How Could States Use Nuclear Weapons?

Four Models After the Bomb*

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November 2, 2021


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*For excellent comments and suggestions, I thank Jean-Francois Belanger, Tyler Bowen, Dale Copeland, James Fearon, Matthew Fuhrmann, Eliza Gheorghe, Charles Glaser, Alexander Lanszka, Nicholas Lotito, Gerard Padro-i-Miquel, Robert Powell, Or Rabinowitz, Kenneth Scheve, Todd Sechser, Joshua Shifrinson, and seminar participants at the ISS Colloquium at Yale. All remaining errors are my own.

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1 Introduction

How could states use nuclear weapons? Do greater nuclear capabilities translating into greater coercive leverage?

These are some of the most important questions in nuclear politics. According to the Theory of the Nuclear Revolution (TNR), nuclear weapons bring peace between great powers because they are the ultimate tools of deterrence (Brodie 1946; Bundy 1988; Glaser 1990; Jervis 1989; Powell 1990; Schelling 1966; Waltz 1981, 1990). Crises are won by states with greater resolve, not greater military capabilities. U.S. nuclear policy in the late Cold War, with its emphasis on nuclear superiority, limited nuclear war options, and counterforce strikes, is simply illogical, oblivious to the true meaning of the nuclear revolution (Jervis 1979-1980, 1984, 1989).

TNR has dominated international relations scholarship for decades. It is currently under attack. Some claim that it is a “myth,” a “failed” revolution...
Recent evidence suggests that the Nixon administration did not privately subscribe to the logic of TNR, despite using it publicly to justify arms control negotiations. Even if it accepted quantitative limits on the size of nuclear arsenals, Washington pressed for a technological edge over Moscow (Cameron 2017; Green 2020; Maurer 2019; Petrelli and Pulcini 2018).

By the end of the Cold War, U.S. capabilities approximated a disarming first strike, able to destroy the Soviet arsenal before Moscow could retaliate. A State Department memo predicted in 1976 that “the Soviets could expect to lose nearly 90 percent of their total strategic warheads from a US first strike in the mid-1980s. This is a reasonably close approximation of a disarming first strike.” In 1990, the President’s Foreign Intelligence Advisory Board wrote: “Although the Soviet strategic nuclear force in the late 1970s was powerful and versatile (over 7,000 strategic nuclear weapons), it was nonetheless highly vulnerable to a US surprise attack - a so-called bolt from the blue” (quoted in Green and Long 2017, 611, emphasis in the original).

In Moscow, Vitalii Kataev, senior advisor to defense policymaking body of the Communist Party Central Committee, declared in the late 1980s that the Soviet Union was capable of hitting less than half of the minimum number of targets deemed necessary for assured destruction (Green and Long 2017, 617, 637). In the early 21st century, the nuclear balance appears even more unstable, as the computer revolution further erodes the survivability of nuclear forces (Lieber and Press 2006, 2017).
In fact, critics argue, Washington’s pursuit of nuclear superiority has been rational. Superiority helps coerce enemies (Green 2020; Kroenig 2018; Lieber and Press 2020) and prevent proliferation among allies (Gavin 2020).

Yet despite their spirited attack, these critiques are very narrow in scope. They concede, to varying degrees, that nuclear weapons have been a force for peace and that they are the ultimate tools of deterrence. To show that nuclear superiority did advance U.S. national security interests, critics must explain how a compellent state could prevail over the deterrent state in a nuclear crisis, and how greater nuclear forces enhance coercion.

The strategic literature, while large and insightful, lacks a compelling answer to this question. It does not capture the challenges inherent in compellence, how they could be overcome, while allowing for rich crisis bargaining interactions.

A natural framework for understanding nuclear standoffs is the crisis pre-emption game, where countries simultaneously choose whether to attack or not, fearful of a surprise attack. Sagan (2021, 138), in reviewing Green (2020), argues that a “better test” of TNR would be to evaluate the impact of nuclear capabilities, such as those pursued by the United States during the Cold war, on such a preemption game. Recent work has advanced our understanding of these games, but debates remain (Schelling 1960, 207; Powell 1990, Chapter 5; Baliga and Sjöström 2004; 2020 [N.d.]; Chassang and Padró i Miquel 2010; Fearon N.d.). Schelling (1960, 207) had wondered if the recip-
rocal fear of surprise attack could lead to war, even with “no “fundamental”
basis for an attack by either side.” [Powell (1990, Chapter 5) concluded that
peace would prevail, if any country could end the crisis. [Baliga and Sjöström
(2004) showed instead that conflict would be inevitable, under some condi-
tions, if countries could strictly prefer to attack no matter what their enemy
chooses (see also Baliga and Sjöström 2020, N.d.). It is not clear, though,
that there is then “no “fundamental” basis for an attack by either side”
or, put differently, that this assumption applies to countries contemplating
a nuclear armageddon (see also, Fearon N.d.). More fundamentally, crisis
preemption games may well represent nuclear standoffs, but they do not al-
low us to evaluate the effectiveness of compellent and deterrent threats, by
assuming that simultaneously choose whether to attack or not.

There is a long literature studying the exchange of threats, but it does
not capture the essential challenge of compellence (Fearon 1994, 2002; Powell
1990, 2015; Schultz 1998). In Fearon (1994, 242)’s baseline model, a deterrent
threat fails whenever it is made. In that model, the deterrent state chooses
between peace and war. Intuitively, compellent threats lack credibility be-
cause the compellent state chooses whether to trigger a nuclear exchange.
Moreover, just like the crisis preemption games, models of nuclear threats do
not allow for rich crisis bargaining interactions, assuming that states make
binary decisions - between attacking or not, escalating or not. As Fearon
(2002, 20) acknowledges, it would be more satisfactory to let states choose
the extent of their demands in diplomatic negotiations.  

I address this problem in a game-theoretic model, where states exchange compellent and deterrent threats and bargain over an issue in dispute before entering a preemption game. I show in a baseline set-up that, consistent with TNR, compellence fails because the coercer would never trigger a nuclear disaster. Then I allow the compellent state to bolster the credibility of its threats through standard techniques: *burning bridges*, removing its ability to back down; *probabilistic threats* or *brinkmanship*, increasing the risk of disaster following non-compliance; and the *rationality of irrationality*, feigning a preference for disastrous war over dishonorable peace (Schelling 1966, 37, 43, 91). I show that compellence may then indeed succeed, and that its success is bolstered by greater military capabilities. However, I conclude that greater capabilities provide coercive leverage by increasing the risk of disaster, with first-strike capabilities being especially destabilizing. As such, even though TNR may have been too optimistic about the stability of the nuclear stalemate, its basic conclusion still holds: the pursuit of nuclear superiority is destabilizing, increasing the risk of nuclear disaster.

The paper proceeds as follows. Section 2 reviews these four recent critiques of TNR. Section 3 presents the game-theoretic argument. Section 4 concludes. Proof of the formal results and discussion of coding rules are

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1Baliga and Sjöström (2020, 3197) partially address this gap, but their extensive game reduces to a simultaneous-move crisis preemption game.

2See also Bélanger and Bowen 2020.
2 All But Compellence and Deterrence: 

The ABCD of TNR’s Critiques

TNR predicts that nuclear weapons bring peace between great powers because they are the ultimate tools of deterrence. Many scholars support the theory and agree on its essential features, even though they differ on some of its secondary implications, on the role of alliances, the importance of territory, etc. (e.g., Jervis 1989; Waltz 1990). The theory is currently under attack.

Yet most recent critiques accept that nuclear weapons have encouraged peace between great powers. Lieber and Press (2020, 2) concede: “To be clear, nuclear weapons have had a huge impact on international relations by helping to prevent great power war.” Gavin (2020, 194, 198) admits that TNR’s “most important insight [...] is correct: few if any political political objectives are worth the extraordinary costs of a thermonuclear war.” The theory offers “a powerful lens to understand [...] the disappearance of great-power war.” Kroenig (2018, 29) argues that TNR “is correct that any rational leader should be incredibly unlikely to intentionally initiate a major war against a state with a secure, second-strike capability.” Green (2020, 1-2) is more skeptical, but he only goes so far as saying that “the prediction of peace”
is “difficult to evaluate” because there could be alternative explanations.

Recent critiques also do little to challenge TNR’s prediction that nuclear weapons are the ultimate tools of deterrence. If two nuclear weapons confront one another, one could attempt to compel, i.e. extract concessions, while the other could hope to deter, i.e. enforce the status quo. According to TNR, the deterrer should have the advantage. Compellence is costly. Countries have already accepted the status quo (Schelling 1966, 70-72, 82, Jervis 1989, 30-31).

To be clear, TNR scholars themselves questioned the superiority of deterrence. Schelling (1966, 100-103) proclaimed the superiority of deterrence if countries know each other’s resolve, but in the real world, countries do not know each other’s resolve. If a state pursued compellence, despite its associated costs, couldn’t it signal greater resolve and therefore prevail? (Jervis 1979, 297-298; Jervis 1989, 34). Could we always identify the “status quo”? Since it may be ambiguous, all sides may claim to defend it and expect to prevail (Jervis 1989, 32).³

Despite TNR’s own misgivings, its critics do not explain how nuclear compellence could overcome deterrence. Lieber and Press (2020, 2, 14) concede: “Nuclear weapons are the most effective instruments of deterrence.” They “are uniquely deterring because they appear to make victory in war

³On the implication of incompatible narratives for mutual optimism and war, see Debs (2020).
impossible. They are the ultimate tools of stalemate.” Kroenig (2018, 114), after presenting a theory of nuclear coercion, admits: “Compellence may be more difficult than deterrence, as Schelling and others have maintained.” Green and Gavin embrace TNR’s own reservations, but do not explain how compellence could prevail (Green 2020, 21-26; Gavin 2020, 63-64)). Gavin ultimately accepts that deterrence is easier than compellence, an “important and obvious” insight from Sechser and Fuhrmann (2013), which “should not be surprising.” (Gavin 2020, 73).

It is not obvious that deterrence is easier than compellence. In the Cuban Missile Crisis, Schelling (1966, 82) concedes, a deterrent failed before a compellent threat succeeded. In September 1962, Kennedy declared that the “gravest issues would arise” if the Soviets deployed any “significant offensive capability” in Cuba (U.S. Department of State 1962). Khrushchev responded by expanding his deployment (Fursenko and Naftali 1997, 204-213). Kennedy then announced a blockade, a classic example of a probabilistic threat, and he succeeding in compelling the Soviets to withdraw from Cuba. Moreover, Sechser and Fuhrmann (2013) do not show that deterrence is easier than compellence. Their dataset contains no deterrent threat.

4See also Sechser and Fuhrmann (2017). Sechser (2011, 395-396) suggests that compellence may be slightly less effective than deterrence, as documented by other datasets. Yet he admits that the difference is small (41.4% vs. 50-59%) and the “conclusion is only tentative,” given concerns over selection effects and confounding factors.
If TNR critics agree with the theory’s main prediction - peace between great powers - and its main mechanism - nuclear weapons are the ultimate tools of deterrence, then why do they call for its rejection? TNR scholars derived additional implications of the theory, which critics argue are not supported by the historical record. For example, Jervis (1989, Chapter 1) outlines the following predictions of TNR: 1. peace between great powers, 2. the preservation of the status quo, 3. the infrequency of crises, 4. states’ frequent attempts during crises to highlight the risk of nuclear disaster, so as to demonstrate their resolve and gain a competitive advantage, 5. a tenuous link between the military balance and political outcomes. TNR critics reject the fifth implication. U.S. policymakers did pursue nuclear superiority, and they were rational in doing so, for its coercive and diplomatic benefits. Some also reject secondary implications of other versions of TNR, mainly Waltz (1990)’s, that nuclear weapons have reduced the value of alliances, and the importance of strategic territory. I discuss these specific critiques below.

TNR has indeed been selective in reviewing the historical record. The absence of war between nuclear powers is evidence in favor of the theory. The U.S. drive for nuclear superiority is evidence of policymakers’ irrationality (Jervis 1979-1980, 1984, 1989). But the fact that U.S. policymakers pursued nuclear superiority does not mean that it served national security interests. We would need to explain how nuclear weapons can coerce in the first place, i.e. how compellence could overcome deterrence. Then we would need to explain how nuclear superiority enhances coercion. Unfortunately, TNR critics
do neither. I analyze their arguments in detail below, and offer my own perspective. For now, I point out that we can make sense of the U.S. drive for nuclear superiority, even if it does not serve U.S. national security interests, without assuming that U.S. policymakers were irrational. While this conclusion strays from TNR, it builds on insights from TNR scholars themselves.

The basic problem, Jervis (1989, 186) explains, is that nuclear policy often eludes clear criteria for success: “In many cases it is hard to find objective indicators of whether a policy has succeeded or failed. Thus there is a great deal of room for states to influence the interpretation of the outcomes, and that may be more important than the outcomes themselves.” In particular, nuclear superiority “matters because others [...] think it matters” (Jervis 1989, 196). As a result, the United States, Jervis concluded, had “become trapped in a world largely of its own making” (Jervis 1989, 212). The U.S. drive to superiority and “credible threats” was chosen to impress the Soviets, “especially,” but also “to reassure the Europeans” and even reassure “itself” (Jervis 1989, 196, 212). According to TNR scholars, politicians should know better and reject this logic. But if it is difficult to learn about the optimal nuclear policy, then rational policymakers may choose policies that appear sensible, consistent with the accepted wisdom, but are in fact inefficient, even dangerous.\(^5\) This perspective can shed some light on the evolution of U.S. nuclear posture.

\(^5\)On the pitfalls of transparency, see, e.g., Canes-Wrone, Herron and Shotts (2001); Debs and Weiss (2016).
A standard narrative begins with the adoption of the New Look doctrine by the Eisenhower administration, threatening massive retaliation to deter against the conventionally superior Soviet army. Concerned about the credibility of nuclear threats, given the Soviet development of ICBMs, the Kennedy administration switched to a policy of flexible response, offering a range of alternatives, conventional and nuclear, to destroy Soviet military power. The impact of flexible response was limited, however. The Kennedy administration aimed for assured destruction, threatening to impose unacceptable damage on the Soviet Union in the event of war. Distraught by the lack of options for conducting nuclear war, Secretary of Defense James Schlesinger proposed a new doctrine in January 1974, offering limited nuclear war options. This approach, targeting Soviet military power, was further pursued by the Carter and Reagan administration. It favored larger nuclear arsenals. Washington should be ready for multiple contingencies posed by a large Soviet arsenal. TNR scholars strongly criticized this development, and the associate push for nuclear superiority, though they recognized the seeds of such developments in prior periods.

Throughout this evolution, we can see, following Jervis (1989, 186-191), that officials appealed to previous criteria for competent nuclear management, even as they confronted changing circumstances. For example, the

French adopted the logic of the New Look to justify their own *force de frappe*. But a small, autonomous nuclear arsenal risked entrapping Washington as Moscow developed its ICBM capabilities.

Flexible response could reduce the risk of entrapment. Washington would press for the centralization of nuclear decisions, while shifting some of the burden for conventional defense onto U.S. allies. But how could the United States convince its allies to spend more on conventional forces, after arguing that Soviet forces were overwhelmingly superior? Washington first had to debunk the claim of Soviet conventional superiority (Enthoven and Smith 2003, Chapter 4). But superiority had to matter in some way. Kennedy had campaigned on the dangers of a missile gap, believing at the time that the Soviets were ahead. Now learning that the reverse was true, the administration boasted of its *nuclear* superiority, as Deputy Secretary of Defense Roswell L. Gilpatric did in October 1961 (see, Bundy 1988 381-382, 418-419; Cameron 2017, 96).

Yet discussions of nuclear superiority could again trap U.S. officials. It would be expensive, perhaps impossible to maintain. In January 1962, Kennedy’s top national security advisers supported an arms buildup because “[s]entiment for more missiles and more nuclear weapons” in Congress was “pretty strong.” At the same time, they encouraged him to question whether “this sentiment could be rationally defended” and state that he did “not subscribe to the doctrine of long-term ‘nuclear superiority’” and believed that “in the long run” Washington was “headed for a nuclear stalemate” (quoted...
in Cameron 2017, 28). U.S. officials continued to speak of nuclear superiority, but downplayed its importance and devised assured destruction as a criterion for effective deterrence which did not rely on the nuclear balance. “In terms of numbers of separately targetable, survivable, accurate, reliable warheads, U.S. strategic forces have remained consistently superior to those of the Soviet Union. However, the relationship of this “superiority” to U.S. military and political objectives is unclear. [...] Once each side has enough nuclear forces virtually to eliminate the other’s urban society in a second strike, the utility of extra nuclear forces is dubious at best. In this context, notions of nuclear “superiority” are devoid of significant meaning” (Enthoven and Smith 2005, 183).

By the time Nixon took office, the end of U.S. nuclear superiority appeared imminent. In his first press conference in January 1969, Nixon promised instead “sufficient military power” for the protection of U.S. interests and commitments (Nixon 1969). This objective was vague, seemingly consistent with assured destruction while allowing future flexibility. NSC staffer Morton Halperin admitted: “we will call whatever option we choose sufficiency.” In the short run, though, Washington’s policies would be measured against previous standards. According to Kissinger, European publics “would be amazed if they heard that we were not vastly superior to the Soviet Union” (U.S. Department of State 1969b, 10, 19).

Ultimately, arms control agreements enshrined Soviet quantitative superiority. Promoting them in 1972, the Nixon administration rejected any role
for the nuclear balance. Kissinger explained that “to the extent that balance of power means constant jockeying for marginal advantages over an opponent, it no longer applies [...] now both we and the Soviet Union have begun to find that each increment of power does not necessarily represent an increment of usable political strength” (U.S. Department of State 1972, 402). Nixon doubled down on “sufficiency,” suggesting that U.S. forces were “without question sufficient for the maintenance of our security and the protection of our vital interests.” Nixon also claimed that U.S. nuclear forces were superior to the Soviet arsenal! “No power on earth is stronger than the United States of America today. And none will be stronger than the United States of America in the future” (Nixon 1972). This had to refer to qualitative superiority, but how could Washington establish such superiority? Certainly, it had innovated with MIRV technology, but what would happen once the Soviets developed their own? In August 1973, Chairman of the Joint Chiefs of Staff Admiral Moorer assured Kissinger that the United States still had “technical superiority.” Exasperated, Kissinger retorted: “I keep hearing about our technical superiority. We haven’t developed a new missile for 15 years and they have three new ones. Where is our technical superiority?” Moving away from superiority could undermine U.S. assurances. As State Department official Seymour Weiss admitted: “We told them [our allies] we were qualitatively superior. We can’t now say that that doesn’t make any difference” (quoted in Green and Long 2016, 42).

The elusive evaluation of nuclear strategy also complicated U.S. relations
with the Soviet Union. The Johnson administration had called for arms control agreements as early as January 1964, but Washington’s insistence on nuclear superiority undermined its argument that Moscow should be content with assured destruction (Cameron 2017, 85-94). After SALT I, the Soviet arsenal was the largest in the world. Brezhnev could now placate Washington’s preference for “sufficiency,” admitting to Kissinger in March 1974: “Let me just say, I would be willing, before your very eyes, to destroy 100 launching sites. Would that change anything? Nothing. President Nixon was right in saying in our first meeting that the Soviet Union could destroy the United States seven times over, and the United States could destroy the Soviet Union seven times over” (U.S. Department of State 1974, 730). In this context, the move toward limited nuclear war options didn’t square with a commitment to sufficiency. In early 1983, Soviet General Secretary Yuri Andropov warned Warsaw Pact leaders that “the new round of the arms race, imposed by the USA, has major, qualitative differences ... in creating modified missile systems, [the Americans] do not hide the that they are really intended for a future war. From here spring the doctrines of ‘rational’ and ‘limited’ nuclear war” (quoted in Green and Long 2017, 618).

In sum, U.S. officials hewed closely to previous discourse on competent nuclear management, when speaking of the benefits of nuclear superiority. Whether nuclear superiority did in fact advance U.S. national security interests is of course the crux of the matter. Let us see how TNR critics tackle this question.
2.1 Lieber and Press on a MAD Competition

Lieber and Press (2020, 2) argue that “the continuation of great power competition under the shadow of nuclear weapons” is “the central anomaly of the nuclear age.” TNR fails to account for the following features of the Cold War: the superpowers engaged in arms races and cared about “relative gains,” strategic territory, and alliances (Lieber and Press 2020, 16). There is a strategic logic justifying a drive for superiority, due the challenges of “creating strategic stalemate, maintaining stalemate, and practicing deterrence under stalemate” (Lieber and Press 2020, 5). Washington at various times built war plans for a disarming first strike and eventually acquired such capabilities (Lieber and Press 2020, Chapters 2 and 3). Aggressive nuclear postures, such as those built on “flexible, limited nuclear options,” can advance a state’s interests even under conditions of MAD, and they are more likely to adopted by conventionally weaker states (Lieber and Press 2020, Chapter 4, esp. p. 96).

This is a thought-provoking critique, but some of the targets are not central predictions of TNR. The fact that nuclear weapons are the ultimate tools of deterrence does not mean that strategic territory and alliances are worthless. Great powers continue to have interests even if they possess nuclear weapons. They wish to advance these interests if they can avoid a nuclear confrontation, and if they are engaged in a nuclear crisis, they may use aggressive tactics to bolster the credibility of their threats (Schelling 1966 and
Jervis’s fourth implication). The fact that nuclear weapons are weapons of the weak suggests that weaker states would rely on nuclear threats more aggressively, fearing that they may need to use them or lose them (e.g., Powell 2015). Flexible, limited options are compatible with TNR if they hope to coerce by raising the risk of nuclear disaster (Powell 2015). They were rejected by TNR scholars because they were presented as a way to control escalation and avoid nuclear disaster (Jervis 1979-1980).

Lieber and Press (2020)’s most powerful critique argues for a link between the military balance and political outcomes. But how do we know that such a link exists, that policymakers held such beliefs, and that this belief motivated their drive for nuclear superiority? Lieber and Press (2020) do not offer any evidence of such a link, and they offer very little evidence of policymakers’ strategic outlook. Their technological analyses may show that the United States was close to acquiring a first-strike capability, but this does not prove that U.S. policymakers intended to build such a capability, or that greater military capabilities improved their coercive leverage.

2.2 Green on MAD Fragility

Green (2020, 247) argues that the nuclear revolution failed, “at least as applied to peacetime nuclear competition,” because U.S. policymakers rejected TNR’s “preferred stabilizing policies,” instead competing aggressively with the Soviet Union in building their nuclear arsenal between 1969 and 1979.
During this period, the United States agreed to quantitative limitations but eschewed qualitative constraints because of its “comparative constitutional fitness” (Green 2020, Chapter 3). This fitness is measured on competitive dimensions - the ability to produce, extract, and direct resources - and on cooperative dimensions - the ability to obtain favorable terms in international negotiations and enforce them. The United States pursued an arms control agreement because it did not have an advantage on all competitive dimensions. Its economic potential, innovative industries, and productive civil-military relations provided an edge for the production and direction of resources, but its political institutions, with strong congressional oversight and fluctuating party politics, limited resource extraction. It preferred a competitive arms control agreement, channeling competition to areas of strength, because it did not have the advantage on all cooperative dimensions. A liberal ideology favored international agreements, irrespective of its terms or the enemy’s compliance, and greater transparency hindered cheating.

Green’s evidence is very rich, built on 20,000 pages of declassified documents. But it does not amount to a wholesale rejection of the nuclear stalemate. As Green (2020) admits, “the American documentary record is replete with examples of leaders bluntly confirming the existence of nuclear stalemate” (Green 2020, 44). What Green’s account really illustrates is the fluidity of assessments of the nuclear balance. Even with large nuclear arsenals, states may worry about losing their retaliatory capabilities. Between 1969 and 1974, Washington went from confidence that neither side could ob-
tain a first strike, to concern that Moscow may have such a capability, to confidence that it was alone in possessing it.

Indeed, in February 1969, Packard asserted that “[n]either side can get a first strike capability.” Still, he worried about future developments: “Uncertainty is if they have new idea, we don’t, ball game could change” (U.S. Department of State 1969a, 2, 4). The following year, Washington worried that improved Soviet capabilities threatened two legs of its triads, its land-based missiles and its bombers. As a result, Washington would have to rely on its submarine-launched ballistic missiles, the Polaris, for deterrence. Packard thus explained in March 1970, “we must then rely increasingly on the Polaris. We have 20 Polaris subs on station with 16 missiles per sub. This means 320 warheads. If we assume 80% reliability, then we have 256 which are reliable. If they have ABM [anti-ballistic missiles] then that would be bad news for us” (quoted in Green 2020, 94-95). Yet by 1974, Washington exuded confidence. Kissinger declared in August: “We are the only ones who would gain in a first strike because most of their force is land-based,” and hence highly vulnerable (quoted in Green 2020, 136).

The question then becomes whether nuclear superiority, and improved first-strike capabilities, advance U.S. national interest. But Green’s theory fares better in explaining how a nuclear power would compete than whether it does and what it gains from superiority. To begin with, the key variables of his theory are, by his own admission, “slow changing” (Green 2020, 59). If they correctly predict the arms control agreements of 1969-1979, they fail
to predict the absence of such agreements in 1959-1969, when the U.S. arsenal more than doubled. Moreover, Green (2020)’s theory does not spell out how state preferences aggregate into arms control agreements. A state may need to trade restrictions in areas of strength for restrictions in areas of weakness. For example, U.S. policymakers had the advantage in ABM technology and cruise missiles. They traded concessions on ABM technology for limits on quantitative competition, but they pressed - unsuccessfully - for an agreement condoning competition on cruise missiles. Even if Green’s theory could explain these different outcomes, they all pertain to the evolution of nuclear arsenals. What we really need is an explanation of the effect of nuclear capabilities on diplomatic outcomes.

2.3 Gavin on the Coherence of U.S. Grand Strategy

Gavin (2020, 194), for his part, argues that TNR “has failed to predict and explain critical aspects of U.S. nuclear policies, including nuclear strategy and nonproliferation.” The nuclear forces built by Washington “made little sense if the United States had fully embraced the consequences of mutual vulnerability” (Gavin 2020, 200). Washington’s opposition to proliferation indicates that it did not perceive nuclear weapons as weapons of peace and stability (Gavin 2020, 195-196). Instead, the United States pursued nuclear primacy because it served as a “strategy of inhibition,” preventing proliferation among allies and neutrals, an objective which “has rarely been understood as a core, long-standing, and driving goal of U.S. grand strategy” (Gavin 2020, 76).
Gavin is correct that TNR eschewed a rational explanation for U.S. nuclear strategy. However, we can use Jervis’ insights, as I show above, to explain why U.S. policymakers would have rationally pursued nuclear superiority, in part to reassure allies.

Gavin’s critique of TNR as a poor explanation for nuclear proliferation seems misplaced. TNR does not attempt to explain proliferation. Moreover, there are theories of proliferation, consistent with TNR, which can elucidate Washington’s opposition to proliferation. Indeed, if nuclear weapons are the weapons of the weak, then the weak would really want to acquire them, but other states, including powerful states like the United States, would be very concerned about the consequences of nuclear proliferation. The literature has long recognized that the United States wished to limit proliferation among allies and neutrals (see, e.g., Trachtenberg 1999, 251-256, 305; Solingen 2007; Maddock 2010; Monteiro and Debs 2014). It has also shown how Washington was willing to compromise on nonproliferation to achieve other goals, and which nonproliferation tools were more or less effective in preventing proliferation (see, e.g., Gheorghe 2019; Lanozka 2019; Monteiro and Debs 2014; Whitlark 2021).

7Gavin (2020, 118)’s historiography is confusing, though. He claims that the impact of flexible response has been “overdrawn,” but it has long been recognized as limited. See footnote 6.

8On the possible effects of nuclear proliferation, see, e.g., Anderson, Debs and Monteiro (2019); Bell (2021).
Gavin (2020)’s broad generalizations - that nonproliferation was a “core, long-standing, and driving goal of U.S. grand strategy” and that it has “rarely been understood” as such - are misleading.

These broad generalizations also obscure the role that history would play in informing debates on nuclear politics. As a historian, Gavin is uniquely placed to share insights on the role of history in answering difficult questions of nuclear politics. In his earlier work, Gavin had criticized political scientists for failing to engage the “treasure trove” of available archival evidence (Kroenig 2013; Sagan and Waltz 2012; Sechser and Fuhrmann 2013; Gavin 2012 576-577; Gavin 2014 29-31). In response, these authors encouraged Gavin to explain how to extract general lessons from history (Sagan and Waltz 2013 147; Sagan 2014 7; Fuhrmann, Kroenig and Sechser 2014 40-42). Unfortunately, Gavin refrains from doing so, instead copying his prior reviews, published some six and eight years earlier.

In his own substantive claims, Gavin (2020) does not explain how he has engaged with the “treasure trove” of archival evidence, and what standard of evidence he set for reaching his conclusions. Gavin (2020 Chapter 6) does not discuss any primary evidence when proposing his theory. He calls it “a heuristic framework” which “does not fully capture the nuance and context of the history of U.S. nuclear statecraft. It is easy to think of many U.S. behaviors or policies that are not explained by or that even contradict this analysis” (Gavin 2020 143). When arguing that NATO’s goal was less to deter the Soviet Union than to prevent proliferation, a goal which has
been “unstated and largely unrecognized” (Gavin 2020, 112), Gavin discusses only one primary document in any meaningful way, MC-48, a 1954 report by the Military Committee to NATO arguing that nuclear superiority is essential in deterring a Soviet attack (Gavin 2020, 114-115). Gavin (2020) again apologizes for the thin evidentiary basis for his claim: “this narrative [...] is more speculative than we would like. We do not have the quality or quantity of documents for the 1970s and 1980s that we do for earlier periods” (Gavin 2020, 122). For these earlier periods, Gavin borrows a narrative “laid out by several scholars,” which he believes is “worth repeating” (Gavin 2020, 112) (see, e.g., Trachtenberg 1999, 305).

Ultimately, it is highly sensible that the pressure to reassure allies played a role in the U.S. drive for nuclear superiority. Still, it would be important to know whether the purported benefits of nuclear superiority were purely imagined, as Jervis (1989, 196-201)’s logic suggests, or whether they truly improved U.S. coercive leverage.

### 2.4 Kroenig and the Ill Logic of Nuclear Superiority

Kroenig (2018) represents the most direct attack on the irrelevance of the military balance for political outcomes. In his view, U.S. officials believed in nuclear superiority, which did offer coercive benefits.

During key crises, he claims, U.S. officials “explicitly linked the nuclear balance of power to policy recommendations about crisis escalation” (Kroenig
2018, 88). In October 1962, General Maxwell Taylor, Chairman of the Joint Chiefs of Staff, wrote to McNamara: “We have the strategic advantage in our general war capabilities... This is no time to run scared.” McNamara himself, while advocating for a “restrained approach [...] took into account the nuclear balance of power, arguing “if we had to fight a war with the Soviet Union, we’d have fewer casualties today than if we had to do it later.”” Ultimately, Secretary of the Treasury C. Douglas Dillon attributed U.S. success to “[o]ur nuclear preponderance [...] That’s what made the Russians back off” (quoted in Kroenig 2018, 88). U.S. officials were correct. Simulations show that U.S. casualties increase with the size of the enemy’s nuclear arsenal and decreases with the size of its own arsenal (see https://nuclearsecrecy.com/nukemap/). Statistical tests show that larger arsenals are associated with more favorable crisis outcomes. They provide bargaining leverage, according to Kroenig’s “superiority-brinkmanship” theory. “[T]he logic of the argument is simple,” Kroenig declares, “in a game of chicken we might expect the smaller car to swerve first even if a crash would be disastrous for both” (Kroenig 2018, 4).

In Kroenig’s view, the book stands out mainly for its qualitative evidence and theoretical argument. The statements from the Cuban Missile Crisis “are as close to “smoking gun” evidence as one can reasonably expect to find in qualitative, social science research” (Kroenig 2018, 88). Researching the book, Kroenig “could not call to mind a single, clear explanation for why a strategic nuclear advantage might translate into a geopolitical advantage” (Kroenig 2018, ix). The theory was the “biggest contribution” of a 2013
article, a precursor to the book (Kroenig 2014, 63).\footnote{For critical reviews, see, e.g., Glaser (2019); Sechser (2019).}

It is difficult to put much weight to the quantitative analyses. Correlations between the nuclear balance and crisis outcomes are interesting, but they should be taken with caution, given the small number of crises, and the difficulty of establishing causation. Larger arsenals can inflict greater casualties, but some differences may not be politically meaningful. For example, Kroenig (2018, 49) concludes that if the U.S. arsenal underwent deep cuts, casualties from a Russian first strike would increase from 70 to 125 million. With fewer U.S. nuclear weapons to destroy, Russia could hurl more missiles at U.S. cities. Does that mean that U.S. officials would view a death toll of 70 million as “low,” ensuring their coercive success?

It is also difficult to read much from the qualitative evidence. Kroenig’s account of the Cuban Missile Crisis misrepresents the views of key officials and does not provide any new evidence to adjudicate between competing interpretations.

For example, McNamara did not “take into account” the nuclear balance of power and “explicitly link it” to policy recommendations about crisis escalation. He recommended restraint, based solely on the risk of nuclear disaster. In the above statement, McNamara simply states that casualties increase with the number of nuclear weapons, but he did not believe that superiority should instruct policy choices. Dillon himself recognized as much,
in the very statement quoted by Kroenig. “I agree totally with Nitze,” Dillon stated, referring to Paul Nitze, Assistant Secretary of Defense for International Security Affairs, “and think the McNamara thesis that our nuclear superiority made little or no difference is dead wrong. Our nuclear preponderance was essential. That’s what made the Russians back off, plus the fact of our total conventional superiority in the region” (Blight and Welch 1990, 152-153). McNamara indeed declared that “nuclear weapons serve no military purpose whatsoever. They are totally useless, except to deter one’s opponent from using them. This is my view today. It was my view in the early 1960s” (McNamara 1983, 79, emphasis in the original). The Secretary of Defense, along with other key decisionmakers, analyzed the crisis as such: “American nuclear superiority was not in our view a critical factor, for the fundamental and controlling reason that nuclear war, already in 1962, would have been an unexampled catastrophe [...] No one of us ever reviewed the nuclear balance for comfort in those hard weeks. The Cuban missile crisis illustrates not the significance but the insignificance of nuclear superiority in the face of survivable thermonuclear retaliatory forces. It also shows the crucial role of rapidly available conventional strength” (Rusk et al. 1982, 85, emphasis in the original).

Which group was most influential in shaping President Kennedy’s outlook, and how did he approach the crisis? Dillon himself acknowledged McNamara’s “great influence on the President” (Blight and Welch 1990, 154). McNamara declared that Kennedy “accepted my recommendation” to “never
initiate, under any circumstances, the use of nuclear weapons” \cite{McNamara1983}. Prior to the crisis, Kennedy had expressed the view that “there will not be winners in the next nuclear war, if there is one, and this country and other countries will suffer very heavy blows” \cite{Kennedy1962}. Early in the crisis, hawks pressed for an attack on Cuba, convinced that U.S. nuclear superiority would deter Soviet escalation. Kennedy refused, telling the congressional leadership on October 22: “If we go into Cuba we have to all realize that we are taking a chance that these missiles, which are ready to fire, won’t be fired. So that’s a gamble we should take. In any case we are preparing to take it. I think that is one hell of a gamble” \cite{MayandZelikow2001}. Looking back at the crisis in his 1963 State of the Union address, Kennedy disputed the benefits of nuclear superiority, declaring that “a line of destroyers in a quarantine, or a division of well-equipped men on a border, may be more useful to our real security than the multiplication of awesome weapons beyond all rational need” \cite{Gaddis1982}. Ultimately, President Kennedy’s handling of the crisis appears more consistent with TNR than with superiority-brinkmanship theory.

Turning to the theory, there is in fact a long tradition explaining “why a strategic nuclear advantage might translate into a geopolitical advantage” \cite[e.g.][]{Kahn1960, Kahn1965, Gray1976, GrayandPayne1980, Nitze1984}. For example, Nitze argued that it was “a copybook principle in strategy that, in actual war, advantage tends to go to the side in a better position to raise the stakes by expanding the
scope, duration or destructive intensity of the conflict. By the same token, at junctures of high contention short of war, the side better able to cope with the potential consequences of raising the stakes has the advantage. The other side is the one under greater pressure to scramble for a peaceful way out” (Nitze 1984, 160).

Kroenig’s argument does go beyond these earlier works, by presenting a sophisticated model. However, the model was developed by Powell (1990, Chapter 3). Kroenig’s contribution is to reinterpret the variables of Powell’s model, assume that military capabilities factor into a country’s resolve, so that they affect diplomatic outcomes.

Even so, Kroenig’s reference to the game of chicken is confusing. In that game, the stronger power does not necessarily prevail. Indeed, consider the representation of the game below, where countries I and II choose to ‘Stand Firm’ or ‘Submit’ (Powell 1990, 35). If both stand firm, disaster ensues, country $i$ receives payoff $d_i$. If country $i$ stands firm and country $j$ submits, country $i$ wins and countries get payoffs $w_i$, $s_j$, respectively. If both submit, they get a compromise payoff $c_i$, where $w_i > c_i > s_i > d_i \ \forall i \in \{I, II\}$. There are two pure strategy Nash equilibria, where either power prevails ($(\text{Stand Firm, Submit})$ and $(\text{Submit, Stand Firm})$), and a mixed-strategy equilibrium, which produces disaster with positive probability.

–Figure 1 about here–

The game’s multiple equilibria explain its complicated legacy in nuclear
politics. It was first used by Bertrand Russell (Russell 1959), who pressed not for superiority but for disarmament, worried that nuclear crises would lead to disaster (Russell 1959, 30). Herman Kahn objected, contending that the side threatening the greatest destruction will be most willing to run the risk of war and “will be victorious in all negotiations” (Kahn 1960, 290-292; see also Kahn 1965, 9-13).

To argue that the stronger party should prevail, Kroenig could appeal to equilibrium selection criteria, say risk dominance (Harsanyi and Selten 1988). A pure-strategy equilibrium is risk dominant if players are willing to play the posited strategies for a larger set of beliefs about their opponent’s play or, equivalently, if the product of deviation losses at that equilibrium is larger (Harsanyi and Selten 1988, 87). The equilibrium (Stand Firm, Submit) risk dominates (Submit, Stand Firm) if and only if

\[
\frac{s_I - d_I}{w_I - c_I} < \frac{s_{II} - d_{II}}{w_{II} - c_{II}}
\]  

(1)

TNR focuses on variation in political stakes to predict crisis outcomes, assuming that nuclear war represents an unmitigated disaster. Countries with “greater resolve” are those with greater political stakes, for example as they defend core interests, and it is reasonable to expect them to prevail. Technically, the above condition is more likely to hold if country I cares more about prevailing peacefully rather than settling on a compromise \((w_I - c_I\)

\(^{10}\)Another criterion, payoff dominance, is undiscriminating here.
increases) and wishes to avoid ceding the issue \((s_I \text{ decreases})\), holding fixed the value of a nuclear disaster \((d_I)\).

Kroenig (2018) instead, assumes that the nuclear balance meaningfully affects disaster payoffs \((d_i)\). A more favorable nuclear balance increases a country’s disaster payoff relative to its enemy, and it is more likely to stand firm, as it is less fearful of a nuclear disaster. Holding everything else fixed, the above condition is more likely to hold \(d_I \text{ increases and } d_{II} \text{ decreases}\).

This result could justify Kroenig’s conclusion. Yet this model misses an important feature of nuclear crises, highlighted by Kroenig’s own superiority-brinkmanship theory: disaster may strike inadvertently. This risk of inadvertent war, it turns out, may allow the weaker power to prevail in the risk dominant equilibrium.

Assume that disaster strikes with probability \(f > 0\) if only one country stands firm. The game otherwise remains the same\(^{11}\)

\[-Figure 2 about here–\]

\((\text{Stand Firm, Submit})\) risk dominates \((\text{Submit, Stand Firm})\) if and only if

\[
\frac{s_I - d_I}{w_I - c_I - f(w_I - s_I)} < \frac{s_{II} - d_{II}}{w_{II} - c_{II} - f(w_{II} - s_{II})}
\]

(2)

As before, this condition is satisfied more easily as the nuclear balance becomes more favorable to country \(I\), holding everything else fixed. However, \(^{11}\)Let \(fd_i + (1 - f)w_i > c_i\), so that this remains a game of Chicken.
the weaker country may now prevail in the risk dominant equilibrium, even if it would not absent any exogenous risk of disaster.\(^\text{12}\)

Here, the weaker nuclear power does fear the harsh consequences of a nuclear exchange. Yet if disaster may follow compliance, the weaker power may rely aggressively on the threat of nuclear weapons, fearing that it needs to “use them or lose them.” Put differently, nuclear threats are effective only if assurances are credible (Schelling 1966, 74-75)\(^\text{13}\). Such is a key feature of brinkmanship crises. It escapes Kroenig’s conceptualization.

2.5 A Reevaluation

In sum, critics do not make a convincing case that TNR should be abandoned. To begin with, they concede that nuclear weapons are a force for peace because they are the ultimate tools of deterrence. They argue that the U.S. drive for nuclear superiority advanced national security interests. But in order to establish that claim, critics first need to show that compellence could overcome deterrence, and then they need to show how military capabilities correlate with diplomatic success. They do not make a convincing case for either claim. I revisit them below.

First, I evaluate whether deterrence has indeed been more effective than

\(^{12}\)Let I be stronger than II, with \(w_i = 1, s_i = 0, d_I = -1, d_{II} = -4, c_I = 3/4, c_{II} = 1/4, f = 1/10\).

\(^{13}\)See also Cebul, Dafoe and Monteiro (2021); Kydd and McManus (2017); Pauly (2019).
compellence in Tables 1 and 2. I use the set of crises where a nuclear power emitted a threat, as identified by Sechser and Fuhrmann (2017, 128). I define a compellent threat as a threat which triggers a crisis, and attempts to change the status quo, and a deterrent threat as a threat emitted during a crisis, which attempts to enforce the status quo ante.\footnote{Of course, the status quo may change during a crisis, at which point an attempt to return to the status quo ante may better be described as a compellent attempt. The approach here is favored as a first step for its simplicity and replicability.}

The tables suggest that compellence may indeed be harder than deterrence. Nuclear threats never succeeded when triggering a crisis and often succeeded in enforcing the status quo.\footnote{The conclusion still holds if we limit our attention to the set of crises between two nuclear-weapons states, or between two nuclear-weapons states with survivable second strikes.} This is small comfort for TNR, given the limited number of cases. Compellence could theoretically overwhelm deterrence, if states use traditional tools to overcome the credibility of their threats, such as burning bridges, probabilistic threats, and the rationality of irrationality (Schelling 1966).

Next, I evaluate whether how compellence could overcome deterrence, and how military capabilities correlate with diplomatic success. States exchange nuclear threats before a preemption game. Country 1 decides whether to
issue a compellent threat, requesting revisions to the status quo. Country 2 decides whether to accept country 1’s demand or to issue a deterrent threat, hoping to enforce the status quo. Country 1 decides whether to back down, accepting the status quo, or escalate, triggering a preemption game.

The baseline model concludes that compellence is indeed ineffective because it is incredible. Then the paper lets country 1 use any of the standard techniques bolstering the credibility of threats. If country 1 burns bridges, i.e. if it commits to attack after country 2’s rejection, then compellence is more effective than deterrence. By construction, deterrence would fail. Country 1 extracts concessions when country 2 lacks resolve. If country 1 uses a probabilistic threat, i.e. if it commits to attack with some probability after country 2’s rejection, then compellence may succeed, depending on how closely probabilistic threats resemble burning bridges. If country 1 feigns irrationality, i.e. if it mimics the behavior of types preferring war to the status quo, then compellence may fully succeed. Under some conditions, all types pool on the same, relatively generous offer. Country 2, uncertain of country 1’s rationality, accepts its offer.

Next, I conclude that a more favorable nuclear balance improves a country’s peaceful terms without increasing the risk of disaster. Country 1 simply exploits its improved bargaining leverage. Greater first-strike capabilities, however, may improve peaceful terms, but only under a heightened risk of nuclear disaster. Only the most resolved types of country 1 consider a first strike. Improved first-strike capabilities emboldens them. They make even
more aggressive offers, tolerating a greater risk of war. I develop this argument below.

3 Game-Theoretic Argument

Consider a game between two countries, 1 and 2, illustrated in Figure 3. They exchange compellent and deterrent before entering a crisis preemption game, with reciprocal fear of surprise attack.

Country 1 chooses whether to trigger a crisis to revise the status quo. If it does not, the game ends. Country $i$ gets its peace payoff $\pi_i$, $i \in \{1, 2\}$, where $\pi_1 + \pi_2 = 1$. If country 1 triggers a crisis, it proposes to give $x_i$ to country $i$, $x_1 + x_2 = 1$.

- Figure 3 about here -

Country 2 chooses whether to accept country 1’s demands. If it does, country 1’s proposal is implemented. If it does not, country 1 can back down, accepting the status quo after all, giving country $i$ a payoff of $\pi_i$, or escalate, triggering a preemption game.\[16\]

The proposal $(x_1, x_2)$ could either be a verbal demand or a change to the status quo presented as a fait accompli. Either way, if country 1 backs down after country 2’s rejection, or if peace prevails in the crisis preemption game, countries return to the pre-crisis status quo. Note too that this set-up abstracts away from any audience costs that could be paid for backing down.
In the crisis preemption game, both countries simultaneously choose whether to attack. If neither attacks, the status quo prevails. Country $i$’s payoff is $\pi_i$. If at least one country attacks, war ensues. If both attack, country $i$ gets a payoff of $p_i - c_i + h_i$, where $p_i$ is the probability that country $i$ wins the conflict, $p_1 + p_2 = 1$, $c_i$ is country $i$’s cost of war, and $h_i$ is a “hostility” parameter, or preference for attacking (Baliga and Sjöström N.d.). If only country $i$ attacks, then country $i$’s payoff is $p_i - c_i + h_i + f_i$ and country $j$’s payoff is $p_j - c_j - f_i$, where $f_i > 0$ is a first-strike parameter, improving country $i$’s payoff at the expense of country $j$. Country $i$’s hostility parameter captures its temptation to use force, which we may call its type or “resolve.” $h_i$ is taken from a distribution with cdf $F_i$ over support $[h_i, \bar{h}_i]$.\footnote{Placing uncertainty on $h_i$, rather than $c_i$, allows us to identify dominant strategy types, which helps produce unique equilibria.}

Following Schelling (1960, 207), we ask whether there could be war when “there is no “fundamental” basis for an attack by either side.” No country wants to initiate conflict, but they may attack if they expect the other country to attack, so as to avoid suffering a first strike. Put differently, the net benefit of attacking is greater if the enemy attacks or, technically, this is a game of strategic complements:

$$\pi_i - (p_i - c_i) > f_i - f_j \quad \forall i, j \neq i$$

(3)

Some countries prefer to attack if and only if the enemy also attacks - call
them coordination types. Others strictly prefer not to attack, for any strategy of their enemy - call them dominant strategy doves. No country strictly wants to attack for any strategy by the enemy, i.e. no country is a strategy dominant hawk:

\[
    h_i < -f_j < \bar{h}_i \quad \forall i, j \neq i
\]  

\[
    \pi_i - (p_i - c_i) > h_i + f_i \quad \forall h_i \forall i
\]

Condition (5) captures the idea that war brings about mutually assured destruction (MAD). The level of destruction would be so large that all types are deterred from attacking when the other does not. Put differently, under MAD, dominant strategy hawks have “irrational” preferences. If a country may escape MAD, though, then the basic premise of TNR would fail and it may be possible to “rationalize” such preferences. We explore whether countries could gain coercive leverage by pretending to hold such preferences (see section 3.1.4).

We solve this game for a Perfect Bayesian Equilibrium, where strategies are optimal given beliefs and the strategies of other players, and beliefs are consistent with Bayes’ rule whenever possible. In the preemption game, we say that an equilibrium is in cut-off strategies if country \( i \) chooses to attack if and only if \( h_i > h_i' \), for some \( h_i' \in [\underline{h}_i, \bar{h}_i] \).

We evaluate the relative effectiveness of “compellent” and “deterrent” threats. A compellent threat is issued when country 1 triggers a crisis to
revise the status quo. It succeeds if country 2 accepts country 1’s offer. A deterrent threat is issued when country 2 rejects country 1’s offer and attempts to enforce the status quo. It succeeds if country 1 backs down.

We also evaluate the effect of military capabilities on the terms of peace and the odds of war, through their effect on the nuclear balance and first-strike advantages. Let $b$ represent the nuclear balance. Greater values representing a balance more favorable to country 1, increasing country 1’s war payoff at the expense of country 2:

$$\frac{\partial(p_1 - c_1)}{\partial b} = -\frac{\partial(p_2 - c_2)}{\partial b} > 0$$  \hspace{1cm} (6)

3.1 Analysis

3.1.1 Baseline Model

First, we ask whether country 1 could extract concessions by using compellent threats. A compellent threat can be effective if it is credible. The credibility of the compellent threat depends on whether war could obtain in the crisis preemption game, and whether country 1 would be willing to escalate and trigger this nuclear disaster.

To begin with, we construct an equilibrium where, because of MAD, compellence fails and deterrence succeeds:

**Lemma 1** The following forms an equilibrium: For any $h_1$, country 1 either chooses the status quo or triggers a crisis, offering $x_2 < \pi_2$; Country 2 accepts
country 1’s offer if and only if \( x_2 \geq \pi_2 \); Country 1 backs down; Country \( i \) does not attack \((i \in \{1, 2\})\).

In this equilibrium, peace prevails because of MAD (condition (5)), which ensures that there are no strategy dominant hawks. If country \( i \) chooses not to attack, then country \( j \) strictly prefers not to attack. Country 2 anticipates that it need not make any concession. Country 1’s threat to trigger war is incredible. It fails to generate any peaceful concession.

This equilibrium is instructive of the challenges of compellence, but it does not rule out the possibility of its effectiveness. The presence of coordination types suggests that there may be multiple equilibria of the crisis preemption game. Some could include war, which could bolster the effectiveness of compellence.

We can show that, under some conditions, there is in fact a unique equilibrium of the crisis preemption game, where peace prevails. Specifically, if there is a critical mass of strategy dominant doves (or, technically, the support of hostility parameters is sufficiently wide), then their presence convinces all types not to attack:

**Lemma 2** If \( F_i \) is the uniform distribution and

\[
\left( \frac{\pi_1 - (p_1 - c_1) - (f_1 - f_2)}{h_1 - h_1} \right) \left( \frac{\pi_2 - (p_2 - c_2) - (f_2 - f_1)}{h_2 - h_2} \right) < 1 \quad (7)
\]

then there is a unique cut-off equilibrium of the preemption game, where
country \( i \) does not to attack for any \( h_i \ (i \in \{1, 2\}) \).

Next, we show that even if there were equilibria with war in the crisis preemption game, country 1 could not harness them effectively. Because of MAD, it is not sequentially rational for country 1 to escalate. Compellent threats lack credibility. They are bound to be ineffective:

**Lemma 3**  (i) If there were a peaceful revision of the status quo to \( x_2' \neq \pi_2 \) in equilibrium, then country 2’s rejection of \( x_2' \) would lead to war with positive probability. (ii) It is not sequentially rational for country 1 to escalate if the preemption game produces war with positive probability; (iii) There is no equilibrium where a peaceful revision of the status quo occurs with positive probability.

These results confirm TNR’s intuition about the challenges of compellence. They also expose the conditions for its success. Country 1 could successfully coerce if it lacked the option of backing down after country 2’s rejection or if it convinced country 2 that it had escaped MAD. These are the standard tools bolstering the credibility of nuclear threats, highlighted by Schelling (1966). I consider each technique in turn.

### 3.1.2 Burning Bridges

Now assume that any compellent attempt by country 1, on or off the equilibrium path, is interpreted as “burning bridges,” committing country 1 to
escalate and attack after country 2’s rejection\footnote{\textsuperscript{18}}. We conclude:

**Lemma 4** If any compellent attempt by country 1 is seen as burning bridges and \( F_i \) is the uniform distribution, then the following forms the unique equilibrium: Country 1 triggers a crisis and offers:

\[
x_2^* = \begin{cases} 
    p_2 - c_2 + h_2 & \text{if } h_1 \leq h' \\
    p_2 - c_2 + \frac{1-(p_1-c_1)-(p_2-c_2)-h_1+h_2}{2} & \text{if } h_1 \in (h', h'') \\
    p_2 - c_2 - f_1 & \text{if } h_1 \geq h''
\end{cases}
\]  

(8) for some \( h' < h'' \). Country 2 accepts \( x_2 \) if and only if

\[
x_2 \geq \begin{cases} 
    p_2 - c_2 - f_1 & \text{if } h_2 < -f_1 \\
    p_2 - c_2 + h_2 & \text{if } h_2 \geq -f_1
\end{cases}
\]  

(9)

In the preemption game, country 2 attacks if and only if \( h_2 \geq -f_1 \).

By burning bridges, country 1 ensures that any rejection by country 2 triggers a nuclear disaster. Country 1 is “turning the tables” by “relinquishing the initiative” (Schelling\textsuperscript{1966}, 43-49). Country 1 then faces a traditional risk-return tradeoff. A more aggressive offer generates a more favorable peace but it is more likely to be rejected. Consistent with TNR, the more willing

\footnote{The assumption that even off the equilibrium path offers are seen as burning bridges pins down off the equilibrium path beliefs, which helps produce unique equilibria.}
is country 1 to run the risk of nuclear disaster, the more favorable are the
terms of peace.

In contrast with TNR, however, the more resolved a state is, the least
likely it is to succeed. The reason is twofold. First, a greater display of
resolve could coerce only if it corresponded with a greater risk of war after
rejection, but by burning bridges, country 1 ensures that war follows any
rejection. Second, country 1 chooses the terms of peace. The more resolved
a state is, the more willing it is to run the risk of war. It chooses a more
aggressive offer, which is more likely to be rejected.

Turning to the effect of country 1’s military capabilities on diplomatic
outcomes, we conclude:

**Result 1** If country 1 burns bridges: (i) as the nuclear balance becomes
more favorable to country 1, it enjoys more favorable peaceful terms and the
probability of war remains unchanged; (ii) as country 1’s first-strike capabili-
ties improve, it may enjoy more favorable peaceful terms, under an increased
probability of war.

A more favorable nuclear balance increases country 1’s war payoff at the
expense of country 2. Country 1’s emboldenment is exactly offset by country
2’s timidity. Only the terms of peace change, not the probability of war.
Country 1’s first-strike capabilities, for their part, matter only if country 2
would not attack, knowing that country 1 would, or only if country 2 is a
strategy dominant dove. These types accept the lowest offers, made by the
most hostile types of country 1. Greater first capabilities embolden these
types of country 1. They make more aggressive offers, tolerating a greater
risk of war.

The strategy of burning bridges may be rarely implemented. Nevertheless, it serves as a useful benchmark for probabilistic threats.

3.1.3 Probabilistic Threats

Now assume that any compellent attempt by country 1, on or off the equilibrium path, is interpreted as a “probabilistic threat,” which may trigger a nuclear disaster. Formally, country 1 is committed to escalate and attack with probability $\epsilon \in (0, 1)$ after country 2’s rejection. With probability $1 - \epsilon$, the status quo prevails after country 2’s rejection. This model stands as a middle ground between the previous two, approximating the baseline model as $\epsilon$ approaches 0 and the model of burning bridges as $\epsilon$ approaches 1.

This model has broad applicability. Whenever policymakers deploy military power, officers assess proximate threats and decide whether to take actions that could quickly escalate. In the Cuban Missile Crisis, the shooting of a U-2 spy plane on October 27 could have triggered a quick escalation, and so could have U.S. efforts to hold the quarantine line. We conclude:

Lemma 5 If country 1 issues probabilistic threats and $F_i$ is the uniform distribution, the following forms the unique equilibrium: Country 1 triggers

\[ 19 \text{For discussion of the Soviet Perimeter program, see, e.g., } \text{Hoffman (2009).} \]
a crisis and offers:

\[
x_2^* = \begin{cases} 
(1 - \epsilon)\pi_2 + \epsilon(p_2 - c_2 + h_2) & \text{if } h_1 \leq h' \\
(1 - \epsilon)\pi_2 + \epsilon \left[ p_2 - c_2 + \frac{1 - (p_1 - c_1) - (p_2 - c_2) - h_1 - h_2}{2} \right] & \text{if } h_1 \in (h', h'') \\
(1 - \epsilon)\pi_2 + \epsilon(p_2 - c_2 - f_1) & \text{if } h_1 \geq h''
\end{cases}
\]

for some \( h' < h'' \). Country 2 accepts \( x_2 \) if and only if

\[
x_2 \geq \begin{cases} 
(1 - \epsilon)\pi_2 + \epsilon(p_2 - c_2 - f_1) & \text{if } h_2 < -f_1 \\
(1 - \epsilon)\pi_2 + \epsilon(p_2 - c_2 + h_2) & \text{if } h_2 \geq -f_1
\end{cases}
\]

In the preemption game, country 2 attacks if and only if \( h_2 \geq -f_1 \).

By issuing probabilistic threats, country 1 engages in a competition in risk taking (Schelling [1966] 91). The greater is the risk of disaster (the closer \( \epsilon \) is to 1), the more probabilistic threats resemble burning bridges, increasing the effectiveness of compellence. Probabilistic threats, therefore, exhibit the same comparative statics as burning bridges with regard to the nuclear balance and first-strike capabilities (see the Appendix).

3.1.4 The Rationality of Irrationality

Finally, let country 1 control whether to escalate, but assume that it may be “irrational,” preferring war to the status quo, even without a first strike: \( h_1 > \pi_1 - (p_1 - c_1) \). Let \( \epsilon = 1 - F_1(\pi_1 - (p_1 - c_1)) \) be the mass of country
1 with these preferences. Otherwise, assume that condition (5) holds for all \( h_2 \), and conditions (3) and (4) hold. We ask whether a “rational” type, which would not trigger nuclear war, can extract concessions by appearing irrational. This strategy may be rare, but it has been considered, for example in Nixon’s initial approach to the resolution of the Vietnam War [Kimball and Burt 2015]. It should also be considered if countries could escape the nuclear stalemate, and devise a splendid first strike. We conclude:

**Lemma 6** If country 1 may be “irrational” and \( F_i \) is the uniform distribution, there are critical values \( h_1', h_1'', h_2' \), such that if \( h_1 \in (h_1', h_1'') \), \( h_2 < h_2' \), then the following forms an equilibrium, with appropriate off-the-equilibrium-path beliefs: Country 1 triggers a crisis and offers

\[
x_2^* = \bar{x}_2 \equiv (1 - \epsilon) \pi_2 + \epsilon (p_2 - c_2 + \bar{h}_2)
\]

for all \( h_1 \). Country 2 accepts \( x_2 \) if and only if

\[
x_2 =
\begin{cases}
(1 - \epsilon) \pi_2 + \epsilon (p_2 - c_2 - f_1) & \text{if } h_2 < -f_1 \\
(1 - \epsilon) \pi_2 + \epsilon (p_2 - c_2 + h_2) & \text{if } h_2 \geq -f_1
\end{cases}
\]

Country 1 escalates after \( x_2 \geq x_2^* \), if and only if \( h_1 > \pi_1 - (p_1 - c_1) \) and after \( x_2 < x_2^* \) if and only if \( h_1 > \pi_1 - (p_1 - c_1) - F_2(-f_1)f_1 \).

In the preemption game, country 2 attacks if and only if \( h_2 \geq -f_1 \). After \( x_2 \geq x_2^* \), country 1 attacks if and only if \( h_1 > -f_2 \). After \( x_2 < x_2^* \), country 1
attacks if and only if \[ h_1 > (1 - F_2(-f_1))(-f_2) + F_2(-f_1)(\pi_1 - (p_1 - c_1) - f_1). \]

In this equilibrium, all types pool on the same offer, which is accepted by country 2. Compellence succeeds, not because it signals anything about country 1’s willingness to fight, but precisely because it does not. Country 2 cannot discern whether it faces a bluffing rational type or an irrational type, which would prefer to trigger a nuclear war. To sustain this equilibrium, country 2 cannot be too bellicose \( (\overline{h}_2 < \overline{h}_2') \), so that it accepts significant concessions, and country 1’s most bellicose preferences must be intermediate \( (\overline{h}_1 \in (\overline{h}_1', \overline{h}_1'')) \), so that the threat of its irrationality is effective, but it is willing to accept peaceful concessions.

Turning to the effect of military capabilities on diplomatic outcomes:

**Result 2** If country 1 may be irrational: (i) as the nuclear balance becomes more favorable to country 1, it enjoys more favorable peaceful terms and the probability of war remains unchanged; (ii) as country 1’s first-strike capabilities improve, it affects neither the terms of peace nor the probability of war.

As before, the nuclear balance may safely improve country 1’s diplomatic outcome. Here, country 1’s first strike capabilities have no effect, because its offer targets the most resolved type of country 2, which would fight in the preemption game, denying country 1 the possibility of striking first.
4 Conclusion: TNR is Dead! Long Live TNR!

The Theory of the Nuclear Revolution (TNR) is under attack. U.S. policymakers seemed to reject its logic than previously believed, and Washington may have been closer to escaping the nuclear stalemate, which TNR assumed was stable. Calls for its rejection do not seem warranted, however. Critics argue that the U.S. drive for nuclear superiority was rational and there is a link between military capabilities and political outcomes. Yet they do little to explain how nuclear weapons could compel and overcome deterrence, and how greater military capabilities provide coercive leverage. The fact that U.S. policymakers pursued nuclear superiority does not mean that it served U.S. national security interests. Trapped by previous discourse on competent nuclear management, rational U.S. policymakers may have had a strong incentive to pursue nuclear superiority, uncertain about its possible benefits.

This paper revisits the challenges inherent in compellence, the ways in which they can be overcome, and the effect of nuclear superiority on coercive leverage. Burning bridges, probabilistic threats, and the rationality of irrationality may bolster the credibility of compellent threats (Schelling [1966]). When they are used, nuclear superiority does improve coercive leverage, but it does so at the cost of an increased risk of nuclear disaster. First-strike capabilities prove especially destabilizing. As such, TNR scholars were right to raise concerns about the development of U.S. nuclear strategy, even if they may have been too sanguine about the stability of the nuclear stalemate.
Looking ahead, the United States should worry about the possibility that a highly resolved state could use compellent threats effectively, for example if China wanted to revise the status of Taiwan. At the same time, as it modernizes its nuclear arsenal and considers other technologies, such as hypersonic weapons, Washington should weigh any potential coercive benefit that it may wish to obtain from improved capabilities with the inherent risk of nuclear disaster.

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Appendix I: Proof of the Formal Results

Proof. (Proof of Lemma 1). Explained above. ■

Proof. (Proof of Lemma 2). In a cut-off equilibrium, country \(i\)'s net benefit of attacking is \(h_i + f_j - F_j(h'_j)[\pi_i - (p_i - c_i) - (f_i - f_j)]\). It is zero at the cut-off \(h'_i\) so that, using \(F_i\) as the uniform distribution:

\[
\frac{h'_i + f_j}{\pi_i - (p_i - c_i) - (f_i - f_j)} = \frac{h'_j - h_j}{h_j - h'_j}
\]

(14)

Simplifying this system of equations (for \(i \in \{1, 2\}\)), we have:

\[
h'_i = h_i - \alpha_i[h_i + f_j] - \alpha_i\beta_i[h_j + f_j]
\]

(15)

where \(\alpha_i = \frac{\pi_i - (p_i - c_i) - (f_i - f_j)}{\pi_i - (p_i - c_i) - (f_i - f_j)}\) and \(\beta_i = \frac{\pi_i - (p_i - c_i) - (f_i - f_j)}{\pi_i - (p_i - c_i) - (f_i - f_j)}\).

Using condition (7), \(h'_i - h_i \geq 0\) if and only if

\[
\left(\frac{\pi_i - (p_i - c_i) - (f_i - f_j)}{h_i + f_j}\right) \left(\frac{\pi_j - (p_j - c_j) - (h_j + f_j)}{h_j - h'_j}\right) \geq 1
\]

(16)

which follows from conditions (3) to (4). ■

Proof. (Proof of Lemma 3). For (i), let peace prevail if country 2 rejects \(x'_2\). Country 2 accepts if and only if \(x'_2 \geq \pi_2\). Country 1 triggers the crisis, offering \(x'_2\) if and only if \(x'_2 \leq \pi_1\). These imply \(x'_2 = \pi_2\). For (ii), if the preemption game produces war with positive probability, then it offers country 1 strictly less than \(\pi_1\), given conditions (4) and (5). Country 1 strictly prefers to back
down. For (iii), note that it follows from (i) and (ii).

Proof. (Proof of Lemma 4). Proceed by backward induction. Country 2’s decision to attack, and its response to \( x_2 \), are straightforward.

Moving up, consider country 1’s optimal offer. Clearly, country 1 prefers \( x_2 = p_2 - c_2 + h_2 \) to any higher offer. It also prefers \( x_2 = p_2 - c_2 - f_1 \), accepted by \( h_2 \leq -f_1 \), to any lower \( x_2 \), rejected by them, given conditions (3) and (5).

Country 1’s problem is to identify \( h_2' = x_2 - (p_2 - c_2) \) to solve:

\[
\max_{h_2' \in [-f_1, h_2]} F_2(h_2')[1 - (p_2 - c_2) - h_2'] + (1 - F_2(h_2'))(p_1 - c_1 + h_1) \quad (17)
\]

This is a convex problem. The interior solution is given by

\[
1 - (p_1 - c_1) - (p_2 - c_2) - h_1 + h_2 - 2h_2' = 0 \quad (18)
\]

Consider the following conditions:

\[
1 - (p_1 - c_1) - (p_2 - c_2) \leq h_1 - h_2 + 2f_1 \quad (19)
\]

\[
1 - (p_1 - c_1) - (p_2 - c_2) \geq \overline{h_1} - \overline{h_2} + 2\overline{h_2} \quad (20)
\]

If condition (19) holds, then for any \( h_1 \), country 1 chooses the lower bound \( h_2' = -f_1 \). The optimal offer is given by equation (8), where \( h' < h_1 = h'' \).

If condition (20) holds, then for any \( h_1 \), country 1 chooses the upper bound \( h_2' = \overline{h_2} \). The optimal offer is given by equation (8), where \( h' = \overline{h_1} < h'' \).
If conditions (19) and (20) fail, then for some $h_1$, the optimal offer is the interior solution. The optimal offer can be summarized by equation (8), where $h_1 \leq h' < h'' \leq \overline{h}_1$. If the upper and lower bounds are offered by some type, then $h'$ and $h''$ are defined by

$$1 - (p_1 - c_1) - (p_2 - c_2) = h' - h_2 + 2h_2$$  \hspace{1cm} (21)$$
$$1 - (p_1 - c_1) - (p_2 - c_2) = h'' - h_2 - 2f_1$$  \hspace{1cm} (22)$$

Finally, country 1 prefers to trigger a crisis, since it can offer $x_2 = p_2 - c_2 + \overline{h}_2$, accepted by any $h_2$, and get more than $\pi_1$, by condition (5).

Proof. (Proof of Result 1). (i) Given condition (6), $\frac{\partial x^*_2}{\partial b} = \frac{\partial p_2 - c_2}{\partial b} < 0$ and $\frac{\partial h'}{\partial b} = \frac{\partial h''}{\partial b} = 0$, using equations (21) and (22). Similarly, $\frac{\partial \text{prob(war)}}{\partial b} = 0$ since

$$\text{prob(war)} = \begin{cases} 
0 & \text{if } h_1 \leq h' \\
1 - F_2 \left(\frac{1 - (p_1 - c_1) - (p_2 - c_2) - h_1 + h_2)}{2}\right) & \text{if } h_1 \in (h', h'') \\
1 - F_2(-f_1) & \text{if } h_1 > h'' 
\end{cases}$$  \hspace{1cm} (23)$$

For (ii), note using equation (8) that $\frac{\partial x^*_2}{\partial f_1} = 0$ for $h_1 < h''$ and $\frac{\partial x^*_2}{\partial f_1} < 0$ for $h_1 \geq h''$. Also note using equations (21) and (22) that $\frac{\partial h'}{\partial f_1} = 0$, $\frac{\partial h''}{\partial f_1} > 0$. Finally, note using equation (23) that $\frac{\partial \text{prob(war)}}{\partial f_1} = 0$ for $h_1 < h''$ and $\frac{\partial \text{prob(war)}}{\partial f_1} > 0$ for $h_1 \geq h''$. ■
Proof. (Proof of Lemma 5). Proceed by backward induction. Country 2’s decision to attack, and its response to $x_2$, are straightforward.

Moving up, consider country 1’s optimal offer. Clearly, it prefers $x_2 = (1 - \epsilon)\pi_2 + \epsilon(p_2 - c_2 + h_2)$ to any higher offer. Also, it prefers $x_2 = (1 - \epsilon)\pi_2 + \epsilon(p_2 - c_2 - f_1)$, accepted by $h_2 \leq -f_1$, to any lower $x_2$, rejected by them, given conditions (3) and (5), and $\epsilon > 0$. Let $h'_2$ be the type $h_2$ indifferent between accepting and rejecting $x_2$, $h'_2 = \frac{x_2 - (1-\epsilon)\pi_2}{\epsilon} - (p_2 - c_2)$. Country 1’s problem is to identify $h'_2$ to solve

$$
\max_{h'_2 \in [-f_1, h_2]} F_2(h'_2)[(1-\epsilon)\pi_1 + \epsilon[1-(p_2-c_2)-h'_2]] + (1-F_2(h'_2))((1-\epsilon)\pi_1 + \epsilon(p_1-c_1-h_1))
$$

(24)

which reduces to (17). The rest of the proof follows the above logic. ■

Result 3 If country 1 issues probabilistic threats: (i) as the nuclear balance becomes more favorable to country 1, it enjoys more favorable peaceful terms and the probability of war remains unchanged; (ii) as country 1’s first-strike capabilities improve, it may enjoy more favorable peaceful terms, under an increased probability of war.

Proof. The proof follows the logic of the proof of Result 7. ■

Proof. (Proof of Lemma 6). First specify countries’ beliefs (cut-off values $\overline{h}_1'$, $\overline{h}_1''$, and $\overline{h}_2'$ are discussed below):

- After $x_2 \geq \overline{x}_2$, country 2 believes that $h_1 \sim U[\overline{h}_1', \overline{h}_1]$. After $x_2 < \overline{x}_2$, country 2 believes that $h_1 = \overline{h}_1$. 64
• After $x_2 < x_2$ is rejected, country 1 believes that $h_2 \sim U[h_2, \bar{h}_2]$. After $x_2 \in [\underline{x}_2, \bar{x}_2]$ is rejected, country 1 believes that $h_2 \sim U[\frac{x_2-(1-\epsilon)\pi_2}{\epsilon}-(p_2-c_2), \bar{h}_2]$. After $x_2 > \bar{x}_2$ is rejected, country 1 believes that $h_2 = \bar{h}_2$.

• After $x_2 \geq \underline{x}_2$ is rejected and country 1 escalates, country 2 believes that country 1’s type $h_1 \sim U[\pi_1 - (p_1 - c_1), \bar{h}_1]$. After $x_2 < \underline{x}_2$ is rejected and country 1 escalates, country 2 believes that $h_1 \sim U[\pi_1 - (p_1 - c_1) - F_2(-f_1)f_1, \bar{h}_1]$.

To prove that the above forms a PBE, proceed by backward induction.

After any $x_2$, country 2 expects country 1 to attack if $\pi_1 - (p_1 - c_1) > -f_2$, which follows condition (3). Thus, country 2 attacks if and only if $h_2 \geq -f_2$.

After $x_2 \geq \underline{x}_2$, country 1 expects country 2 to attack if $\frac{x_2-(1-\epsilon)\pi_2}{\epsilon}-(p_2-c_2) \geq -f_1$, which is true since $x_2 \geq \underline{x}_2$. Therefore, country 1 attacks if and only if $h_1 \geq -f_2$. After $x_2 < \underline{x}_2$, country 1 expects country 2 to attack with probability $1 - F_2(-f_1)$. Therefore, country 1 attacks if and only if $h_1 > (1 - F_2(-f_1))(-f_2) + F_2(-f_1)(\pi_1 - (p_1 - c_1) - f_1)$.

Now consider country 1’s decision to back down or escalate. After $x_2 \geq \underline{x}_2$, country 1 expects country 2 to attack. Any $h_1 < -f_2$ would not attack and prefers to back down if and only if $\pi_1 > p_1 - c_1 - f_2$, which holds by condition (3). Any $h_1 \geq -f_2$ would attack and prefers to escalate if and only if $h_1 > \pi_1 - (p_1 - c_1)$. After $x_2 < \underline{x}_2$, country 1 expects country 2 to attack with probability $1 - F_2(-f_1)$. Any $h_1 < (1 - F_2(-f_1))(-f_2) + F_2(-f_1)(\pi_1 -
\((p_1 - c_1) - f_1\) would not attack and prefers to back down if and only if
\(\pi_1 > (1 - F_2(-f_1))(p_1 - c_1 - f_2) + F_2(-f_1)(\pi_1)\), which holds by condition \([3]\).

Any \(h_1 \geq (1 - F_2(-f_1))(-f_2) + F_2(-f_1)(\pi_1 - (p_1 - c_1) - f_1)\) would attack and prefers to escalate if and only if \(h_1 > \pi_1 - (p_1 - c_1) - F_2(-f_1)f_1\).

Moving up, consider country 2’s evaluation of \(x_2\). If \(x_2 \geq x_2\), country 2 expects country 1 to escalate and attack with probability \(\epsilon\) and to back down with probability \(1 - \epsilon\). It proceeds as in condition \([13]\). If \(x_2 < \bar{x}_2\), country 2 expects country 1 to back down. It rejects since \(x_2 < \bar{x}_2 < \bar{\pi}_2\). Thus, it proceeds as in condition \([13]\).

Moving up, consider country 1’s optimal offer. Clearly, \(x_2 = \bar{x}_2\) is preferable to \(x_2 > \bar{x}_2\). Choosing \(x_2 \in [x_2, \bar{x}_2]\) reduces to \([17]\). Given the proof of Lemmas \(4\) and \(5\), all types \(h_1\) strictly prefer \(x_2 = \bar{x}_2\) to any \(x_2 \in [x_2, \bar{x}_2]\) if condition \([20]\) holds. Condition \([20]\) specifies an upper bound \(\bar{h}_2'\) for \(\bar{h}_2\).

Next evaluate country 1’s preference between \(x_2 = \bar{x}_2\) and any \(x_2 < \bar{x}_2\). Any \(h_1 \leq \pi_1 - (p_1 - c_1) - F_2(-f_1)f_1\) prefers \(x_2 = \bar{x}_2\) if and only if \(1 - \bar{x}_2 > \pi_1\), which holds given condition \([5]\) for \(i = 2\). Any \(h_1 > \pi_1 - (p_1 - c_1) - F_2(-f_1)f_1\) prefers \(x_2 = \bar{x}_2\) if and only if \(1 - \bar{x}_2 > p_1 - c_1 + \bar{h}_1 + F_2(-f_1)f_1\) or

\[
\pi_1 - (p_1 - c_1) - \bar{h}_1 - F_2(-f_1)f_1 + \epsilon(\pi_2 - (p_2 - c_2) - \bar{h}_2) > 0 \tag{25}
\]

which holds if and only if \(\bar{h}_1 \in \left(\bar{h}_1', \bar{h}_1''\right)\) for some values \(\bar{h}_1', \bar{h}_1''\). Indeed, the left-hand side of the above condition is concave in \(\bar{h}_1\), since \(\frac{\partial^2}{\partial \bar{h}_1^2} \leq 0\). The condition fails when \(\bar{h}_1 = \pi_1 - (p_1 - c_1)\) and when \(\bar{h}_1\) tends to infinity. It can
be satisfied, along with all others, in the following example: $\pi_i = p_i = 1/2$, $c_1 = 1$, $c_2 = 4$, $f_i = \frac{1}{4} \forall i$, $h_i = -1 \forall i$, $h_1 = 2$, $h_2 = 0$.

Moving up, country 1 prefers to trigger a crisis, since offering $x_2$ generates strict concessions ($1 - x_2^* > \pi_1$) and is accepted with probability 1.

**Proof.** (Proof of Result 2) (i) and (ii) are immediate from equation (12) and the fact that peace prevails.
Appendix II: Coding Rules and Decisions for Tables 1 and 2

Cases are taken from Sechser and Fuhrmann (2017, Table III.1, p. 128), excluding catalytic threats between allies or neutral states. Whether threats trigger a crisis is based on the ICB project and Sechser and Fuhrmann (2017), unless otherwise noted. The nuclear coercer was successful if it achieved “victory” peacefully, according to the ICB project, unless otherwise noted.

Korean War, 1953

Summary of the crisis: After PRC-DPRK attacks on UN troops on April 16, 1953, Washington approved contingency nuclear war plans on May 19. The next day, Secretary of State John Foster Dulles told Indian Prime Minister Jawaharlal Nehru of U.S. intentions to “make a stronger rather than a lesser military exertion,” a threat to be relayed to Beijing (quoted in Sechser and Fuhrmann 2017, p. 176). Four days later, Washington performed a nuclear test. A month later, Beijing agreed to an armistice, making key concessions on the issue of prisoners of war.

Did nuclear threats trigger the crisis? No. The crisis began on April 16. The ICB dataset identifies three crises during the war: June-September 1950, September 1950-July 1951, and April-July 1953. Sechser and Fuhrmann (2017, p. 128) identify a single crisis for the entire war, but adopt a narrower time frame in other wars, i.e. the Indochina War and the Vietnam War. I do so here.

Was the nuclear coercer successful? Yes. Hostilities ended, with key concessions from the PRC.

Indochina War, 1954

Summary of the crisis: On March 13, 1954, French positions were attacked at Dien Bien Phu. In March, Dulles told the press that the conflict might easily escalate to massive attacks on China itself. In April, he declared that NATO should use nuclear weapons “whenever or wherever it would be of advantage to do so, taking account of all relevant factors.” Dien Bien Phu fell on May 7. Later in May, news leaked that the Chairman of the Joint Chiefs of Staff, Admiral Arthur W. Radford, had told the House Foreign Affairs Committee that “any United States intervention in Indochina should be on an all-out basis, including use of atomic weapons” (quoted in Sechser and Fuhrmann 2017, p. 183). A peace agreement was signed on July 21.

Did nuclear threats trigger the crisis? No. The crisis began with the attack on French forces.

Was the nuclear coercer successful? Yes. Terms of peace improved after U.S. nuclear coercion (Trachtenberg 2013, p. 22). Though the ICB project codes the US as defeated, Sechser and Fuhrmann (2017, p. 128) codes US nuclear coercion efforts as “apparently successful.”
First Taiwan Strait crisis, 1954-5

Summary of the crisis: In August 1954, the creation of SEATO, to include the ROC, was being discussed. The PRC began shelling Quemoy and Matsu, controlled by the ROC, on September 3. Nine days later, Washington sent the Seventh Fleet to the region. In March 1955, it publicly suggested using tactical nuclear weapons. The PRC proposed negotiations. The crisis abated.

Did nuclear threats trigger the crisis? No. The crisis began with negotiations over SEATO (per the ICB project) or the shelling of Quemoy and Matsu (per Sechser and Fuhrmann 2017, p. 189).

Was the nuclear coercer successful? Yes. The status quo endured. The ICB project codes the outcome as a stalemate. Sechser and Fuhrmann (2017, p. 128) codes US efforts as “apparently successful.”

Suez crisis, 1956

Summary of the crisis: On July 26, 1956, Egypt nationalized the canal from an Anglo-French corporation. Israel invaded Sinai on October 29, later joined by the UK and France. On November 5, Soviet Prime Minister Nikolai Bulganin asked British Prime Minister Anthony Eden: “In what situations would Britain find herself if she was attacked by stronger states, possessing all types of modern destructive weapons?” (quoted in Sechser and Fuhrmann 2017, p. 225). He reminded Eisenhower that the US and USSR “are two great powers possessing all contemporary forms of armaments, including atom and hydrogen weapons,” and warned: “If this war is not stopped, it is fraught with danger and can grow into third world war” (U.S. Department of State, 1956, pp. 993-994). The UK and France agreed to cease fire and withdraw their forces. Israel later withdrew its forces.

Did nuclear threats trigger the crisis? No. The crisis began with the nationalization of the canal.

Was the nuclear coercer successful? Yes. Britain, France, and Israel withdrew from the area.

Second Taiwan Strait crisis, 1958

Summary of the crisis: The PRC began shelling Quemoy and Matsu on August 23. Two days later, Washington deployed military forces to the region, invoking the nuclear option. On September 4, Dulles said that “acquiescence” to the PRC’s aggression “would threaten peace everywhere.” Three days later, Soviet premier Nikita Khrushchev complained that Washington was “trying […] to resort to atomic blackmail against China.” On September 17, Washington deployed three nuclear-capable artillery guns on Quemoy. In late September, Air Force Secretary James Douglas declared that the U.S.’s “most modern fighters are on the spot” and “are as capable of using high-explosive bombs as more powerful weapons” (quoted in Sechser and Fuhrmann 2017, pp. 195-196). Talks between the US and PRC led to a ceasefire on October 6, later extended. The crisis abated. On October 23, the United States and the ROC issued a joint communique, reaffirming their alliance while stressing its defensive nature.
Did nuclear threats trigger the crisis? No. The crisis began either in July, with the deployment of PRC forces (according to the ICB dataset), or on August 23, with the shelling of Quemoy and Matsu (according to Sechser and Fuhrmann 2017).

Was the nuclear coercer successful? Yes. The ICB dataset codes all actors (PRC, ROC, and the US) as victorious. The PRC could see the joint communique as a victory. Yet the status quo endured. U.S. effort are seen as “apparently successful” by Sechser and Fuhrmann (2017, p. 128).

Berlin ultimatum I, 1958-9

Summary of the crisis: On November 27, 1958, Khrushchev gave six months for West Berlin to be demilitarized and declared a “Free City,” threatening to sign a peace treaty with East Germany, which would control access routes to West Berlin, and come to its defense against the West. On December 1, he threatened to enforce the agreement, telling Hubert Humphrey: “We have rockets... We mean business,” invoking a recent hydrogen-bomb test (quoted in Sechser and Fuhrmann 2017, p. 134). In May 1959, Washington redeployed aircraft carriers, armed with nuclear weapons, to the Mediterranean. Khrushchev revoked his ultimatum.

Did nuclear threats trigger the crisis? Yes. The crisis began with the Soviet ultimatum.

Was the nuclear coercer successful? No. The status quo endured. The ICB dataset codes the outcome as a stalemate. Sechser and Fuhrmann (2017, p. 128) code Soviet efforts as a “failure.”

Berlin ultimatum II, 1961

Crisis summary: Khrushchev renewed his ultimatum in June 1961, threatening “all the consequences” after any violation of East German sovereignty (U.S. Department of State, 1961, pp. 90-91). On August 13, he built the Berlin Wall. In October, he dropped his ultimatum.

Did nuclear threats trigger the crisis? Yes. Though the ICB codes the crisis as beginning in August 1961, triggered by a non-state actor - refugees moving to West Berlin - Sechser and Fuhrmann (2017, pp. 136-137) begin their narrative with Khrushchev’s ultimatum, a conventional choice.

Was the nuclear coercer successful? No. Though the ICB dataset codes the Soviet Union as achieving “victory” - it did restrict defections to the West, the status quo otherwise prevailed. Sechser and Fuhrmann (2017, p. 128) codes this Soviet nuclear coercion effort as a “failure.”

Cuban Missile Crisis, 1962

Summary of the crisis: On October 16, Kennedy learned of the Soviet deployment to Cuba and announced a quarantine on October 22 to remove them. Two days later, the US raised its alert state to DEFCON 2. On October 28, the US and USSR agreed on the removal of Soviet missiles.
Did nuclear threats trigger the crisis? No. The crisis began on October 16.

Was the nuclear coercer successful? Yes. The USSR removed its missiles from Cuba.

Seizure of USS Pueblo, 1968

Summary of the crisis: On January 21, 1968, a DPRK commando unit attempted to assassinate the ROK president in his residence. On January 22, the DPRK seized the USS Pueblo, a U.S. intelligence vessel. President Johnson demanded the return of the ship and its crew, threatening a military response, deploying forces, equipped with nuclear weapons, to the area. Washington eventually backed down. The DPRK returned the crew but not the ship itself.

Did nuclear threats trigger the crisis? No. The crisis began either with the assassination attempt (per the ICB dataset) or the seizure of the Pueblo (per Sechser and Fuhrmann 2017, p. 166).

Was the nuclear coercer successful? No. North Korea returned the crew but not its ship.

Sino-Soviet border crisis, 1969

Summary of the crisis: On March 2, 1969, Chinese forces ambushed Soviet guards on Zhenbao Island in the Ussuri River. Moscow struck back on March 15, later placing their Strategic Rocket Forces on high alert, reminding Beijing in radio broadcasts of its nuclear superiority. High-level negotiations began on October 20, reducing tensions. By early February 1970, the Soviets had ceded Zhenbao and other disputed islands, and adopted a less aggressive patrolling posture.

Did nuclear threats trigger the crisis? No. The crisis began on March 2.

Was the nuclear coercer successful? Yes. The status quo was enforced. The ICB dataset, which ends the crisis in October 1969, codes the outcome as a “stalemate.” Sechser and Fuhrmann (2017, p. 128) describes Soviet efforts as “apparently successful.”

Vietnam War, 1969


Did nuclear threats trigger the crisis? Yes. The ICB dataset does not record a crisis for this specific episode. Sechser and Fuhrmann (2017, p. 142)’s narrative begins with U.S. threats.

Was the nuclear coercer successful? No. The United States did not extract any concessions.
Bangladesh War, 1971

Summary of the crisis: In 1970, the Awami League won the right to form the government of Pakistan. The national assembly was suspended. On March 25, West Pakistani forces attacked Dacca University students. The following day, East Pakistani politicians declared independence. As East Pakistan, supported by India, was prevailing, Washington deployed a task force to the region, equipped with nuclear weapons. The following day, India agreed to a ceasefire.

Did nuclear threats trigger the crisis? No. The crisis began on March 25.

Was the nuclear coercer successful? Yes. Nuclear threats helped end the conflict. The ICB does code Pakistan as defeated, but Sechser and Fuhrmann (2017, p. 128) describes U.S. coercion as “apparently successful”.

Yom Kippur war, 1973


Did nuclear threats trigger the crisis? No. The crisis began on October 5.

Was the nuclear coercer successful? Yes. All parties agreed to a ceasefire. Sechser and Fuhrmann (2017) identifies nuclear threats by “Israel/United States” against “United States/Egypt/Soviet Union,” which were “apparently successful.” I ignore Israel’s attempt to catalyze U.S. actions and focus on U.S. nuclear coercion against Egypt and USSR.

Falklands War, 1982

Summary of the crisis: On March 31, 1982, the UK learned of an imminent invasion by Argentina of the Falklands islands. Argentina took control of the islands on April 2. The UK deployed troops to area, carrying nuclear weapons, and attacked on June 3, winning on June 14.

Did nuclear threats trigger the crisis? No. The crisis began on March 31.

Was the nuclear coercer successful? No. The British did not peacefully prevail.

Kashmir crisis, 1990

told his counterpart that “war clouds would hover over the subcontinent if timely action was not taken,” who later stated that he “comprehended the nuclear connotations of Yakub’s warning and reported immediately to Prime Minister Singh” (quoted in Ganguly and Hagerty 2005, p. 89). Both countries deployed forces to the border. Pakistan allegedly readied its nuclear arsenal, hoping to catalyze U.S. intervention. In May, U.S. Deputy National Security Advisor Robert Gates traveled to the region. The crisis soon abated.

*Did nuclear threats trigger the crisis?* Yes. The ICB project says that it began when Pakistan formulated its policy on January 14, reacting a January 13 massacre. The dates appear incorrect. Ganguly and Hagerty (2005, p. 88) call the January 20 massacre “the first of many spasms of mass violence”. Pakistan chose its policy on January 21, issuing its nuclear threats.

*Was the nuclear coercer successful?* No. The status quo endured. Sechser and Fuhrmann (2017, p. 128) codes Pakistan as coercing “India/United States” in an “apparently successful” effort, yet their narrative discusses Pakistani success in catalyzing U.S. intervention, and acknowledge that India could not detect Pakistan’s nuclear preparations (Sechser and Fuhrmann, p. 230).

**Third Taiwan Strait, 1995-6**

*Summary of the crisis:* On May 22, 1995, Washington allowed ROC president Lee Teng-Hui to visit his alma mater, Cornell University, in June. The PRC interpreted this move as promoting Taiwanese independence, and conducted military exercises in the East China Sea in July. In October, PRC Lieutenant General Xiong Guangkai told U.S. diplomat Charles Freeman that unlike in the 1950s, when the United “threatened nuclear strikes on us,” the PRC “can hit back. So you will not make those threats. In the end you care more about Los Angeles than you do about Taipei” (quoted in Sechser and Fuhrmann 2017, p. 170). In March 1996, the PRC tested nuclear-capable M-9 missiles near Taiwan, hoping to hurt Lee’s chances in the upcoming elections. These were held as scheduled on March 23. The PRC ended its military exercises.

*Did nuclear threats trigger the crisis?* No. The crisis begins on May 22.

*Was the nuclear coercer successful?* No. The PRC did not obtain any concessions. Sechser and Fuhrmann (2017, p. 128) codes nuclear threats by “China/US” against “Taiwan/China/US,” but only discuss those issued by the PRC (pp. 170-171), my focus of analysis as well.

**Kargil War, 1999**

*Summary of the crisis:* On May 9, 1999, rockets were launched against Kargil, Kashmir. India blamed Pakistan, retaliating against guerrilla positions on May 26. The next day, Prime Minister Nawaz Sharif claimed that Pakistan could respond to India on “equal terms,” later claiming: “If there is war, or if the present confrontation continues on the borders, it will bring so much devastation, the damage of which will never be repaired.” (quoted in Sechser and Fuhrmann 2017, pp. 147-148). Pakistan allegedly readied its arsenal, detected by U.S. and Indian
intelligence. On July 4, Sharif met with President Bill Clinton, who insisted on Pakistan’s withdrawal. Sharif agreed, ending the war.

Did nuclear threats trigger the crisis? No. The crisis began on May 9.

Was the nuclear coercer successful? No. Pakistan failed to obtain concessions and lost the war (on whether nuclear threats deterred India from crossing the Line of Control, see Sechser and Fuhrmann 2017, pp. 151-152).

Indo-Pakistani border crisis, 2001-2


Was the nuclear coercer successful? No. Pakistan’s fight against terrorism was limited. The ICB project codes India as achieving “victory” in the first crisis and a “stalemate” in the second, but Sechser and Fuhrmann (2017, pp. 128, 156) describes its efforts as a “failure.”

Korean crisis, 2013

Summary of the crisis: On February 12, the DPRK conducted a nuclear test and threatened to hit the ROK and the US with “lighter and smaller nukes.” Arguably, it hoped for a loosening of sanctions, recognition as a nuclear power, and an end to joint US-ROK exercises. Instead, these were held the next day. On March 7, the U.N. condemned the nuclear test, imposing additional sanctions. On March 11, the DPRK nullified the 1953 armistice and threatened to use “the right to a pre-emptive nuclear attack to destroy the strongholds of the aggressors” (quoted in Sechser and Fuhrmann 2017, pp. 162-163). In June, it proposed a resumption of six-party talks.

Did nuclear threats trigger the crisis? Yes.

Was the nuclear coercer successful? No. The DPRK did not obtain any concessions.
Figure 1: Nuclear Crisis as a Game of Chicken

<table>
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<tr>
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<td><em>d_I, d_{II}</em>, <em>w_I, s_{II}</em></td>
<td></td>
</tr>
<tr>
<td><strong>II</strong></td>
<td><em>s_I, w_{II}</em>, <em>c_I, c_{II}</em></td>
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Figure 2: Nuclear Crisis as a Game of Chicken with Exogenous Risk

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<tr>
<td><strong>II</strong></td>
<td><em>f d_I + (1 - f) s_I, f d_{II} + (1 - f) w_{II}</em>, <em>c_I, c_{II}</em></td>
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</tr>
</tbody>
</table>
Figure 3: Extensive Form

Country 1

Status Quo

Country 2

Trigger

Accept

Country 1

Back Down

Country 2

Reject

Attack

Country 1

p_1-c_1+h_1, p_2-c_2+h_2

p_1-c_1-f_2, p_2-c_2+h_2+f_2

Not

Country 2

Attack

p_1-c_1+h_1+f_1, p_2-c_2-f_1

Not

π_1, π_2
Table 1: Nuclear Threat and Crisis Outcome
– Nuclear Threat Triggers Crisis

<table>
<thead>
<tr>
<th>Crisis Name</th>
<th>Years</th>
<th>Challenger</th>
<th>Target</th>
<th>Outcome</th>
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<tbody>
<tr>
<td>Berlin ultimatum I</td>
<td>1958-9</td>
<td>USSR</td>
<td>US</td>
<td>Failure</td>
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<tr>
<td>Berlin ultimatum II</td>
<td>1961</td>
<td>USSR</td>
<td>US</td>
<td>Failure</td>
</tr>
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<td>Vietnam War</td>
<td>1969</td>
<td>US</td>
<td>USSR, North Vietnam</td>
<td>Failure</td>
</tr>
<tr>
<td>Kashmir crisis</td>
<td>1990</td>
<td>Pakistan</td>
<td>India</td>
<td>Failure</td>
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<tr>
<td>Korean crisis</td>
<td>2013</td>
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<td>South Korea, US</td>
<td>Failure</td>
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</table>

Table 2: Nuclear Threat and Crisis Outcome
– Nuclear Threat Does Not Trigger Crisis

<table>
<thead>
<tr>
<th>Crisis Name</th>
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<th>Challenger</th>
<th>Target</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Korean War</td>
<td>1953</td>
<td>US</td>
<td>China, North Korea</td>
<td>Success</td>
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<tr>
<td>Indochina War</td>
<td>1954</td>
<td>US</td>
<td>China, USSR, Viet Minh</td>
<td>Success</td>
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<td>1954-5</td>
<td>US</td>
<td>China</td>
<td>Success</td>
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<td>Suez crisis</td>
<td>1956</td>
<td>USSR</td>
<td>France, UK</td>
<td>Success</td>
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<td>Second Taiwan Strait crisis</td>
<td>1958</td>
<td>US</td>
<td>China</td>
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<td>Cuban missile crisis</td>
<td>1962</td>
<td>US</td>
<td>USSR</td>
<td>Success</td>
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<td>Seizure of USS Pueblo</td>
<td>1968</td>
<td>US</td>
<td>North Korea</td>
<td>Failure</td>
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<td>Sino-Soviet border crisis</td>
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<td>China</td>
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<td>Bangladesh War</td>
<td>1971</td>
<td>US</td>
<td>India</td>
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<td>1973</td>
<td>US</td>
<td>Egypt, USSR</td>
<td>Success</td>
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<td>Falklands War</td>
<td>1982</td>
<td>UK</td>
<td>Argentina</td>
<td>Failure</td>
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<tr>
<td>Third Taiwan Strait crisis</td>
<td>1995-6</td>
<td>China</td>
<td>Taiwan, US</td>
<td>Failure</td>
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<tr>
<td>Kargil War</td>
<td>1999</td>
<td>Pakistan</td>
<td>India</td>
<td>Failure</td>
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<td>Indo-Pakistani border crisis</td>
<td>2001-2</td>
<td>India</td>
<td>Pakistan</td>
<td>Failure</td>
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