risk for this situation, an expectation verified by the actual relative risk increase of 67% compared to a situation in which neither side has nuclear weapons. In contrast, if both sides have extensive experience with nuclear weapons, Side A will be believed to have high credibility with its nuclear challenges while Side B will likely view the issue as not essential to its credibility, explaining the 65% decreased relative risk of dispute reciprocation. Similarly, if Side A has had nuclear weapons for a few decades but Side B is a new nuclear state, Side A will have some nuclear credibility built for its challenges but Side B will be especially likely to select into the dispute because of its nuclear arsenal, explaining the 26% increase in the relative risk of dispute reciprocation. In contrast, if Side A is a very experienced nuclear state and Side B has a "medium" level of nuclear experience, the relative risk of reciprocation drops 42%.

One problem with the results from the dyadic models is that a selection process might be at work since Side A initiates a dispute with knowledge of the nuclear capabilities of Side B. The variables significantly related to militarized dispute

reciprocation may just reflect the decision-making of dispute initiators, biasing the results.

If the selection argument were true, one would expect to see nuclear-armed defenders only challenged when Side A is especially resolute, so they will not be deterred by nuclear capabilities. However, over 75% of the challenges to nuclear-armed defenders in the dataset occur over policy issues, not territorial or regime change issues where, presumably, Side A would be more resolute. While the issue-specific data for dyads where only Side B has nuclear weapons is relatively inconclusive, it does slightly tilt against this particular selection argument. Of the 136 total challenges against nuclear-armed defenders when only the defender has nuclear weapons, 23% are over territorial issues, 72% over policy issues, and 4% are over regime change issues. In comparison, when Side B does not possess nuclear weapons, 25% of challenges occur over territorial issues and 6% over regime change issues, while 66% are over policy issues. So, Side B is marginally more likely to be challenged on policy issues, as opposed to territorial or regime change issues, when Side B possesses nuclear weapons.

To more effectively test for the presence of selection effects that might inaccurately make the nuclear experience argument appear more powerful than it actually is, a series of models were estimated to look at MID initiation and the link between initiation and reciprocation. These can also help shed light on the potential applicability of the arguments presented in this paper to questions of initiation. The dataset is all MID dyads and 10% of non-dispute dyads from 1946-2002, a rare events selection model (King and Zeng 2001). There are two probit models presented that mimic models 2 and 3 from Table 1, following by a bivariate probit selection model, since MID reciprocation is

dependent on MID initiation, and a censored probit model that just looks at reciprocation given initiation. The dependent variable in the selection equation is MID initiation and the dependent variable in the outcome equation is reciprocation. The results are presented below in Table 3.[26]

[Insert Table 3 about Here]

The results provide some limited support for the nuclear experience argument that reinforces both the dyadic results above. Interestingly, in the pure initiation equation, adding the same controls used above makes both nuclear experience variables insignificant. While the nuclear possession variables are both significant, combined with the work by Gartzke and Jo (this issue), these results suggest the relationship between nuclear possession and initiation is more complicated than initially thought.

However, in the censored probit selection model, the nuclear age variable for Side A is significant and positive in the selection equation, meaning as states gain experience with nuclear weapons they become significantly more likely to initiate disputes. The nuclear age variable for Side B is not significant. In the outcome equation, the nuclear experience variables are significant for both Side A and Side B in the same directions as in the censored dyadic analysis. Accounting for selection into disputes, increasing levels of nuclear experience on the part of challengers make their challenges less likely to be reciprocated. Similarly, while inexperienced nuclear states are extremely likely to reciprocate when they are militarily challenged, the effect faded over time as states gain experience with nuclear weapons. In the censored model, the results are actually stronger than in Table 1.

Discussion

These results are consistent with variants of the nuclear experience hypotheses presented above. The nuclear experience is not immutable – there are changes over time in the behavior of nuclear states. It is hard to untangle the different causal mechanisms or logics that govern the learning process, but some initial findings stand out. First, nuclear learning seems to occur especially for challengers, as more experienced nuclear states more efficiently challenge and succeed in militarized disputes. Second, new nuclear states appear the most "risky" from the perspective of low-level militarized disputes, with a higher probability of reciprocation than either experienced nuclear states or even non-nuclear states. One possible explanation is that nuclear defenders learn over time to differentiate those challenges worth pursing and those not worth the effort. The nuclear card cannot be played every time – otherwise the defender is exposed as a likely bluffer, making brinkmanship by initiators increasingly likely in repeated games. Third, if nothing else, the results suggest nuclear weapons increase the influence of proliferators. Acquiring nuclear weapons make a state harder to leverage, at least initially. This is consistent with the findings elsewhere in this issue, especially by Beardsley and Asal (this issue)

US and Soviet learning during the Cold War demonstrates the plausibility of the nuclear experience argument. Experience over time with civil-military relations and command authority for launching nuclear weapons created shared U.S.-Soviet knowledge about the risk of nuclear war and led to a mutual appreciation of the costs and the condition of incomplete information in which nuclear escalation would likely occur (George 1983; Nye 1987).

One example of the willingness of new nuclear states to brandish their nuclear arsenals is the way the United States responded during the first Berlin Airlift crisis (1948-1949). According to Kohler, the U.S. chargé in the Soviet Union, American possession of the atomic bomb allowed the U.S. to stand firm. Soviet apprehension about fighting a nuclear-armed adversary, especially in a war over Berlin, a territory some thought Stalin did not consider worth a conventional or nuclear war, influenced the U.S. decision (United States Department of State 1973, 1196; United States Department of State 1974, 920). The relative strength of the U.S. atomic arsenal allowed the U.S. to oppose Soviet actions (Druks 1967, 167-168; Halperin 1987, 7).

As the Cold War went on, both sides gained experience in crisis situations and with different deployment strategies. These experiences provided information that, though imperfectly aggregated into national policy over time, led to shifts in both micro-level decisions like doctrine and more macro-level decisions about strategy (George 1983). Even while critiquing reforms and pointing out areas where learning was incomplete, Sagan writes that the American military extensively studied the 1962 nuclear alert during the Cuban Missile Crisis, seeking to improve its procedures to enhance both effectiveness and safety. The October 1973 alert then demonstrated learning through the institutionalization of previously ad-hoc procedures during the 1963 Cuban Missile Crisis like placing nuclear warheads on test missiles at Vandenberg and not dispersing nuclear-armed bombers when DEFCON 3 was instituted (Sagan 1993, 219-224). The fact of learning, whether effective or not, shows that the logic described above is a plausible way to think about nuclear strategy over time.

Some argue that because nuclear war has not happened since 1945, nuclear weapons lack importance for international politics because threats to use them are not credible (Geller 1990). In contrast, the evidence presented in this paper suggests that nuclear weapons do have some degree of inherent credibility. Even if a state never makes an explicit nuclear threat, the mere presence of nuclear weapons may exert a powerful coercive role in low-level militarized disputes.[27]

Another alternative explanation for the results is that more experienced nuclear states have larger and more sophisticated arsenals and those factors drive the shifting behavior of nuclear states over time. The Natural Resources Defense Council has collected systematic data on the arsenal sizes of nuclear states from 1945-2001.[28] A control run that added a variable measuring the nuclear arsenal size of each nuclear state in a given year was estimated to test this theory, but did not change the results. To further control for differences in nuclear arsenals, using the NRDC Nuclear Databook and other sources I generated a Nuclear Sophistication variable. It is coded a 1 if a country has a deliverable nuclear weapon, a 2 if a country has both air and land-based missile delivery systems, and a 3 if a country has a sea-based delivery system as well.[29] Including this variable did not change the results either. So, while arsenal size and the nuclear balance of power are obviously important factors governing the behavior of nuclear states in militarized disputes against each other, the theory is more focused on asymmetrical nuclear interactions.[30]

One could further argue that the results are driven by states' actual participation in militarized disputes, meaning militarized incidents, not experience, really drive change. However, control runs with MID participation did not produce significant changes. Even

if MID participation shifts how countries think about nuclear weapons and how opponents evaluate resolve, however, it still demonstrates a learning process that contradicts static understandings of the impact of nuclear weapons on politics.

Finally, it is possible that the results are just an artifact of a changing international system since 1945, especially as knowledge about nuclear weapons has spread. As Knopf, Reiter, and others describe, learning does not just happen on a direct basis, but through the vicarious observation of others. If it is shifts over time that matter, meaning new nuclear states now learn "faster" than their predecessors, it is consistent with the broad argument made in this paper. Time-based effects still demonstrate that possessing nuclear weapons is not an immutable characteristic, but is subject to a learning process.

From a measurement perspective, the problem is that "time" is already captured to a large extent in the nuclear age variables, making it difficult to add an independent "time" variable without running into correlation problems. A pure calendar time variable would also suffer from problems of interpretation, since it would not be clear whether the variation it explained was due to changes in beliefs about nuclear weapons or other facets of the international system. A variable just counting the number of nuclear weapons states is similarly hard to interpret, since it linearly increases the nuclear age variables, excluding when South Africa drops out of the nuclear club in 1990.[31]

Conclusion

This paper finds that there are important consequences for international politics as states gain experience with nuclear weapons. The initial evidence, while tentative, suggests that new nuclear states are especially risky – their challenges are reciprocated

more often, while their desire to demonstrate their nuclear clout makes them substantially less likely to concede when facing a challenge. However, it is difficult to tell whether it was the logic of inexperience or the logic of uncertainty driving the results. The behavior of defending states over time is harder to unravel. One possibility is that, as defending states gain experience with nuclear weapons, they reconceptualize the way they think about national security. Instead of viewing all challenges as potentially risky for the survival of the state, nuclear-armed defenders come to rely on their nuclear arsenals as guarantors of security, making it more acceptable to make concessions on issues unrelated to core national interests. However, the evidence does not yet support going that far. These results indicate that nuclear learning is an issue worth studying both in academic and military settings. More detailed tests building on this research are necessary to clarify this issue and determine the actual reasoning driving nuclear learning, keeping in mind that learning may work differently for different states at different times. As we consider how possession of nuclear weapons impacts the capabilities and resolve of states involved in crisis bargaining situations, learning over time may be an important part of the process.

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Table 1: Relationship between Nuclear Weapons Possession, Time of Possession, and Militarized Dispute Reciprocation

	Simple Logit Model	**Full Logit Model**	**Full Logit Model with US and Russia control[32]**
	Coefficient (Robust Standard Error)	*Coefficient (Robust Standard Error)*	*Coefficient (Robust Standard Error)*
Side A Nuclear	-.246 (0.302)	0.158 (0.355)	0.466 (0.374)
Side B Nuclear	.733 (0.302)**	1.063 (0.364)***	1.034 (0.39)***
Side A Nuclear Age	-.0217 (0.011)**	-0.024 (0.012)**	-0.026 (0.012)**
Side B Nuclear Age	-.034 (0.012)***	-0.024 (0.013)*	-0.028 (0.014)**
Joint Nuclear		-0.688 (0.570)	-0.527 (0.607)
Conventional Balance of Forces		0.618 (0.286)**	0.666 (0.292)**
Dyadic Satisfaction		-0.028 (0.288)	0.017 (0.287)
Side A Democracy		-0.511 (0.230)**	-0.757 (0.242)***
Side B Democracy		-0.049 (0.158)	-0.05 (0.164)
Territorial Dispute		2.026 (0.476)***	2.038 (0.489)***
Regime/Government Change		1.782 (0.551)***	1.686 (0.56)***
Policy		0.415 (0.464)	0.389 (0.476)
United States			0.668 (0.348)*
Russia			-0.936 (0.372)**
Constant	-0.705 (0.079)***	-1.717 (0.581)***	-1.742 (0.591)***

Splines Suppressed: Simple Model – N: 1057, Wald chi2(7): 60.12, Prob > chi2: 0, Pseudo R2: 0.0549, Log pseudo likelihood: -611.4322. Full Logit Model – N: 1036, Wald chi2(15): 151.21, Prob > chi2: 0, Pseudo R2: 0.1519, Log pseudo likelihood: -547.829. Full Model with US and Russia controls – N: 1036, Wald chi2(17): 161.35, Prob > chi2: 0, Pseudo R2: 0.1626, Log pseudo likelihood: -540.976: * p < .10 ** p < .05 *** p <.01

Figure 1: Substantive Relationship between Years of Nuclear Weapons Possession and Militarized Dispute Reciprocation

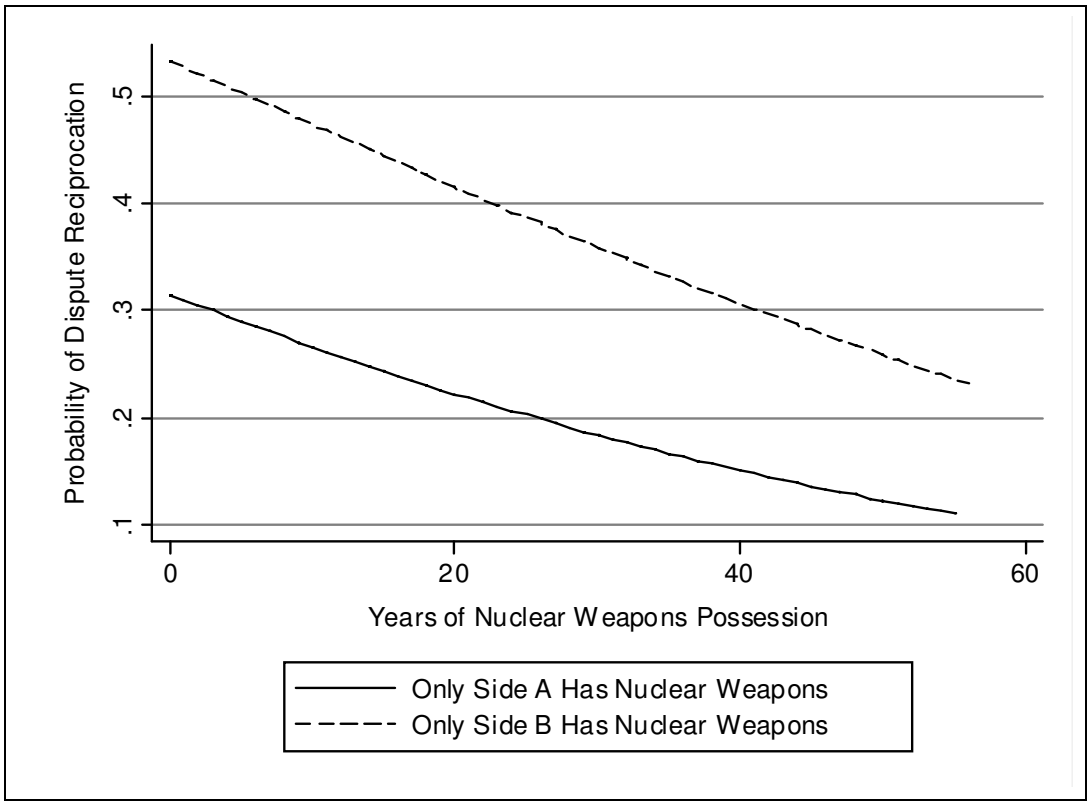

Table 2: Substantive Impact of Different Levels of Dyadic Nuclear Experience

	Probability of Reciprocation	*First Difference with No Nuclear Weapons*	*Relative Risk*	*Odds Ratio*
No Nuclear Weapons	0.287	0.000	0.00%	1.000
Side A "New"	0.281	-0.006	-1.94%	1.028
Side A "Medium"	0.191	-0.096	-33.43%	1.704
Side A "Experienced"	0.122	-0.165	-57.41%	2.890
Side B "New"	0.491	0.205	71.37%	0.416
Side B "Medium"	0.367	0.080	28.07%	0.693
Side B "Experience"	0.245	-0.042	-14.57%	1.239
Both “New”	0.480	0.193	67.49%	0.435
Both “New-Medium”	0.379	0.093	32.34%	0.657
Both “Medium”	0.253	-0.033	-11.67%	1.185
Both “Experienced”	0.101	-0.185	-64.64%	3.563
Side A “Medium” Side B “New”	0.362	0.075	26.20%	0.709
Side B Medium Side A “New”	0.359	0.072	25.08%	0.719
Side A “Experienced” Side B “Medium”	0.166	-0.121	-42.06%	2.018
Side B “Experienced” Side A “Medium”	0.161	-0.126	-43.85%	2.095
Side B “Experienced” Side A “New”	0.241	-0.046	-16.08%	1.269
Side A “Experienced” Side B “New”	0.250	-0.036	-12.73%	1.204

New/Medium/Very Experienced are derived from the summary data for the nuclear age variables. New – 5th percentile: Side A – 3, Side B – 1. Medium – Mean: Side A – 25.3, Side B – 23.6. Very Experienced – 95th percentile: Side A – 51, Side B – 48. Results generated using Clarify (King et al. 2000; Tomz et al. 2003).

Table 3: Relationship between Nuclear Weapons Possession, Time of Possession, Militarized Dispute Initiation, and Militarized Dispute Reciprocation

			Selection Model		
	Probit: MID Initiation	Probit: MID Initiation with Controls	MID Initiation	MID Reciprocation	Censored Probit: Reciprocation (Censored on MID Initiation)
Side A Nuclear	0.611 (0.064)***	0.512 (0.068)***	0.634 (0.064)***	-0.341 (0.153)**	.493 (0.225)**
Side B Nuclear	0.705 (0.063)***	0.610 (0.066)***	0.715 (0.07)***	0.026 (0.185)	.704 (0.253)***
Side A Nuclear Age	0.008 (0.002)***	0.002 (0.002)	0.008 (0.002)***	-0.01 (0.005)	-.0161 (0.007)**
Side B Nuclear Age	0.002 (0.002)	-0.003 (0.002)	0.002 (0.002)	-0.014 (0.006)**	-.019 (0.009)**
Joint Nuclear		0.249 (0.108)**	0.176 (0.118)	-0.193 (0.22)	-.57 (0.501)
Conventional Balance of Forces	0.221 (0.029)***	0.221 (0.029)***	0.218 (0.035)***	-0.09 (0.117)	.346 (0.18)*
Dyadic Satisfaction	0.134 (0.042)***	0.153 (0.042)***	0.99 (0.058)***		.106 (0.181)
Side A Democracy	-0.188 (0.029)***	-0.173 (0.030)***	-0.202 (0.029)***	0.024 (0.081)	-.337 (0.142)**
Side B Democracy	0.136 (0.026)***	0.143 (0.026)***	0.146 (0.026)***	-0.218 (0.068)***	-.069 (0.102)
Territorial Dispute					1.172 (0.274)***
Regime/Government Change					.948 (0.323)***
Policy					.176 (0.265)
United States		0.473 (0.063)***			.408 (0.217)*
Russia		0.427 (0.063)***			-.646 (0.228)***
Constant	-2.069 (0.039)***	-2.090 (0.040)***	-2.45 (0.039)***	1.247 (0.276)***	-1.103 (0.343)***

All splines suppressed: Initial Probit – N: 108694, Wald chi2(11): 1581.97, Prob > chi2: 0, Pseudo R2: 0.1509, Log pseudolikelihood: -6738.0045. Add controls – N: 108694, Wald chi2(14): 1777,78, Prob > chi2: 0, Pseudo R2: 0.1556, Log pseudolikelihood: -6700.4332. Selection Model – N: 108694, Censored Obs: 107189, Uncensored Obs: 1505, Wald chi2(11): 101.39, Prob > chi2: 0, Log likelihood: - 7591.311, LR Test of Independent Equations: chi2(1): 10.59, Prob > chi2: 0.0011. Censored Probit – N: 936, Wald chi2(17): 151.32, Prob >chi2: 0, Pseudo R2: 0.1581, Log pseudolikelihood: --479.37.

Notes

[1] Replication data are available at http://jcr.sagepub.com/supplemental.

[2] Nuclear weapons are also interesting because once a demonstration occurs they have some degree of inherent credibility. In the current security environment, many new potential nuclear proliferators are already relatively dissatisfied with the international system, meaning their arsenals may send signals to existing powers like the United States absent explicit threats.

[3] In cases of slow proliferation, adaptation can more easily occur as states anticipate new capabilities and adjust accordingly.

[4] On the other hand, inexperienced operators in new nuclear states might be especially cautious. A lack of experience and the costs expended in arsenal development could lead leaders to be especially conservative in the brandishing of their new nuclear arsenal. States are often reluctant to risk their most prized military assets – with German reticence to deploy its fleet for most of World War I representing just one example.

[5] There could also be a selection effect where knowledge of those new capabilities leads to fewer challenges.

[6] This follows from Sartori's understanding of crisis bargaining, where behavior in past crises influences the way states are perceived in future crises (Sartori 2005).

[7] Alternatively, as states learn how to leverage their nuclear arsenal they might become more confident and likely to reciprocate challenges. An example of an older power not escalating a potential military dispute is the American non-response to frequent threats emanating from North Korea.

[8] Another potential alternative argument might concern a growing nuclear taboo. However, since this paper is concerned with coercion at levels below war, the taboo argument is less applicable, though a taboo might influence the credibility of nuclear threats.

[9] For an explanation of the merits of utilizing dyad-years, see Bennett and Stam and Gleditsch and Hegre (Bennett and Stam 2004; Gleditsch and Hegre 1997).

[10] One could argue that the theory presented above also applies to dispute initiation. However, this paper focuses on reciprocation for several reasons. First, the theory is specific to the way states behave when they get into disputes – how inexperience and uncertainty influence the way nuclear states and their opponents respond. While the theoretical logic may apply to initiation, modeling dispute initiation is much more complicated. I limited the core tests to reciprocation since this is a first attempt to examine the role of nuclear experience. Future work could certainly re-focus on the initiation question. Second, states often acquire nuclear weapons in part due to security concerns, so we should not necessarily expect to see an effect on dispute initiation – it may be endogenous to nuclear weapons acquisition. The disputes already exist. It is the way states behave within those disputes that change. Moreover, as Gartzke and Jo (this issue) point out, endogenizing predictions about nuclear proliferation into the study of MID initiation shows that nuclear weapons may not be related to initiation. Finally, tests conducted using non-endogenized models (in the language of Gartzke and Jo) show that the probability of dispute initiation does increase when states get nuclear weapons, though it seems to increase with time (resulted generated from Model 1, Table 3, using Clarify and available upon request). Therefore, bracketing the caveats, new nuclear

states appear somewhat more prone to initiate disputes and face initiations than non-nuclear states, but more experienced nuclear states are even more likely to initiate.

[11] There is a sample size question, since the total number of nuclear weapons states is so small. However, since the unit of analysis is the dyad year, each nuclear weapons state is counted each time it gets into a dispute. Since the paper tests whether the way nuclear states behave changes as they gain experience with nuclear weapons, having multiple observations per-nuclear state does not bias the results. Of 1,057 total conflict dyads, once the revisionist variable corrections are made, only Side A has nuclear weapons in 18% of cases, only Side B has nuclear weapons in 13% of cases, and both have nuclear weapons in 4% of cases.

[12] The post-Soviet states are excluded. (Gartzke and Kroenig, this issue). Including them does not substantively change the results.

[13] The results that follow are robust even when run on different nuclear possession codings.

[14] These variables were generated using EUGene (Bennett and Stam 2000)

[15] Adding an interaction term between democracy and the nuclear weapons did not significantly influence the results.

[16] All results are consistent whether using S scores or Bueno de Mesquita's Tau-B scheme.

[17] The equation used to produce the relative power variable was cap_1/(cap_1+cap_2). Using alternative conventional capability measures (military spending and personnel) or adding an arms race variable did not significantly change the results.

[18] The "other" revisionist issue variable was forcibly dropped due to extremely high collinearity. Of 1,706 post-1945 dyadic MIDs, set up with Side A as the initiator, 142 (8%) are dyads in which Side B, not Side A, had revisionist aims. In another 279 cases (16%), both sides had types of revisionist aims. If Side A is not revisionist or if both sides are revisionist, it will influence state behavior in different ways by changing the nature of the stakes to both sides. So the paper drops the problematic cases for the main data runs but also conducts analyses that do not include the revisionist types variables at all.

[19] Selection and fixed effects models are estimated below to capture any omitted strategic interaction effects.

[20] Adding a peace years count variable (time since the last MID) had no impact on the results.

[21] This is also likely because only a small fraction of the cases, 39 of 1057, come from interactions between two nuclear states and because, excluding the United States and Soviet case, the nuclear balance of power within nuclear dyads has been relatively constant.

[22] This result was also consistent in two fixed effects models, one pooling on nuclear states and the other on dyadic interactions.

[23] For more on leveraging North Korea see Horowitz (2005.

[24] In the opposite situation, when Side A possesses an asymmetric nuclear advantage over Side B, only 10% of total challenges (19 of 187) involve territorial or regime change issues.

[25] Marginal effects controlling for issue type available upon request.

[26] The results are consistent using bivariate probit and seemingly unrelated bivariate probit models as well.

[27] For example, the placement of American bombers on alert in 1958 after a coup in Iraq apparently influenced Soviet behavior despite the lack of an explicit statement or threat (Betts 1987, 66-68).

[28] While some of the sizes are only estimates given opacity about the arsenals of some countries, the NRDC data is arguably the best available public source on nuclear arsenal sizes and a source frequently cited by scholars interested in the topic.

[29] Thanks to an anonymous reviewer for suggesting multiple delivery mechanisms as a metric. Since submarine-launched missiles are generally considered the most survivable delivery vehicle, the presence of sub-launched missiles is considered the highest level of sophistication. Alternative specifications did not change the results.

[30] A nuclear second-strike variable was not added because it is not relevant for most smaller nuclear powers and because of measurement problems. The total of 39 joint nuclear cases occurs due to the exclusions given the revisionist issue variables.

[31] Despite these, I tried adding a calendar time variable and a "number of nuclear states" variable (each in a separate model) and re-estimated the core models of Table 2, interacting the nuclear age variables with the time variable in question. The results are hard to interpret, since there is already a tacit relationship between the nuclear weapons possession and nuclear age variables. However, in a control run with the other key controls – arsenal size and sophistication – there was a significant interaction between time and nuclear experience on the part of Side A.

[32] Given the small number of nuclear powers, it is important to make sure the results are not an artifact of just one or two countries. Models excluding countries as opposed to controlling for them did not alter the results.