The Disadvantage of Nuclear Superiority

Abby Fanlo and Lauren Sukin*†

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Abstract

When crises occur between nuclear-armed states, do relative nuclear capabilities impact the outcome? Existing literature offers no consensus about nuclear superiority's effect on crisis victory, but this paper demonstrates that this effect depends on the size of the disparity between states' nuclear arsenals. While superiority is correlated with victory in crises between states with similarly sized nuclear arsenals, superiority provides no advantage in asymmetric crises. Because a vastly inferior state risks annihilation in a nuclear conflict, it will acquiesce to an opponent's demands before the crisis occurs, unless backing down implies an existential threat as well. Given an asymmetric crisis has emerged, therefore, the inferior side will be willing to bid up the risk of nuclear war, deterring superior opponents. Using quantitative analyses of crisis data and case studies, this paper shows the positive association between nuclear superiority and crisis victory decreases as the disparity between competing states' arsenals increases.

*Abby Fanlo and Lauren Sukin, Ph.D. Candidates, Department of Political Science, Stanford University, 616 Jane Stanford Way, Stanford CA 94305, (650) 723-1806.

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What role do nuclear weapons play in international crisis politics? How does nuclear superiority affect the likelihood that a state achieves its goals in an international crisis? Most scholars argue that having large nuclear arsenals does not especially benefit states in crisis situations. However, others have concluded states with larger nuclear arsenals than their opponents are more likely to achieve their goals during crises.

In this paper, we introduce a new theory about nuclear superiority that offers a different prediction. Our theory takes into account the interaction between nuclear superiority and the disparity between competing states' arsenal sizes. We argue there is a limit to the potential advantages of nuclear superiority. States with superior nuclear arsenals are at a disadvantage during crises against asymmetric nuclear opponents. In such crises, highly inferior nuclear states are better able to demonstrate resolve and therefore are able to deter their superior opponents.

Scholars have long been skeptical about the benefits of nuclear superiority. In 1987, Glenn Snyder and Paul Diesing argued that even states with small nuclear arsenals should be able to successfully threaten superior opponents, since the costs of nuclear war for any state, regardless of their nuclear capabilities, would be massive (Snyder and Diesing 2015). In 1945, Bernard Brodie wrote: "It would make little difference if one power had more bombs and were better prepared to resist them than the opponent," since any nuclear war would be so destructive to both sides (Brodie 1945). An important implication is articulated in *The Illogic of American Nuclear Strategy*, an influential work where Robert Jervis argued that, while second-strike capabilities were essential to deterrence, capabilities much beyond this point held little practical utility (Jervis 1984). Jervis explains: "It does not matter which side has more nuclear weapons... Deterrence comes from having enough weapons to destroy the other's cities; this capability is an absolute, not a relative one" (Jervis 1979). In a world where nuclear war would be all-out, completely devastating, and irreversible, nuclear superiority ought not to matter.

Several scholars and politicians have disputed the idea that nuclear wars can be won.

President Reagan stated that "a nuclear war cannot be won and must never be fought" (Deudney and Ikenberry 1992, 123-138). Similarly, by the end of his presidency, Harry Truman believed that "starting an atomic war [would be] totally unthinkable for rational men" (Treverton 1988, 178). In 1982, McGeorge Bundy, George F. Kennan, Robert S. McNamara and Gerard Smith famously wrote: "Any use of nuclear weapons... carries with it a high and inescapable risk of escalation into the general nuclear war which would bring ruin to all and victory to none" (Bundy et al. 1982). If this is correct, then even nuclear superiority cannot allow states to meaningfully win a nuclear war. In turn, superior states should have few advantages over their inferior opponents, so long as those inferior opponents can credibly demonstrate that they are willing to risk nuclear escalation.

More recent academic literature echoes this argument. Barry Blechman and Robert Powell argue nuclear superiority is not useful once a nuclear country has a second-strike capability.[1] According to Todd Sechser and Matthew Fuhrmann, "nuclear weapons are uniquely poor instruments of compellence," meaning nuclear states do not have an advantage over nonnuclear ones in an effort to compel opponents to make concessions or act in certain ways (Sechser and Fuhrmann 2013). Charles Glaser also concludes that superiority ought not to affect crisis outcomes, writing that the case for nuclear superiority, "is weak, proponents have done little to support their claims, and efforts to fill in the logical gaps in their arguments encounter overwhelming difficulties" (Glaser 2014). Studying crises from 1900-1980, Paul Huth and Bruce Russett determine that "a quest for strategic nuclear superiority is unlikely to be the most effective means for providing security to America's friends and allies in a crisis, or to America itself" (Huth and Russett 1984).

Yet, policymakers still invest in "overkill" capabilities and seemingly believe in the importance of nuclear superiority.[2] Many policymakers have, for example, attributed American

1. Blechman and Powell conceptualize a second-strike capability as a "robust" nuclear arsenal that is "capable of withstanding an attack and retaliating with devastating effect" (Blechman and Powell 1982, 590).

2. Rosenberg 1983 puzzles over nuclear "overkill," or the ability to destroy much more than necessary for the purposes of nuclear deterrence. While the crisis literature does not offer an explanation, other scholars have addressed overkill by focusing on the deterrent value of nuclear weapons and other strategic advantages

success in the Cuban Missile Crisis to nuclear superiority over the U.S.S.R. (Trachtenberg 1985; Betts 1987). Similarly, strategists argued the United states should fear Soviet nuclear superiority, as it could threaten the U.S. ability to make credible threats.[3]. For the history of U.S. nuclear strategists' interest in strategic superiority, see McDonough 2013 Kier Lieber and Daryl Press explain that, throughout the Cold War, "both superpowers were well aware of the benefits of nuclear primacy, and neither was willing to risk falling behind" (K. Lieber and D. Press 2006). This logic suggests nuclear superiority lowers a state's expected costs should nuclear war break out. Therefore, a superior state can demonstrate stronger resolve, providing a crisis advantage over states with more to lose.

More recently, the superiority debate has been hashed out in quantitative research. Matthew Kroenig linked nuclear superiority and political victory during crises (Kroenig 2018, 2013). Todd Sechser and Matthew Fuhrmann questioned Kroenig's empirical results, showing that nuclear superiority provides no advantage to states that make compellent threats against their adversaries. The debate remains at an impasse.

More work is needed to reconcile these disparate conclusions, especially because previous quantitative work treats superiority as binary; a superior state simply has more nuclear weapons than its opponent. In contrast, many experts argue a state could have functional superiority and fewer nuclear weapons, because delivery capabilities, posture, targeting, and other elements are critical to the functionality of a nuclear arsenal. Yet even if we accept numerical advantage as an indicator of superiority, this approach misses critical nuance. The size of the difference between competing states' nuclear capabilities is also essential to understanding the effects of nuclear superiority.[4]

This paper presents a new theory that considers how the magnitude of arsenal disparity impacts the effect of nuclear superiority. Pro-superiority scholars would argue the positive

(K. A. Lieber and D. G. Press 2020; Green 2020).

3. See Kaiser et al. 1981

4. Incorporating the size of the difference between competing arsenals negates the need to assess many of the components of functional superiority, because, with very large disparities, even elements such as strategy, intelligence, platform diversity, etc. would not be able to compensate for the size difference.

effects of superiority should increase as the disparity between arsenals increases, precisely because a larger superiority advantage should provide states with a more reliable guarantee of victory in a nuclear exchange. Work by Jervis and others would suggest that, since even small nuclear arsenals can successfully deter, nuclear superiority generally should not provide an advantage regardless of the disparity between arsenals.

We are agnostic about whether superiority provides an advantage when there is a small disparity in the size of states' nuclear arsenals. States with similar nuclear arsenals will likely be able to deter each other from making significant incursions against their sovereignty. Yet, smaller crises may still emerge (Bell and Miller 2015). Due to the low-stakes nature of these crises, neither side should be able to very credibly threaten nuclear escalation, so nuclear superiority should be largely irrelevant, although it may have some marginal effect in increasing the risk-tolerance of superior states.

While many scholars would argue the effect of superiority would increase as the disparity between arsenals increases, we argue it actually disappears entirely. Vastly inferior states likely face existential consequences from backing down during a crisis; otherwise, they would have acquiesced to the superior opponent's demands. Vastly inferior states cannot threaten the superior opponent's core interests militarily, however, so the superior side likely does not face existential risks from backing down. Because states should be unwilling to use nuclear weapons over a non-critical issue, the superior side will be risk-averse in an asymmetric crisis. This selection dynamic suggests vastly inferior states will be more willing to escalate, demonstrating sufficient resolve to prevent superior opponents from achieving their goals.

North Korea, for example, must signal resolve in the face of American threats to its territory or leadership. Otherwise, the United States could initiate a war that would pose an existential threat to the regime. However, if the United States made a small demand, such as that North Korea come to the negotiating table to discuss the future of its nuclear program, Pyongyang would be better off acquiescing than resisting. In this way, only crises that are high-stakes for the inferior side will emerge in asymmetric settings.

Nuclear superiority matters in asymmetric crises—but not as scholars have traditionally thought. Instead, the nuclear capabilities of the superior state in an asymmetric crisis allow it to severely threaten the core interests of its inferior competitor in a way it could not do against a symmetric opponent. In turn, the inferior state must demonstrate a very high level of resolve, and this demonstration is only credible because the superior state knows the inferior one cannot back down.

This contradicts the conclusions of other scholarly work on existential threats. For example, Bryan Early and Victor Asal argue that when superior states can levy existential threats against states with "significant existential vulnerability," then superior states' "nuclear deterrence policies should work" (Early and Asal 2014, 316). Early and Asal explain that the inability to impose reciprocal existential threats makes inferior states vulnerable. In contrast, we argue that—as the U.S.-North Korea example shows—superior states with low stakes can be deterred even by less-than-existential threats.

The debate over the importance of nuclear superiority has significant implications for the future of nuclear policy. If states only need small, survivable arsenals, as some scholars have suggested, then nuclear policy ought to be oriented towards arms control, including reductions in arsenal size. However, if nuclear superiority provides states with meaningful strategic advantages, then disarmament would have serious strategic drawbacks. Our findings offer nuance by suggesting the disparity between states' arsenal sizes influences the effect of superiority. Moreover, we address a critical puzzle: While superior nuclear powers may start crises with significantly inferior adversaries, they often are unable to accomplish their objectives, despite obvious military and material advantages. Our theory suggests this occurs because superiority is not especially beneficial at high levels of arsenal disparity, due to a selection effect that allows high-stakes crises to emerge in asymmetric dyads but not symmetric ones.

First, we outline our theory, which argues that nuclear superiority should not provide a meaningful advantage in asymmetric crises. States with vast nuclear inferiority are likely to face existential stakes during crises with nuclear adversaries. As a result, they can successfully demonstrate their resolve, thereby deterring superior opponents. Second, using data on international crises and their outcomes, we show that nuclear superiority has little or no effect at high levels of arsenal disparity.

1 Theory

According to scholars like Kroenig, nuclear superiority provides states with significant strategic advantages.[5] Because a superior state would win a nuclear war against an inferior opponent, a superior state can more credibly threaten nuclear escalation. As a result, we might expect that the greater a state's nuclear superiority is over its opponent, the larger an advantage it has in competitions of brinkmanship. However, this approach minimizes the crucial function of resolve in brinkmanship and ignores what the balance of capability implies about each side's resolve.

1.1 Symmetric Crises

The literature on nuclear parity suggests comparably sized nuclear arsenals encourage peace because both states can inflict significant damage (Kugler and Zagare 1990; Mc-

5. Kroenig uses numerical superiority to measure nuclear superiority. Our measure similarly relies on counts of states' nuclear weapons. Yet our measure will also assess disparity between states' nuclear arsenals. We recognize that some scholars might object to assessing the magnitude of nuclear superiority with numerical differences alone. Factors such as secure second-strike capabilities, counterforce capabilities, and platform diversity may impact which side is likely to incur fewer costs in a nuclear exchange. From this perspective, we should evaluate each side in every crisis individually to properly determine which state possessed superiority and to assess the degree of that superiority. However, characterizing asymmetric crises based only on the magnitude of numerical disparity provides a hard test of our argument. When one state has, for example, more than fifty times the nuclear weapons of its opponent, differences in delivery capabilities, posture, and other factors are unlikely to change which player would suffer fewer costs in nuclear war. In contrast, these factors may matter when states have similarly sized nuclear arsenals. One side's slight numerical advantage could be outweighed by an opponent's nuclear capabilities or posture. Therefore, if nuclear superiority matters at all, but numerical superiority does not accurately measure this concept in symmetric cases, then numerical disparities should only be correlated with victory in highly asymmetric crises. Our theory predicts the opposite, however. We argue nuclear superiority does not matter in asymmetric crises but may provide an advantage in symmetric ones. The use of our superiority measure therefore strongly biases against our hypothesis.

Donough 2013). Thus, only low-level crises emerge between nuclear states at parity. This insight underlies the 'cold' nature of the Cold War—rather than directly threaten each others' territory or sovereignty, the United States and Soviet Union fought distant conflicts through proxies. In these crises, because nuclear use carries very high costs for both sides, both states have incentives to avoid escalation. Indeed, this is the crux of the argument for why nuclear weapons compel states to caution (Sagan and Waltz 2003). Therefore, symmetric states will struggle to credibly signal resolve during crises, making stalemates likely.

Does nuclear superiority matter during symmetric crises? Here we are largely agnostic. Our theory suggests neither state should be able to credibly threaten nuclear escalation. As a result, nuclear superiority should largely be irrelevant. However, even if nuclear superiority is not a focus in these crises, it could remain a background factor affecting states' risk-tolerance. There may also be rare symmetric crises where, for idiosyncratic reasons, states believe that their adversary could escalate to the nuclear level, even if the crises is not over a core interest. After all, the 'madman' theory of deterrence is designed to produce just this perception.

Even if nuclear superiority could theoretically provide an advantage in symmetric crises, this argument is difficult to test because of challenges associated with operationalizing nuclear superiority. For states with similarly-sized nuclear arsenals, a handful of additional weapons does not necessarily indicate functional superiority. Measuring superiority would require case-by-case assessment of states' delivery capabilities, platform diversity, second-strike capabilities, missile defense, counterforce capabilities, intelligence, targeting policies, nuclear postures, geographical size, population size, and more. Many of these factors are classified and difficult to estimate. This also means measuring superiority requires not only knowing the actual capabilities of states, but also knowing what each state estimates for its opponents.[6] Moreover, to the extent nuclear superiority may matter in a crisis, it is most

6. Early and Asal 2014 use many of these factors to estimate the size of the threat various nuclear states posed to each other in 2011. This measure improves upon earlier scholarship that uses numerical superiority. However, this analysis is difficult to replicate across years for the reasons noted above. Because of this, and because the use of numerical superiority biases against our hypothesis as previously described, we do not

likely because states *believe* their opponent would be willing to use their nuclear arsenal, even over a relatively nonessential issue. This belief requires subjective measurements about the reputations and leaders of nuclear states. These factors vary between states, years, and crises, making accurate, systematic measurement difficult.

1.2 Asymmetric Crises

An inferior state's ability to demonstrate resolve is different when states' nuclear arsenals are of vastly different sizes. When one state is vastly superior, the inferior side likely faces an existential risk from escalating or backing down. This regularity follows from work by James Fearon, which concludes that high-capability defenders are likely to be challenged on low-stakes issues, while low-capability defenders are likely to be challenged on high-stakes issues (Fearon 1994). Perhaps counter-intuitively, an inferior state in an asymmetric dyad is therefore likely to respond to a crisis with demonstrations of resolve that can effectively deter a superior opponent. The implications of this observation have largely been missed in the current literature on nuclear superiority.

Consider a state facing a crisis against a vastly superior nuclear adversary with only a small negative consequence associated with conceding to the superior power's demands. In such a situation, a crisis should not emerge, since the vastly inferior state should anticipate the existential consequences of noncompliance. However, if the stakes for the vastly inferior state were very high—such as if its territory or sovereignty were threatened by inaction—then the state may be willing to resist its opponent and risk nuclear escalation. Thus superiority affects selection into crises.

Despite having a vastly inferior arsenal, the fact that the inferior state possesses nuclear weapons allows it to credibly threaten to inflict significant damage. If the vastly inferior state were nonnuclear, the costs of escalation to the superior state may not be high enough for this strategy to work.[7] In a nuclear dyad, however, a vastly inferior state can impose

use Early and Asal's NAT index as a way of measuring superiority in this paper.

7. As a result, the theory does not necessarily apply to non-nuclear states. For more on crises between

significant costs if escalation occurs—even if it cannot impose reciprocally severe costs.

Because the risk of nuclear conflict is only worthwhile for a vastly inferior state if the payoff of successful deterrence is significant, asymmetric crises should typically involve existential stakes for the inferior side. Therefore, the vastly inferior state should take risks rather than make concessions. Simply put, states who are fighting for their continued existence will accept a higher risk of nuclear war than states fighting over low-stakes issues.

For example, consider the 2009 U.S.-North Korea crisis, which began with a North Korean underground nuclear test in May 2009, followed by the imposition of sanctions against North Korea in UNSC Resolution 1874. The costly sanctions and accompanying ratcheting up of tensions with the United States posed a direct threat to North Korea and its nuclear deterrent—the only thing, in many North Korean leaders' minds, keeping the country safe from U.S. military intervention or regime change efforts. In exchange for dismantling the program, the United States could offer sanctions relief, not an end to its regime change policy. In fact, the United States would have been unable to credibly commit to reverse this policy even if it wanted to, given that dismantling Pyongyang's nuclear program would increase the United States' relative power and encourage a preventive regime change operation before North Korea could re-arm.

Thus, while the actual threat to North Korea appeared economic—from sanctions—the true threat was an existential risk to the survival of the regime. Concerned, North Korea was forced to take dramatic measures to demonstrate its resolve and deter the United States. North Korea responded with a satellite launch, which was a critical test of missile technology essential to the robustness of the North Korean nuclear deterrent. The launch successfully demonstrated North Korea's resolve, and while North Korea was unable to coerce the United States into dropping the sanctions, it was also able to deter any additional U.S. efforts. While the United States would have suffered less than North Korea if the situation escalated to nuclear war, the United States still would have suffered significant costs to military assets

nuclear and non-nuclear states, see Appendix H.

and citizens in the Asia-Pacific region. Yet, because of U.S. superiority, the United States' core interests were not threatened. It therefore acted in risk-adverse manner. The costs threatened by North Korea, although smaller than the costs threatened by the United States, discouraged the United States from reciprocating North Korea's escalatory action. Because North Korea credibly demonstrated its resolve, the crisis ended in a stalemate and the status quo persisted.

As this illustrates, an inferior nuclear state facing an existential threat can demonstrate sufficient resolve to deter a superior opponent. Therefore, vastly inferior states can prevent opponents from winning crises, even if they cannot necessarily *compel* superior opponents. Because asymmetric crises are unlikely to emerge unless the core interests of the vastly inferior state are threatened, superiority shouldn't provide an advantage when the arsenal disparity between competing states is large.

Bell and Macdonald 2019 offers an alternative, suggesting there may be far greater incentives for counterforce operations by the superior state and "use them or lose them" pressures for the inferior state in asymmetric circumstances. This, in turn, could increase the likelihood of a nuclear exchange in asymmetric crises relative to symmetric ones and thereby increase the utility of nuclear superiority in asymmetric cases. This is because superiority is more valuable as the likelihood of a nuclear exchange increases, as the utility of superiority is related to the ability to limit damage in a nuclear war and minimize an opponent's retaliatory capabilities. This theory, however, does not consider the endogeneity of stakes to the balance of power.

The proposition that the stakes of a crisis may be able to moderate the effects of nuclear superiority is certainly not new. The side facing a graver threat has been theorized to be more likely to prevail (Kroenig 2013, 145). The literature to date, however, has found little empirical evidence to this end. Kroenig, for example, finds no evidence that the threat level of a nuclear crisis[8] impacts the outcome (Kroenig 2013, 2018). Kroenig does find that

8. Threat level is as coded by the International Crisis Behavior (ICB) database. Here, threats to geopolitical influence are considered more severe than threats to political leadership or territorial sovereignty, but

proximity to the crisis location is associated with a higher chance of victory, but he finds no evidence that the effect of nuclear superiority is conditional on proximity. Fuhrmann and Sechser, using the Militarized Compellent Threat dataset (MCT), account for whether a threat is made over leadership or territory in contrast to lower-stakes issues like economic policy. They find no evidence that the balance of stakes impacts outcomes (Sechser and Fuhrmann 2013).

In this previous work, however, 'grave threats' are conceptualized as exogenous to the nuclear balance, when, in fact, comparative capabilities are an essential element of the threat states face. Therefore, nuclear superiority shapes the stakes of a crisis; the stakes will be low in symmetric crises and high in asymmetric ones. High stakes facilitate demonstrations of resolve that can deter superior opponents. This theory has an important observable implication: states with superior nuclear arsenals should be unlikely to win crises—and vastly inferior states should be very unlikely to lose crises—when the disparity between their arsenal size and their opponent's arsenal size is large.

2 Empirical Analysis

We provide evidence for our theory in two stages. First, we provide descriptive statistics on crises in the International Crisis Behavior (ICB) dataset, showing superiority does not lead to victory at high levels of arsenal disparity. Second, we use statistical tests to show superiority is counterproductive in asymmetric crises. In these crises, inferior states are able to prevent superior opponents from achieving their goals.

2.1 The Nuclear Balance and Crisis Outcomes

We must both assess the impact of nuclear superiority at high levels of disparity and investigate whether inferior states face high stakes. We test our theory using crisis data

we argue such threats are generally existential for vastly inferior nuclear states.

from the ICB dataset, which includes 24 unique crises and 9 unique actors.[9] Every nuclear state except South Africa appears in our dataset.[10] Data on the approximate sizes of states' nuclear arsenals are taken from Kristensen and Norris 2015. ICB codes a victory if a state achieves its goals; since not all goals are mutually exclusive, crises can have multiple or no winners. We categorize data according to the level of arsenal disparity within a dyad.

Table 1 depicts all crises in our dataset. The first column presents the crisis-dyad, with the superior state listed first. The second column records the ratio between the nuclear arsenals of the states. The third column presents an approximation of the stakes experienced by the inferior state in the dyad. We use two datasets for this coding. The first is the ICB dataset, which codes crises in terms of their gravity. We code threats that are political, territorial, threats of grave damage, and threats to existence as high-stakes. We consider threats to influence, economic threats, and limited military threats as low-stakes issues. We also use MCT, which contains a subset of the ICB cases where compellence was used (Sechser 2011). MCT notes whether the compellent threat at the core of the crisis was about a political or territorial issue, which we consider high-stakes, or whether the crisis was about lower-stakes issues, such as economic issues. The table also lists crisis outcomes.[11]

As our theory predicts, asymmetrically inferior states often have high stakes and prevent their superior opponents from achieving victory. If we consider asymmetric superiority to require an arsenal 50 times larger than the inferior state, then every time an inferior state in an asymmetric crisis-dyad had high stakes, the superior state failed to achieve its goals. Moreover, the inferior state had high stakes in all but one asymmetric crisis.[12]

9. The dyadic structure of the ICB data presents a limitation. See Appendix D.

10. South Africa is omitted only because, according to ICB, it does not experience any crises with other nuclear states during the years in which it possesses nuclear weapons.

11. All outcomes are determined by ICB, which has no U.S. outcome coding for Taiwan Straits IV. We code U.S. victory, following Kroenig (2013). ICB also has no U.S. outcome coding for Able Archer or U.S.S.R. outcome coding for Cienfuegos or Nicaragua MiGs-21S. In these cases, Kroenig codes each actor as 'not achieving its goals.' We follow this convention.

12. Complications with the Berlin Wall crisis explain this anomaly. First, the data includes only crises between nuclear-armed states, and while France had conducted its first nuclear test by 1961, it had 0 weapons in its arsenal when the crisis occurred. Whether France counts as a nuclear power at this time is therefore debatable. Second, the crisis occurs because of a Soviet demand for the United States and its allies to withdraw from West Berlin. While the Soviet Union may have had nuclear superiority over France

We find that asymmetrically inferior states are more likely to win a crisis than asymmetrically superior states. Asymmetrically superior states are more likely to lose than to win. They typically end up in stalemates, draws, and compromises. Nuclear superiority appears to provide no advantage as the degree of superiority gets very large. States with asymmetric nuclear superiority over their opponents fail to achieve their crisis objectives more often than they accomplish them.

This contradicts both the predictions of scholars who argue nuclear superiority provides strategic advantages—as they would expect superiority to be more helpful as the disparity in arsenal sizes increases[13]—and the predictions of scholars who argue nuclear superiority is insignificant[14]—as they would not expect nuclear superiority to have a positive correlation with victory in crises at low levels of arsenal size disparity. We also directly contradict Bell and Macdonald 2019, which anticipates superiority to provide more of an advantage in asymmetric crises than symmetric crises.[15] Instead, we find high stakes allow asymmetrically inferior states to credibly demonstrate resolve and thereby deter opponents.

If we relax our conception of asymmetry to instead require a nuclear ratio of 30, we still find that asymmetrically inferior states with high stakes successfully prevent a superior victory in all cases, and we find that inferior states have high stakes in three-fourths of crises. In addition, when asymmetrically inferior states have low stakes, their crisis involvement can be explained by alliances. We can further relax our definition of asymmetry to require a much smaller nuclear ratio, such as 5, 3, or 2, and we still find that in at least half of cases, the inferior state has high stakes and the superior state does not succeed.[16]

on its own, the French decision to remain in West Berlin was made in coordination with the other powers occupying Berlin (Schick 1971). At the time of the crisis, the United States had nearly 10 times as many nuclear weapons as the Soviet Union. Third, while the crisis is coded as a victory for the Soviet Union, it may more properly be considered a stalemate. The resolution of the crisis occurred when Khruschev withdrew his demand and the Soviet Union erected the Berlin Wall (Zubok 1993). Successful coercion would have resulted in a French withdrawal, as the Soviets had originally demanded.

13. See Kroenig 2013, Kroenig 2018, and Early and Asal 2014.

14. See Jervis 1984, Blechman and Powell 1982, and Sechser and Fuhrmann 2013.

15. While this is an implication of other work on superiority, e.g. Kroenig 2013, it is made explicit in Bell and Macdonald 2019, which also suggests limited utility to superiority in many types of symmetric crises.

16. Later, we test all possible thresholds. Higher thresholds should bias against our argument, since greater degrees of inferiority make states less able to threaten significant damage on their opponents.

Table 1: Vastly inferior states have high stakes in their crises and prevent superior states from achieving victory.

Crisis-Dyad (Superior vs. Inferior)	Nuclear Ratio	Inferior Stakes	Outcome
Afghanistan Invasion (U.S.S.R. vs. U.S.)	1.1	Low	Superior Victory
Kaluchak (Pakistan vs. India)	1.1	High (ICB)	No Victory
War in Angola (U.S. vs. U.S.S.R.)	1.4	Low	Inferior Victory
Able Archer Exercise (U.S.S.R. vs. U.S.)	1.5	Low	No Victory
Nicaragua MIG-21S (U.S.S.R. vs. U.S.)	1.6	Low	No Victory
Yom Kippur War (U.S. vs. U.S.S.R.)	1.8	Low	Superior Victory
India Parliament Attack (India vs. Pakistan)	2.0	High (ICB, MCT)	Superior Victory
Cienfuegos Submarine Base (U.S. vs. U.S.S.R.)	2.2	Low	Superior Victory
Kargil (India vs. Pakistan)	2.6	Low	Superior Victory
India/Pakistan Nuclear Tests (India vs. Pakistan)	3.3	Low	No Victory
Kashmir 1990 (India vs. Pakistan)	3.4	High (ICB)	No Victory
Six Day War (U.S. vs. U.S.S.R.)	3.7	Low	Superior Victory
Congo II (U.S. vs. U.S.S.R.)	5.9	Low	Superior Victory
Cuban Missile Crisis (U.S. vs. U.S.S.R.)	8.2	High (ICB)	Superior Victory
Berlin Wall (U.S. vs. U.S.S.R.)	9.8	Low	Inferior Victory
Suez Nationalization (U.S. vs. U.S.S.R.)	10.8	Low	Superior Victory
Berlin Deadline (U.S. vs. U.S.S.R.)	11.3	High (ICB)	No Victory
Taiwan Straits (U.S. vs. China)	27.4	High (ICB, MCT)	Superior Victory
Suez Nationalization (U.S.S.R. vs. U.K.)	28.4	High (ICB)	Superior Victory
Berlin Deadline (U.S.S.R. vs. U.K.)	39.5	Low	No Victory
Berlin Wall (U.S.S.R. vs. U.K.)	49.4	Low	Superior Victory
Korean War (U.S. vs. U.S.S.R.)	73.8	High (ICB, MCT)	Inferior Victory*
Sino-Soviet Border (U.S.S.R. vs. China)	210.8	High (ICB, MCT)	No Victory
North Korea Satellite Launch (U.S. vs. North Korea)	511.3	High (ICB)	No Victory
North Korea Nuclear 2006 (U.S. vs. North Korea)	758.3	High (ICB)	No Victory
Yom Kippur War (U.S.S.R. vs. Israel)	1224.2	High (ICB)	No Victory
War of Attrition (U.S.S.R. vs. Israel)	1455.4	High (ICB)	No Victory
Six Day War (U.S.S.R. vs. Israel)	4169.5	High (ICB)	Inferior Victory
Berlin Wall (U.S.S.R. vs. France)	∞	Low	Superior Victory

2.2 Quantitative Analyses

Using the ICB data, we analyze the effect of superiority on the probability of victory in crises. The unit of analysis is the crisis-directed-dyad, and there are 58 observations. The outcome variable in each observation identifies whether 'Side A' achieved victory. Winning a crisis is determined by whether or not a state achieves its objectives, and there are many conditions–draws, stalemates, or compromises–that can cause crises to end without a victor. Additionally, crises are not zero-sum, meaning it is possible for both states to emerge victorious. We test the effect of nuclear superiority on victory, meaning we are comparing victory to cases in which both states lose as well as cases in which the inferior state wins. This accurately reflects our theory. We predict asymmetrically inferior states will gain a *deterrent* advantage, not a *compellent* advantage, meaning that they are more likely to win *or* draw.[17]

While previous quantitative work on nuclear crises ends in 2001 (Beardsley and Asal 2009; Kroenig 2013, 2018), ICB has since been extended. This allows us to include more cases. We add three nuclear crises that occurred between 2001 and 2010: the Kaluchak terrorist attack in 2002, the North Korean Nuclear Test in 2006, and the North Korean satellite launch in 2009.[18]

Previous scholarship has investigated the effects of symmetry and asymmetry using the nuclear ratio as the independent variable. While advocates of nuclear superiority would suspect that, as the ratio increases, the likelihood of victory should also increase, we perform a series of robustness checks that reveal the nuclear ratio does not have a clear, consistent effect on crisis outcomes or militarized interstate dispute outcomes.[19]

Using the nuclear ratio to test our theory is not ideal. The distribution of the nuclear ratio is bimodal, rather than normal, violating a crucial assumption for the validity of a

17. We group draws, stalemates, and compromises.

18. ICB also includes one U.S.-North Korea crisis and one India-Pakistan crisis up to 2015, but information on national material capabilities, a control variable, was not available past 2012.

19. See Appendix G.

regression model. Moreover, because there are so few observations, at any given level of the nuclear ratio, the model is extrapolating heavily to make a prediction. Therefore, we construct a dichotomous measure that captures changes in the degree of superiority. Using this measure, we find states with the highest levels of superiority rarely achieve victory.

Specifically, we construct a separate binary indicator of superiority for each nuclear ratio threshold that changes the number of observations that are coded as asymmetrically superior. At each threshold, within a given dyad, one state can be coded as asymmetrically superior and the other as asymmetrically inferior, or both states can be coded such that neither has asymmetric superiority over the other. When two opponents possess arsenals roughly equivalent at a particular threshold, we consider their arsenals symmetrical. To illustrate, consider an asymmetric superiority threshold of 1.5, where a state with more than 1.5 times as many nuclear weapons as its opponent is coded as asymmetrically superior. The other state will be coded as asymmetrically inferior. During the Yom Kippur War, for example, the United States possessed an arsenal that was about 1.78 times the size of the Soviet Union's arsenal. For the U.S.-U.S.S.R. dyad in the Yom Kippur War, the United States is asymmetrically superior at the 1.5 threshold and the Soviet Union is asymmetrically inferior. When the threshold is changed to 2, however, both states are coded as symmetric. To test our argument, we need to identify the effects of nuclear superiority at various definitions of what makes a crisis asymmetric. Although we purport that asymmetry requires a high threshold, we test all possible definitions of asymmetry to validate this claim.[20]

For each new, distinct coding of asymmetric superiority, we use a logit model to estimate the effect of asymmetric superiority in comparison to asymmetric inferiority on crisis outcomes. We control for conditions of symmetry in each of the models, so that asymmet-

20. See Appendix I for the nuclear ratio in every crisis. High thresholds bias against the empirical implications of our theory and reflect situations in which inferior states can neither leverage reciprocal repercussions nor hope to seriously harm adversaries' ability to retaliate against a nuclear first strike. Our measurement strategy circumvents issues associated with the use of simple arsenal size to operationalize nuclear superiority. When arsenals are similarly sized, components such as targeting, delivery methods, and nuclear strategy can affect which state has the more capable nuclear arsenal. These elements are less important, however, when the superior state has many times more nuclear weapons than the inferior state.

ric inferiority is the base category. In all models, following Kroenig 2013, we control for *proximity*[21], regime type[22], *material capabilities*[23], *population* size[24], the level of *violence* in the crisis[25], and *security*.[26] We also control for *second-strike* capability, measured by whether a state possesses submarine-launched ballistic missiles (SLBMS), mobile missiles, or nuclear-armed aircraft on continuous airborne alert.[27]

We do not control for stakes, since we expect this to be endogenous to the nuclear balance.[28] We posit that high stakes is the result of having asymmetric nuclear inferiority and that asymmetrically inferior states are able to credibly signal resolve because of high stakes. Our theory therefore suggests stakes is post-treatment, and including this variable in the model would therefore produce bias (Rosenbaum 1984; Angrist and Pischke 2008). Furthermore, we cannot directly test the interaction of asymmetric inferiority and high stakes because there is no meaningful variation. In all cases in our data, with the exception of France in the Berlin Wall crisis, asymmetrically inferior states have high stakes, as we would predict.

The results, displayed in Figure 1, suggest asymmetric nuclear superiority has a positive, significant effect on the probability of victory when the threshold is set at 1 or 1.5. However, when the threshold increases, the significant effect mostly disappears. This means that when the superior state in a crisis has a nuclear arsenal slightly larger than the inferior state's arsenal, the superior state tends to win. However, when the superior state has an arsenal more than 1.5 times as large as the inferior state's arsenal, the superior state is no

21. Proximity is a binary variable measuring which state the geographic location of the crisis is closer to

22. See Marshall et al. 2010.

23. This ratio assesses relative capabilities using the Correlates of War composite capabilities index, described in Singer et al. 1972, version 3.02.

24. See Singer et al. 1972, version 3.02.

25. This is a four point ordinal variable drawn from the ICB dataset that ranges from 1 (no violence) to 4 (full-scale war).

26. This is the average number of crises State A experiences per year, from Beardsley and Asal 2009.

27. We define second-strike capability in the same way as Kroenig (Kroenig 2013, 157). We include all states with nuclear-capable submarines, but this may overstate when the Soviet Union acquired a secure second-strike capability, because early Soviet nuclear submarines were likely not sufficient. However, this approach biases against our theory, which expects second-strike capability will be positively associated with the likelihood of victory, meaning even small arsenals can deter.

28. See Appendix B for a model with stakes as a control.

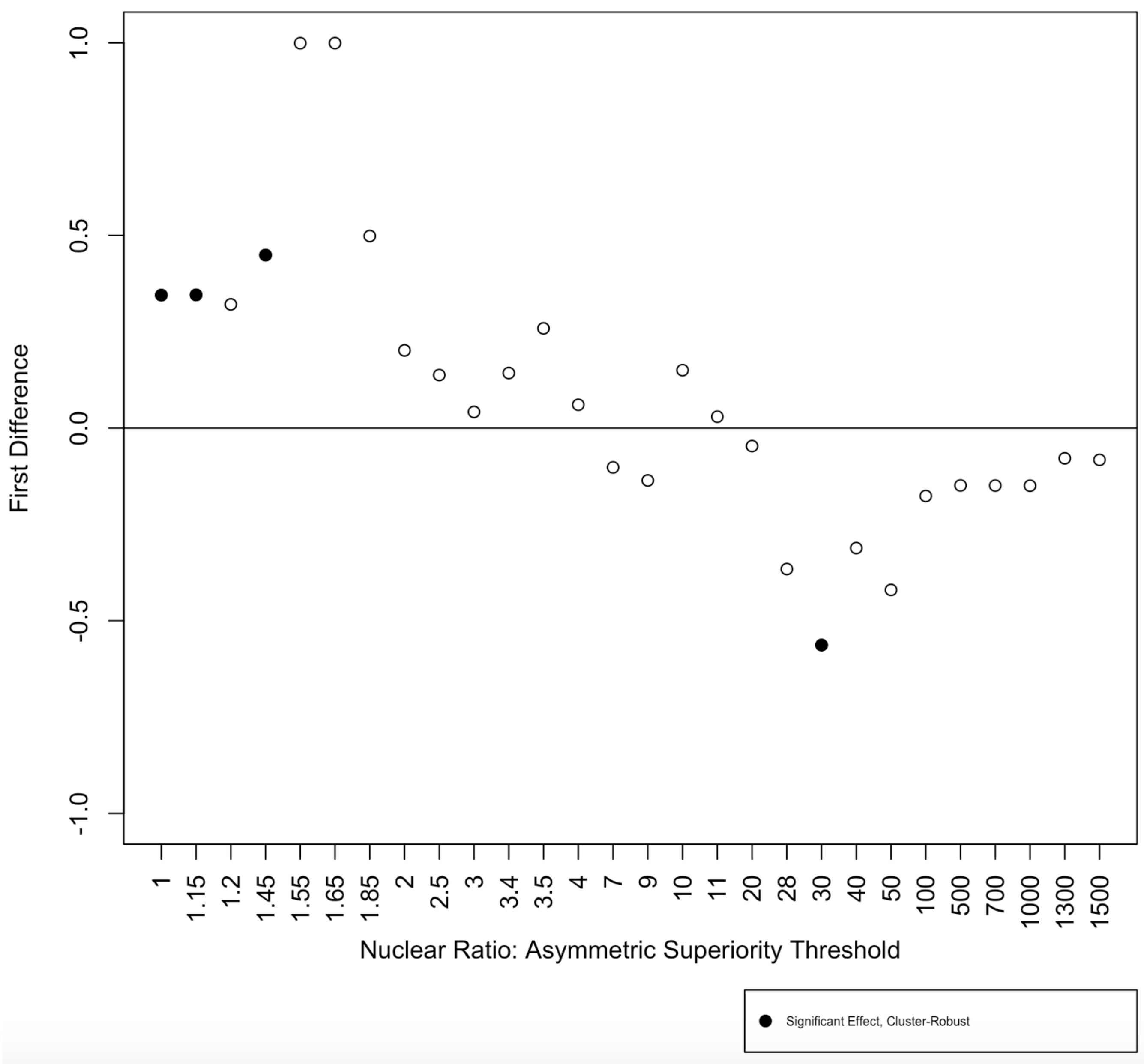
longer more likely to win. At even higher thresholds, nuclear superiority generally does not provide a meaningful strategic advantage and may even be a disadvantage. This evidences our theory.

Interestingly, the effect of conventional military capabilities is positive and significant in models where asymmetric superiority is coded at a threshold of 18 or above. Conventional superiority appears to matter more when nuclear superiority matters less. The second-strike capability control variable always has a positive, significant effect. *Security* has a negative, significant effect in all but the first model, where the threshold for asymmetric superiority is having at least one more nuclear weapon. *Proximity* and *violence* have positive, significant effects in all but two of the models.[29] *Regime type* is positive and significant and *population* is negative and significant, in a few models, but there is no consistent pattern between the threshold and whether these variables are significant.[30]

29. Proximity is insignificant at the 1.55 and 1.65 thresholds, and violence is insignificant at the 7 and 9 thresholds.

30. Because each figure represents the findings of dozens of models, we do not include the full models in the interest of space.

Figure 1: Difference in Probability of Victory for Superiority vs. Inferiority



Furthermore, the relationship between asymmetric superiority and victory becomes negative when the necessary threshold is more than 20 times the size of the opponent's arsenal. This negative relationship is only significant, according to cluster-robust standard errors,[31] when asymmetric superiority is defined as having at least 28 times as many nuclear weapons as an opponent. Sandwich estimators for dyadic data, however, are not valid if there are fewer than 50 base countries (Aronow et al. 2015). However, N is only 9 in our data. As a robustness check, we implement a non-parametric approach from Erikson et al. 2014 that uses randomization inference to estimate standard errors for dyadic data. Randomization tests do not rely on any assumptions about the distribution of the underlying data, but instead on the exchangeability of the errors, which is a much weaker assumption than the independent and identically distributed assumption traditional significance tests require. This test evaluates the "sharp null" that nuclear superiority has no effect on the outcome of a nuclear crisis. Figure 2 reports the first differences in the probability of victory, with the significance determined by randomization inference.[32] In keeping with the results in Figure 1, we find that asymmetric superiority has a significant, positive effect on crisis outcomes for most thresholds up to 1.55 but not for thresholds above that level.[33] We find that asymmetric superiority often has a significant, negative association with victory when the threshold is relatively high: at least more than 30 times the size of the opponent's arsenal.

We find that having more nuclear weapons than one's opponent—though not more than 1.5 times as many weapons—provides a strategic advantage. The positive effect of nuclear superiority uncovered in previous work is therefore being driven by cases where states have arsenals that are fewer than 1.5 times larger than their opponents' arsenals. Nuclear superiority may provide some advantage to slightly superior states—although we do not test any

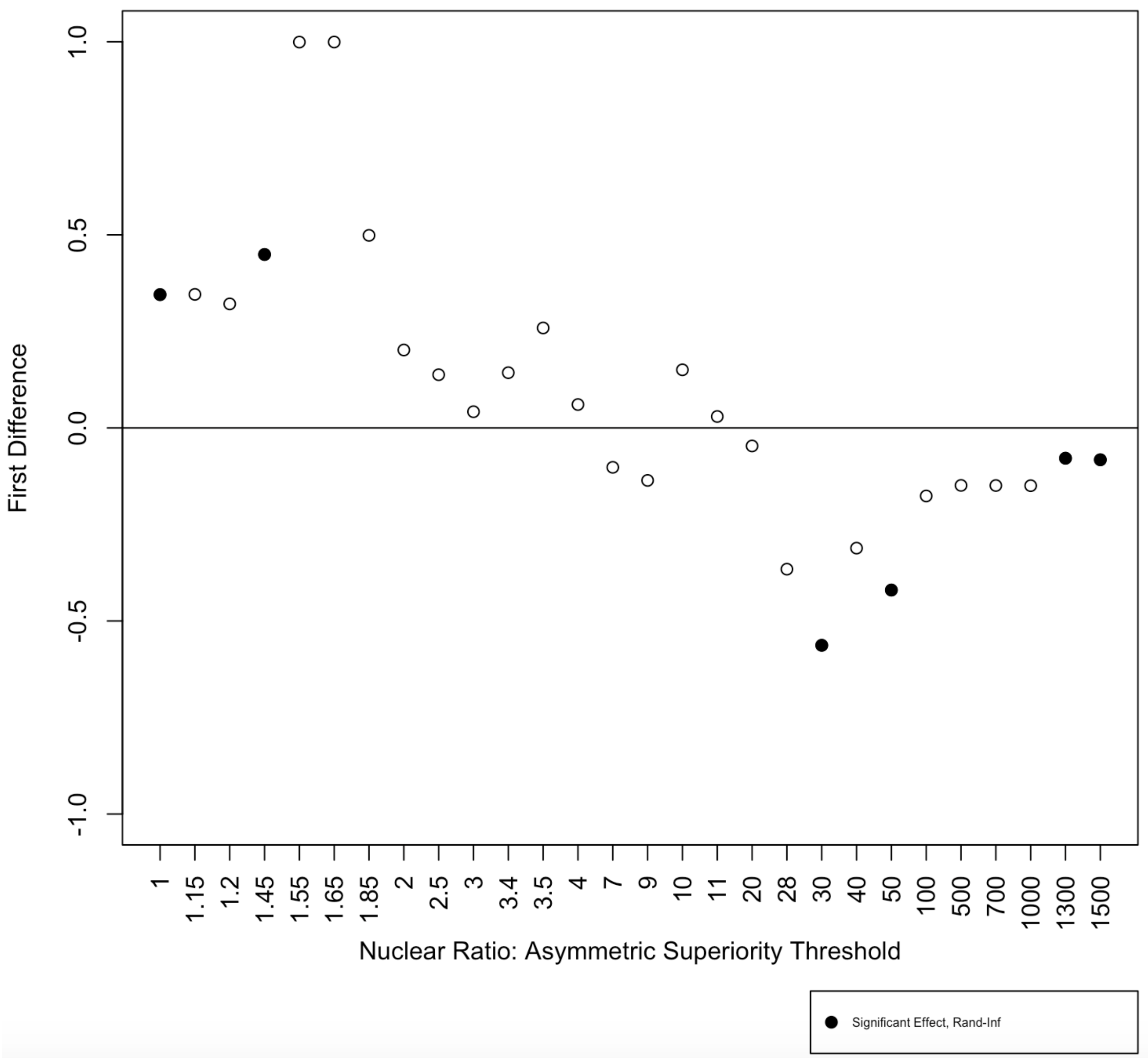
31. We cluster by crisis-dyad.

32. In the randomization inference procedure, we control for the same variables as when we assessed significance with cluster-robust standard errors. We only randomize asymmetric superiority. Therefore, we do not use the randomization inference procedure to assess the significance of any controls.

33. Due to the small sample size, perfect separation occurs in some iterations. We discard these iterations. We perform 10,000 simulations in our procedure, so even when we discard iterations, there are still thousands of simulations that form the basis of our calculation. There are never more than 200 simulations to be discarded.

mechanisms for why this might be the case—but superiority provides no advantage or poses a disadvantage in crises against states with much smaller arsenals.

Figure 2: Difference in Probability of Victory, Significance Via Randomization Inference



To assess robustness, we re-estimate our models with amended codings for the outcomes of the Korean War and the Berlin Wall crisis,[34] as well as the codings used in Kroenig's work (Kroenig 2013, 2018), which differ from the ICB codings.[35] We also estimate a version of our models that drops the France-U.S.S.R. dyads in the Berlin Wall crisis.[36] The main results persist. Regardless of whether we use cluster-robust standard errors or randomization inference, we find that asymmetric nuclear superiority provides no advantage and may even have a negative effect on the probability of victory when there is a vast discrepancy between opponents' arsenal sizes.

We also estimate our main models using asymmetric inferiority as the primary independent variable instead of asymmetric superiority.[37] In this case, asymmetric superiority becomes the reference category. This allows us to assess the prediction that the probability of victory for the inferior state increases as the disparity between the arsenal sizes of the states in the dyad increases. This robustness test is useful because victory is not zero-sum in our dataset. We find that, at low thresholds of the nuclear ratio, inferior states are more likely to lose crises. However, inferior states do have an advantage at larger arsenal size disparities. The probability of victory for the inferior state increases as the disparity between arsenal sizes increases. These findings match our theoretical predictions.

We also test a simpler binary measure of superiority, where superiority is the condition where one state possesses a second-strike capability and a nuclear arsenal at least thrice the size of its opponent's. This reflects a stylized standardization of the capabilities presumed to be sufficient confidence that one can adequately damage an opponent's nuclear arsenal in a first strike or can respond to a second strike. This operationalization reflects the fact that nuclear targeting often assigns multiple nuclear weapons per target.[38] It also recognizes nuclear strategists have long emphasized the necessity of survivable capabilities that ensure

34. See Appendix E.
35. See Appendix F.
36. See Appendix C.
37. See Appendix A.
38. In damage estimates, Kroenig 2018 presumes states would assign up to three nuclear weapons per target.

retaliatory abilities. Using both logit models and randomization inference models, with and without the inclusion of a measure of stakes, and using both the original ICB outcome measures and the re-coded versions from Kroenig 2013, we find no effect of superiority on the likelihood of victory.[39]

Our tests confirm our theory. We find that, while nuclear superiority may help states win crises when their nuclear arsenals are only slightly larger than their opponents', it does not provide the same advantage over opponents with much smaller arsenals. In the most asymmetric crisis-dyads, the superior state is more likely to lose the crisis. We argue this is because inferior states in asymmetric crises are highly threatened; they face a nuclear risk from escalating, but they also cannot back down in response to very credible threats against their core interests. This difficult position has a silver lining. It allows the inferior state to successfully demonstrate resolve in a way that would not be credible in a lower-stakes scenario. With this, inferior states can persuade vastly superior opponents not to continue escalating. Superior opponents will be unwilling to risk nuclear exchange. In this way, asymmetry provides inferior states with a way to counter superior opponents. Our findings support this and are robust to a number of specifications, including tests designed specifically to account for the small number of cases.

2.3 Case Studies

This logic is evident in our motivating U.S.-North Korea cases. This dyad is clearly asymmetric, with North Korea having less than 100 nuclear weapons and the United States having thousands. This asymmetry is considered a key obstacle to North Korean denuclearization (Tan and Park 2020). At the core of recent crises between the United States and North Korea is a commitment problem involving tensions over the future of the North Korean nuclear program and regime. Because the United States cannot credibly commit to refrain from a regime change policy, North Korea cannot commit to disarm. Backing down

39. See Appendix J.

to U.S. threats isn't an option, as doing so would pose an existential threat to the North Korean regime. Pyongyang is therefore left with the option of an offensive strategy, using threats and provocations to signal its resolve in an attempt to deter the United States from taking further actions. Nuclear asymmetry motivates North Korea's escalatory behavior. And the strategy works. Despite having a comparative advantage, the consequences of nuclear escalation on the Korean Peninsula are far too great for the United States to bear. As a result, credible signals of resolve by North Korea are often sufficient for deterrence, despite a comparative lack of capabilities.

We illustrate for our theory using two hard cases: the asymmetric crises of the Korean War (U.S.-U.S.S.R.) and the Yom Kippur War (U.S.S.R.-Israel). In the Yom Kippur War, whether Israel faced high stakes is unclear. The crisis was not ultimately over Israel's most core territory, although Israel may have feared it would be, and the ICB dataset does not code Israel as having 'grave' stakes in the crisis. The Korean War is a difficult case because the role of the Soviet Union in the crisis is debated. There is also some disagreement about the outcome. ICB codes the Korean War as a victory for the inferior state, but Kroenig re-codes it as a stalemate (Kroenig 2013). However, in either coding, the inferior state did not lose the crisis, in keeping with our predictions.

The Soviet Union had high stakes in the Korean War. This occurred in the Soviet Union's backyard, while the Korean Peninsula is far from the United States. The Soviet government's investment in Korea was longstanding, and Korea was seen as important for protecting Soviet territory. A report sent to negotiators at the Potsdam conference noted:

> "Korean independence must be effective enough to prevent Korea from being turned into a staging ground for future aggression against the U.S.S.R. not only from Japan, but also from any other power that would attempt to put pressure on the U.S.S.R. from the east. The surest guarantee of the independence of Korea and the security of the U.S.S.R. in the Far East would be the establishment of friendly and close relations between the U.S.S.R. and Korea." (Zhihua 2000)

Access to Korea also meant access to the Pacific, which Stalin considered vital. The Soviet Union had relied on its 1945 agreement with China for access to a warm-water port in Manchuria, which it viewed as strategically valuable. After the Chinese Community Party's victory, the treaty was renegotiated, and negotiations over the 1950 version of the treaty resulted in a Soviet agreement to withdraw from its port at Lushun. With access to Lushun in jeopardy, continued access to Korea became even more valuable. Evidence suggests Stalin was worried that if the Soviet Union didn't support North Korea, the relationship with China would sour, posing a great risk to Soviet stability (Weathersby 1993). These motives meant that Korea was a vital Soviet security interest.

The Soviet Union's high stakes contributed to its ability to demonstrate resolve. When the Soviets intervened, the United States believed Moscow would be willing to use nuclear weapons to protect their regional interests (Friedman 1975; Pollack 2017; Gaddis 2006). This belief deterred the United States from escalating to nuclear use in Korea, although the option was considered (Crane 2000). Although some scholars have argued that the settlement of the war resulted from U.S. nuclear threats, other scholars have demonstrated that these threats were viewed with skepticism and resisted by both the Soviets and Chinese (Friedman 1975; Foot 1988). Nuclear escalation in Korea would have had devastating consequences for the United States, despite the fact that the Soviet arsenal was, at the time, smaller than the U.S. one.

Similarly, Israel was able to avoid losing to the Moscow during the 1973 Yom Kippur War despite the asymmetric superiority of the Soviet nuclear arsenal. The U.S. and Soviet nuclear arsenals were fairly symmetric at the time, with the United States having about 28 thousand nuclear warheads and the Soviet Union having about 16 thousand. In comparison, Israel had an arsenal of approximately 150 weapons (Kristensen and Norris 2015).

In the 1973 Yom Kippur War, Egypt and Syria, backed by the Soviet Union, attempted to regain territory lost to Israel during the 1967 conflict. While these territorial demands may not appear existential on their face, if Israel lost the Sinai and the Golan Heights, the small country would be highly vulnerable to further conquest by either Egypt or Syria in the future (Kumaraswamy 2013). Indeed, Israel has long viewed the loss of the Golan Heights as one "which might develop into an existential threat" (Inbar 2007). Both Egypt and Syria opposed the existence of Israel, so neither country could credibly commit not to exploit their relative power gain if Israel were to give up territory. Neither could Israel count on conventional military capabilities to successfully deter future incursions into its territory, since Egypt and Syria were both backed by the more-powerful and nuclear-armed Soviet Union. Thus, Israel faced potentially existential consequences.

Yet, throughout the crisis, Israel bid up the risk of conflict with the Soviet Union. After reversing initial Arab gains, Israel went on the offensive, despite the fact that all seven Soviet airborne divisions were on high alert. The Israelis crossed the Suez Canal and began seizing Egyptian territory on the other side of the waterway, which led the Soviets to consider intervening if the Israelis did not stop their onslaught (Rabinovich 2007; Golan 1990; Israelyan 2010). In response, the Soviets put their forces on high alert. The CIA may even have received intelligence that the Soviets moved nuclear warheads into the region (Scherer 1978).

Fearing that continued Israeli advances might prompt Soviet intervention or ultimately result in nuclear escalation, the United States stepped in, putting their own forces on nuclear alert and stepping up efforts to end the crisis (Scherer 1978; Sagan 1995). A stalemate emerged when the United States increased pressure on Israel to agree to ceasefire negotiations in exchange for, as Nixon called it, "an offer [Israel] couldn't refuse," consisting of further military support and promised assistance in the ceasefire negotiations (Scherer 1978, 10). The Americans stepped in because of concern that Israeli aggression would cause an out-of-control escalation spiral; Washington reportedly provided the Israelis with evidence of a planned Soviet intervention in order to persuade them to come to the negotiating table.

As the United States had promised, in the ceasefire agreement, Israel was not forced to give up the territory it had gained during the 1967 war. The United States made it a goal to be sure the Israelis did not suffer any clear defeat (Sagan 1979). Israel's risk had paid off. It was able to defend its territory, resisting demands from Arab neighbors to return the Sinai and Golan Heights, all despite the risks of nuclear escalation by the Soviet Union. Israel's credible signals of resolve invoked U.S. intervention and secured backing at ceasefire negotiations that enabled Israel to keep its territory intact. Our analysis of these cases shows that in high-stakes, asymmetric crisis-dyads, inferior states can successfully leverage nuclear arsenals against superior opponents. Asymmetrically inferior states can credibly demonstrate resolve and bid up the risk of nuclear conflict. This can deter superior adversaries, allowing inferior states to avoid losing. We bolster this conclusion with descriptive data on ICB crises as well as statistical analyses showing nuclear superiority does not provide an advantage in asymmetric crises.

3 Conclusion

Previous scholarship focuses on the relationship between nuclear superiority and advantages in deterrence or compellence. It does not address how varying degrees of superiority may impact these factors. We introduce important nuance by showing the relationship between nuclear superiority and crisis outcomes depends on the size of the disparity between states' nuclear arsenals.

Specifically, we argue brinksmanship and crisis escalation operate differently in symmetric and asymmetric dyads. The low-level and low-stakes nature of symmetric crises makes it difficult for either side to credibly signal resolve to escalate to the nuclear level, making stalemates likely. But inferior states have an advantage in asymmetric crises. In these cases, threats to inferior states' core interests are credible, and superior states cannot credibly commit to exercise restraint. An asymmetrically inferior state would not allow a disagreement to escalate to a crisis if acquiescing to the superior state's demands did not pose an severe threat. Because they face significant consequences should they back down, inferior states in asymmetric dyads must risk escalating in order to demonstrate resolve and deter more-powerful opponents. The significant consequences associated with acquiescing to threats lends credibility to these demonstrations of resolve.

We evidence this theory in three ways. First, descriptive statistics show our main hypotheses hold in nearly all nuclear crises in the ICB data. Second, quantitative analyses show the probability of superior states' victory decreases as the arsenal disparity relative to inferior states increases. Third, we illustrated how asymmetrically inferior states in several crises—those between the United States and North Korea as well as in the Korean War and Yom Kippur War—have been able to resist their superior opponents.

These findings have important policy implications. We find an upper limit to the potential benefits of nuclear superiority. This poses a dilemma for the United States, which has significant concerns about asymmetric nuclear opponents. For example, the United States' current major nuclear security concerns are North Korea, a highly asymmetric opponent, and a potential Iranian nuclear arsenal, which would also be vastly inferior to U.S. nuclear assets. Even China's nuclear arsenal is nearly 19 times smaller than the United States'. Although the United States often approaches these adversaries as if it had a clear deterrent advantage, our findings suggest that a 'big stick' may not be sufficient. Our results indicate U.S. nuclear superiority will provide no advantage if disagreements with these highly asymmetric adversaries escalate to full crises. Therefore, policies meant to contribute to a larger nuclear arsenal—like perennial propositions on the resumption of nuclear testing—may not be the right strategy with respect to many pressing and ongoing security concerns.

References

Angrist, Joshua D, and Jörn-Steffen Pischke. 2008. *Mostly harmless econometrics: An empiricist's companion.* Princeton University Press.

Aronow, Peter M., Cyrus Samii, and Valentina A. Assenova. 2015. "Cluster–Robust Variance Estimation for Dyadic Data." *Political Analysis* 23 (4): 564–577.

Beardsley, Kyle, and Victor Asal. 2009. "Winning with the Bomb." *Journal of Conflict Resolution* 53, no. 2 (April): 278–301.

Bell, Mark, and Nicholas Miller. 2015. "Questioning the Effect of Nuclear Weapons on Conflict." *Journal of Conflict Resolution* 59 (1): 74–92.

Bell, Mark S, and Julia Macdonald. 2019. "How to Think About Nuclear Crises (February 2019)." *Texas National Security Review.*

Betts, Richard. 1987. *Nuclear Blackmail and Nuclear Balance.* Brookings Institution.

Blechman, Barry M., and Robert Powell. 1982. "What in the Name of God Is Strategic Superiority?" *Political Science Quarterly* 97 (4): 589–602.

Brodie, Bernard. 1945. "The Atomic Bomb and American Security." *Yale Institute of International Studies Memorandum,* no. 18.

Bundy, McGeorge, George F. Kennan, Robert S. McNamara, and Gerard Smith. 1982. "Nuclear Weapons and the Atlantic Alliance." *Foreign Affairs* 60 (4): 753.

Crane, Conrad C. 2000. "To avert impending disaster: American military plans to use atomic weapons during the Korean War." *The Journal of Strategic Studies* 23 (2): 72–88.

Deudney, Daniel, and G. John Ikenberry. 1992. "Who Won the Cold War?" *Foreign Policy,* no. 87, 123.

Early, Bryan R, and Victor Asal. 2014. "Nuclear weapons and existential threats: Insights from a comparative analysis of nuclear-armed states." *Comparative Strategy* 33 (4): 303–320.

Erikson, Robert S., Pablo M. Pinto, and Kelly T. Rader. 2014. "Dyadic Analysis in International Relations: A Cautionary Tale." *Political Analysis* 22 (4): 457–463.

Fearon, James D. 1994. "Signaling versus the balance of power and interests: An empirical test of a crisis bargaining model." *Journal of Conflict Resolution* 38 (2): 236–269.

Foot, Rosemary J. 1988. "Nuclear coercion and the ending of the Korean conflict." *International Security* 13 (3): 92–112.

Friedman, Edward. 1975. "Nuclear blackmail and the end of the Korean War." *Modern China* 1 (1).

Gaddis, John Lewis. 2006. *The Cold War: A new history.* Penguin.

Glaser, Charles. 2014. *Analyzing Strategic Nuclear Policy.* Princeton University Press.

Golan, Galia. 1990. *Soviet Policies in the Middle East: From World War Two to Gorbachev.* Vol. 2. CUP Archive.

Green, Brendan Rittenhouse. 2020. *The Revolution that Failed: Nuclear Competition, Arms Control, and the Cold War.* Cambridge University Press.

Huth, Paul, and Bruce Russett. 1984. "What makes deterrence work? Cases from 1900 to 1980." *World Politics* 36 (4): 496–526.

Inbar, Efraim. 2007. *Israel's national security: issues and challenges since the Yom Kippur War.* Routledge.

Israelyan, Victor. 2010. *Inside the Kremlin During the Yom Kippur War.* Penn State Press.

Jervis, Robert. 1979. “Why Nuclear Superiority Doesn’t Matter.” *Political Science Quarterly* 94 (4): 617–633.

———. 1984. *The Illogic of American Nuclear Strategy.* Cornell University Press.

Kaiser, Karl, Georg Leber, Alois Mertes, and Franz-Josef Schulze. 1981. “Nuclear Weapons and the Preservation of Peace.” *Foreign Affairs* 60.

Kristensen, Hans, and Robert Norris. 2015. “Global nuclear weapons inventories, 1945–2013.” *Bulletin of Atomic Scientists* 69 (5).

Kroenig, Matthew. 2013. “Nuclear Superiority and the Balance of Resolve: Explaining Nuclear Crisis Outcomes.” *International Organization* 67, no. 1 (January): 141–171.

———. 2018. *The Logic of American Nuclear Strategy: Why Strategic Superiority Matters.* Bridging the gap. New York, NY: Oxford University Press.

Kugler, Jacek, and Frank C Zagare. 1990. “The long-term stability of deterrence.” *International Interactions* 15 (3-4): 255–278.

Kumaraswamy, Prasanna R. 2013. *Revisiting the Yom Kippur War.* Routledge.

Lieber, Keir, and Daryl Press. 2006. “The Rise of US Nuclear Primacy.” *Foreign Affairs* 85.

Lieber, Keir A, and Daryl G Press. 2020. *The myth of the nuclear revolution: power politics in the atomic age.* Cornell University Press.

Marshall, Monty, Keith Jaggers, and Ted Robert Gurr. 2010. “Polity IV Data Series Version 2010.” *College Park, MD: University of Maryland. Retrieved from http://www. systemicpeace. org/polity/polity4. htm,* 1–16.

McDonough, David. 2013. *Nuclear Superiority: The New Triad and the Evolution of American Nuclear Strategy.* Routledge.

Pollack, Jonathan D. 2017. *No Exit: North Korea, nuclear weapons, and international security.* Routledge.

Rabinovich, Abraham. 2007. *The Yom Kippur War: The epic encounter that transformed the Middle East.* Schocken.

Rosenbaum, Paul R. 1984. "The consequences of adjustment for a concomitant variable that has been affected by the treatment." *Journal of the Royal Statistical Society: Series A (General)* 147 (5): 656–666.

Rosenberg, David Alan. 1983. "The Origins of Overkill: Nuclear weapons and American strategy, 1945-1960." *International Security* 7 (4).

Sagan, Scott. 1979. "Lessons of the Yom Kippur Alert." *Foreign Policy,* no. 36, 160–177.

———. 1995. *The limits of safety: Organizations, accidents, and nuclear weapons.* Princeton University Press.

Sagan, Scott, and Kenneth Waltz. 2003. *The Spread of Nuclear Weapons: A Debate Renewed.* WW Norton New York.

Scherer, John L. 1978. "Soviet and American Behavior during the Yom Kippur War." *World Affairs* 141 (1): 3–23.

Schick, Jack M. 1971. *The Berlin Crisis, 1958-1962.* University of Pennsylvania Press Philadelphia.

Sechser, Todd S. 2011. "Replication data for: Militarized Compellent Threats, 1918-2001."

Sechser, Todd S., and Matthew Fuhrmann. 2013. "Crisis Bargaining and Nuclear Blackmail." *International Organization* 67 (1).

Singer, J. David, Stuart Bremer, John Stuckey, et al. 1972. "Capability distribution, uncertainty, and major power war, 1820-1965." *Peace, war, and numbers* 19 (48): 427.

Snyder, Glenn, and Paul Diesing. 2015. *Conflict Among Nations: Bargaining, decision making, and system structure in international crises.* Princeton University Press.

Tan, Erwin, and Jae Jeok Park. 2020. "The US-North Korean asymmetrical security dilemma: Past the point of nuclear no return?" *International Area Studies Review,* 2233865920918508.

Trachtenberg, Marc. 1985. "The influence of nuclear weapons in the Cuban missile crisis." *International Security* 10 (1).

Treverton, Gregory F. 1988. "Book Review Essay: Danger and Survival: Choices About the Bomb in the First Fifty Years by George McBundy." *Foreign Affairs* 68:178.

Weathersby, Kathryn. 1993. *Soviet Aims in Korea and the Origins of the Korean War, 1945-1950: New Evidence from Russian Archives.* Vol. 8. Cold War International History Project, Woodrow Wilson International Center …

Zhihua, Shen. 2000. "Sino-Soviet relations and the origins of the Korean War: Stalin's strategic goals in the Far East." *Journal of Cold War Studies* 2 (2): 44–68.

Zubok, Vladislav Martinovich. 1993. *Khrushchev and the Berlin crisis (1958-1962).* Vol. 6. Cold War International History Project, Woodrow Wilson International Center.