Conflicts that Leave Something to Chance

Forthcoming, International Organization

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Abstract

The development of nuclear weapons added a new dimension to conventional conflict: the possibility that it could inadvertently escalate into a nuclear exchange. How does this relationship between conventional war and nuclear escalation shape deterrence? I present a formal model of deterrence and arming. The novelty here is that investing in conventional capabilities has a direct effect on the balance of power and an indirect effect on conflict duration and the likelihood of an accidental nuclear exchange. I find that introducing the risk of nuclear escalation may require greater conventional force postures for deterrence, thus lowering welfare in the absence of nuclear war. I also find the nuclear era will be more peaceful, but when conflicts occur, they may be more aggressive and decisive. These results (and others) offer insight into the difficulty of substituting nuclear weapons for conventional arms, and into the Soviet response to the 1956 Hungarian Revolution.

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> "*Discussions of troop requirements and weaponry for NATO have been much concerned with the battlefield consequences of different troop strengths and nuclear doctrines. But the battlefield criterion is only one criterion, and when nuclear weapons are introduced it is secondary. The idea that European armament should be designed for resisting Soviet invasion, and is to be judged solely by its ability to contain an attack, is based on the notion that limited war is a tactical operation. It is not. What that notion overlooks is that a main consequence of limited war, and potentially a main purpose for engaging in it, is to raise the risk of larger war.*"
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> — Thomas C. Schelling, *Arms and Influence*, 1966

1 Introduction

The defining feature of international politics since 1945 has been the absence of direct great power conflict.[1] To explain this historical anomaly, some scholars classify this "long peace" as the "nuclear peace," where the fear of a nuclear exchange prevents significant conflict among great powers.[2] How the nuclear peace functions in practice is subtle. It is not as if states can credibly deter all revisionist behavior through the threat of a nuclear first strike. After all, unless it is facing an existential threat, no state would ever intentionally launch a strategic nuclear strike against an opponent with a credible second strike capability, as doing so would be tantamount to suicide. And, the existence of nuclear weapons does not prevent states from fighting conventional wars over non-existential issues. In theory, states with nuclear weapons could forgo them and fight conventional conflicts with one another, just as they did before the advent of nuclear weapons. Instead, what preserves the nuclear peace is the threat of unintended escalation.[3] In the nuclear era, any conventional conflict is unstable and could accidentally or inadvertently escalate to a nuclear exchange. Proponents of the nuclear peace suggest that the near absence of large-scale, direct conventional conflict between nuclear states stems from a new and unsettling reality: conventional conflicts now carry the risk of escalating uncontrollably to a nuclear exchange.[4]

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[1] Gaddis 1986.

[2] Waltz 1981; Bueno de Mesquita and Riker 1982; Mearsheimer et al. 2001.

[3] Schelling 1960; Schelling 1966; Powell 2015.

[4] Snyder 1965; Jervis 1976; Schelling 1966; Powell 2015.

While the nuclear peace can be rationalized within the current theoretical framework connecting conventional conflict to nuclear escalation, other salient features of the nuclear era are more difficult to understand. Scholars have theorized that the nuclear era should be a period of limited wars and restraint, where deterrence becomes easier to achieve.[5] Yet the nuclear peace has come at exceptionally high cost. During the Cold War, both the Warsaw Pact and NATO spent enormous sums on conventional capabilities every year (in absolute terms) preparing for a conventional assault by their opponents.[6] Despite predictions that the nuclear era should be a period of restraint, no state in the Cold War expected its opponents to actually use such restraint, and they armed themselves accordingly. Additionally, while there have undoubtedly been instances of nuclear-armed states exhibiting restraint in crises (e.g., the Kargil War), the Soviet Union also showed little restraint in repressing revolutionary movements within its sphere of influence in Eastern Europe, despite the possibility of Western intervention. What then explains the nuclear era, where peace largely persists between nuclear powers, there is an extensive conventional force buildup, and international crises can feature either restraint or aggressive military maneuvers?

To better understand state behavior in the nuclear era, we must follow Schelling's insight: conventional force posture shapes both the conventional balance of power and the risk of a nuclear war. In this paper, I model a deterrence setting between two states in a crisis over an asset. The asset in dispute is important to the two actors, but not important enough for either state to deliberately launch a strategic nuclear first-strike to deny an opponent the asset (i.e. this is not a matter of existential importance). Instead, states may be willing to engage in a conventional conflict over the asset, but unlike in traditional deterrence models, this scenario introduces a particular danger: the risk that the conflict could accidentally or inadvertently escalate into a strategic nuclear exchange, capturing the essence of brinkmanship.[7]

Using this model, I establish two key theoretical results. First, I find that increasing the risk of inadvertent nuclear escalation may require states to increase or decrease their spending on conventional forces for deterrence, compared to what they would spend in a world without

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[5] Snyder 1965; Waltz 1981; Bueno de Mesquita and Riker 1982; Mearsheimer 1984; Mearsheimer 1990; Powell 2015.

[6] Facer 1985; Karber and Combs 1998; Gaddis 2005.

[7] Carter 2010; Gurantz and Hirsch 2017; Spaniel 2019b; Yoder 2019b; Baliga, Bueno de Mesquita, and Wolitzky 2020; Di Lonardo and Tyson 2022.

nuclear weapons. Why? By introducing the possibility that a conventional conflict could escalate into a nuclear exchange, all actors fare worse in a conventional-but-now-potentially-nuclear conflict. In cases where imposing costs on a challenger is essential for deterrence, increasing nuclear risk makes a (now risky) conventional war worse for the challenger, thereby allowing a defender to deter a challenger with lower levels of conventional arming. For the purpose of imposing costs on a challenger, nuclear risks reinforce conventional force postures. However, in cases where deterrence hinges on a defender's willingness to escalate in response to a challenge, increasing nuclear risks makes a conventional war worse for the defender, thereby requiring a defender to arm more to be willing to escalate. For the purpose of keeping a defender motivated to fight, nuclear risks can undermine the deterrent threat from a conventional force posture. In contrast to other writing on the matter,[8] this latter result suggests that credibly remains an issue in extended deterrence in the nuclear era.

Second, I find that actors in the nuclear era will sometimes demonstrate restraint, while at other times they will act more aggressively and decisively than they otherwise would. This duality can be explained based on the logic of how nuclear risk is generated within a conventional conflict. Conventional conflicts could become strategic nuclear exchanges through accidents, decentralized decision-making, or inadvertent escalation.[9] Across all these mechanisms, the time spent in conflict is critical. When conflicts between nuclear powers are short and decisive, there are fewer opportunities for unintended escalation leading to a nuclear exchange; if a conventional conflict in the nuclear era is a war of nerves similar to "rocking the boat",[10] then the shorter the time spent rocking, the less likely actors are to get soaked. Nuclear risk incentivizes actors to take steps that will make a conflict more decisive, which can lead to more or less aggressive force postures (whichever leads to shorter conflicts).

To the best of my knowledge, these two theoretical results are new. However, findings like these are only valuable insofar that they explain real world behavior that the existing state-of-the-art theories cannot rationalize. The finding that nuclear risk may incentivise actors to act more decisively in a conflict offers insight into the Soviet repression of the 1956 Hungarian Revolution and recent (2019) Indian activity in Kashmir. In both cases, rather than act with

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[8] Waltz 1990.

[9] Sagan 1994; Posen 2014.

[10] Schelling 1966.

restraint as past research would predict,[11] actors took decisive actions to quickly resolve the conflicts; the theory here suggests that these actors may have behaved more aggressively to avoid the nuclear risks of becoming mired in a protracted conflict. And, the finding that nuclear risk does not always compliment conventional forces offers insight into the challenges the Eisenhower Administration faced attempting to replace an expansive conventional force posture with strategic nuclear weapons, and why the West relied on nuclear risks for the defense of West Germany while avoiding nuclear risks in the Vietnam War.

This paper identifies a series of other results. It offers a new formal theoretical grounding for the nuclear peace. It offers some additional support for (and qualifiers to) the stability–instability paradox. It describes how increasing nuclear instability can (perversely) lead to more instances of deterrence failure. It discusses how aspects of the nuclear revolution beyond strategic nuclear weapons—like tactical nuclear weapons—shape our understanding of deterrence. And it establishes how, in an incomplete-information environment, using conventional force posture to signal resolve can lead to fewer instances of conflict and a lower risk of a nuclear exchange relative to signaling with nuclear risk (as examined by Powell[12]).

This paper is related to others that consider crises where multiple levels of conflict are feasible.[13] The key difference here is that, because this paper considers accidental or inadvertent nuclear escalation, escalation from the lower (conventional) to higher (nuclear) level is probabilistic. This paper is most similar to work by Powell,[14] which also considers nuclear risk stemming from a conventional conflict. However, Powell applies a different theoretical grounding to how nuclear risk is generated, and his results generally suggests that actors will behave with restraint; this means that Powell can explain cases like the Kargil War, but not the Hungarian Revolution and India's recent activity in Kashmir (as discussed further below). Additionally, this paper is naturally related to the topic of nuclear proliferation,[15] but here it is already established that both sides possess a nuclear capability.

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[11] Powell 2015.

[12] Powell 2015.

[13] Lanoszka 2016; McCormack and Pascoe 2017; Spaniel and Malone 2019; Baliga, Bueno de Mesquita, and Wolitzky 2020; Kenkel and Schram 2021; Guenther and Musgrave 2022; Joseph 2023; Gibilisco 2023.

[14] Powell 2015.

[15] Bas and Coe 2016; Lanoszka 2018; Spaniel 2019a; Mehta and Whitlark 2018; Mehta and Whitlark 2021.

2 On Conventional Force Posture, Conventional Conflict, and Nuclear Risk

I assume that there is a non-monotonic (increasing-then-decreasing) relationship between the defender's conventional force posture and nuclear escalation risk. To summarize, this structure rests on three key relationships: (1) increases in the defender's conventional posture can increase or decrease force parity with the challenger; (2) longer conventional conflicts occur when the sides' capabilities are more balanced; and (3) nuclear escalation risk increases with conflict duration. Together, these imply that increasing one's conventional force posture could make conflict more or less decisive, which could lead to less or more nuclear risk (respectively).

Adding conventional forces can increase or decrease military parity. This first relationship is mechanical. Adding conventional forces can narrow the gap between two sides if the defender's capabilities approach the challenger's, or widen it if the defender's capabilities surpass the challenger's.

Closer military parity between actors results in longer conflicts. If military parity is low, then a decisive war or a rapid surrender is more plausible. On the other hand, if militaries are more evenly matched, then neither side has an immediate reason to stop fighting. Because closely matched militaries will trade battle victories and defeats, war between them will be less informative or less clearly decisive, which will incentivize them to continue fighting. This logic is illustrated in a series of theoretical models,[16] and is echoed by empirical findings.[17][18]

Longer conflicts generate a greater likelihood of a nuclear exchange. Conventional conflicts could escalate to a nuclear exchange through several mechanisms. First, it could arrive entirely through accident. In any complex system, including missile detection or early warning systems, system failures are possible.[19] When states are at war, there is heightened risk that a faulty signal could be interpreted as an act requiring a nuclear response.[20] Nuclear escala-

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[16] Smith 1998; Filson and Werner 2002; Langlois and Langlois 2012; Slantchev 2004.

[17] Bennett and Stam 1996; Bennett and Stam 2009; Slantchev 2004; Krustev 2006; Chiba and Johnson 2019.

[18] This result does not always hold (Bueno de Mesquita, Koch, and Siverson 2004).

[19] Sagan 1994; Sagan and Waltz 2003; Perrow 2011.

[20] Sagan 1994.

tion could also arise through the course of conventional conflict operations. Whether through mechanical error (a malfunctioning GPS), human error (misread maps), agency problems, or the fog of war, sometimes soldiers or operators take actions beyond what a rational, unitary decision-maker would want, which could make a crisis over an auxiliary issue seem existential and necessitate escalation.[21] Also, in a protracted conventional war, states may target their opponent's communication or command-and-control infrastructure, which could inadvertently undermine the targeted state's second-strike capability, endangering nuclear escalation.[22][23] While these risks are typically ascribed to newer nuclear states, all states implement some degree of decentralized decision making within crises or conflicts that can result in some risk of accidental escalation.[24] Recent research suggests this dynamic may be further exacerbated by how states respond to cyber capabilities and vulnerabilities.[25]

Across all these different ways a conventional conflict could turn nuclear, time is an underlying factor. When conventional conflicts between nuclear powers are short and decisive, there are fewer chances or reasons for system failures, overambitious operations, or the targeting of command-and-control infrastructure. But as conflicts become protracted, the likelihood of errors leading to a strategic nuclear exchange increases. Taking these considerations together, if a defender's force posture ensures a swift, one-sided conflict, then the risk of nuclear escalation is low.[26] But if the defender's force posture lends itself to a prolonged conventional conflict, then there will be greater risk of a nuclear exchange.

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[21] Sagan 1994; Posen 2014; Lin-Greenberg 2023.

[22] Posen 2014.

[23] In the logic of mutually assured destruction, an actor on the verge of losing its second-strike capability might undertake dramatic, escalatory steps in an attempt to degrade its opponent's first-strike capability and preserve its own second-strike capability.

[24] Feaver, Sagan, and Karl 1997; Sagan and Suri 2003.

[25] Bahney and Sopher 2023; Schneider, Schechter, and Shaffer 2023.

[26] Alternate setups where a more significant first strike carries a greater risks of nuclear escalation or where rapid decision making leads to greater escalation risks should be explored in future research.

3 Model

3.1 Game Form and Assumptions

Two players, a challenger (C) and a defender (D), are in a deterrence game with complete information. The game order is as follows.

1. D selects a conventional force posture (or arming level) $p \in [p_0, p_1]$, which denotes is D's likelihood of winning in a conventional conflict. I assume $0 < p_0 < p_1 < 1$.[27]

2. C selects whether to challenge or not.[28] If C does not challenge, the game ends with C receiving payoff 0 and D receiving payoff $v_D - K(p)$, where $K : \mathbb{R}_+ \to \mathbb{R}_+$ is D's costs from the conventional force level. I assume $K(p_0) = 0$, and K is continuous and increasing in p. If C does challenge, the game moves to the next stage.

3. D selects whether to acquiesce or escalate to conflict. If D acquiesces, C receives payoff v_C and D receives payoff $-K(p)$. If D escalates to conflict, then both states receive their conflict payoffs (described below).

I include the game form in Figure 1.

Conflict is a reduced-form, stochastic process that will end in one of three outcomes: C wins a conventional victory, D wins a conventional victory, or there is a catastrophic nuclear exchange. Because actors do not "move" within the conflict, conflict duration and outcome will be shaped by endogenous selections (in p) and several exogenous hazard rates, which characterize the likelihood of a given conflict outcome occurring at any point in time.[29] I let variable t denote time, and, if D chooses to escalate, then conflict starts with $t = 0$.

Let $n \geq 0$ denote the hazard rate for the termination of the conflict through a nuclear exchange. Essentially, n represents the "nuclear instability" of a conflict; n takes on greater values when C

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[27] While substantively we might expect the gap between p_0 and p_1 to be small, the results will hold for any p_0 and p_1 satisfying the inequality.

[28] Similar to Powell (2015), only one side (here D) can arm. It C could arm, this would sometimes undermine the results discussed in the Remarks. See the Appendix for a further discussion.

[29] Put another way, I am not treating conventional conflict as a continuous-time, war-of-attrition-type game like in Nalebuff (1986). This assumption should be relaxed in future research, but the hazard rate structure is still included here to allow for flexibility in conflict costs and risk *vis a vis* conflict duration.

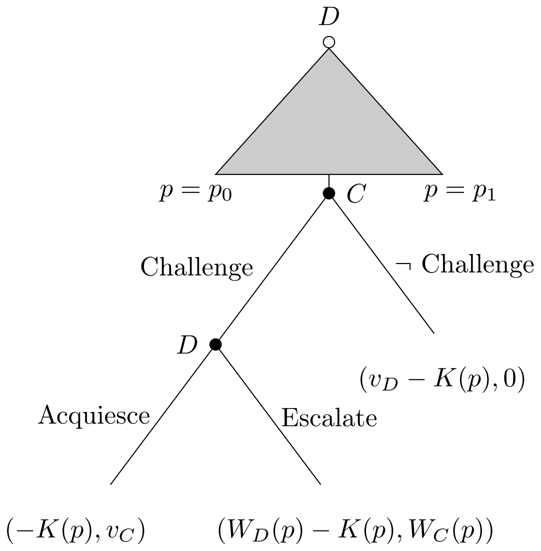

Figure 1: The game tree

or D are more accident prone,[30] have decentralized or automated the nuclear launch decision,[31] have a more expansive nuclear arsenal, are fighting near critical nuclear infrastructure,[32] or, for the conflict below the level of a strategic nuclear exchange, are using tactical nuclear weapons. The case when $n = 0$ is particularly significant: it reflects a scenario with no risk of nuclear escalation, representing conflict prior to the nuclear revolution. Following the logic discussed in Section 2, I let $\frac{\alpha}{p(1-p)}$ denote the hazard rate for the termination of conflict through conventional means. The choice variable p was defined above; for conflicts between lopsided adversaries ($p \approx 0$ or $p \approx 1$) the hazard rate is large, which is consistent with one-sided conventional conflicts ending quickly.[33] The parameter $\alpha > 0$ scales the hazard rate for conflict ending conventionally relative to the hazard rate for conflict ending with a nuclear exchange. Together, this means that $h(p) = n + \frac{\alpha}{p(1-p)}$ is the hazard rate for conflict ending in the next unit of time, $n/h(p)$ is the likelihood that conflict ends in a nuclear exchange, $\frac{\alpha}{h(p)p(1-p)}$ is the likelihood that conflict ends conventionally, and $\frac{1}{h(p)}$ is the expected time to conflict termination.

If the game ends with a nuclear exchange, D's and C's expected payoffs are $-N_D < 0$ and $-N_C < 0$, respectively. If the conflict ends conventionally, D wins with probability p, and C

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[30] Sagan 1994.

[31] Feaver, Sagan, and Karl 1997; Schneider, Schechter, and Shaffer 2023.

[32] Posen 2014.

[33] Slantchev 2004; Bennett and Stam 2009.

wins with probability $1-p$. Similar to Powell,[34] because there is no repeated play, p can most cleanly be thought of as mobilization levels within a crisis, but could also be interpreted as long-term investments in deterrence of an area.[35] Regardless how conflict ends, by fighting, actors accrue conventional conflict costs at the rate $c_D \geq 0$ and $c_C \geq 0$, respectively.

C's expected utility from conflict is

$$W_C(p) = \frac{n}{h(p)} * (-N_C) + \frac{\alpha}{h(p)p(1-p)}((1-p)v_C) - \frac{c_C}{h(p)},$$

and D's expected utility—without considering arming costs $K(p)$—is

$$W_D(p) = \frac{n}{h(p)} * (-N_D) + \frac{\alpha}{h(p)p(1-p)}(pv_D) - \frac{c_D}{h(p)}.$$

Figure 2 illustrates the likelihood of a nuclear exchange and D's expected utility without arming costs (without $K(p)$), from a conflict for a range of possible p's under one set of parameters. First, consider the likelihood of nuclear exchange (the solid line in the figure). For small or large conventional arming levels ($p \approx 0$ and $p \approx 1$), $h(p)$ becomes large and $h(p)p(1-p)$ becomes small; thus, when the conventional arming level leads to an unbalanced or one-sided conventional conflict, there is little risk of a nuclear exchange ($\frac{n}{h(p)}$ is smaller) and there is a greater likelihood of the conflict ending conventionally ($\frac{\alpha}{h(p)p(1-p)}$ is greater). In a more balanced conventional conflict ($p \approx \frac{1}{2}$), there is greater risk of nuclear exchange and a (relatively) lower likelihood the game ends with a conventional victory or defeat.

Now consider D's payoff from conflict without arming costs (the dashed line). As p increases from 0 to roughly 0.35, the conflict becomes more protracted, and the increasing risks of a nuclear exchange reduce D's payoff. Then, for p values greater than 0.35, the defender continues becoming more likely to win the conflict, and the nuclear risk increases more slowly and then eventually decreases; together, this means D's utility switches to increasing in p until reaching p_1. Note that the non-monotonicity in utility follows from this parameter set; while D's fighting utility will always be increasing for $p \geq 0.5$, the payoff from fighting could be increasing over

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[34] Powell 2015.

[35] There are some caveats to treating this as long-term deterrence; to the extent that force posture can be scaled quickly in response to a crisis, then interpreting p as long-term investment is less precise.

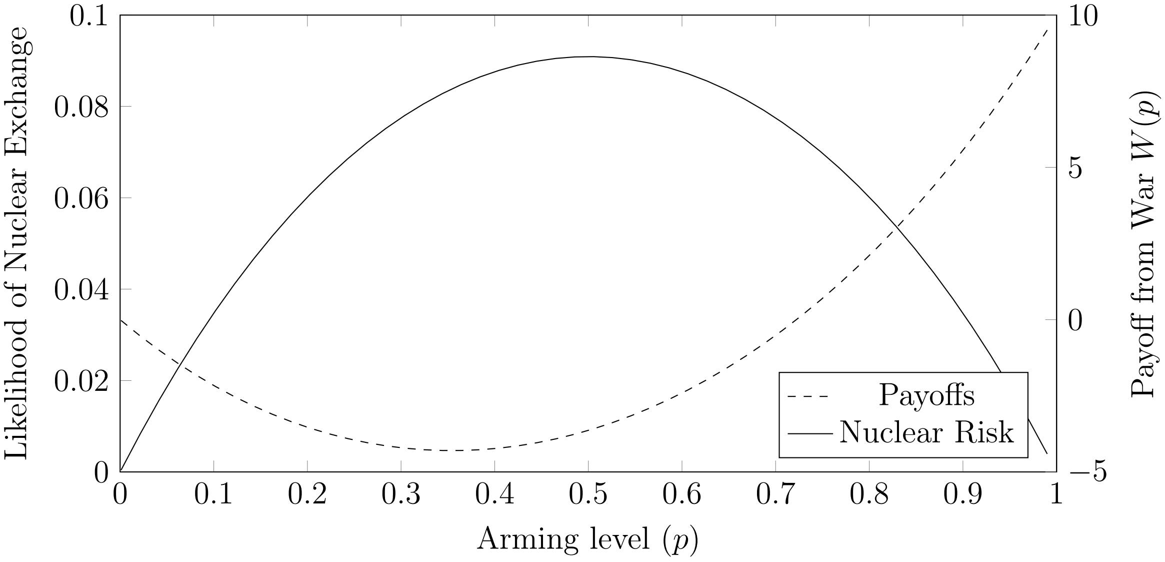

Figure 2: Nuclear risk and payoffs with the costs of arming excluded. Parameters for this figure (and all other figures) are in the Appendix.

the full range under alternate parameters.[36]

3.2 Comments on Model Assumptions

This is a deterrence model.[37] The model setup is most similar to Powell,[38] but differs in two key respects. First, in the model presented here, nuclear risk in a conventional conflict is determined indirectly through the defender's arming level. In Powell, the defender is able to directly manipulate the level of nuclear risk within a conventional war without altering its likelihood of winning in the conventional war. Second, Powell finds that adding conventional forces to a conflict always increases the risk of escalation. Unlike this model, Powell does not consider that a swift and decisive deployment might reduce the likelihood of a nuclear exchange by preventing a prolonged conflict. Naturally, these different assumptions lead to different results from Powell, as highlighted throughout the paper; for more details on this, see the Online Appendix.

This paper also has benefited from decades of iterations of models of nuclear deterrence.[39] I

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[36] For example, for $n \approx 0$ and a low enough c_D, then increasing p strictly increases D's utility from fighting for all $p \geq p_0$.

[37] See Powell 2015, Gurantz and Hirsch 2017, Di Lonardo and Tyson 2022, Baliga, Bueno de Mesquita, and Wolitzky 2020, and others.

[38] Powell 2015.

[39] Schelling 1960; Nalebuff 1986; Zagare and Kilgour 1993; Powell 1989; Powell 2003; Bahney and Sopher

will not cite the entire set of studies on nuclear deterrence but refer readers to several excellent reviews.[40] Additionally, the model integrates features from the formal literature on endogenous transgressions and deterrence.[41] Of course, nearly every model cited above considers only two types of outcomes: war and peace. This paper is related to a new branch of research considers conflict that can be more multifaceted.[42]

Important scope conditions apply to the results. The model is well suited to describe crises between two nuclear-armed states, where the crisis is over not-existentially-important issues: in this model, actors cannot launch a strategic nuclear missile when faced with the prospect of an opponent seizing the asset. Instead, the model can capture settings where there actors are willing to escalate to conventional conflict with nuclear risks. It encompasses scenarios with low nuclear risk, such as Cold War crises in Eastern Europe,[43] as well as higher-risk conflicts, like those involving newer nuclear states (e.g., Pakistan, India, or North Korea), where missteps in nuclear command and control are more likely. Additionally, as a special case, the model can also describe crises where conventional conflict generates no nuclear risk, as it was in the era before nuclear weapons were developed (formally, $n = 0$). That said, the model cannot describe every crisis during the Cold War, including the Second Taiwan Strait Crisis (where China did not possess a nuclear weapon) and the Cuban Missile Crisis (where nuclear escalation risk was generated outside of conflict).

4 Equilibrium

D's initial arming selection will shape how D and C behave, ultimately leading to three different equilibrium paths. First, D could not arm, resulting in C challenging, D acquiescing, and C getting the asset. Second, D could arm to deter C, resulting in D holding on to the asset. And third, D could arm to a level where C and D will fight.

For D to deter C, D must select a conventional force level where two conditions hold: (a) D

2023.

[40] See Jervis 1979a, Huth 1999, Quackenbush 2011 and Gartzke and Kroenig 2016.

[41] Fearon 1997; Debs and Monteiro 2014; Gurantz and Hirsch 2017.

[42] Tarar 2016; Powell 2015; Lanoszka 2016; Coe 2018; Yoder 2019a; Spaniel 2019a; Baliga, Bueno de Mesquita, and Wolitzky 2020; Schram 2021a; Schram 2021b.

[43] Sagan and Suri 2003; Posen 2014.

must be willing to fight when challenged, and (b) C knows that fighting D is sufficiently bad for it. These two conditions function as constraints that must be satisfied for deterrence to hold. When condition (a) is met, D has selected force posture that satisfies their *war participation constraint*, meaning that D has selected a force posture at or beyond the minimum level where D would be willing to fight if challenged. Formally, this is any p greater than or equal to p^D, where[44]

$$p^D = 1 - \frac{\alpha v_D}{c_D + nN_D}.$$

To remain willing to fight when challenged, D must select greater conventional force postures p^D if c_D, N_D, and n increase, and α and v_D decrease. Why? As some intuition, increasing c_D, N_D, and n all increase the costs from war, decreasing α makes the nuclear outcome option more likely, and decreasing v_D makes D value the asset less; faced with these changes, D would only be willing to fight if D wins the asset with higher likelihood, necessitating an increased p.

For deterrence condition (b) to be met, D must select a force posture that meets C's *war cost constraint*, which is a sufficient defensive force posture where C's costs from going to war outweighs C's benefits from challenging. Formally, this is any p greater than or equal to p^C,[45] which satisfies

$$p^C = \frac{\alpha v_C}{c_C + nN_C}.$$

The value p^C is decreasing in c_C, n, and N_C, and increasing in α and v_C. As intuition, as C's costs from going to war increase (n, N_C, and c_C all increase and α decreases) or C's valuation of the asset (v_C) decreases, C is less willing to go to war, which makes it easier to deter C at lower force postures.

Together, for deterrence, D will select the smallest force posture where both D's war participation constraint and C's war cost constraint are met—formally, if D sets $p = max\left\{p^C, p^D\right\}$, C will be deterred. Importantly, only one constraint will bind. When C's war cost constraint

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[44] Formally, p^D solves $0 = W_D(p)$.

[45] Formally, p^C solves $0 = W_C(p)$.

binds ($p^D < p^C$), D can arm to a level where D is willing to fight, but must arm further to make war sufficiently costly for C to deter C. In contrast, when D's war participation constraint binds ($p^D > p^C$), so long that D has armed to a level where D is willing to fight, C will be deterred.

Alternatively, sometimes D and C will fight. Suppose D has armed to a level where D's war participation constraint is met but C's war cost constraint is not met—this results in war. Formally, whenever $p^D < p^C$, D may prefer selecting some arming level that results in fighting.[46] When fighting, D optimizes by setting $p = \hat{p}$, where

$$\hat{p} \in \underset{p \in [max\{p^D, p_0\}, min\{p^C, p_1\}]}{argmax} \{W_D(p) - K(p)\}$$

I define D's utility from setting $p = \hat{p}$ as $U_D(\hat{p})$.[47]

Finally, D may opt not to arm. If D does not value the asset much or faces high costs to arming, D may select the smallest force posture and acquiesce when challenged.

In addition to assuming that equilibria must be subgame perfect, I also assume the following:

Complete Information Game Assumptions: *There is a feasible level of arming where D is willing to fight. Formally,* $p^D \leq p_1$.

This assumption rules out a fairly uninteresting case. If $p^D > p_1$, then D's war participation constraint is never met, making deterrence impossible and outside of the scope of interest.

With this assumption in place, I can describe the equilibrium behavior (Proposition 1). To summarize the intuition around the three cases in the Proposition, D's arming decision depends on what arming options are available, and what gives D the greatest utility. For example, suppose C's war cost constraint cannot be met ($p^C > p_1$), which means D cannot ever keep C from challenging and therefore cannot deter C. Whenever $p^C > p_1$, D will choose between (a) not arming and acquiescing (setting $p = p_0$) and (b) going to war (setting $p = \hat{p}$), depending on which gives D the greater utility. Alternatively, suppose D's war participation constraint binds,

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[46] The set of feasible p values that result in fighting are $p \in [max\{p^D, p_0\}, min\{p^C, p_1\})$. Whenever $p^D \geq p^C$ holds, fighting does not occur in equilibrium.

[47] There are two technical issues to note. First, the set $\hat{p}$ may not be singleton, in which case I abuse notation and let $\hat{p}$ define the smallest element of that set. Second, whenever $\hat{p} = p^C$—when p^C is the corner solution to the optimization—then D prefers arming to level $p = p^C$, which in equilibrium will result in C being deterred.

meaning D being willing to fight is enough to deter C ($p^C \leq p^D$). Here, D chooses between deterring C and acquiescing. The equilibrium is as follows.

Proposition 1*: There exists an essentially unique*[48] *subgame perfect equilibrium taking the following form. Working backwards, if challenged, D will fight whenever* $p \geq p^D$ *and will acquiesce otherwise. Before D fights or acquiesces, C will challenge unless both* $p \geq p^C$ *and* $p \geq p^D$*. And, before C challenges or not, D will select the following arming levels (letting* p^* *denote equilibrium arming levels).*

- ***Case 1:*** *When* $p^D < p^C \leq p_1$,
    - *If* $p^D \geq p_0$, $V_D - K(p^C) \geq 0$ *and* $V_D - K(p^C) \geq W_D(\hat{p}) - K(\hat{p})$, *or* $p^D < p_0$ *and* $V_D - K(p^C) \geq W_D(\hat{p}) - K(\hat{p})$, *then D selects* $p^* = p^C$ *(D deters C).*
    - *If* $p^D \geq p_0$, $0 > V_D - K(p^C)$, *and* $0 > W_D(\hat{p}) - K(\hat{p})$, *then D selects* $p^* = p_0$ *(D acquiesces).*
    - *Otherwise, D selects* $p^* = \hat{p}$ *(D and C fight).*
- ***Case 2 (deterrence is impossible):*** *When* $p^D < p^C$ *and* $p^C > p_1$,
    - *If* $p^D \geq p_0$ *and* $W_D(\hat{p}) - K(\hat{p}) \geq 0$, *or* $p^D < p_0$ *then D selects* $p^* = \hat{p}$ *(D and C fight).*
    - *Otherwise, D selects* $p^* = p_0$ *(D acquiesces).*
- ***Case 3 (fighting is impossible):*** *When* $p^C \leq p^D$,
    - *If* $p^D \geq p_0$ *and* $V_D - K(p^D) \geq 0$, *or* $p^D < p_0$, *then D selects* $p^* = max\left\{p_0, p^D\right\}$ *(D deters C).*
    - *Otherwise, D selects* $p^* = p_0$ *(D acquiesces).*

Proofs are given in the appendix.

Figure 3 displays the logic of Proposition 1 for one set of parameters. v_D values are increasing on the x-axis, and v_C values are increasing on the y-axis. As v_D and v_C increase, actors value the asset more and become more willing to fight.

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[48] This equilibrium is unique insofar that when players are perfectly indifferent over actions, they only play one action (as defined). For example, when C is indifferent between acquiescing and fighting, C always acquiesces.

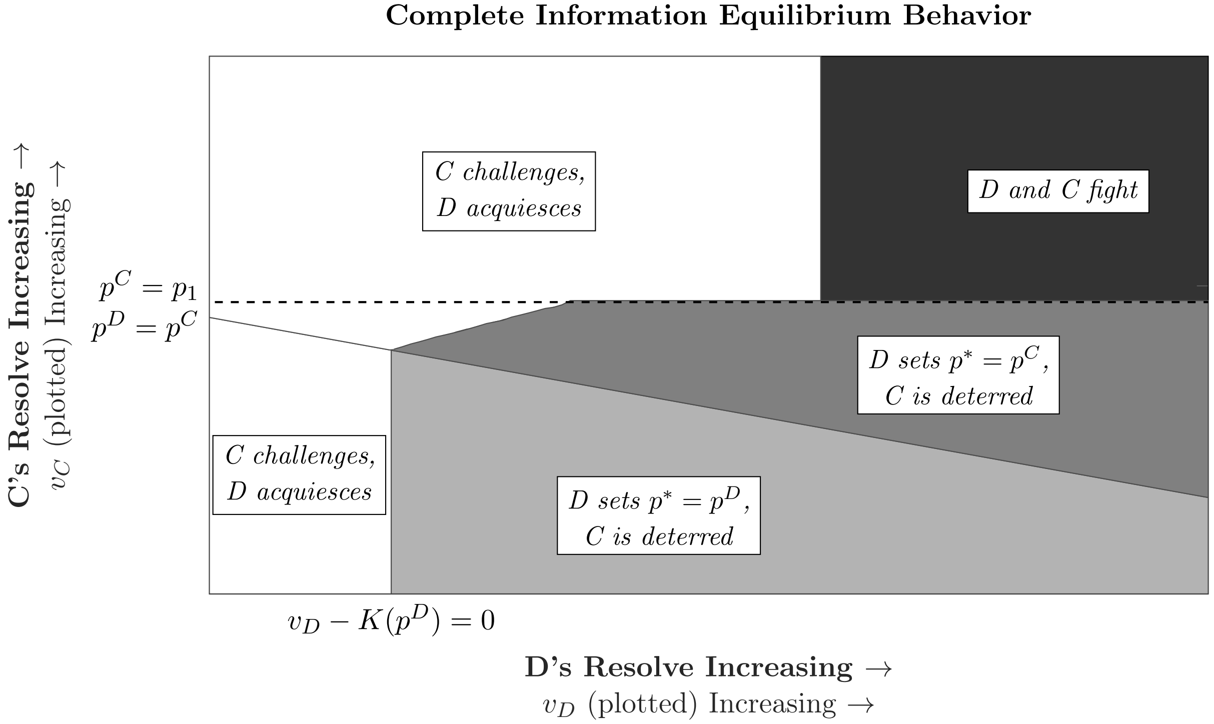

Figure 3: Equilibrium spaces in the complete-information deterrence game. For all white spaces, C will challenge and D will acquiesce. For all light-gray spaces, C will be deterred. And for all dark-gray spaces, C and D will fight.

First, consider the diagonal line labeled on the y-axis as $p^D = p^C$. For all values below this line, $p^C < p^D$, meaning fighting is not possible, but deterring C is possible (Case 3). For the lowest values of v_D (bottom-left), D does not value the asset enough to arm to deter. Here D will set $p^* = p_0$, C will challenge, and D will acquiesce. Then, moving to the right, when v_D increases enough, D prefers arming to the level that will deter C from challenging to not arming and letting C have the asset; for all v_D values including and to the right of the $v_D - K(p_D) = 0$ cut-point, D will arm to level $p^* = p^D$ and deter C.

Next, consider the v_C and v_D values that fall above the $p^D = p^C$ line, where $p^D < p^C$, but below the $p^C = p_1$ dotted line, where $p^C < p_1$ (Case 1). Here D can arm with the intent of acquiescing, deterring, or fighting. When D does not value the asset much (low v_D), D will set $p^* = p_0$ and acquiesce. And when D values the asset more, D will arm to level $p^* = p^C$, which will deter C. In this region, for the selected parameters, D never prefers going to war.

Finally, consider the region above the dotted line labeled $p^C = p_1$, which is where $p_1 < p_C$. For this region, C values the asset so highly that no feasible arming level will fully convince C not to fight—deterrence is not possible (Case 2). Thus D will either not arm and acquiesce (when v_D is lower), or arm in preparation for a fight (when v_D is higher).

In the next section, I discuss the general features of the equilibrium.

5 Results

Before discussing the results, it is worthwhile describing how to practically interpret comparative statics on parameter n. Most simply, the advent of nuclear weapons increased n. Before the nuclear era, competition and conflict between great powers carried no risk of an accidental nuclear launch because these weapons did not exist ($n = 0$); within the nuclear era, such risks now exist ($n > 0$). Furthermore, in the nuclear era, states that decentralize launch decisions, rely on potentially faulty automated systems for launch determinations, or expand their nuclear arsenals (introducing more moving parts and opportunities for failure) heighten the nuclear risks of any conflict that they become involved in.[49] Thus, changes in n can also approximate the changes that states make to their nuclear command and control infrastructures.

To further preview the analysis, the comparative statics in Remarks 1, 2, and 5 depend on whether C's war cost constraint binds (when $p^C > p^D$) or D's war participation constraint binds (when $p^C < p^D$). Before discussing these Remarks, it is worthwhile describing when, substantively, C's war cost constraint would be expected to bind. This is perhaps clearest when, generally, both C and D place relatively high value on the asset. Based on how the terms are defined, if D places a high value on the asset (high v_D), then p^D will be smaller; and, if C places a high value on the asset (high v_C), then p^C will be greater. Together, this implies that for jointly-high-value assets, C's war cost constraint is more likely to bind.[50] As one example of this, consider NATO as D, the Soviet Union as C, and West Germany as the high-value asset. NATO plausibly placed a high value on keeping West Germany outside of the Eastern Bloc, both for direct strategic reasons and for maintaining the "status quo" of European borders.[51] And, plausibly, the Soviet Union also viewed West Germany as a high-value asset; in addition to the strategic value of expanding the Eastern Bloc, Stalin's concerns over West Germany's move

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[49] Sagan 1994; Sagan and Waltz 2003.

[50] This same rationale also holds when D and C both have low costs to fighting conventionally.

[51] Brodie 1965; Jervis 1979b; Schelling 1966.

into NATO and its rearmament could be addressed through the Soviet Union reunifying and controlling all of Germany [109-112]trachtenberg1999constructed. Together, in this example, the challenger's (Soviet Union's) war cost constraint would bind.

It is also useful to know when D's war participation constraint would be expected to bind. This is clearest when both D and C place relatively low value on the asset. If C and D place low value on the asset (low v_C and v_D), this lowers p^C and raises p^D, which together can imply that D's war participation constraint is more likely to bind. Substantively, this could describe many Cold War crises that occurred in countries in regions that were, while still important, outside of the prioritized European theater.

Interestingly, in cases where one side places a high value on the asset and the other side places a low value on it, then it is more difficult to determine whether p^C or p^D is bigger, which in turn makes understanding the effects of changes in n on outcomes more difficult.[52] And, naturally, these generalizations—like that D's war participation constraint is more likely to bind when D and C care less about an asset—may break down when other features of conflict prove more influential.

5.1 Introducing Nuclear Risk may Require More or Less Conventional Arming for Deterrence

Introducing or increasing the unintended risk of nuclear escalation makes both C and D do worse should a conflict occur. This shapes force posture decisions.

Remark 1: *Conventional forces and nuclear risks are imperfect substitutes. Formally, if n increases and D's war participation constraint binds ($p^C < p^D$), then D must increase their conventional force posture to maintain deterrence. Alternatively, if n increases and C's war cost constraint binds ($p^C > p^D$), then D can select a lower conventional force posture and still maintain deterrence.*

Recall that for deterrence, both D's war participation constraint and C's war cost constraint

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[52] Formally, suppose D places a high value on the asset and C places a low value on the asset. Because p^D decreases as v_D increases and and p^C decreases as v_C decreases, p^D and p^C are moving together, making it more difficult to determine whether p^C is bigger than p^D.

must be met (formally, D must set $p = max\left\{p^C, p^D\right\}$). Consider when D's war participation constraint binds ($p^D > p^C$). Here, to deter C, D must arm to the level where D is willing to fight. As nuclear instability increases, in order for D to continue being willing to fight, D must attain a better expected outcome when the conflict ends conventionally to compensate for the greater risk of a nuclear exchange. To achieve this better conflict outcome and maintain deterrence, D must select a greater initial force posture, or greater p.[53] Alternatively, consider when C's war cost constraint binds ($p^D < p^C$). Here, to deter C, D must arm to the level where C perceives war as unproductive. As the risk of nuclear escalation increases, C does worse in the conflict and wants to challenge less, meaning C will be deterred by a more limited conventional force posture, or lower p.[54] Together, depending on whether D's war participation constraint or C's war cost constraint binds, increasing nuclear instability could result in D needing greater or lower force postures for deterrence.

Of course, whether nuclear risk makes deterrence easier or harder—whether p^C is bigger than p^D or vice versa—can be substantively identified, as discussed earlier. If C and D both place relatively high value on the asset, then C's war cost constraint is more likely to bind and added nuclear instability makes deterrence achievable at lower force postures. And, similarly, if C and D both place relatively low value on the asset, then D's war participation constraint is more likely to binds, and added nuclear instability requires D to raise their conventional force posture for deterrence. Importantly, these results describe effects following changes in nuclear instability. They do not imply, for example, that D prefers crises when both v_D and v_C are high—it is still the case that deterrence is easiest to achieve when v_D is high and v_C is low. Rather, Remark 1 speaks to the marginal effect of nuclear instability on the level of arming needed for deterrence.

Overall, Remark 1 underscores the difficulty of replacing conventional deterrence capabilities with nuclear risk, especially for extended deterrence. Relying on nuclear risks in crises over non-existential issues introduces previously overlooked challenges. For example, Waltz (1981; 1990) claims that the catastrophic threat of nuclear retaliation clarifies confidence in deterrence, thereby reducing the need for defenders to conduct large build-ups in conventional forces. How-

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[53] By definition, p^D is increasing in n.

[54] By definition, p^C is decreasing in n. Also note that this analysis (and the analysis in Remarks 2 and 5) assumes n does not increase so much that it makes $p^D > p^C$ (unless specified otherwise).

ever, in crises where an intentional nuclear escalation is avoided, nuclear risks can undermine a defender's willingness to fight, which can then be exploited by a challenger. In contrast to what is discussed in Waltz,[55] this model suggests that the credibility problem in deterrence cannot be solved solely through threats of catastrophic outcomes and may also require a further commitment of conventional forces. After all, both challengers and defenders have agency in choosing whether to confront such risks; when nuclear risks are too high and conventional conflict outcomes are unfavorable, defenders may choose to disengage.

5.2 Welfare Effects When Conflict Does Not Occur

Increasing nuclear instability can impact overall ex-ante welfare outside of changing how conflict plays out.

Remark 2: *Increasing nuclear instability can either increase or decrease equilibrium conventional arming levels, thus raising or lowering overall ex-ante welfare. Formally, suppose D deters C in equilibrium. If n increases and D's war participation constraint binds ($p^C < p^D$), then ex-ante welfare decreases. Alternatively, if n increases and C's war cost constraint binds ($p^C > p^D$), then then ex-ante welfare increases.*

Consider what increasing nuclear instability means for welfare when D optimally deters C. As discussed in Remark 1, as nuclear instability increases, D may select greater or lower force postures to deter C; in turn, this generates either greater costs or lower costs (respectively) for D to achieve the same deterrence outcome. Here, increasing nuclear instability can constitute a Pareto improvement when D can deter C by arming less, as can happen when D and C both place relatively high value on the asset (in other words, when C's war cost constraint binds). And, increasing nuclear instability can be Pareto inefficient when D must arm more to deter C, as can happen when D and C both place relatively low value on the asset (when D's war participation constraint binds).

Note that the paragraph above is limited to discussing how n affects force posture and welfare when D deters C in equilibrium. Outside of deterrence, the comparative statics become more complex. For example, suppose under some n D optimally deters C and $p^D > p^C$. If n

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[55] Waltz 1990.

increases, D may not want to pay the higher costs to deter C any longer and may instead prefer to acquiesce; here increasing n would then decrease D's arming level and could improve welfare.[56] To elaborate on these comparative statics, in the Appendix, I include an expanded discussion on the general effects of changing n on arming and welfare.

This point has not been studied. In previous scholarship, nuclear optimists point to the decrease in great power conflict as a virtue of the nuclear era.[57] In contrast, nuclear pessimists typically note that, even if nuclear weapons reduce the likelihood of war, whenever war occurs, it becomes more costly as it bears the risk of a catastrophic nuclear exchange.[58] This trade-off—nuclear weapons mean fewer wars but introduce existential risks—has dominated the academic discourse.[59] However, this paper presents a new trade-off. In the nuclear era, while deterring direct threats to critical assets may be cheaper, establishing extended deterrence may necessitate more robust force postures, ultimately generating greater systemic costs.

5.3 Evidence of a Nuclear Peace

Consistent with the arguments of nuclear optimists and some empirical evidence,[60] this model suggests that introducing nuclear instability can lead to a more peaceful state of the world.

Remark 3: *Increasing nuclear instability results in fewer instances of war. Formally, consider nuclear instability parameters* $n', n'' \in \mathbb{R}_+$*, with* $n' < n''$*. If* n' *shifts to* n''*, then the set of parameters where war occurs shrinks, and the likelihood of war decreases.*

Moving from a low to a high level of nuclear instability will shrink the parameter set under which a conventional war will occur. To interpret this result, Remark 3 implies that if we compared how history played out from 1950 to the present ($n > 0$) to a counterfactual history without the development of nuclear weapons (with $n = 0$), we would observe more conventional conflicts in the counterfactual history. Put simply, this model confirms that added nuclear instability lowers the likelihood of conventional war.

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[56] Technically, transferring the asset from D to C could constitute a welfare gain or loss if one actor values the asset more. This scenario will always constitute a welfare improvement if C and D value the asset the same.

[57] Bueno de Mesquita and Riker 1982.

[58] Sagan 1985; Sagan 1994.

[59] Kydd 2019.

[60] Asal and Beardsley 2007.

Two forces drive the nuclear peace. First, as nuclear instability increases, a conventional war becomes worse for the defender because the risk of nuclear escalation grows. Second, as nuclear instability increases, the set of possible force posture levels that could result in war—in other words, arming levels where C would be willing to challenge and D would be willing to escalate if challenged—is shrinking, potentially making deterrence cheaper. Together, D will do worse from fighting a conventional war, and therefore will go to war less.[61] Note that this decrease in war arises either from D using its conventional force posture to deter C more frequently, or from D avoiding escalation more frequently (essentially accepting C's *fait accompli*).

Figure 4 shows this visually. It includes three plots, each with fixed parameters (other than n). In the top plot, $n = 0$ (there is no risk of a nuclear exchange), and there is a large range of values where the game ends in war. In the middle plot $n = 0.03$, and in the bottom plot $n = 0.06$. As n increases, the dark-gray region where war occurs shrinks, and the regions where D acquiesces and where D deters C grow.

5.4 Nuclear Instability and Arming Incentives

In the nuclear era, the defender seeks to avoid prolonged conflicts that carry a high risk of a nuclear exchange. To accomplish this, when the defender prepares for a fight, they may select a more aggressive or a less aggressive force deployment.

Remark 4: *Under select conditions, as nuclear instability increases, D is incentivised to make conflict shorter and more decisive, and, to accomplish this, may select a more or a less aggressive force posture. Formally, assume the solution set to* $\hat{p}$ *is singleton and both actors place high value on the issue.*[62] *Consider nuclear instability parameters* n' *and* n''*, where* $n' < n''$*. If* $p^*(n')$ *is small enough, then* $p^*(n') > p^*(n'')$*. And if* $p^*(n')$ *is large enough, then* $p^*(n') < p^*(n'')$*.*

Figure 5 visualizes one version of Remark 4. The left graph plots the equilibrium force posture (y-axis) for a range of v_D values (x-axis) where, for this set of parameters, C and D will fight in equilibrium. The dashed line plots the equilibrium force posture levels when the likelihood of

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[61] Formally, D's payoff from fighting a conventional war is the maximum of a constrained optimization problem: as nuclear instability increases, D's objective function produces worse options, and the set over which D optimizes shrinks.

[62] I elaborate on this and offer a more technical version of Remark 4 in the Appendix.

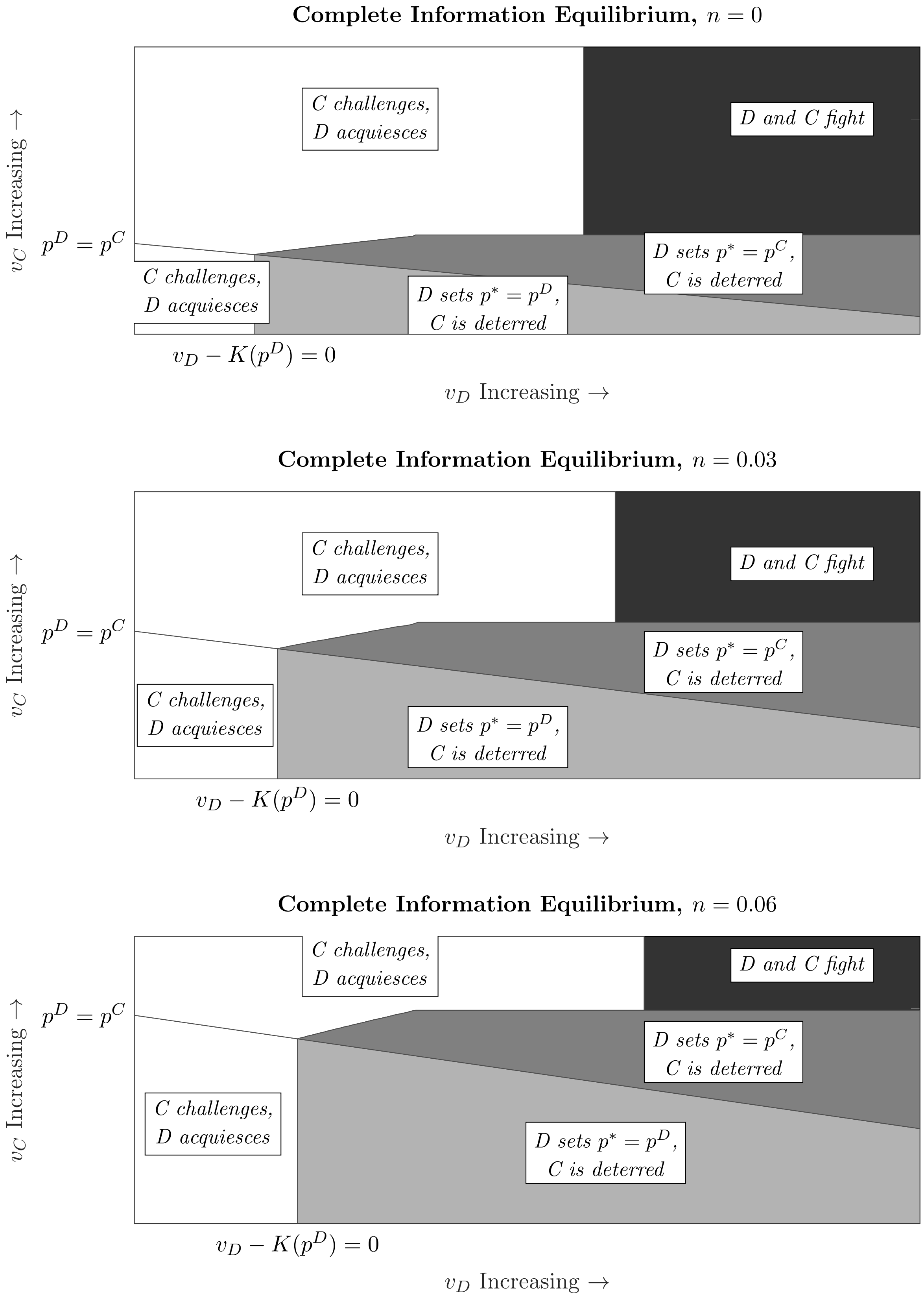

Figure 4: Equilibrium spaces in the complete-information deterrence game. Instability parameter n increases from top to bottom.

a nuclear exchange is non-existent ($n = 0$), and the solid line plots equilibrium force postures when nuclear instability is positive ($n = 0.015$). The right graph plots the expected time in conflict[63] (y-axis) for the same v_D values (x-axis) and nuclear instability parameters.

Consider the left plot in Figure 5. For the lowest v_D values (for example $v_D = 35$), as n increases (moving from dashed to solid line), equilibrium arming levels decrease. In contrast, for the highest v_D values (for example $v_D = 49$), as n increases, equilibrium arming levels increase. Together, increasing the likelihood of a nuclear exchange generates different effects on arming decisions, but these decisions are driven by the same underlying tensions. Recall how added force posture generates more nuclear risk when it makes both sides more equal and less risk when it makes both sides less equal. Following that logic, for any initial arming level below $p = 0.5$ for $n = 0$, adding nuclear risks presents new costs to staying in conflict, which incentivises D to arm less to make conflict shorter (as it was in the $v_D = 35$ example).[64] And, for any initial arming level above $p = 0.5$ for $n = 0$, adding nuclear risks similarly presents new costs to staying in conflict, which now incentivises D to arm more to make conflict shorter (as it was in the $v_D = 49$ example). As is shown in the right plot, these different arming responses to the introduction of risk both work to shorten the expected conflict duration.

However, as Remark 4 states (and the Appendix further discusses), the logic of the previous paragraph holds for large or small initial (i.e. under $n = 0$) arming levels. For initial arming values around 0.5, competing effects can dominate arming decisions. In addition to introducing new costs to more prolonged conflicts, increasing n makes D's arming less productive by decreasing the likelihood that D attains the asset, and increasing n mechanically shortens conflict duration, which in turn influences D's anticipated conventional war costs. Furthermore, the marginal effects of changes in p on expected conflict duration are the smallest around $p = 0.5$, meaning D would be least willing to try to manipulate p to shorten conflict here. While at low or high initial arming values we would anticipate movement towards the extremes with increases in n, for intermediate values, comparative statics become more complex. This is visualized in the left graph. For example, at $v_D = 42$, the arming level under $n = 0$ is $p^* \approx 0.54$, and the

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[63] Using the hazard rate setup, expected time in conflict is $\frac{p^*(1-p^*)}{np^*(1-p^*)+\alpha}$, where p^* is the equilibrium force posture.

[64] Because expected time in conflict is $\frac{p^*(1-p^*)}{np^*(1-p^*)+\alpha}$, the marginal effect of increasing p^* is positive for all $p < \frac{1}{2}$ and negative for all $p > \frac{1}{2}$.

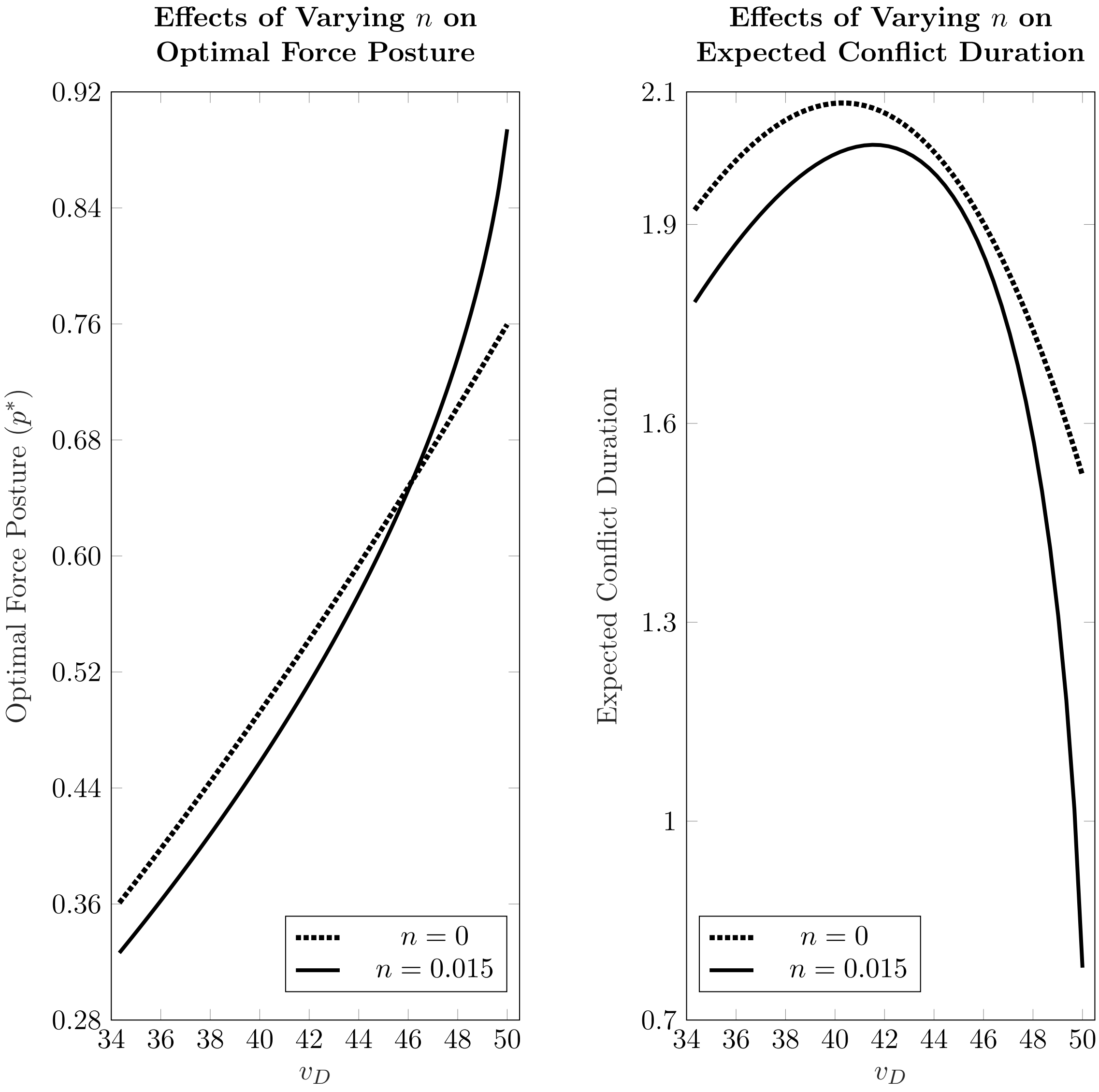

Figure 5: Optimal arming levels (y-axis, left) and expected conflict duration (y-axis, right) at different asset valuations (x-axis) for D at different levels of nuclear instability. Increasing the nuclear instability parameter from $n = 0$ to $n = 0.015$ can result in D arming less (for low v_D) or more (for high v_D), in both cases leading to shorter conflicts under $n = 0.015$.

arming level under $n = 0.015$ is $p^* \approx 0.52$.

In-line with the stability-instability paradox, Powell[65] finds that strategic states always respond to greater nuclear instability with more restrained levels of force in conflicts, as was observed in the Kargil War (1999). Under some parameters my results echo Powell, but at other times I find that defenders commit more force to a conflict when faced with greater nuclear instability and greater nuclear costs. Why? Here (unlike in Powell), the defender can avoid prolonged conflicts by reducing military parity through greater or lower levels of arming. While Powell argues that nuclear risk leads to reduced force deployments to minimize escalation, I find that conflicts with nuclear risks tend to be more decisive and shorter, potentially involving either more restrained or more aggressive force deployments to prevent escalation. My findings provide a theoretical basis for both restraint and excess in force deployment for conflict in the nuclear era, suggesting the stability-instability paradox may not be observed in cases where aggressive maneuvers can reduce escalation risks.

5.5 Deterrence Failure and Nuclear Instability

Remark 5: *Increasing nuclear instability can increase or decrease the likelihood of deterrence failures. Formally, suppose D deters C in equilibrium and $p^D > p^C$; if n increases, then the arming level required to deter C increases, and D may optimally switch to acquiescing. Now suppose D acquiesces to C in equilibrium and $p^D < p^C$ holds; if n increases, then the arming level required to deter C decreases, and D may optimally switch to arming up to the level that will deter C.*

I define a "deterrence failure" as any equilibrium in which C challenges D. The frequency of these failures may rise or fall with increasing nuclear instability, driven by two competing effects. First, suppose for a given n that D's war participation constraint binds ($p^D > p^C$). In this scenario, an increase in n makes D less willing to fight, raising the required arming level for deterrence p^D. The increase in p^D could reach a point where D becomes unwilling to bear the cost of arming necessary to deter C's challenge. If D opts not to deter C, then the rise in n results in a deterrence failure. Second, suppose for a different set of parameters, C's war cost constraint

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[65] Powell 2015.

binds ($p^C > p^D$). In some cases, D may initially be unwilling to arm to the level p^C required to deter C under low nuclear instability. However, increased nuclear instability reduces p^C, potentially making D willing to arm at the new, lower level and achieve deterrence. Ultimately, whether D experiences more or fewer deterrence failures following increases in nuclear instability depends on the underlying conditions of the case.

It is perhaps counterintuitive that when both C and D don't place high value on the asset (i.e. $p^C < p^D$), then deterrence failures are more common following increases in nuclear instability. Reasonable readers might question why C would challenge over assets that it does not highly value, especially in the face of increased nuclear instability. Ultimately, that intuition is incomplete because it does not also take into account D's agency and willingness to fight. To deter C from challenging, it is not enough for C to view war as prohibitively costly; D must also be willing to fight. If D places low value on the asset, then its willingness to fight becomes decisive, as C realizes it can challenge without triggering escalation. In this scenario, even though C places low value on the asset and recognizes that elevated n increases the risk of catastrophic outcomes in war, C also understands that higher n might prevent D from engaging in a war altogether, enabling C to seize the asset without escalation.

6 Empirical Implications

6.1 Asymmetric Response, Flexible Response, and the Value of Nuclear Instability

This model provides insights into the strengths and limitations of the "flexible response" and "asymmetric response" strategies. The flexible response strategy, adopted by the Kennedy Administration, expanded U.S. military capabilities to enable a broader range of responses to threats. This expanded conventional force posture can be represented in model variations where force posture p is chosen from a broader set (when $p_0 \approx 0$ and $p_1 \approx 1$). As presented in the equilibrium, if a defender can choose from a wide range of force levels, they will often do so, thus establishing deterrence across a range of crises. However, flexible response cannot universally uphold deterrence. The model shows that deterrence can still fail—such as when both the challenger and defender highly value the asset (leading to war), or when only the challenger highly values the asset (causing the defender to acquiesce when challenged). Ultimately, actors' underlying preferences—how much each side values the asset—remains crucial in determining whether deterrence succeeds or fails, even with flexible force posture options.

To assess the effectiveness of flexible response, we can compare it to its predecessor, the Eisenhower Administration's asymmetric response strategy. The asymmetric response strategy prioritized nuclear threats or first-use over conventional responses to international threats. Since asymmetric response minimized the development of conventional forces, this doctrine can be represented formally by a lower and narrower range of force postures—formally, a lower p_1 when compared to the broader range in flexible response. With the narrower range of force postures, deterrence under asymmetric response would fail under more settings when compared to flexible response. Deterrence may break down if the challenger cannot implement the necessary force posture to deter the challenger (whenever $p_1 < p_C$), or if fighting becomes less advantageous for the defender (occurring because D's utility from fighting is decreasing in p_1). In this setting, the restricted conventional force posture of asymmetric response weakens deterrence.

Understanding how the advent of nuclear weapons shaped Cold War deterrence strategies is also crucial. Remarks 1, 2, and 5 suggest that the development of these weapons (moving from zero nuclear instability to positive levels of nuclear instability) made deterrence easier, more cost-effective, and less likely to fail when both challenger and defender place relatively *higher* value on the asset (resulting in $p_C > p_D$). Substantively, this could describe the case of Western Germany, especially West Berlin, which was of central concern to both the U.S. and Soviet Union.[66] This theory supports claims that, for much of the Cold War, territories like West Berlin were vulnerable to a Soviet invasion, but nuclear risk strengthened Western deterrence [46-48]schelling2020arms. Put another way, in a counterfactual world where nuclear weapons had never been created, the West would have needed a relatively larger and costlier conventional force posture to deter the Soviet Union from invading Germany.

In contrast, Remarks 1, 2, and 5 also suggest that the advent of nuclear weapons can make deterrence harder in settings where both challengers and defenders place relatively *lower* value

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[66] Trachtenberg 1999.

on the asset (resulting in $p_D > p_C$). Substantively, this could describe settings outside of the strategically prioritized European theater, like in Latin America, Africa, and Asia. Consider, for example, what this theory means for the U.S. decision to not use tactical nuclear weapons during the Vietnam War. While multiple factors can explain the non-use of nuclear weapons,[67] these results emphasize a potential strategic tension. Deploying tactical nuclear weapons raises the risk of escalation to a strategic nuclear exchange (raises n). Using tactical nuclear weapons might have then, perversely, required the U.S. to commit even more conventional forces to remain willing to fight under the elevated nuclear risks—a step the U.S. was likely hesitant to take. In other words, the U.S. might not have been willing to fight the Vietnam War if it carried a higher risk of escalation to a strategic nuclear exchange, which could explain its reluctance to deploy tactical nuclear weapons and raise those escalation risks. While the U.S. ultimately failed to re-establish deterrence in South Vietnam, using tactical nuclear weapons may have proven strategically counterproductive.

These dynamics—whether added nuclear risk raises or lowers the conventional force posture needed for deterrence—relate to the asymmetric response and flexible response doctrines. Consider the possibility that the asymmetric response strategy not only lowered p_1 (as discussed above), but also raised levels of nuclear instability (higher n).[68] The added nuclear risk under asymmetric response may have proven counterproductive. When both sides place low value on the asset ($p_D > p_C$), higher nuclear instability requires increasing arming levels for deterrence, thereby raising the costs for deterrence or making deterrence infeasible under asymmetric response.[69] Conversely, when both sides place high value on the asset ($p_C > p_D$), even if a higher level of nuclear instability reduces the arming level needed to deter C, C's high valuation means that the conventional arming requirement for deterrence would be high regardless; because asymmetric response limits the available conventional force posture available, raising nuclear instability may not be enough to deter a challenger when the defender has limited conventional options.[70] In contrast, because flexible response still maintains a wide range of possible con-

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[67] See Tannenwald 2006.

[68] Asymmetric response relied on using nuclear means as a response to even conventional threats; plausibly, this could mean that conventional engagements carried greater risks of escalating.

[69] Formally, when $p_D > p_C$, raising n and lowering p_1 can result in a higher p_D (i.e. requiring a greater force posture for deterrence) or in $p_D > p_1$ (i.e. making deterrence impossible).

[70] Formally, when $p_C > p_D$, raising n and lowering p_1 will lower p_C , but the lower p_1 may ultimately result in $p_C > p_1$ even under the higher n, which would make deterrence impossible.

ventional force postures, in many cases, it can still often uphold deterrence at the lower nuclear instability levels.

Of course, the comparison between flexible response and asymmetric response comes with necessary caveats. This model best describes cases where the asset is important but not existentially important, which, based on past critiques of the asymmetric response strategy, is where asymmetric response would be expected to perform worst. Ultimately, generalizing this evaluation of the doctrines under a broader set of assumptions is needed.

6.2 Nuclear Risk and Force Postures: The Hungarian Revolution and Kashmir (2019)

The remarks also offer insight into aggressive uses of force in the nuclear era.

In late October 1956, Budapest was in crisis. Following a series of clashes between student protesters and government forces, a group of anti-Soviet revolutionaries ousted or killed a critical mass of Hungarian communist leaders and members of the Hungarian secret police, eventually (on October 27) installing Imre Nagy as prime minister. At first Soviet leadership considered negotiating with Nagy and the new Hungarian government, but after several days they changed course and invaded Hungary. By November 3, Operation Whirlwind was underway; 30,000 Soviet troops invaded Hungary and circled Budapest.[71] Eight days later, Soviet forces decisively defeated the revolutionaries, deposed the revolutionary government, and resumed control of Hungary.

In the broader Cold War context, the Soviet activities in Hungary were not without international risks. Until that point, the Eisenhower administration had publicly advocated the "rolling back" of Soviet influence in Eastern Europe, even if it required using armed forces.[72] In fact, Soviet leadership acknowledged that the crisis in Hungary had international dimensions, believing the crisis could spread to other Soviet states[73] and could potentially lead to a confrontation with the West.[74] But these escalation risks did not convince the Soviet Union to apply restraint;

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[71] Gati 2006.

[72] Borhi 1999.

[73] Kramer 1998.

[74] Göncz, Gati, and Ash 2002.

instead, it acted aggressively and crushed the revolution. Why?

Before analyzing the events, it is worthwhile grounding the case in the model's terms. The Hungarian Revolution presented the U.S. and Soviet Union with a crisis that could have escalated into a general war that would have come with nuclear risk.[75] I treat the Soviet Union as the model's "defender" (defending the pre-revolution status quo in Hungary), and the West as the "challenger," who could have backed the Hungarian Revolutionaries. The Soviet Union achieved the decisive outcome it did by putting forward a strong conventional force deployment. And, in response to the Soviet Union's force posture, the United States had the option to challenge and support the revolution or to stay back.

The model presented here can offer insight into the Soviet Union's robust response. The Soviet Union's conventional force posture in Eastern Europe and the significant forces deployed to quell the Hungarian Revolution all but guaranteed that the Soviet Union would do well should the crisis escalate into a conflict with the West—essentially, the Soviets had selected a high p. This meant that the West would be likely deterred from escalating this crisis, but even if it was not deterred, Soviet conventional forces could plausibly end a U.S. challenge quickly enough. To explain this aggressive force posture, consider the implications of Remark 4: the existing nuclear risk may have incentivized the Soviet Union to adopt a more aggressive conventional force posture than it otherwise might have. By acting decisively to end the crisis quickly, the Soviet Union sought to avoid a protracted conflict that could accidentally or inadvertently escalate to a nuclear exchange, at the expense of the Hungarian revolutionaries and public. While caveats naturally apply here—there are many reasons to end a revolution quickly—the benefits of decisive action were not lost on Khrushchev. As we now know, after the invasion, when Khrushchev's son asked his father why the Americans had not intervened with military force in Hungary, Khrushchev replied that "everything happened so quickly that possibly they simply did not have time to do so".[76]

Furthermore, the Hungarian Revolution is not a the only time that a nuclear-armed state, while maneuvering a crisis with another nuclear-armed state, acted decisively. For the past several decades, India and Pakistan have periodically clashed over disputed territory in the

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[75] Holloway and McFarland 2006.

[76] Holloway and McFarland 2006.

Kashmir region, including during the Kargil War (1999). Then, in 2019, the government of India abrogated Article 370 of the Indian constitution and passed the Jammu and Kashmir Reorganization Bill, which together dramatically altered the status of the Kashmir territory currently administered by India.[77] Whereas before Jammu and Kashmir possessed a special status as a fairly autonomous Indian state, New Delhi's actions eliminated this status, dismantled the existing institutions and laws, and placed Jammu and Kashmir under the Union government's overarching control. While these abrupt political changes to the contested (and recently fought-over) region heightened tensions between India and Pakistan, in preparation to any potential challenges, New Delhi sent between 40,000 and 45,000 additional soldiers and police forces to Jammu and Kashmir, bringing the number of Indian troops in the region to approximately 100,000,,[78][79] implemented a lockdown of mobile and internet communications, and rolled out extensive and protracted curfews.

India's dramatic policy shift inflamed tensions in a long-simmering regional conflict that has been punctuated by both direct military confrontation and third-party-backed terrorist attacks. While we do not have access to the deliberations of Narendra Modi and his inner circle, it is reasonable to assume that Modi and his advisors believed that Pakistan would challenge the abrogation, potentially through conflict. In the past, Pakistan's Inter-Services Intelligence (ISI) has backed terrorist groups who have conducted attacks over less dramatic changes to Kashmir's politics.[80] And, in the weeks after India's actions, Imran Khan publicly threatened a confrontation; in a televised address, Khan stated "Whether the world joins us or not, Pakistan will go to any lengths and its people will support [Kashmiris] till their last breath".[81] And, while past behavior or messaging may not be predictive of behavior in a crisis, after the abrogation, scholars and policymakers suggested that Pakistan, in response, may support terrorists or issue nuclear threats.[82][83]

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[77] Lalwani and Gayner 2020; Bose 2021.

[78] Bose 2021.

[79] Chohan and Aamir 2020 discusses how this made Kashmir one of the most militarized zones in the world, with a 1:8 ratio of security-personnel to civilians.

[80] Ahlawat and Izarali 2020; Chohan and Aamir 2020.

[81] Ahlawat and Izarali 2020.

[82] Kazmin and Bokhari 2019; Ahlawat and Izarali 2020; Chohan and Aamir 2020.

[83] A few weeks after abrogation, Khan raised the possibility of a direct confrontation with nuclear risks in a New York Times opinion piece (Khan 2019).

While Pakistan challenging the abrogation was a possibility, after India flooded Jammu and Kashmir with security forces, Pakistan faced limited options. Pakistan would struggle to directly confront India in Kashmir; when pressed by hawkish opposition members in Parliament to respond to India's actions, Khan replied, incredulously, "What do you want me to do...Should I go to war with India?".[84] Additionally, Pakistan's more common response of supporting militant groups in Kashmir seemed likely to fail given the circumstances. Given the concentration of security forces, militant or terrorist attacks seemed unlikely to dislodge Indian forces or change politics. Altogether, India's force deployment suggested a readiness to quickly address any challenge that Pakistan presented. Consistent with Remark 4, the nuclear risks plausibly motivated India to act more decisively than it would have in a non-nuclear scenario, resulting in a quick resolution to the crisis and minimial escalation risks.

7 Additional Results and Extensions

I consider several extensions to the model and analysis.

7.1 Making n endogenous

In some circumstances, the defender may be able to manipulate the level of nuclear risk. A modified version of the game, discussed in the Appendix, explores this prospect. The key change is that as the defender selects their arming level, the defender can also costlessly select some n_D, where n_D determines the level of nuclear instability. For this across-game-form analysis to be informative,[85] I assume that D selects n_D from a compact subset of $\mathbb{R}^1$ that contains n, where n is the nuclear instability parameter from the non-modified game form.

In the equilibrium, sometimes D will select greater levels of nuclear instability (i.e. $n_D > n$), and other times D will select lower levels of nuclear instability (i.e. $n_D < n$). Why? If C's war cost constraint binds, then by selecting some $n_D > n$, D can deter C at a lower conventional force posture and at lower cost. On the other hand, if D's war participation constraint binds, then by selecting some $n_D < n$, D becomes more willing to fight when challenged, which allows D to

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[84] Nasir 2019; Ahlawat and Izarali 2020.

[85] Here I am comparing the results from the game where n is exogenous to the game form where n is endogenous.

establish deterrence at a lower force posture. Together, granting D the option to manipulate nuclear instability levels will expand the parameter range where D can deter C.

7.2 Bargaining

The model in the main text was a deterrence model, like the paper this model is closest to.[86] However, some readers may have concerns about the absence of bargaining. Ultimately, if the crisis bargaining setting also has some kind of commitment problem, then the deterrence setting can resemble the crisis-bargaining setting.[87] In the Appendix, I modify the model to (a) allow for endogenous bargaining and (b) have a commitment problem stemming from a power shift. In doing so, I find that while the crisis bargaining model with commitment problems presents new scope conditions under which fighting is possible, the results are largely the same.

7.3 Extension: Incomplete Information Game

7.3.1 Model and Equilibrium Intuition

I also analyze a version of the game with incomplete information. Its form is nearly identical to the one described earlier, only here, before D selects its conventional force level, nature designates D's resolve (i.e., how much D cares about the issue) as low or high. Formally, nature sets $v_D \in \{\underline{v}_D, \bar{v}_D\}$, with $0 < \underline{v}_D < \bar{v}_D$. I let $\pi \in (0,1)$ denote the probability that D is type $\bar{v}_D$, and $1-\pi$ the probability D is type $\underline{v}_D$. D knows their type, but C does not. In this game, I limit analysis to an essentially unique perfect Bayesian Nash equilibrium that satisfies the intuitive criterion.[88] I summarize the key points here, and offer a full discussion in the appendix.

In the incomplete information game, there is a new strategic tension: because C is uncertain of D's resolve, sometimes C is uncertain whether D is willing to fight. This in turn can shape D's force posture decisions in new ways, leading to bluffing or signaling (discussed below). But the incomplete information assumption does not change the game everywhere, and much of the behavior is similar to the complete information game (i.e., sometimes different types of D will acquiesce, deter, or fight).

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[86] Powell 2015.

[87] Because this is a complete information game, without the commitment problem, war would not occur.

[88] Cho and Kreps 1987.

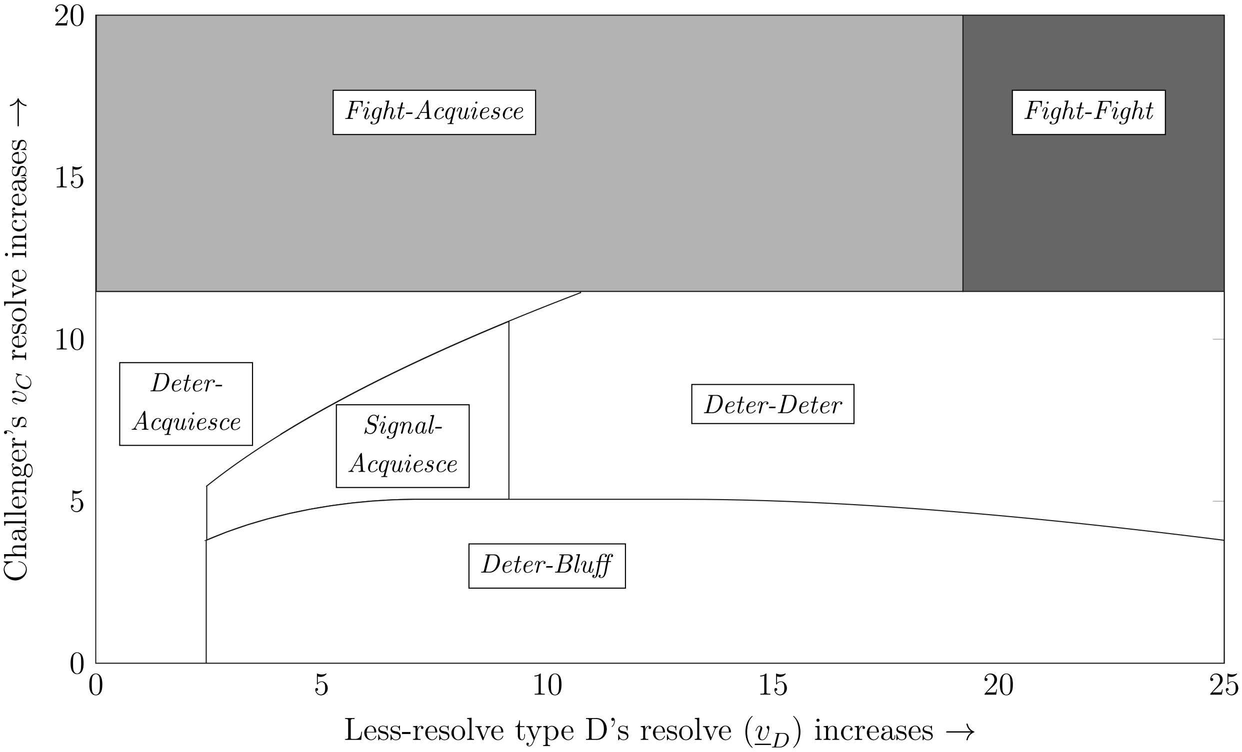

Figure 6: Equilibrium spaces in the incomplete-information game. The x-axis varies $\underline{v}_D$, which is the less-resolve type's valuation of the asset, and the y-axis varies v_C, which is the challenger's valuation of the asset. The darkness of shading represents the likelihood of war. In the white equilibrium spaces, war never occurs. In the light-gray "Fight-Acquiesce" equilibrium space, war occurs when D is type $\bar{v}_D$. In the dark-gray "Fight-Fight" equilibrium space, war always occurs.

I depict the equilibrium spaces in Figure 6. Here $\underline{v}_D$ varies on the x-axis, and v_C on the y-axis, while other parameters are fixed. The text boxes describe how type $\bar{v}_D$ behaves, then how type $\underline{v}_D$ behaves in each parameter space. A range of equilibrium behavior can be supported. For the highest values of $\underline{v}_D$ and v_C, both types of D will always go to war. For the lowest values of $\underline{v}_D$ and v_C, sometimes low-resolve defenders will drop out and acquiesce, while high-resolve defenders deter C. Other times, low-resolve defenders will mimic a high-resolve defender's force posture to convince C to not challenge, despite their being unwilling to fight at that force posture (i.e., they bluff). Other times, high-resolve defenders will select a high-enough force posture to get low-resolve defenders to stop mimicking them, effectively "over-arming" to demonstrate that they are resolved types, which keeps C from challenging (i.e., they signal). In the remaining spaces, deterrence, acquiescing, and fighting largely plays out as it does in the complete information model, though here sometimes different types behave differently (see the Appendix for full details).

7.3.2 Results

Adding incomplete information to the complete information model is a natural modification: actors plausibly may not know how much their opponent cares about the issue at stake.[89] But, this model modification does not change any of the earlier remarks.

Remark 6: *Remarks 1–5 hold in the incomplete information model.*

Remark 6 is a useful robustness check. Actors play different kinds of equilibrium strategies in the different versions of the model (complete versus incomplete information). Despite this, Remark 6 implies that Remarks 1–5 can also apply to settings where the degree of resolve is unknown, thus expanding the real-world applicability of these results.

The incomplete information model can also generate new results. The model with private resolve here works differently from the model with private resolve in Powell.[90] Here it is possible for the defender to signal its private resolve without ever having to go to war.

Remark 7: *Peaceful signaling of resolve is possible.*

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[89] Fearon 1995.

[90] Powell 2015.

High-resolve defenders signal their resolve by arming beyond the level needed to make themselves willing to fight. Essentially, they must arm to a level low-resolve defenders would not be willing to match (due to the cost). This is $\bar{p}$.[91] As a result, in equilibrium, only high-resolve D's arm to level $\bar{p}$; C knows upon seeing $p = \bar{p}$ that D is resolved and would fight if challenged, and C will never challenge.[92] Within the parameter set where D signals, arming as a costly signal of resolve always works in that high-resolve defenders can always achieve peace through deterrence.

In Powell,[93] signaling functions differently. There, manipulating nuclear risk—which is how the defender signals its resolve—is costless unless a conventional war breaks out. And, following the standard signaling logic, unless the signal is costly, low-resolve types are incentivized to mimic high-resolve types, undermining the informative value of the signal. As a result, in Powell, the defender can only signal its resolve by sometimes actually going to war, because the signal only generates costs through war.

This distinction has real-world implications. My model suggests that resolved defenders can deter challengers and prevent conflict through the costly signal of a robust conventional force posture. In contrast, Powell[94] finds that resolved defenders cannot fully deter challengers by manipulating nuclear risk, rather showing that conflict must sometimes occur as part of a costly signalling mechanism. There are two ways to interpret these results. First, I am presenting a more optimistic perspective. For Powell, war is an inevitable part of the signaling of resolve, whereas I find it is possible to signal resolve and deter an opponent without ever having to resort to conflict. Second, from a practical perspective, if a defender wants to signal resolve and avoid conflict, that defender should signal by manipulating force posture rather than manipulating nuclear risk (as in Powell).

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[91] Formally, this value is characterized by $\underline{v}_D - K(\bar{p}) = 0$, with $\bar{p} \geq p^D(\bar{v}_D)$.

[92] Naturally, this supposes that $\bar{p} \geq p^C$.

[93] Powell 2015.

[94] Powell 2015.

8 Conclusion

The advent and proliferation of nuclear weapons has introduced a disturbing reality: conventional conflicts between great powers now carry the risk of accidentally escalating into a catastrophic nuclear exchange.[95] The magnitude of this risk has profoundly shaped deterrence and conflict dynamics in the nuclear era. This paper examines these dynamics in the context of crises over non-existential issues.

Most novel, within conflicts over non-existential issues, I find that leveraging nuclear risks only sometimes supports deterrence. Why? For conventional deterrence to hold, a defender must be willing to fight if challenged, and the cost from fighting must be high enough to dissuade the challenger. In cases where deterrence depends on imposing costs on a challenger—meaning the defender is already motivated to fight—increased nuclear risk makes conventional conflict more costly for the challenger, thereby strengthening the defender's deterrent threat. In contrast, in cases where deterrence depends on the defender's willingness to respond to a challenge, increased nuclear risk makes conventional conflict more costly for the defender, thus undermining defender's credibility. This latter result—that the nuclear revolution may require expanded conventional force postures for deterrence—suggests that the nuclear revolution may result in additional challenges to extended deterrence, more costly and expansive force postures, and more instances of deterrence failures. While much attention has been paid to the underlying risks that nuclear weapons hold,[96] this paper demonstrates that nuclear weapons may reduce welfare through other channels as well.

Furthermore, This paper offers a new perspective on conflict in the nuclear era, suggesting it is not solely an era of restraint and limited wars but also one of aggression, where actors adopt robust conventional force postures in order to shorten conflicts. This formal result is new, and arises from bridging two previously unrelated strands of research: research on conventional capabilities and conflict duration, and research on how nuclear risk is generated.

And finally, this paper finds some normative benefit of the nuclear era. My model suggests that the observed "long peace" could be a "nuclear peace," where the nuclear great powers are less

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[95] Sagan 1985.

[96] Sagan and Waltz 1995; Kydd 2019.

willing to engage in protracted conventional wars and more willing to engage in more decisive, shorter contests with reduced risk of nuclear escalation.

Future research should continue examining these under-formalized topics. Moving forward, war should not be treated as a game-ending move with a specific functional form. One way to move forward would be to treat war as a continuous-time process, where states can "drop out" at any time. Indeed, the setup here would lend itself to this, with n and $\frac{\alpha}{p(1-p)}$ being used as hazard rates for the conflict ending via a nuclear exchange or a conventional victory, respectively. Alternatively, the functional forms for conflict could be generalized; for example, future iterations could consider risks from both the scope of the initial confrontation and time in conflict. Beyond these cases, "gray zone conflict," where adversaries target low-value assets with limited capabilities,[97] warrants further study on how the evolving nuclear landscape might shape its dynamics.

References

Ahlawat, Dalbir and M Raymond Izarali (2020). "India's revocation of Article 370: Security dilemmas and options for Pakistan". In: *The Round Table* 109.6, pp. 663–683.

Asal, Victor and Kyle Beardsley (2007). "Proliferation and international crisis behavior". In: *Journal of Peace Research* 44.2, pp. 139–155.

Bahney, Benjamin and Braden Sopher (2023). "The Delicate Balance Redux: Nuclear Forces, Damage Limitation and Uncertainty in Future U.S.-China Crises". In: *Working Paper.*

Baliga, Sandeep, Ethan Bueno de Mesquita, and Alexander Wolitzky (2020). "Deterrence with imperfect attribution". In: *American Political Science Review* 114.4, pp. 1155–1178.

Bas, Muhammet A and Andrew J Coe (2016). "A Dynamic Theory of Nuclear Proliferation and Preventive War". In: *International Organization* 70.04, pp. 655–685.

Bennett, D Scott and Allan C Stam (1996). "The duration of interstate wars, 1816–1985". In: *American Political Science Review* 90.2, pp. 239–257.

– (2009). "Revisiting predictions of war duration". In: *Conflict Management and Peace Science* 26.3, pp. 256–267.

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[97] Mazarr 2015; Gannon et al. 2024.

Borhi, László (1999). “Rollback, liberation, containment, or inaction? US policy and eastern Europe in the 1950s”. In: *Journal of Cold War Studies* 1.3, pp. 67–110.

Bose, Sumantra (2021). *Kashmir at the Crossroads: Inside a 21st-century Conflict*. Yale University Press.

Brodie, Bernard (1965). *Escalation and the Nuclear Option*. RAND Corporation.

Bueno de Mesquita, Bruce, Michael T Koch, and Randolph M Siverson (2004). “Testing competing institutional explanations of the democratic peace: The case of dispute duration”. In: *Conflict Management and Peace Science* 21.4, pp. 255–267.

Bueno de Mesquita, Bruce and William H Riker (1982). “An Assessment of the Merits of Selective Nuclear Proliferation”. In: *Journal of Conflict Resolution* 26.2, pp. 283–306.

Carter, David B (2010). “The strategy of territorial conflict”. In: *American Journal of Political Science* 54.4, pp. 969–987.

Chiba, Daina and Jesse C Johnson (2019). “Military Coalitions and Crisis Duration”. In: *The Journal of Politics* 81.4, pp. 1466–1479.

Cho, In-Koo and David M Kreps (1987). “Signaling games and stable equilibria”. In: *The Quarterly Journal of Economics* 102.2, pp. 179–221.

Chohan, Usman W and Omer Aamir (2020). “Kashmir: Beyond Imbroglios”. In: *Journal of Indo-Pacific Affairs* 174, pp. 159–183.

Coe, Andrew J (2018). “Containing Rogues: A Theory of Asymmetric Arming”. In: *The Journal of Politics* 80.4, pp. 000–000.

Debs, Alexandre and Nuno P Monteiro (2014). “Known unknowns: power shifts, uncertainty, and war”. In: *International Organization* 68.01, pp. 1–31.

Di Lonardo, Livio and Scott A Tyson (2022). “Political Instability and the Failure of Deterrence.” In: *Journal of Politics* 84.1.

Facer, Roger LL (1985). *Conventional Forces and the NATO Strategy of Flexible Response, The RAND Corporation*. Tech. rep. R-3209-FF, January.

Fearon, James D (1995). “Rationalist explanations for war”. In: *International organization* 49.03, pp. 379–414.

– (1997). “Signaling foreign policy interests tying hands versus sinking costs”. In: *Journal of Conflict Resolution* 41.1, pp. 68–90.

Feaver, Peter D, Scott D Sagan, and David J Karl (1997). “Proliferation pessimism and emerging nuclear powers”. In: *International Security* 22.2, pp. 185–207.

Filson, Darren and Suzanne Werner (2002). “A bargaining model of war and peace: Anticipating the onset, duration, and outcome of war”. In: *American Journal of Political Science*, pp. 819–837.

Gaddis, John Lewis (1986). “The long peace: Elements of stability in the postwar international system”. In: *International security* 10.4, pp. 99–142.

– (2005). *Strategies of Containment.* Oxford University Press.

Gannon, J Andres et al. (2024). “The shadow of deterrence: Why capable actors engage in contests short of war”. In: *Journal of Conflict Resolution* 68.2-3, pp. 230–268.

Gartzke, Erik and Matthew Kroenig (2016). “Nukes with numbers: empirical research on the consequences of nuclear weapons for international conflict”. In: *Annual review of political science* 19, pp. 397–412.

Gati, Charles (2006). *Failed Illusions: Moscow, Washington, Budapest, and the 1956 Hungarian Revolt.* Stanford University Press.

Gibilisco, Michael (2023). “Mowing the grass”. In: *Journal of Theoretical Politics* 35.3, pp. 204–231.

Göncz, Árpád, Charles Gati, and Timothy Garton Ash (2002). *The 1956 Hungarian revolution: a history in documents.* Central European University Press.

Guenther, Lindsey and Paul Musgrave (2022). “New Questions for an Old Alliance: NATO in Cyberspace and American Public Opinion”. In: *Journal of Global Security Studies* 7.4, ogac024.

Gurantz, Ron and Alexander V Hirsch (2017). “Fear, appeasement, and the effectiveness of deterrence”. In: *The Journal of Politics* 79.3, pp. 1041–1056.

Holloway, David and Victor McFarland (2006). “The Hungarian Revolution of 1956 in the Context of the Cold War Military Confrontation”. In: *Hungarian Studies* 20.1, pp. 31–49.

Huth, Paul K (1999). “Deterrence and international conflict: Empirical findings and theoretical debates”. In: *Annual Review of Political Science* 2.1, pp. 25–48.

Jervis, Robert (1976). *Perception and misperception in international politics.* Princeton University Press.

– (1979a). “Deterrence theory revisited”. In: *World Politics* 31.2, pp. 289–324.

Jervis, Robert (1979b). "Why nuclear superiority doesn't matter". In: *Political Science Quarterly* 94.4, pp. 617–633.

Joseph, Michael F (2023). "Do Different Coercive Strategies Help or Hurt Deterrence?" In: *International Studies Quarterly* 67.2, sqad018.

Karber, Phillip A and Jerald A Combs (1998). "The United States, NATO, and the Soviet threat to Western Europe: Military estimates and policy options, 1945–1963". In: *Diplomatic History* 22.3, pp. 399–429.

Kazmin, Amy and Farhan Bokhari (2019). "Pakistan's Imran Khan faces limited options on Kashmir". In: *Financial Times* 15.

Kenkel, Brenton and Peter Schram (2021). *Uncertainty in Crisis Bargaining with Multiple Policy Options: A Game-Free Analysis.*

Khan, Imran (2019). "The World Can't Ignore Kashmir. We Are All in Danger". In: *The New York Times* 30.

Kramer, Mark (1998). "The Soviet Union and the 1956 Crises in Hungary and Poland: Reassessments and New Findings". In: *Journal of Contemporary History* 33.2, pp. 163–214.

Krustev, Valentin L (2006). "Interdependence and the duration of militarized conflict". In: *Journal of Peace Research* 43.3, pp. 243–260.

Kydd, Andrew H (2019). "The sturdy child vs. the sword of Damocles: Nuclear weapons and the expected cost of war". In: *Security Studies* 28.4, pp. 645–676.

Lalwani, Sameer and Gillian Gayner (2020). *India's Kashmir Conundrum: Before and After the Abrogation of Article 370.* United States Institute of Peace.

Langlois, Jean-Pierre P and Catherine C Langlois (2012). "Does the principle of convergence really hold? War, uncertainty and the failure of bargaining". In: *British Journal of Political Science* 42.3, pp. 511–536.

Lanoszka, Alexander (2016). "Russian hybrid warfare and extended deterrence in eastern Europe". In: *International Affairs* 92.1, pp. 175–195.

– (2018). *Atomic assurance: The alliance politics of nuclear proliferation.* Cornell University Press.

Lin-Greenberg, Erik (2023). "Evaluating Escalation: Conceptualizing Escalation in an Era of Emerging Military Technologies". In: *The Journal of Politics* 85.3, pp. 000–000.

Mazarr, Michael J (2015). *Mastering the Gray Zone: Understanding a Changing Era of Conflict.* United States Army War College.

McCormack, Daniel and Henry Pascoe (2017). “Sanctions and Preventive War”. In: *Journal of Conflict Resolution* 61.8, pp. 1711–1739.

Mearsheimer, John J (1984). “Nuclear weapons and deterrence in Europe”. In: *International Security* 9.3, pp. 19–46.

– (1990). “Why we will soon miss the Cold War”. In: *The Atlantic Monthly* 266.2, pp. 35–50.

Mearsheimer, John J et al. (2001). *The tragedy of great power politics.* WW Norton & Company.

Mehta, Rupal N and Rachel E Whitlark (2018). “Shaping the Next Phase of US Non-proliferation Policy”. In: *US Foreign Policy in a Challenging World: Building Order on Shifting Foundations*, pp. 83–98.

Mehta, Rupal N and Rachel Elizabeth Whitlark (2021). “Nuclear Proliferation: The Next Wave in 2020”. In: *Oxford Research Encyclopedia of Politics.* Oxford University Press.

Nalebuff, Barry (1986). “Brinkmanship and nuclear deterrence: the neutrality of escalation”. In: *Conflict Management and Peace Science* 9.2, pp. 19–30.

Nasir, Abbas (2019). “A robust response that’s viable too.” In: *Dawn.* URL: `https://www.dawn.com/news/1499113`.

Perrow, Charles (2011). *Normal accidents.* Princeton university press.

Posen, Barry R (2014). *Inadvertent escalation.* Cornell University Press.

Powell, Robert (1989). “Nuclear deterrence and the strategy of limited retaliation”. In: *The American Political Science Review*, pp. 503–519.

– (2003). “Nuclear deterrence theory, nuclear proliferation, and national missile defense”. In: *International Security* 27.4, pp. 86–118.

– (2015). “Nuclear brinkmanship, limited war, and military power”. In: *International Organization* 69.03, pp. 589–626.

Quackenbush, Stephen L (2011). “Deterrence theory: where do we stand?” In: *Review of International Studies* 37.2, pp. 741–762.

Sagan, Scott D (1985). “Nuclear alerts and crisis management”. In: *International Security* 9.4, pp. 99–139.

– (1994). “The perils of proliferation: Organization theory, deterrence theory, and the spread of nuclear weapons”. In: *International Security* 18.4, pp. 66–107.

Sagan, Scott D and Jeremi Suri (2003). “The madman nuclear alert: Secrecy, signaling, and safety in October 1969”. In: *International Security* 27.4, pp. 150–183.

Sagan, Scott D and Kenneth N Waltz (1995). “The spread of nuclear weapons: A debate”. In:

Sagan, Scott Douglas and Kenneth Neal Waltz (2003). *The spread of nuclear weapons: a debate renewed*. WW Norton & Company.

Schelling, Thomas C (1960). *The Strategy of Conflict*. Harvard university press.

– (1966). *Arms and influence*. Yale University Press.

Schneider, Jacquelyn, Benjamin Schechter, and Rachael Shaffer (2023). “Hacking Nuclear Stability: Wargaming Technology, Uncertainty, and Escalation”. In: *International Organization* 77.3, pp. 633–667.

Schram, Peter (2021a). “Hassling: how states prevent a preventive war”. In: *American journal of political science* 65.2, pp. 294–308.

– (2021b). “When Capabilities Backfire: How Improved Hassling Capabilities Produce Worse Outcomes”. In: *Accepted for publication, Journal of Politics*.

Slantchev, Branislav L (2004). “How initiators end their wars: The duration of warfare and the terms of peace”. In: *American Journal of Political Science* 48.4, pp. 813–829.

Smith, Alastair (1998). “Fighting battles, winning wars”. In: *Journal of Conflict Resolution* 42.3, pp. 301–320.

Snyder, Glenn H. (1965). “The Balance of Power and the Balance of Terror”. In: *World in Crisis*. Ed. by Fredrick H. Hartmann. The Macmillan Company. Chap. 20, pp. 180–191.

Spaniel, William (Feb. 2019a). *Bargaining over the Bomb: The Successes and Failures of Nuclear Negotiations*. en. Cambridge University Press. ISBN: 978-1-108-47705-5.

– (2019b). “Rational overreaction to terrorism”. In: *Journal of Conflict Resolution* 63.3, pp. 786–810.

Spaniel, William and Iris Malone (2019). “The Uncertainty Trade-off: Reexamining Opportunity Costs and War”. In: *International Studies Quarterly* 63.4, pp. 1025–1034.

Tannenwald, Nina (2006). “Nuclear weapons and the Vietnam War”. In: *Journal of Strategic Studies* 29.4, pp. 675–722.

Tarar, Ahmer (2016). “A Strategic Logic of the Military Fait Accompli”. In: *International Studies Quarterly* 60.4, pp. 742–752.

Trachtenberg, Marc (1999). *A constructed peace: the making of the European settlement, 1945-1963*. Vol. 79. Princeton University Press.

Waltz, Kenneth N (1981). "The spread of nuclear weapons: More may be better: Introduction". In: *The Adelphi Papers*.

– (1990). "Nuclear myths and political realities". In: *American Political Science Review* 84.3, pp. 730–745.

Yoder, Brandon K (2019a). "Hedging for better bets: Power shifts, credible signals, and preventive conflict". In: *Journal of Conflict Resolution* 63.4, pp. 923–949.

– (2019b). "Retrenchment as a screening mechanism: power shifts, strategic withdrawal, and credible signals". In: *American Journal of Political Science* 63.1, pp. 130–145.

Zagare, Frank C and D Marc Kilgour (1993). "Asymmetric deterrence". In: *International Studies Quarterly* 37.1, pp. 1–27.