SIGNALING OR SAFEGUARDING: THE LOGIC OF MOBILIZATION IN CRISIS BARGAINING

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ABSTRACT

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This dissertation reexamines the often cited conclusion in diplomatic crisis bargaining that sunk cost signals, such as military mobilization and arms races, are inefficient compared to tied hands signals. This conclusion ignores the the investment potential that the most frequent examples of sunk cost signaling have in terms of increasing preparedness for war. Through a novel game theoretic model, I demonstrate that signals with a sunk investment can be optimal in comparison to tied hands signals. The conclusion of the model suggests that signals with a sunk investment, such as mobilization, have value as a hedged bet against deterrence, increasing in value as the investment would make the state more powerful in war, the state is pessimistic about deterrence, and the state is risk averse. I contextualize these conclusions in historical case studies of the Berlin Crisis and NATO intervention in Kosovo.

1. INTRODUCTION

The literature on signaling in diplomatic crisis bargaining often cites the inefficiency of military mobilization. Mobilization is often argued to be either no more informative of a state's resolve than other methods, but at greater cost(Fearon 1997; Fuhrmann & Sechser 2014), or outright less informative (Krause 2004). Much of the argument lies in mobilization having an ex ante sunk cost, which could be avoided if a state used comparatively cheaper tied hands signals. Despite their supposed inefficiency, states frequently take actions that are often cited as having a sunk cost in crisis bargaining, such as military mobilization, arms races, and forward deployments.

Rationalist explanations suggest that these mobilization initiatives are optimal only when less costly tied hands signals are unavailable. While this might be a plausible explanation for authoritarian regimes, it still leaves puzzle as to why democratic states, in which free and fair elections allow leaders to tie their hands by potentially incurring audience costs, have undertaken large sunk cost measures, such as military mobilization. Were the US stationing of troops in Europe during the Cold War and in South Korea simply irrational acts?

The reason for disconnect between reality and rationalist theory is that the most frequently cited examples of sunk costs signals in crisis bargaining, mobilization, arms races, and forward deployments, in reality have functions beyond burning resources to signal resolve. They are in fact, actions with a sunk cost component, capable of signaling resolve, but they are also investments which can increase the probability a state will prevail if it goes to war. Few works have treated these actions as sunk cost investments, and none have reexamined what treating these actions as a sunk cost investment means in terms of their optimality versus other signals. For game theoretic knowledge to be of practical use to foreign policy, therefore, models should make assumptions closer in line with the reality of crisis bargaining.

I attempt to bridge this gap between theory and reality in this dissertation by using a game theoretic model to demonstrate that sunk cost investments, such as mobilization, are a bet hedging strategy against deterrence failure, acting as signal of resolve and preparation for war if deterrence fails. The model's conclusions suggest that sunk costs can be preferred to tied hands when states are sufficiently pessimistic about deterrence succeeding and would receive substantial military benefits through early preparation. I then evaluate these implications empirically, using case studies of US foreign policy during the Berlin Crisis of 1961 and NATO intervention in Kosovo in 1999.

1.1 The Problem: Theory vs Reality

Early game theoretic models laid the foundation for a rich body of research of signaling in crisis bargaining, however, these models also gave rise to the misconception about the inefficiency of mobilization, which has yet to be broken. The classic Fearon model of sunk costs versus tied hands signaling, in which he lists mobilization as a sunk cost, concluded that states were strictly better off conveying their resolve by tying their hands rather than sinking costs (Fearon 1997). This conclusion was been based off ideal types, in which sunk costs and tied hands functioned solely as a signal of resolve. While ideal typification demonstrated the inefficiency of sunk costs solely as a means of conveying information, it left a theoretical blind spot about the real life cited examples of sunk costs, for example mobilization, most of which in reality are better defined as investments with sunk costs than pure sunk costs.

This is problematic as the examples Fearon gave of sunk costs, arms races and mobilization, have the potential to increase military power. While the conclusions are theoretically sound, the assumptions about the model deviate too far from reality to be practically informative regarding foreign policy. Scholars have not yet identified signals used in crisis bargaining that purely burn money, as many in the literature assume, meaning the most frequent examples of sunk cost signals are not purely sunk

costs, but sunk investments. As scholars on international relations have yet to identify a pure sunk cost signal used cited regularly in crisis bargaining, models should reflect sunk cost investments which are a more realistic reflection of the instances scholars have identified. The model I present in this dissertation addresses this gap treating sunk costs as a military investment, increasing the probability a state will prevail in war and directly comparing it with tying hands. While treating mobilization as a military investment has been explored by a prior formal model (Slantchev 2005), this model did not incorporate a strategic choice between signals. However, modeling signaling choice while incorporating sunk investments allows us to revisit the conventional wisdom on mobilization's inefficiency and see if it still holds.

Frequently, signaling models examine one signal and analyze how its informativeness is influenced by the parameters. While this method is useful for generating hypotheses about when signals are likely to deter adversaries, it is less useful for understanding a state's choice between signaling strategies. Modeling signaling choice is valuable because it generates hypotheses about when certain signaling actions are likely. This modeling choice is a more realistic picture of foreign policy, as leaders have an array of diplomatic options to choose from to signal resolve, including but not limited to public threats and military measures. For the comparison of tied hands and sunk cost signals the closest the literature has come to this method is comparing the welfare levels each strategy provides in separate models. The model I present allows for signaling choice, making it clear the conditions under which certain signals are preferred over others.

1.2 Importance

This dissertation makes a number of theoretical, empirical, and practical contributions. The first theoretical contribution is that it gives the literature a framework for understanding signal preference. Previous models of coercive diplomacy have only incorporated one signal, either only being able to demonstrate the mechanism a signal

uses to be informative (Slantchev 2005; Fearon 1997), or a signal's relative efficiency (Fearon 1997). The model presented in this dissertation specifies the conditions for empirically testable hypotheses about when we should expect sunk cost signals.

Another theoretical contribution is that it refutes the literature's assumption that military mobilization is an inefficient crisis bargaining strategy. Fearon's sunk cost versus tied hands model, which does not incorporate the potential benefits of military mobilization, set off a wave of empirical research on the relative value of military mobilization versus public threats, much of which finds that deterrence is more likely/not less likely to fail when mobilization is employed (Krause 2004; Fuhrmann & Sechser 2014). While several scholars argued that this was an empirical vindication of Fearon's theory, my model proposes an alternative explanation, that states are incentivized to mobilize when they believe diplomacy is more likely to fail in the first place. Model suggests that rather than mobilization being a poor method of deterrence, it is a hedged bet against the success of diplomacy. Mobilization is no more or less to make diplomacy succeed than a tied hands signal, but is a preferable option to states when the probability of diplomacy's success is low.

The final theoretical contribution is that the model highlights the importance of the signaling state's risk preferences in crisis bargaining. Some have argued that the distinction between tying hands and sinking costs disappears when mobilization is treated as a military investment because in both cases states can commit themselves to fighting by changing the relative cost/benefits of going to war and backing down on a crisis. Tied hands signals do this through upping the costs of acquiescing and mobilization does this by increasing the expected payoffs of fighting. However, the argument that they are the same type of signal, despite using different mechanisms to change the relative costs, ignores the very different impacts the signals have on the payoffs of successful deterrence versus war. A sunk investment, like mobilization is wasted if deterrence succeeds, however, should war occur the expected payoff would be higher relative to a tied hands signal. This would suggest that risk averse signalers would place more value on a sunk investment than tying hands ceterus paribus, as they

are more willing to forgo cheap deterence for being prepared to fight an advantageous war.

The empirical contribution of this dissertation is that it can explain a wider array of cases of coercive diplomacy than previous theories. As previous theories and empirical work have suggested that mobilization is inefficient in crisis bargaining, rationalist frameworks have limited ability to speak to why they occur. Some could argue that tied hands signals may have not been available to certain governments. However, mobilizations by democratic governments, with the ability to generate audience costs through competitive elections, would remain anomalies explained by irrational behavior. The United States has forward deployments across the globe, costing billions of dollars. Currently, rationalist theory has a problem of explaining the signaling behavior of the international system's hegemonic power. This is a very big outlier to be left unaddressed.

Finally, this model takes signaling theory into greater practicable applicability to foreign policy. While previous models have laid the scientific foundation for work on signaling theory, the models have remained very abstract, leaving little potential to be informative in the practice of foreign policy. The original model of sunk cost versus tied hands signaling did not take into account that the examples of sunk costs in crisis bargaining frequently come with a military benefit. While it may make a theoretical point about sunk costs being an inefficient method of deterrence, the non-existence of a pure sunk cost in reality make the findings of little practical use in foreign policy. While later models make realistic assumptions about mobilization and demonstrate the conditions under which it could be considered credible (Slantchev 2005), they do not show more realistic situations when states have a variety of policy tools at their disposal. Current game theoretic knowledge at most shows when individual signals are credible, but do not show when they are optimal in comparison to one another. The model in this dissertation makes realistic assumptions about how mobilization operates and assumes that the signaling state has a choice between signals allows for

a direct comparison between signals. This takes theory closer in line with reality, meaning there it has greater practical significance to foreign policy.

By bringing game theory closer in line with reality we can speak more to pressing foreign policy debates. While stating that mobilization can be a rational strategy makes an academic contribution to the debate on signaling, the most practical contribution are the conditions under which mobilization is optimal. This is particularly important as the US grand strategy of deep engagement has come under greater scrutiny in recent years. Increasingly US policy of spending trillions of dollars and stationing troops across the globe has come into question. The model presented in this dissertation suggests that it may be premature to immediately label these forward deployments as wasteful spending. Additionally, the model's equilibrium conditions give a framework for mobilization to be evaluated on a case by case basis. The insights from the model would suggest that US military resources could be optimized by stationing forces in areas where conflict is likely and preemptive mobilization would considerably impact the likelihood of US victory. These guidelines present a path for a leaner method of defending US interests abroad, scaling back in regions which provide little return on military mobilization, and refocusing these resources in regions with the greatest return. The implications of this model can re-frame the current debate from more or less military engagement around to globe to smarter and more efficient military engagement around the globe.

1.3 Empirical Evaluation

The question of why states mobilize is of importance from an empirical perspective as well. The US spends billions annually deploying forces around the globe. However, our current understanding of crisis bargaining would suggest that the US could save these scarce resources by simply demonstrating its resolve through verbal threats. As a democracy with a leader held accountable to its electorate, public threats should generate a potential audience cost, which will hold the leader to their threat and

make it credible. Through my empirical evaluation I will demonstrate how my model can explain why states prefer to undertake actions involving a sunk cost in some situations, such as the Berlin Crisis in 1961, and tied hands signals are preferred in others, such as Kosovo in 1999.

The case studies will follow the method of Goemans and Spaniel (2016). Each case study will define the equilibrium from the theoretical model and discuss how the parameters were operationalized in each case. This method is conducive to empirically evaluating game theoretic models, as the theoretical parameters, such as beliefs, are often abstract and difficult to quantify.

In the case study of the Berlin Crisis of 1961 I will show that sunk costs were preferred to tied hands because they increased US military capabilities in West Berlin. While the US hoped that mobilization would demonstrate its resolve to defend allied access to Berlin, it was uncertain about Soviet intentions and wanted to be prepared for the worst. US strategic thinkers believed that increasing its forces in Berlin would allow it to hold on to the city longer in the event the USSR cut off allied access by force, increasing the chances that Soviets would capitulate fearing escalation to a general war. In this case the US was willing to undertake the sunk costs associated with mobilization because they believed it would meaningfully alter the outcome in the event of war, and believed their was a sufficient probability the USSR would resort to force.

In the case study of Kosovo I demonstrate that tied hands signals still have value in the new model, but its optimality is possible under a narrower set of conditions. In the lead up to the US's involvement in Kosovo it offered Slobodan Milosevic tied hands ultimatums, not because they are always optimal, but because mobilization provided few benefits. The US's instance on an air campaign meant that many of the resources necessary to take on such a limited campaign were readily available. Allocating additional resources through mobilization would not have significantly altered the probability of a US victory in the event it had to use force. This meant that regardless of the US's beliefs about Milosevic's resolve, the lack of military

benefits from mobilization meant that it was not worth the ex-ante sunk cost. The US instead opted to avoid this cost by staking its credibility on the international stage if it were to back down.

The empirical implications of the model have several policy relevant applications. The model implies sunk cost signals are likely to be favored in enduring rivalries, which are more likely to escalate to war than isolated diplomatic disputes (Goertz & Diehl 1992). This suggests that the prevailing wisdom of tied hands optimality may be ill suited to understanding disputes between great power rivals, which produce some of the most consequential diplomatic crises. Additionally, understanding the dynamics under which sunk cost signals, such as force deployments and mobilizations, are optimal is critical, especially as the US is increasingly critical of its grand strategy of deep engagement and skeptical of the price tag of its military commitments abroad.

1.4 Overview

The following chapter will review the literature on signaling in crisis bargaining. This chapter will identify the disconnect between theory and reality in crisis bargaining. It will also identify potential reasons for this disconnect and propose a theoretical solution. In Chapter 3 I build a game theoretic model based on this proposed solution. The model addresses the gaps in the literature by comparing mobilization versus tied hands signals and treating mobilization as a sunk cost investment. Chapter 3 concludes by examining the equilibria and discussing the parameters under which mobilization is optimal.

In the remaining chapters I evaluate the model empirically using cases of signaling in US foreign policy. In Chapter 4 I examine US signaling behavior in the Berlin Crisis of 1961. This chapter demonstrates the value that mobilization had as a hedged bet against deterrence, showing that the US both saw mobilization as a signal and a costly preparation for war in the event it had to defend allied access to Berlin through force. In Chapter 5 I examine US signaling behavior in NATO's 1999 intervention in Kosovo.

This chapter demonstrates that tied hands still have value in crisis bargaining, but its optimality exists under a narrower set of conditions than previously suggested by the signaling literature. This case shows that the US found issuing public threats to be the optimal strategy, but that there was little to gain from mobilization because of the US's insistence on an air campaign. Finally Chapter 6 makes concluding remarks on the model, the cases, and implications for further research.

2. LITERATURE REVIEW

States involved in diplomatic disputes must make decisions on whether to respond to threats by capitulation, escalation, or war based on their own resolve and beliefs about their adversary's resolve (Morrow 1989). While war is an inefficient crisis outcome because of its costliness, the existence of private information can lead states to fight because they are incentivized to misrepresent their resolve to gain concessions (Fearon 1992, 1995). This incentive causes a credibility problem for signaling resolve, and as such, rationalist literature suggests that resolved states must take actions that unresolved states would be unwilling or unable to take to be seen as credible (Tingley & Walter 2011,999). One way a state can do this is to undertake a cost, or a risk of incurring a cost, that is high enough to distinguish it from an unresolved type (Schelling 1966; Fearon 1992, 1997; Sartori 2005).

The most frequently cited examples of costly signals are tied hands and sunk costs (Fearon 1992, 1997). Tied hands signals are when a state attempts to demonstrate its resolve by increasing the cost of capitulation Fearon (1997). As such tied hands signals only carry an ex-post cost when a signaling state capitulates. If the adversary is deterred or the signaling state chooses to fight the cost is avoided. If the cost of capitulation is high enough, a tied hands signal can inform the receiving state of the signaler's resolve by making bluffing to costly for an unresolved state. In its most extreme form the cost of capitulation is high enough so that states initially unresolved states can create credible commitments to fight because the cost of capitulation is higher than a disadvantageous war.

Tied hands signals are commonly conceptualized as audience costs, in which a state leader issues a public threat and faces a potential backlash from a domestic audience if the leader backs down (Fearon 1994; Levendusky 2010; Tomz 2007). The public nature of the threat allows the audience to observe and punish a leader for

inconsistency in the event they back down (Fearon 1997). This exemplifies tied hands signaling the audience cost is only paid for capitulation, giving resolved leaders a method of cheap deterrence by taking on a threat of incurring a cost rather than paying upfront (Fearon 1997). There is an extensive body of both theoretical and empirical literature on audience costs in crisis bargaining (Fearon 1994; Levendusky & Horowitz 2012; Tomz 2007). These works have refined the concept theoretically, validated the existence of audience costs in international crisis bargaining (Tomz 2007; Baum & Groeling 2009; Davies & Johns 2013; Kertzer & Brutger 2016; Brutger & Kertzer 2018), and demonstrated its value as a deterrent signal.

Not only has the literature suggested that audiences punish leaders for backing down on their threats, but it has also suggested that the ability to generate audience costs does indeed impact the ability of the signaling state to convey its resolve. Work by Haynes (2012) tested this by examining crises in which democratic leaders were no longer able to run for reelection because of term limits. As these leaders' can no longer be threatened by electoral pressure, their costs for backing down from a threat are lower. Haynes found that lame-duck leaders were less likely to deter adversaries in crisis bargaining than their counterparts who faced potential reelection. This provides further evidence that states can convey their resolve using audience costs, and that their credibility is related to their costliness.

There has been less research on sunk cost signaling. Sunk costs are paid ex-ante regardless of the crisis outcome (Fearon 1997). A state can provide information about its resolve by undertaking some upfront cost that would be prohibitively costly for an unresolved type to undertake. Undertaking a sunk cost demonstrates to the recipient of the signal, that signaler is unlikely to have high signaling costs (Spence 1973). Therefore, by undertaking a sunk cost signal a state can credibly convey to an adversary that it is unlikely to have high costs for war, suggesting that it would be resolved to fight over a given foreign policy issue (Fearon 1997).

In practice, sunk costs can include arms build-ups, military mobilization, and troop deployment (Fearon 1997; Slantchev 2005). The expenditure of resources for

military purposes is a costly way of signaling resolve and demonstrates to other actors the leader's resolve to fight (Fearon 1997; Slantchev 2005).

Fearon's seminal work on these different forms (Fearon 1997) of costly signals may explain this lopsided focus (Slantchev 2005, 533). In this piece Fearon compares crisis bargaining models for tied hands and sunk cost signals. From the comparison of the models Fearon concludes that leaders receive better outcomes from signaling by tying their hands versus sinking costs. This is because the tied hands signal is paid ex-post and only in the event that the leader must back down from the threat, and sunk cost signals are paid regardless of whether the leader fights or not. Tied hands signals, therefore, have the same value as a signal for less cost than sinking costs.

While the debate between tied hands and sunk cost optimality has remained largely theoretical, some empirical work has been conducted to assess optimality. Using data on alliances Fuhrmann and Sechser examined how deterrence differed between states allied with nuclear powers, and states that had foreign nuclear deployments Fuhrmann & Sechser (2014). They found that sinking costs through foreign nuclear deployments does not significantly increase the likelihood of deterrence more than an alliance with a nuclear power. From this evidence they suggest that tying hands using the threat of nuclear retaliation is sufficient to deter enemies, and that the extra sunk cost of nuclear mobilization may be inefficient. However, much like the Fearon model, its claim of mobilization's inefficiency stems from the assumption that mobilization is a pure sunk cost and not an investment with a sunk cost as in the Slantchev model.

Empirical work has also suggested that mobilization is not only an inefficient means of conveying information, but actually increases the likelihood of war. Krause Krause (2004) found correlational evidence showing that states that received arms transfers, a sunk cost, from major powers were more likely to go to war with adversaries than those who only received formal commitments, tied hands, from major powers. While Krause's theory argues mobilization increases the likelihood of war, the empirical evidence is correlational, and does not rule out the possibility that mo-

bilization is better suited to situations when the probability of war is already high. Additionally, this empirical dynamic has not yet been encompassed in a formal model.

The conclusion of tied hands optimality leave a puzzle: why do leaders undertake the sunk costs associated with mobilization in the real world when our current theories have concluded that it is a strictly worse off option? Were the stationing of US troops in Europe during the Cold War and in South Korea, simply irrational acts taken by a state that could have just as easily relied on cheap deterrence through public threats? One explanation that has been offered is that it is not always possible for a leader to tie their hands (Fearon 1997). However, this explanation is not satisfactory. Although audience costs and sunk costs are both costly signals, they differ substantially in their nature. Leaders always have the ability to draw red lines publicly, and always have the ability to pay an audience cost. Even if these costs may vary within democracies based on factors such as term limits (Haynes 2012), democratic leaders are still more susceptible to loss of public support and political capital than autocratic leaders. Tying one's hands is costly because it threatens the leader's position or influence, therefore, when a leader draws a red line they will pay the resulting audience cost should they back down (Weeks 2008). Even if one were to cede that audience costs may be constrained for autocratic leaders, signaling theory currently would have difficulty explaining major sunk cost initiatives taken by the United States.

Actions that involve sunk costs, however, by definition have costs paid ex-ante. The buildup of arms and the mobilization of troops requires physical resources, which leaders do not necessarily have access to. The ability of a leader to tie their hands is in most circumstances available to democratic leaders, whereas sinking costs might not be an option depending on a leader's resource constraints.

Another potential explanation, which Fearon acknowledges [1], is that many of the often cited examples of sunk costs provide benefits beyond conveying information. While the concept of sunk costs was borrowed from the economics literature, the literature in international relations treats the concept quite differently. In international

[1]See footnote 27 in Fearon (1997).

relations actors undertake sunk costs as a method of demonstrating their resolve in a foreign policy issue. However, in the economics literature actors frequently undertake sunk costs as an investment, a down payment in the current period in hopes of greater returns in future periods (Dixit 1980; Arvan 1986; Chavas 1994; Shaanan 1997; Fader 2002; Cabral 2012; Duxbury 2012; Pyone & Emich 2016; Yoon 2018). One type of sunk cost investment that is translateable to international relations, though not in widespread use, are sunk costs that actors undertake in order to build capacity in the future (Dixit 1980; Arvan 1986; Shaanan 1997). This begs the question of whether the most frequent examples of sunk costs in international relations are truly pure signals, or if they function as investments as well.

Assuming that mobilization is a sunk cost is logical. The time and resources spent gathering and deploying troops cannot be recouped once forces have been mobilized, but can sinking costs build capacity? Sinking costs through mobilization would prepare a state's troops for military conflict and allow state to strike before the potential challenger could mobilize. Arms buildups could improve the technological capability of a state's army. In these instances, sunk costs could act as an investment, which increases a state's relative power and thus the likelihood that it will win in a military contest. Sunk costs could then serve a dual purpose of both acting as a signal of resolve, while preparing for the possibility of conflict. If the most frequent examples of sunk cost signals in crisis bargaining are not pure sunk costs, but truly investments with an associated sunk cost, and the literature continues to examine these examples if they were pure sunk costs, then the literature is only sound in theory. In order to take the theoretical insights and make them applicable to explaining real world behavior in crisis bargaining models need to make more realistic assumptions about the signaling options world leaders have available to them.

While it is more realistic to assume that examples of sunk costs in international relations are truly sunk investments, making this assumption comes with complications. One issue with treating sunk costs as a military investment is that it can blur the lines between sunk costs and tied hands signals (Fearon 1997; Slantchev 2005).

If sunk costs were to alter power between two states, then much like tied hands signals, they change the relative desirability of war and capitulation (Slantchev 2005). There is a trade-off here between conceptual clarity and the ability to practically speak to foreign policy. Fearon's conceptual clarity demonstrates that sunk costs are inefficient solely in the way they convey information. However, with the model's conceptual clarity he lost the ability to speak practically to the real world examples of sunk costs that he gave, military mobilization and arms races. While this conceptual clarity provided a solid theoretical starting point, for the signaling literature to have practical relevance to foreign policy more realistic assumptions about signaling must be made.

Although it has not been the norm in the international relations literature, some works have explored mobilization as a sunk investment, making war a more attractive option for the mobilizing state, rather than a pure sunk cost signal (Lai 2004; Slantchev 2005). Fearon (1997) acknowledges this possibility, but nonetheless does not include it in the model for reasons of conceptual clarity. Both Fearon (1997) and Slantchev (2005) have argued that when sunk costs are an investment that increases the probability of the state winning in a military contest the conceptual clarity between sunk cost and tied hands signals become blurred. For this reason, Fearon (1997) did not include an increase in power in his model of sunk costs. The logic behind the argument is increasing power through sunk costs increases the attractiveness of going to war versus backing down, much like a tied hands signal (Fearon 1997; Slantchev 2005). However, just because the public would be more supportive of a war when costs are sunk does not mean that the leader will suffer an audience cost for not fighting, one reason being that the general public is not likely to be aware of how military mobilization would affect the balance of power between the potential combatants. Another reason is that the concept of an audience cost is that leaders are punished by their domestic audience for backing down on a threat issued because the leader is perceived to have damaged the state's international standing or appears incompetent. However, a sunk cost, on its own, does not have a specific threat issued

with it, and therefore, no red line to cross. This highlights a gap in the literature for theories that would treat a sunk cost as an investment while providing conceptual clarity between sunk costs and tied hands.

Slantchev's model also demonstrated how conceptual clarity could be blurred if mobilization was treated as both a signal and an investment. While he assumed that states would pay upfront costs for mobilization, as in a traditional sunk cost signal, he also assumed that this would lead to an increase in power. His model showed that much like states could commit themselves to war by increasing the cost of backing down so high that they could not rationally capitulate through tying hands, states could also commit themselves to war by increasing the probability that they win through mobilization (Slantchev 2005). While Slantchev sacrificed conceptual clarity in his model of mobilization, he showed a tool that state leaders could use to create commitments independent of their domestic audiences and brought the assumptions of the signaling literature closer to reality.

While Slantchev's assumption that sunk costs can affect the outcome of war is more realistic, his model does not address whether the assumption would change the implications for mobilization's efficiency compared to other signaling strategies. Particularly Slantchev does not compare how mobilization would compare with a tied hands signal, such as a public threat. In Slantchev's model sunk costs can create commitments for states to fight; however, mobilization is the only available method of signaling. Without a model that directly compares mobilization with tied hands signals the question of why a state would rationally choose to mobilize still remains. The contribution of Slantchev's model was providing more realistic assumptions of how mobilization functions as a signal, the conditions under which it is informative, and demonstrate that states could create credible commitments to fight through mobilization, much like they would be able to do through a traditional tied hands signal. However, without revisiting what this means for mobilization's efficiency versus a tied hands signal, the literature has largely relied on the original Fearon conclusion, treating mobilization as a sunk cost signal less efficient than tied

hands. This is seen in the empirical works of Fuhrmann and SechserFuhrmann & Sechser (2014) and Krause Krause (2004), who frame their works as empirical tests on mobilization as empirical tests of Fearon's tied hands optimality conclusion.

Slantchev makes more realistic assumptions of how mobilization functions in foreign policy crisis by treating mobilization as a sunk investment. However, Slantchev's model did not reassess what treating mobilization as a sunk investment meant for mobilization's optimality versus tied hands signals. I attempt to take these assumptions and re-compare mobilization with tied hands signals to address the question of why a state would rationally choose to mobilize when it has the cheaper option of tying its hands to signal its resolve. This approach is novel as signaling models frequently demonstrate how a particular type of signal can be informative, but frequently ignore why states would prefer one signal over another. My model addresses this by showing that mobilization can be an optimal strategy compared to tied hands signals, not merely a last resort for leaders unable to generate audience costs.

The model presented in this paper updates Fearon's model by comparing tied hands signals to mobilization, in which mobilization is treated as a sunk cost investment rather than a pure sunk cost, and by fixing the cost of signaling. The equilibrium solutions to this model come to three conclusions on the optimality of sunk cost investments: sunk costs investments will be most likely when there is a high return on military investment, when the defender believe that the challenger is more likely to be resolved, and when the defender is risk averse. This conclusion provides a rational theoretical framework for why a state would rationally choose to mobilize. Rather than being inefficient, mobilization is more likely to be an efficient strategy when deterrence is more likely to fail and preparation would yield significant military benefits. The conclusion also allows for the derivation of empirically testable hypotheses on when mobilization is likely to be employed in a diplomatic crisis. Finally, the conclusion also provides some undiscussed distinction between mobilization and pure tied hands signals. While mobilization and tied hands signals both allow the state to create commitments by altering the relative attractiveness of capitulation

versus war, they alter the costs and benefits have very different implications for risk preferences.

3. MODEL & THEORY

This chapter presents a model of signaling choice between mobilization and tied hands. The model builds on Fearon's model of sunk cost versus tied hands. The model simulates a diplomatic crisis by giving the signaling state a choice between signaling strategies of mobilization, tying hands, or not signaling. The opposing state observes the signal and makes a decision on whether to challenge the signaler for the good. Finally, the signaling state has the choice to follow through and fight or acquiesce if challenged.

Tied hands signals operate much like they do in the Fearon model. However, much like the Slantchev model, mobilization is treated as a sunk investment, with an ex-ante cost but also increases a states military potential if chosen as a signal. This gives a direct comparison between mobilization and tied hands signals, allowing for a reevaluation of the conventional wisdom of whether mobilization is an inefficient strategy.

The equilibria of the model suggest that undertaking sunk costs can be optimal under the relatively permissive condition that there is an expected return on military investment. The following section will discuss the implications of treating sunk costs as a military investment for risk preferences. The final section will use the intuition behind the model's equilibria and the implications for risk preferences to derive a theory of when tied hands and sunk cost signals are most likely. The theory suggests that sunk cost signals are most likely when there is a high increase in power from sinking costs, the signaler is relatively sure that its enemy is resolved, and when the signaler is risk averse.

While this implications hold across the several equilibria presented in this chapter, the equilibria highlight different ways that sunk investments have value as a strategy. Sunk investments can be used as a hedged bet against the success of deterrence,

serving as both a costly signal and a preparation for war. They can also be used, as Slantchev (2005) argued, as a way for signaling states to create commitments to fight by increasing their expected benefits for war. Finally, and also an area that is yet unexplored in the literature, states can use sunk investments to alter the strategic calculus of their adversaries. Unlike tied hands signals, which alter the costs of war for the signaling state, sunk investments alter the balance of power between states. Since increasing the balance of power for the signaler necessarily decreases the balance of power for its adversary, states can use sunk investments not only deter their adversaries by conveying their resolve, but also by making war too costly for its adversary.

The chapter concludes with a discussion of the equilibria, in which the practical and empirical implications of the model are discussed. The discussion suggests, against the conventional wisdom, that mobilization can be an effective strategy under relatively permissive conditions. Additionally, it suggests that the equilibria are congruent with current empirical studies, and are well suited to explain cases outside the scope of current theory in crisis bargaining.

3.1 The Model

The premise of the game is that there are two states $i \in \{D, C\}$, a defender, D, and a challenger C in dispute over a good with a value normalized to 1. Both D and C are assigned types by nature. They can either be low cost types denoted as D_L for D and C_L for C, or they could be high cost types, denoted D_H for D and C_H for C. The types are differentiated by their costs for war. Low cost types are assigned costs $\underline{c_D}$ and $\underline{c_C}$ for D_L and C_L respectively, and high cost types are assigned costs $\overline{c_D}$ and $\overline{c_C}$ for D_H and C_H respectively.[1] Each low cost player is assumed to have lower costs for war than their high cost counterpart, $\overline{c_D} > \underline{c_D}$ and $\overline{c_C} > \underline{c_C}$.

[1]The values of c_D and c_C are distinct. They can be, but are not necessarily the same values. The only assumptions imposed on the costs for war are that they are positive and $\overline{c_i} > \underline{c_i}$.

These assumptions not only differentiate the types of each player, but also satisfy the rationalist assumption that war is costly (Fearon 1995).

The first move of the game is nature assigning each player a type with the probability of D being low cost μ_D and C being low cost μ_C. Conversely, the probability of D being high cost is $1 - \mu_D$ and C being high cost is $1 - \mu_C$. While the values of the costs of war for each player/type combination and the probabilities of being a low cost type are public information, each player only knows their own type assignment. For example, D would know the value of both $\underline{c_C}$ and $\overline{c_C}$, as well as μ_C, but C actual type assignment.

After nature selects player types, D moves first, selecting between a sunk cost, tied hands, or no signal strategy. With a sunk cost strategy, the cost of the signal, m, is paid regardless of the strategies D and C play in the future. With the tied hands strategy, the cost of the signal is only paid if D backs down from a challenge. There is no cost associated with choosing a no signal strategy. Upon observing D's signaling strategy C then chooses whether it will challenge D or not. If C chooses not to challenge the game ends and D receives the entire good.

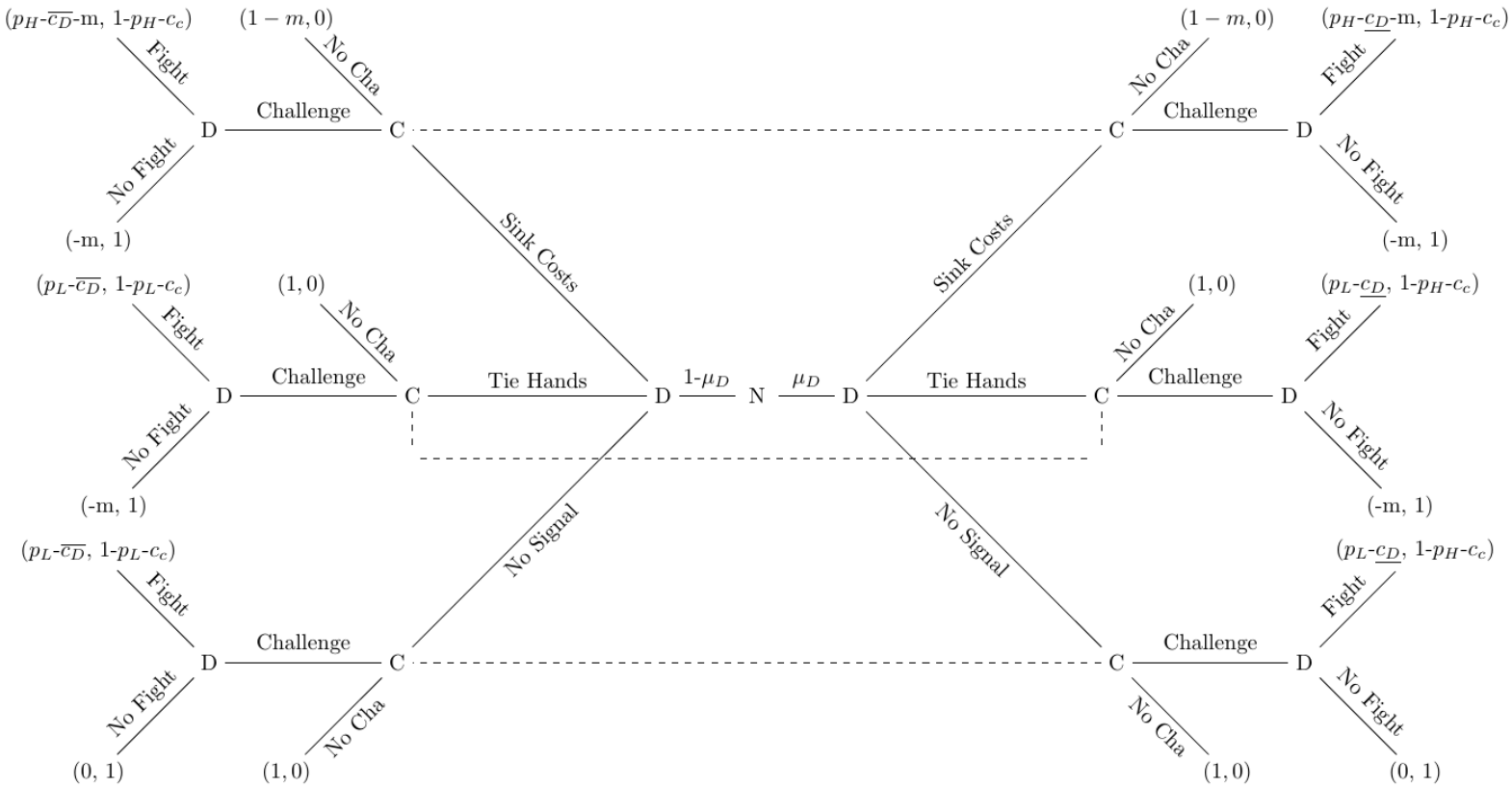

Figure 3.1. Game Tree

If C chooses to challenge, then D must decide whether it will fight over the good or not. If D decides to fight then it will win the good with publicly known probability, p_L and this probability is increased to p_H if D sunk costs[2]. If D chooses to fight, then the expected payout for the D and C is the probability they win minus their costs for war. In the event D sinks costs the sunk cost is subtracted from their expected payoff as well. If D backs down C will receive the entire good and D will receive nothing if it did not signal and pay the signaling cost, m, otherwise.

In this model C does not have an opportunity to signal in response to D, a choice other signaling models have made[3]. Additionally, the contested good is indivisible, unlike many bargaining models that allow players to offer splits of the good. While aspects of these assumptions may be unrealistic, these choices were made deliberately to demonstrate how treating sunk costs as a military investment changes the generally accepted conclusions of the Fearon model, which made these assumptions. As the purpose of this model is to draw comparisons with Fearon's conclusions with mobilization treated as a sunk investment, the indivisibility of the good is unchanged to keep as many of the original Fearon assumptions as possible.

There are several different parameter spaces examined in this paper. The first is when C_L & D_L will have positive payoffs for war, and high cost types will have negative payoffs for war, regardless of D's choice to sink costs. I will refer to this space as the signal only space. In this space the gap in costs between D_L and D_H is wide enough where sinking costs will not impact its final decision to fight or not.

The second space is when D_H's choice to sink costs would make war preferable to backing down. I will refer to this space as the commitment space. In this space the gap in costs between D_L and D_H relative to p_H than in the signal only space. In this space not only does D_L prefer to fight than back down, but the increase in power from sinking costs is great enough where if D_H did choose to mobilize it would choose to fight.

[2] $p_H > p_L$ by assumption in this model to reflect the concept of military investment
[3] See Slantchev (2005)

The third space I will examine is when D's choice to sink costs alters the balance of power so that C_L has negative payoffs for war, but does not alter D_H's decision to go to war or back down. I will call this the de-commitment space. With respect to D the de-commitment space is much like the signal only space, in which D's signaling choice does not alter D_H's optimal strategy being backing down from a challenge. However, in this space, the net benefits of war for C_L are low enough that the reduction in its relative power coming from D's choice to sink costs would make C_L prefer not to challenge D for the good.

Finally, I will examine a space in which D's choice to sink costs would create a commitment for D_H and make C_L's war payoffs negative. I will call this the De-commitment/Commitment space. This space has both the effects of the commitment creation and de-commitment spaces. In this space D_H's costs for war are small enough and C_L's costs for war are high enough relative to the increase in power from sinking costs that if D chooses to sink costs D would challenge regardless of type and C would back down regardless of type.

While there are many equilibria across the spaces in this game, the purpose of this dissertation is to examine when sunk investments would be optimal. Therefore, the equilibira that are presented are pure strategy equilibria in the four parameter spaces in which either or both types of D choose to sink costs. Although there are several equilibria across these four parameter spaces in which D will sink costs, for the sake of brevity one equilibrium will be discussed per parameter space.

3.2 Equilibrium 1: Signal Only

The signal only space is characterized by low cost types of D and C having positive payoffs for war and high cost types having negative payoffs for war regardless of D's signaling strategy. In this space, nature's assignment of a low cost type is synonymous with being resolved and the assignment of a high cost type is synonymous with being unresolved. For these conditions to hold assumptions need to be placed on the values

of the parameters. The condition that D_L is resolved and D_H is unresolved and cannot create a commitment through sinking costs requires the following boundaries: $p_H - \overline{c_D} < 0 < p_L - \underline{c_D}$. The condition that C_L has positive war payoffs and C_H has negative war payoffs regardless of D's strategy requires the following boundaries: $1 - p_L - \overline{c_C} < 0 < 1 - p_H - \overline{c_C}$. These conditions make it so that D_H's net costs for war are considerably large compared to the potential increase in power from sinking costs. Therefore, even if D_H were to choose to sink costs, it would still choose to back down from fighting if challenged. Similarly the net benefits for war for C_L are so large relative to the decrease in power that it would experience if D were to sink costs that its decision to challenge remains unchanged by D's signal choice. These conditions will be assumed in the following section.

In the signal only space there are four pure strategy equilibria in which sunk costs are optimal for D. In all of these equilibria D_L chooses to sink costs. The condition for sunk cost optimality for D_L is the same across all four equilibria in the signal only space. For D_L to prefer sunk costs to tied hands the cost of the signal must be less than the increase in power from sinking costs discounted for the belief that the challenger is resolved, $\frac{m}{\mu_C} < p^*$, with p^* representing the return on a sunk cost, $p_H - p_L$. This inequality shows the value of a sunk cost investment compared to a tied hands signal. The ratio of cost to beliefs about C's resolve must be low enough to offset the opportunity cost of forgoing a tied hands signal. This is intuitive because although D can only receive an increase in power through the sunk cost, D_L does not pay signaling costs for tying hands and will only realize the value of the sunk cost investment when war occurs. Therefore, D becomes more willing to pay the signaling cost as it becomes lower and is more pessimistic about the prospect of deterrence. As the left term of the inequality is the ratio of the cost to D's belief that C is resolved the inequality will be referred to as the Cost/Threat (CT) condition. The CT condition is universal for all pure strategy sunk cost equilibria in the signal only space[4].

[4]This condition holds even for any value of C's off path beliefs

This section will focus on a separating equilibrium with D_L sinking costs and D_H not signaling. This means C is perfectly informed about D's type. C_H, therefore, will challenge if it D does not signal and will back down if D sinks costs and C_L challenges regardless. D_L will fight if challenged and D_H will back down. Thus, the conditions of the first SCNS equilibrium are[5]:

$$1 - \mu_C < m < \begin{cases} \mu_C p^* \\ \overline{c_D} - p_L \end{cases} \tag{3.1}$$

The top term in the upper bound ensures the CT condition is satisfied. The added military benefit of sinking costs must offset the ratio of the signaling cost to D's beliefs of C's resolve, $\frac{m}{\mu_C} < p^*$. This is intuitive because tying hands is a cheap strategy of deterrence for D_L, and sunk costs are more expensive, but a simultaneous war preparation. If D sinks costs it will benefit from a more advantageous war if it occurs, but will waste resources if C is deterred because it could have costlessly signaled resolve by tying hands. Since there is an added benefit to sinking costs which only is realized in war, D will be willing to pay a higher upfront signaling cost as it becomes more pessimistic C can be deterred and as preparations would make war more advantageous.

The bottom term in the upper bound, $m < \overline{c_D} - p_L$, is an extra assumption that prevents D_H from creating a commitment to fight through tying its hands[6]. Since D_H would reveal its type by tying its hands and cannot credibly commit itself to fighting, it would guarantee a challenge from C, making its payoffs negative. Not signaling would also guarantee a challenge, but D_H could back down without cost. This means for no signal to be the best strategy for D_H the expected sunk costs payoffs must be negative which occurs when $m > 1 - \mu_C$.

[5]Full characterizations of the equilibria are available in Appendix

[6]A D_L sinks costs D_H no signal equilibrium exists and is subject to the CT condition when D_H could create a commitment through tied hands. This does however change the conditions on the lower bound

For the sunk cost to be informative, it must be costly enough to prevent D_H from signaling. Despite the added military benefit that sinking costs provides, the lower bound is entirely dependent on D's beliefs about C's resolve. This is because D_H solely uses sinking costs as a bluff in the signal only space. If D_H chooses to sink costs it will either deter C or be forced to back down if challenged. The more confident D_H is that C is unresolved, the more it is incentivized to sink costs. Therefore, as D becomes more convinced C is unresolved, the sunk cost must be greater to remain informative.

3.3 Tied Hands Equilibrium

To demonstrate the converse I will show a tied hands equilibrium in the same signal only space. The condition that D_L is resolved and D_H is unresolved and cannot create a commitment through sinking costs requires the following boundaries: $p_H - \overline{c_D} < 0 < p_L - \underline{c_D}$. The condition that C_L has positive war payoffs and C_H has negative war payoffs regardless of D's strategy requires the following boundaries: $1 - p_L - \overline{c_C} < 0 < 1 - p_H - \overline{c_C}$. As the tied hands equilibrium exists in the signal only space, all of the conditions until this point are the same as in the equilibrium from the last section. However, the tied hands equilibrium in this space only exists under the following condition $m > \mu_C p^*$.

We know from the characterization of the pure strategy equilibrium in which the resolved defender sinks costs and the unresolved defender does not signal that the resolved defender is indifferent between sinking costs and tying hands when $m = \mu_c p$. This means when the discounted return on investment is lower than the signaling cost, $m > \mu_C p$ the resolved defender will prefer to tie hands. We also know that in separating equilibria in which an unresolved defender does not signal choosing not to signal guarantees a challenge. This means that a resolved defender would receive an expected payoff of $p_L - c_D$ from fighting, which is weakly less than if the defender tied its hands, receiving an expected payoff of $\mu_C(p_L - c_D) + (1 - \mu_C)$. The defender

is resolved to fight, which means it will not pay the signaling cost, and there is a probability, c that the challenger will be deterred without a fight. Therefore, for a tied hands separating equilibrium it must be the case that the cost of signaling is greater than the return on investment for sinking costs discounted for the belief of the challenger's resolve, $m > \mu_c p$.

For the optimal strategy for the unresolved type, we also know from the sunk cost equilibrium that the tied hands signal will make the unresolved defender strictly better off than the sunk cost, as the military investment of the sunk cost will never be realized by an unresolved defender. In this equilibrium not signaling guarantees a challenge with certainty, and since the defender is unresolved the guaranteed payoff is 0. The optimal strategy for the defender is to not signal so long as the expected payoff for tying hands, $\mu_C(-m) + (1 - \mu_C)$ is negative. Therefore, the signal costs that support a separating equilibrium, in which the resolved type ties hands and the unresolved type does not signal is:

$$\mu_C p^* < m < \begin{cases} \frac{1-\mu_C}{\mu_C} \\ \overline{c_D} - p_L \end{cases} \tag{3.2}$$

For this equilibrium D_L ties its hands and D_H does not signal, making the tied hands signal perfectly informative to C. The left term means that the expected utility of mobilization is too low relative to the signaling cost for D_L to choose to sink costs. The term on the top right ensures that D has sufficient beliefs in C's resolve to keep D_H from signaling, keeping the tied hands signal informative. Finally the term on the bottom right of the inequality is a condition of the signal only space that means that D_H cannot ratchet up the costs of capitulation high enough to commit itself into fighting. Compared to Equilibrium 1 we can see that the main difference between the equilibria, is m's relation to the expected utility of mobilization. While this is not the only equilibrium condition that differs, this condition drives the choice between D_L's decision to sink costs or tie hands, which in turn drives the change about how costly the signal must be to be informative.

3.4 Equilibrium 2: Commitment Creation

The commitment creation space is characterized by C_L and C_H having positive and negative payoffs for war respectively, regardless of D's strategy. D_L and D_H are assigned positive and negative payoffs for war respectively, however, the power increase from sinking costs is great enough to commit D_H to fighting. The boundaries regarding C's payoffs remain unchanged, $1-p_L-\overline{c_C}<0<1-p_H-\overline{c_C}$, however, the boundaries for D are $p_L-\overline{c_D}<0<p_H-\overline{c_D}$ & $p_L-\underline{c_D}>0$. These parameters will be assumed in the following section.

In the commitment creation equilibria the condition for D_L to prefer sunk costs is once again when the CT condition is met, $m<\mu_C p^*$.[7] The strategies for a separating equilibrium with D_L sinking costs and D_H not signaling are the same as in the signal only space. Upon observing a sunk cost only C_L will challenge and D_L would fight if challenged.[8] The conditions for equilibrium 2 are:

$$\mu_C(p_H-\overline{c_D})+1-\mu_C<m<\begin{cases}\mu_C p^* \\ \overline{c_D}-p_L\end{cases} \tag{3.3}$$

The upper-bound is unchanged in this scenario because D_L is resolved by nature, and therefore, the ability to create a commitment adds no extra value. The CT condition still must be met, and the condition so D_H cannot commit itself to fight through tied hands are unchanged. However, for D_H the sunk cost is always more valuable than in the the signal only space because it can credibly commit itself to fighting. Since D_H will go to war, rather than backing down, after it issues a sunk cost signal it benefits from the military investment. This makes the lower-bound condition a function of both D's beliefs and war payoffs, rather than just beliefs as in

[7] There is one possible equilibrium in this parameter space when D_H will sink costs without the CT condition being met. This equilibrium has been excluded from discussion because it compares a tied hands signal without the ability to create a commitment with a sunk cost signal with the ability to create a commitment

[8] D_H would fight if challenged in the commitment creation space. However, since this is a separating equilibrium with D_H not signaling, D_H would never reach the decision node making it an off-path strategy.

the signal only space. Since D_H has greater incentives to sink costs, the parameter space supporting a sunk cost/no signal separating equilibrium shrinks compared to the Equilibrium 1 in the signal only parameter space.

Another contrast between the commitment creation space and the signal only space is the informativeness of the sunk cost signal. In the signal only space, if the signal is not costly enough to prevent D_H from signaling, then there is a pooling equilibrium with all types of D sink costs. In the pooling equilibrium C's beliefs about D's type are unchanged by the signal. Uncertainty about D's type means that C is uncertain about D's strategy because D_L will fight and D_H will back down. However, in commitment creation space the sunk cost signal always informs C about D's strategy. If D sinks costs it will always prefer fighting to backing down because D_L is resolved regardless of signal and D_H finds fighting preferable to backing down as a result of its enhanced military capabilities. Even when the signaling cost is low enough to permit a pooling equilibrium, C knows D will fight regardless of its type if C observes a sunk cost.

While it may seem odd, these differences suggest that sunk costs are more informative in the commitment creation space, but simultaneously increase the likelihood of war compared to the signal only space. Sunk costs are more valuable to D_H the commitment creation space, meaning D_H is willing to signal at higher costs compared to the signal only space. Not only is D_H more likely to sink costs in the commitment creation space, it will also fight if it is challenged, whereas D_H in the signal only space will back down if its bluff is called. The greater latitude for D_H to escalate the crisis and commit itself to fighting means that the commitment creation space makes signals more informative, but also increase the likelihood for war relative the the sunk cost equilibrium in the signal only space.

3.5 Equilibrium 3: De-Commitment

Much like a tied hands signal a sunk cost can alter D's calculus of whether war is preferential than surrendering the good. However, the sunk cost alters this calculus through an increase in power, which is a relative measure between two states, rather than an increase in costs for backing down, which has no impact on C's payoffs. This gives sunk costs the unique ability to alter C's calculus of whether war is preferred to surrendering the good. I will refer to this concept as de-commitment, the event when nature gives C positive payoffs for war, but D's choice to sink costs gives C negative war payoffs. De-commitment is only possible with a sunk cost signal because power is relative. If D increases its power through sinking costs, it necessarily decreases C's power. Since tied hands signals alter D's costs which are in no way linked to C's costs, tied hands signals cannot have a similar effect.

In this space I assume that C_L's preference between war and surrendering the good can be altered by D's decision to sink costs, and D_H's decision between war and backing down is not altered by its signaling strategy. For the first condition the following boundaries are needed: $1 - p_H - \underline{c_C} < 0 < 1 - p_L - \overline{c_C}$. For the second condition the following boundaries are needed: $p_H - \overline{c_D} < 0 < p_L - \underline{c_D}$. This set of constraints will be referred to as the de-commitment space and will be assumed in the following section.

In the de-commitment space there is no separating equilibrium in which D_L sinks costs and D_H does not signal. For this reason, this section will examine the sunk cost pooling equilibrium. In this equilibrium, D always sinks costs making the signal uninformative. C will not challenge provided its initial beliefs about C's resolve are high enough to prevent it from doing so. Finally D_L would fight if challenged and D_H would back down, however, this decision node will not be reached on the equilibrium path. The conditions of equilibrium 3 are:

$$\begin{cases} \frac{1}{p_H + \underline{c_C}} < \mu_D \\ m < \begin{cases} \mu_C - \mu_C(p_L - \underline{c_D}) \\ p_L - \overline{c_D} \end{cases} \end{cases} \tag{3.4}$$

In this space sunk costs are uninformative. Unlike the other two spaces there is no separating sunk cost/no signal equilibrium, which makes it impossible for D to signal its type. Since D cannot convey its type by signaling and D_H cannot credibly commit itself to fighting the sunk cost does not inform C about D's strategy. Even though C has negative payoffs for war, C may be incentivized to call a bluff. Since D_H would back down if challenged, C will call a bluff if it is confident enough that D is D_H. This is why equilibrium 3 has a constraint on μ_D because C must be confident enough in D's resolve to prevent itself from challenging. Compared to the signal only space and the commitment creation space sunk cost signals are less informative, and equilibria involving sunk costs are more restrictive.

This equilibrium creates very strong incentives for weak states to sink costs. Without the sunk cost D_H would have to forfeit the good. However, with the sunk cost not only can it afford to escalate the conflict, but D's increase in relative power forces C out of the conflict. Despite war being a worse outcome for D_H than surrendering the good in the first place, it can escalate the conflict with confidence, not because it is willing to take C on in combat, but because it can make combat too costly for C.

3.6 Equilibrium 4: De-Commitment/Commitment

Finally, consider what happens when sunk costs create a commitment for D and de-commit C. In this parameter space sunk costs make D_H's war payoffs positive and make C_L's war payoffs negative. The boundaries for the first condition are $1 - p_H - \underline{c_C} < 0 < 1 - p_L - \underline{c_C} < 0 <$ and the boundaries for the second condition are $p_L - \overline{c_D} < 0 < p_H - \overline{c_D}$. These parameters will be assumed throughout this section.

This section will once again examine a pooling equilibria with D always sinking costs. Although this provides no information about D's type, C knows that D will fight regardless because the sunk cost investment changes D_H's preferences between war and backing down. Since C is de-committed by the sunk cost and knows D will fight, C has no incentive to challenge. The conditions of equilibrium 4 are:

$$m < \begin{cases} \mu_C - \mu_C(p_L - \underline{c_D}) \\ p_L - \overline{c_D} \end{cases} \tag{3.5}$$

The equilibrium conditions are the same as the de-commitment space with one exception, they lack restrictions on C's beliefs about D's resolve. This is because D can credibly commit itself to fighting in this space, so C has no incentive to call a bluff. Also, notice for this pooling equilibrium that the condition that D_H prefers to sink costs is non-binding. This is because D_H is not in a position to use force unless it sinks costs. In the de-commitment/commitment space when D sinks costs it guarantees C relinquishes the good because it credibly commits itself to fighting and ensures C has negative payoffs for fighting. Since D_H's next best option would be to not signal and receive nothing, D_H will sink costs so long as the sunk cost is less than the value of the good. However, D_L is in a position to use force regardless of its signal, and for all options has positive expected payoffs. D_L's higher opportunity cost for sinking costs compared to D_H means it places less value on a sunk cost strategy and is willing to pay less for the signal.

This D_H's non-binding constraint demonstrates that when sunk costs can both alter C's strategic calculus and credibly commit itself to fighting the signal becomes incredibly valuable and will only not be a viable strategy when the signaling cost is greater than the value of the good. D_L's constraint shows a familiar pattern; the value of sunk costs increases as D becomes more confident C is resolved and decreases the more powerful D is prior to the investment.

3.7 Discussion of Equilibria

This model demonstrates that when accounting for military benefits of sunk costs, the long held conclusion that tying hands is always optimal no longer holds. Not only is it possible for sunk costs to be optimal, but there are several equilibria across the parameter spaces that sustain sunk costs beyond those discussed in this paper. This conclusion suggests that we should no longer assume that sunk costs are a last resort option for state leaders unable to generate audience costs, but a savvy strategy in which a state is willing to pay upfront costs to prepare itself for confrontation with an enemy it believes is likely resolved.

Despite having several equilibria across the four parameter spaces we can still derive a general rule about which parameters influence sunk cost optimality. Consider signal only and commitment spaces. The CT condition, $m < \mu_C p^*$, necessary for any type of D to choose sunk costs. In the de-commitment and de-commitment/commitment spaces $m < \mu_C - \mu_C(p_L - \overline{c_D})$ was necessary for any type of D to sink costs. This condition is more expansive, but interestingly is always satisfied when the CT condition is satisfied.

Proposition - The CT Condition is always more restrictive than the upper bound condition in the de-commitment and de-commitment/commitment spaces. Therefore, if the CT condition is met, so is the upper bound condition for the de-commitment/commitment spaces.

Since satisfying the CT condition implies that the upperbound conditions in the de-commitment and de-commitment/commitment space are satisfied as well, the CT condition is a good rule of thumb for the value of a sunk cost. Higher power levels from sinking costs make sunk costs more valuable either by preparing a state for a more advantageous war or increasing the likelihood that the adversary finds relinquishing the good preferable to war. Sunk costs also become more valuable with the signaler's belief that the adversary is resolved either by increasing the likelihood war preparations will be necessary or increasing the expectation that sunk costs are the

only way to avoid war. Unsurprisingly, the signaling cost decreases the value of the signal by forcing the signaler to use resources. The initial power level of the state also decreases the value of a sunk costs because strong states are already well suited to use force if needed. Though logic of why certain parameters increase/decrease across parameter spaces, the direction of the relationship is unchanged and captured by the CT condition.

Although the equilibria have similar relationships with the parameters, they demonstrate the different ways a state derives value from sunk costs. Equilibria 1 and 2 show how sunk cost can be used as a hedged bet against deterrence. While the signaler would prefer deterrence, it is pessimistic enough to expend resources it would otherwise save by tying hands to prepare for a more advantageous war. Equilibrium 2 demonstrates the value of sunk costs in creating commitments. This allows D to enter more foreign policy crises, however, simultaneously increases the risks of war as military investment makes it a more preferable option.

Equilibria 3 and 4, while satisfying CT condition, demonstrate a different way sunk costs have value, by altering the enemy's calculus about whether war is preferable to backing down. While scholars have examined the value of sunk costs as a signal[9] and as a method of creating commitments[10], this aspect has gone unexplored. In these spaces it is impossible to sustain a separating equilibrium in which D_L signals and D_H does not, showing the immense value of sunk cost especially for states that would otherwise be unresolved. When bolstered by the ability to create a commitment, tied hands are only preferred when signaling costs are greater than the value of the contested good. Given that sunk costs can be incredibly valuable in these spaces, more focus should be devoted to how sunk costs can alter an adversary's strategic calculus.

[9]See Fearon(1997)
[10]See Slantchev(2005)

3.8 Implications for Risk Preferences

There is little use in exploring the role risk preferences play in signaling if sunk costs are not treated as a military investment. When examined purely as a signal upfront sunk costs make D worse off in both the cases of deterrence and war compared to tying hands. However, when there is some material benefit to sinking costs, risk preferences are worth examination. This is because sunk costs are able to make D better off in the worst case scenario of war at the expense of being worse off in the best case scenario of deterrence.

Sunk costs can provide certainty for D by constraining the range of possible crisis outcomes. Consider the payoffs of a resolved defender when the expected payoffs of a sunk cost signal were equal to the expected payoffs of a tied hands signal, $m = \mu_c p*$. In this situation a risk neutral actor would be indifferent between tied hands and sunk costs, however, D's signaling choice still impacts its payoffs. In this situation D's preferences over the outcomes would be 1) costless deterrence using tied hands 2) costly deterrence with sunk costs 3) an advantageous war using sunk costs 4) a disadvantageous war using tied hands. If D chooses tied hands it is choosing a lottery between outcomes 1 and 4, whereas if it chooses sunk costs it is choosing a lottery between outcomes 2 and 3. Although the lotteries have the same expected value there is a greater risk and a greater reward for tied hands, the lottery between the best and worst outcomes, and conversely less risk and less reward for sunk costs, the lottery between the middling outcomes. The implication of this is that by assuming that sunk cost signals have informational value and value as investments, this also creates a third value of sunk costs, risk mitigation for risk averse defenders. Conversely, this also creates a second value for tied hands signals, a high risk/high reward scenario for risk loving defenders.

Figure 1 shows this situation graphically with a utility function for risk averse D, $u(\cdot)$, which is strictly concave and monotonic. The expected value of a sunk cost and tied hands signal is the same, $E[\cdot]$, so the cost of the signal is $m = \mu_c p*$. The line

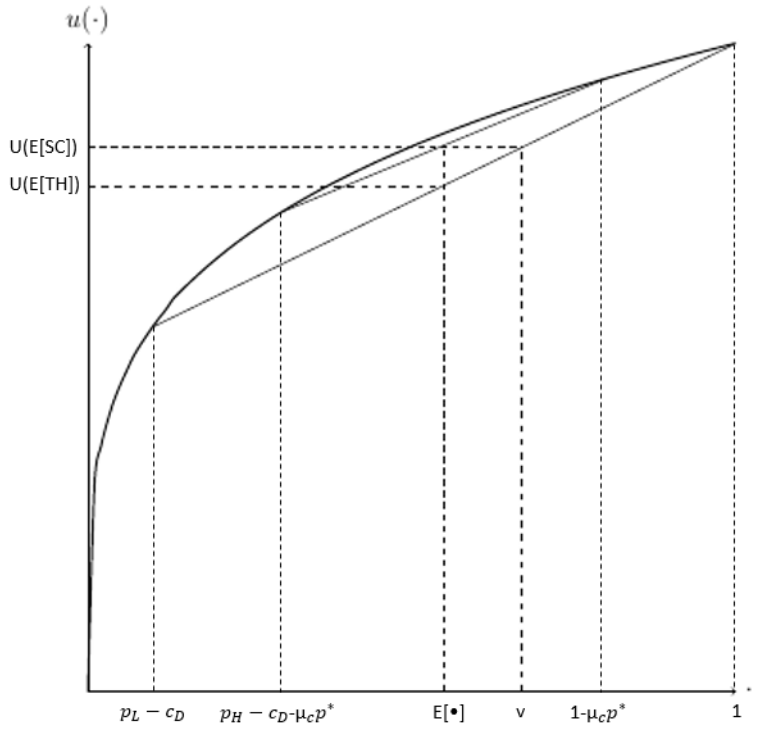

Figure 3.2. Risk Aversion: Signals Have Same Certainty Equivalent

segment connecting $U(p_L - c_D)$ and $U(1)$ shows the utility for a tied hands signal for all values of μ_c. Similarly line segment connecting $U(p_H - c_D - \mu_c p^*)$ and $U(1 - \mu_c p^*)$ shows the utility for a sunk cost signal for all values of μ_c. While expected value is the same for both signals the utility of the expected value for a sunk cost, $U(E[SC])$, is higher than the utility of the expected value for tied hands, $U(E[TH])$. For the risk averse defender the tied hands signal would only be as valuable as the sunk cost signal at $E[\cdot]$ if it were compensated for the extra risk. This occurs when the expected value of the tied hands signal is at v. The distance between $E[\cdot]$ and v is the risk premium for the sunk cost signal, or the extra value the sunk cost signal has to a risk averse defender because it is less risky than the tied hands signal.

3.8.1 Empirical Implications

The model suggests that the value of a sunk cost investment decreases in cost/threat ratio. A resolved state can signal its resolve costlessly by tying hands, therefore, sunk costs must provide a material benefit to offset its inefficiency in conveying information. While the sunk cost provides a higher level of power, higher signaling costs detract from this benefit. Additionally, since the value of a sunk cost is only realized in war, sunk costs become less valuable as states become less confident that their adversary is resolved.

$$p^* > \frac{m}{\mu_C}$$

The left side of the inequality demonstrates that larger returns on sunk cost investments can sustain sunk cost optimality with a larger range for the CT ratio. The model would, therefore, suggest that sunk cost value depends on four parameters. Sunk cost value decreases in signaling cost and the state's initial level of power. This reflects the opportunity cost from using tied hands as a costless signal. However, sunk cost value will increase with the post-investment power level, reflecting D's ability to conduct a more advantageous war. Sunk cost value also increases with D's belief that C is resolved, reflecting the likelihood that the military investment from sinking costs will be needed. This is intuitive as, if a state believes there is a 95% chance an enemy can be deterred, it may find sunk costs to be a waste of resources even if there was a large ROI in the 5% chance of war.

The CT Ratio demonstrates how the value of sunk costs increase as the signal increases military power and war becomes more likely, and conversely demonstrates how the opportunity cost for tied hands increases with signaling costs and as war becomes less likely. This is because sunk costs allow a state to hedge its bets, both sending a deterrent signal, but undertaking costly preparations for war. Whereas, tied hands are more of a gamble, offering cheap deterrence at the expense of preparing for war. Sunk costs decrease the range of potential outcomes by making the worst case

scenario of war more advantageous at the expense of wasting resources in the best case scenario of deterrence. This creates a potential source of value for sunk costs, as risk averse states will place value on certainty.

While the model demonstrates that mobilization can be optimal under relatively permissive conditions, its theoretical insights, interestingly, square well with empirical research that many claim supports the conclusion of tied hands optimality. For instance, Fuhrmann and Sechser's conclusion that sunk costs offer no additional deterrent benefits after a state has already tied their hands is not contradicted by the model Fuhrmann & Sechser (2014). Their study found that states that had tied hands commitments to fight were no more likely to deter adversaries if they had a sunk cost of a foreign deployed nuclear weapon in their territory. They argued that this demonstrated Fearon's theory as the nuclear weapons were costly and were no more likely to credibly display resolve than tied hands signals.

The model presented in this dissertation can still capture Fuhrman and Sechser's dynamic and additionally provide a richer explanation of the data they use on foreign deployments. My model does not dispute Fearon's conclusions that a sunk costs are costlier to the user to convey the same amount of information. However, the model shows that although compared to tying hands sunk costs are still an inefficient means of conveying information, this inefficiency can be offset by the benefits of preemptive mobilization. Much like Fearon suggested, if C is deterred then the sunk cost was wasted. However, when we treat mobilization as an overall strategy. Since this conclusion has not been changed Fuhrmann and Secher's findings do not disprove the model.

In fact not only does the model square well with Fuhrmann and Secher's findings, but it can provide explanation to the range of their dataset. Their data on foreign nuclear weapons deployment shows states deployed weapons on foreign soil only from the 1940s through the 1960s. Given the conclusion of my model that mobilization would need to significantly alter the balance of power between states for D to be incentivized to mobilize, it should not be surprising that foreign deployments only

occurred in this time frame. During this time period ICBM technology was either non-existent or nascent. With no or more primitive ICBM technology states would have to rely more heavily on bombers in order to conduct a successful nuclear strike. The more states would have to rely on bombers rather than missiles, the greater return there was on having the nuclear weapons in the countries a state was making a commitment to defend. However, as ICBM technology developed it became easier to conduct successful nuclear strikes from a distance. This means as time went on, the return from having nuclear weapons in the theaters a state was resolved to defend decreased because technology allowed states to house the weapons at home and launch them across the globe. Therefore, not only are Fuhrmann and Secher's findings congruent with the model, the model provides a richer understanding of foreign deployments of nuclear weapons than examining mobilization solely as a signal of resolve.

While Fuhrmann and Secher's work looks at instances in which mobilization was added on top of a tied hands signal, there could be another potential critique from emprical works that find that mobilization is less likely to deter adversaries than tied hands signals. While on its face this would suggest that works like Krause'sKrause (2004), who found that states that used sunk cost signaling were more likely to end up at war, disprove the model by suggesting that mobilization provides little information about resolve, the results align well with the conclusions of the model .

While the correlation has been interpreted as a source of sunk cost inefficiency, my model offers an alternative explanation. Sunk costs are most valuable when war is likely because sunk cost advantages are only actualized when fighting occurs. Hedged bets against deterrence become more valuable as deterrence is more likely to break down. The model would suggest that when war is likely states are more likely to safeguard through sunk costs, so this correlation should be unsurprising. Although these empirical works are often cited as evidence of sunk cost inefficiency, this model can take their findings and organize them into a more coherent logic of signaling.

Since rationalist theories of crisis bargaining dictate that states maximize their utility, we should expect that states are most likely to use sunk cost signals as they

increase in value. The model would, therefore, make the following predictions. The likelihood of sinking costs will increase with the post-investment power level, as states will be be enticed by a more advantageous war. The likelihood of sinking costs will also increase with the signaler's belief of its adversary's resolve, as the signaler believes war preparations will be necessary. The likelihood of sinking costs also increases with the signaler's risk aversion, as the signaler is willing to pay a premium for greater certainty over the crisis outcome. Finally, the likelihood of sinking costs will decrease with the signaling cost because this cost could be avoided by tying hands.

For these hypotheses to be useful for the understanding of international politics, they must be taken out of the abstract world of parameters and used to create empirical predictions. The model concludes states are more likely to sink costs as they believe their adversary is undeterrable, one implication might be that we would expect sunk cost signaling between rival states. Crises between rivals increase the risk of escalating to war (Goertz & Diehl 1992). Therefore, states in a dispute enduring rival should be more likely to believe the crisis will end in war. Additionally, with rivals there may be several points of confrontation which could lead to general war between them. Similarly, we may expect that sunk costs are more likely when the adversary has a reputation for resolve. States that have not backed down in prior crises gain reputation for resolve (Sartori 2005), which could lead others to believe deterrence is unlikely. In terms of signaling cost, we might expect that sunk costs are less likely the further the signaling state is away from the crisis. This is because the costs of mobilization are likely to be greater if forces have to be moved to another continent compared to if the crisis location bordered the signaling state. Risk aversion is likely to be higher when states have more at stake. States are less likely to gamble in a foreign policy crisis when the losses would threaten their core national interests, or pose an existential threat. Finally, additional military benefits provided from sinking costs may be difficult to measure, however, there are some instances in which we might assume mobilization has more/less impact. For example, we might expect that sunk cost signals are more likely when the signaling state expects to use a

ground campaign compared to when a state only expects to use airstrikes. The logic behind this is that moving ground forces is a time consuming and logistically intensive endeavor, whereas, aircrafts are likely to be able to reach even remote locations in a matter of hours.

A situation that seems to encompass many of these conditions is great power rivalry. By definition the states are rivals, which is likely to increase fears crises will escalate to war. Great power rivalries are likely to have higher military benefits from sinking costs, as power is not already heavily lopsided in favor of the signaler. Finally, risk aversion is likely to be high in great power rivalry because vital national interests are at stake, having potentially existential consequences for losing on risky bets.

The following section will examine several of these hypotheses in a case study of US signaling in the Berlin Crisis. This case study is not to be used a test of the model, but rather to illustrate a case of the use of sunk costs in great power competition. The examination of declassified documents shows that US policy makers understood the underlying logic that sunk costs could be used as a bet hedging strategy which hoped to deter the USSR, but simultaneously prepare the US for war if deterrence broke down.

4. THE BERLIN CRISIS (1961)

One case that is particularly illustrative the model is the Berlin Crisis of 1961. The case study will follow the Goemans and Spaniel methodology for applying cases to formal models. This method is appropriate for empirically evaluating the model as qualitative evidence is well suited to tracing causal mechanisms and providing avenues to examine parameters that are difficult to quantify, such as beliefs, that are frequent in game theoretic models (Goemans & Spaniel 2016). This section will trace out the logic of the model in the Berlin Crisis. This case is consistent with Equilibrium 1. In this equilibrium a low cost defender will fight regardless of its signaling strategy. However, the low cost defender will choose to mobilize because the defender has sufficient beliefs that the challenger is resolved and there are sufficient benefits to mobilization, making the investment worth the initial sunk cost. In this equilibrium the sunk investment is a hedged bet against deterrence, both sending a costly signal of resolve and preparing for war in the event deterrence fails.

Vital security interests had the US resolved to use force from the onset of the crisis. However, although the US was already resolved to fight in Berlin, their mobilization was undertaken strategically both as a signal of resolve and to increase the odds of prevailing if the crisis resulted in the use of force. This equilibrium was sustained because beliefs of Soviet resolve were elevated by Khrushchev's increasingly belligerent rhetoric over Berlin's status, and return on military investment was high because years of the USSR's advantage with conventional forces in Eastern Europe. These factors all increased the expected value of mobilization versus its sunk cost. This led the US to believe that mobilization would allow the US to hold on to West Berlin longer in the face of a Soviet invasion, and they believed the longer they could hold out in West Berlin the greater the chance of Soviet capitulation to US resistance because the Soviets ran a greater risk of triggering a general war.

During the Crisis the U.S. mobilized its defense resources, in terms of conventional forces, non-conventional forces, and financial resources, in response to Soviet Premier Nikita Khrushchev's threats to cut off allied access to Berlin. This case is at odds with the current state of the literature on signaling in crisis bargaining, as Kennedy consciously decided to sink costs and attempted to avoid tying his hands. However, taking into account the signal's investment value can incorporate the use of sunk costs as a rational strategy for deterrence.

The conditions surrounding the Berlin Crisis strongly incentivized the Kennedy Administration to mobilize, rather than to tie its hands. There were strong returns on investment for mobilization to the conventional imbalance between the US and Soviet militaries, which would make it difficult for the US to credibly defend positions further east in Europe. Documents also suggest that US was both resolved to use force to defend access to Berlin, and feared Khrushchev would not be deterred by the existent forces, suggesting that US beliefs about Soviet resolve were fairly high. In addition, the Berlin Crisis came about in the context of the Cold War. The US was competing for hegemony with the USSR, a country that could have potentially posed an existential threat to it. In addition, West Germany was a NATO ally and Europe was a key theater in the Cold War. As such, US interests in the Berlin Crisis were vital making the United States more risk averse in its strategy. Evidence from public statements and classified documents suggest that not only does the case align closely with the parameters of the model, but also the US understood the strategic logic of using mobilization in Berlin as a bet hedging strategy that simultaneously signaled resolve and prepared the US for a potential use of force to keep allied access to Berlin open. The US was ultimately incentivized to mobilize forces in West Berlin because doing so would allow them to hold off a Soviet invasion longer, increasing the chance that the USSR would find the risk of further escalation too costly and capitulate. Additionally, the US was uncertain about Soviet resolve to block off Berlin through force, further incentivizing their mobilization strategy.

This chapter will begin with a brief historical overview of the crisis. It will then establish that military mobilization during the US Berlin Crisis fits both the traditional definition of sunk cost signaling and the more expansive definition offered by the model in the previous chapter. The following section will define the appropriate equilibrium to analyze the case, as well as define and assess the relevant parameters. Finally, the chapter will conclude with a discussion of the strategies of the US and the USSR and assess how they align with the equilibrium in question.

4.1 Historical Overview of the Crisis

The crisis started on November 10th of 1958 when Khrushchev publicly demanded that the US and its allies cease occupation of West Berlin, and redraw the terms of the Potsdam occupation agreement in favor of a new treaty (Williamson 2012, 32-6). Khrushchev's proposed treaty to end foreign occupation was a bilateral treaty between GDR and FRG, with the USSR ceasing its occupation of East Berlin and handing security operations to the GDR (Williamson 2012, 206). Khrushchev's demands would have left the allies without the prior agreed upon ground and air access to West Berlin without a new agreement being reached with the Soviet influenced GDR (Burr 1994, 177). The crisis became more severe on November 27th when the Soviet Union issued a notice demanding the end to allied occupation of West Germany, and turning Berlin into a demilitarized "free city" (Burr 1994, 192). The USSR had also stated that if no new agreement was reached with the allied powers within six months, the USSR would make an agreement with the GDR relinquishing complete control over its territory, which would necessarily bring into question guaranteed allied land and air access to West Berlin (Burr 1994, 192; Freedman 2001,92).

Khrushchev's demands put the US in a delicate position, in which the United States sought to remain firm in maintaining access to West Berlin, but hopefully not escalate the situation into a use of military force. Some negotiation occurred between Eisenhower and Khrushchev, but after the U2 incident of 1960 Khrushchev

had suspended negotiations on Berlin with the United States until the upcoming US presidential administration had taken power (Barker 1963, 62; Freedman 2001, Schick 1971, 96).

John F. Kennedy was critical of the Eisenhower administration's defense policy during his presidential campaign, arguing that it was too rigid and created a capability gap between the US and the Soviet Union (Schick 1971, 144). Kennedy criticized the Eisenhower administration's reliance on nuclear retaliation as a cheap form of defense, which he thought left the both nuclear, but particularly conventional forces in a poor position to deal with the Soviet Union (Schick 1971, 141). In 1961, with tensions over Berlin still unresolved, Kennedy assumed the presidency of the United States after campaigning on strengthening US defense capabilities (Freedman 2001, 75).

With the new administration in place, Khrushchev continued to press his agenda on Berlin. Preceding a meeting with Kennedy at a summit in Vienna in June of 1961, Khrushchev told the US ambassador to the USSR that if an agreement on Berlin was not reached until autumn the USSR would take unilateral action. This caused Kennedy to announce new measures to bolster conventional forces in Europe (Freedman 2001, 87). The tension grew into a full crisis in June during a summit in which Kennedy and Khrushchev met. There the issue gap between the US and the USSR widened as Khrushchev's position at the end of the summit was that it would unilaterally make a peace treaty with the GDR (Freedman 2001, 92).

In mid-June, after the Summit, the Kennedy administration began devising ways to demonstrate its resolve, and contingency planning if the USSR was not deterred and access to Berlin was indeed cut off. Kennedy's strategy toward Berlin took a more flexible approach than the previous administration, as Kennedy favored gradual mobilization with room for diplomacy (Schick 1971, 148). West Berlin, encircled by the Soviet occupied GDR, was not in a favorable spot for the NATO to defend. At this juncture, Kennedy's planned response if access was blocked to Berlin would be to threaten Soviet interests in more defensible areas, such as a blockade of Cuba, rather than defending Berlin through force directly (Schick 1971, 149-50).

While Khrushchev had previously demanded deadlines for reaching an agreement with the United States on Berlin, after the Vienna conference he took action to up the ante. Thousands of refugees fled from East to West Berlin fearing future closure, fears which were vindicated (Schick 1971, 159). On August 13th, 1961, the GDR, with approval from the Soviet Union, issued a declaration accusing Western powers of meddling in the refugee crisis, put up a barbed wire fence, which would slowly be constructed into the Berlin Wall, effectively separating and preventing any movement between East and West Berlin through all but a few checkpoints (Schick 1971, 159). The GDR also began harassment of air traffic corridors into West Berlin. Two days later Kennedy responded to the measure with a televised public address, in which he reiterated the US commitment to West Germany and maintaining allied access to West Berlin. Kennedy also called on Congress to increase military spending, increase the authorized strength of the Army, move reservists up to active duty, and delay the retirement of certain military assets. Congress gave approval to the President's requests later that month. Kennedy also sent another Army battle group to West Berlin in response on August 19th **?**[185]Schick1971. Ultimately the crisis reached its most tense moment when in October the US stationed tanks at the primary checkpoint and the Soviets responded in kind (Trauschweizer 2006).

Tension began to deescalate, though it by no means fully subsided, in October 1961 when Khrushchev withdrew his six month deadline for reaching an agreement on Berlin (Schick 1971,184). The Crisis continued into 1962, but the tensest point had passed. Ultimately, the conflict ended non-violently. Kennedy's actions to bolster conventional forces to conduct limited war, and gradual escalation, which bought time to increase capacities necessary for conducting more extensive military operations were incentivized by factors that created a high ROI for sunk costs and made the US more risk averse.

4.2 Players and Types

The game from Chapter 3 features two players, a defender D, and a challenger, C, competing for a zero-sum good. Each player is assigned a type, either low or high cost, with low cost types preferring war to capitulation and high cost types preferring capitulation to war at the onset of the crisis. The players are aware of their own type assignment, but only have beliefs of the probability of the other's type assignment. In this section I will define the players, type assignments, and the good in dispute, as well as provide justification on why these definitions are appropriate to the model.

Players D and C will be defined as the US and the USSR respectively. The good they were in dispute over was allied access to West Berlin, with both the US and the USSR trying to maximize their mutually exclusive preference on the issue. Finally the US was a low-cost type, making it resolved to resort to force at the onset of the crisis, and the USSR was a high-cost type, making it unresolved to fight at the onset of the crisis.

The player assignments are the most straightforwardly valid given the model. In the model it is D that signals, and in this model the US is using mobilization as a signal of its resolve to fight over Berlin. In the model C is the state that observes and interprets the signal and competes with D over the good. The Soviet Union is appropriately assigned C as the signal was directed toward it, and it competed with the US over allied access to Berlin.

The good they were competing over is also well defined. The US wanted to maintain allied access to West Berlin, while the Soviet Union wanted the city to fall under the control of the GDR. These goals are mutually exclusive. This can easily be interpreted as a zero-sum good that the US and the USSR competed over. As they were engaged in a superpower rivalry, one state's loss on the issue of access to Berlin would be the others gain in terms of their respective balance of power and influence in Europe.

The type assignments are appropriate definitions given the model. The US signalled its intention to defend Berlin. The USSR, upon observing the signal, had to decide whether to challenge or not to challenge the US by unilaterally signing a treaty with the GDR on the status of Berlin. Had the USSR signed the treaty the US would have needed to decide whether they would have defended their position in Berlin with force or if they would back down and respect a USSR-GDR treaty. As the US was the state that signaled its intentions and would have to make the decision on the use of force if challenged, it is appropriately assigned the role of defender. Since the USSR would have to respond to the US's signal, it is appropriately assigned the role of the challenger.

As far as resolve the US is appropriately defined as a low-cost type, as it was resolved to use force from the onset of the crisis. Contingency planning documents show that the US intended to fight over Berlin, with or without the resources that it intended to muster through mobilization. The stakes for the US, its position in Europe, and its credibility as the leader of NATO gave the US low net costs for defending Berlin, even if it was at a military disadvantage in terms of absolute power in the city. The USSR's type is a little more straightforward, as for all its bluster it ultimately did not challenge the US position in Berlin, making it appropriately assigned as a high-cost type. Though it may have started the crisis believing that the US would capitulate, it ultimately would not challenge the US with force post-mobilization.

One could argue that the USSR backing down from the crisis is not evidence that it was unresolved from the onset, but that it became decommitted as a result of the US's sunk cost investment, as in Equilibrium 3. Khrushchev's statements to his allies suggest that he underestimated and tested Kennedy's, but was not prepared to risk war over the Berlin issue (Lunak 2003). In a 1960 meeting with GDR President Ulbricht, Khrushchev argued for a gradualist approach toward signing a peace treaty, stressing to Ulbricht that he could not expect the USSR to risk war by invading West Berlin (Lunak 2003, 69). However, in the same meeting Khruschev felt comfortable

agreeing to a unilateral peace treaty with the GDR if an agreement could not be met with the new US administration by the end of 1961. Khruschev was convinced that war was unlikely as a result of the peace treaty stating to Ulbricht that "fourtunately our opponents have not gone mad" (Lunak 2003, 69). The statements by Khrushchev in his promises to Ulbricht suggest that the USSR's escalation of the Berlin Crisis were based on low initial beliefs in American resolve, and that Khruschev had no intention of going to war over the issue.

The ability to clearly define two players that have to make decisions similar to that in the structure of the game, an indivisible foreign policy good in dispute between them, and a clear signal of resolve made by one of the players makes the case of the Berlin Crisis a good test of the model. Ultimately should the parameters of the model support the defined signaling strategy chosen by the US, this will provide evidence to support the theoretical model's ability to explain empirical situations.

4.3 Kennedy's Response as a Sunk Cost Signal

The Berlin Crisis is well suited to being analyzed through signaling games. The Kennedy Administration clearly employed a signaling strategy with a sunk cost to it versus the USSR during the Berlin Crisis. This section will establish that Kennedy's mobilization strategy was a signal with a sunk cost element to it. In this sense it fits the traditional definition of a sunk cost signal as it had an ex-ante cost and was at least partly intended to convey resolve to the USSR. The costs associated with Kennedy's increases in military spending and deployments to West Berlin necessarily came ex-ante, with the intention of deterring the Soviet Union from further escalating the crisis by cutting off allied access to Berlin. After establishing that mobilization for the Berlin Crisis fits the traditional definition of a sunk cost signal, I demonstrate that Kennedy's strategic logic for mobilization also fits the more expansive logic outlined in the model, as both a signal with a sunk cost component and a hedged bet against deterrence.

One of the most obvious aspects of the sunk cost was Kennedy's public call for extra military spending in response to Khrushchev's demands in his July 1961 televised address to the nation. Kennedy called for on congress for an additional $3,247,000,000[1] in military spending (Kennedy 1961), which put a literal financial cost to the administration's deterrence efforts. Kennedy's request was approved by Congress through Public Law 87-118, enacted on August 3rd, allocating extra resources for conventional forces. This was clearly a significant cost as this request was roughly 20% of the size of the total national defense outlays for major public direct physical capital investment.

The address also called for an increase in physical and human capital, as well as mobilization. Kennedy called for a 125 thousand troop increase in the authorized strength of the Army (642), roughly a 14% increase in the Army's authorized strength. Kennedy also called for increasing the active duty of the Navy by 29 thousand and the Air Force by 63 thousand. Congress gave approval for the calling up of reservists in Public Law 87-112, authorizing the President to call up to 250,000 reservists to active duty. Both the mobilization of forces and military spending are evidently ex-ante costs, as once the resources were spent, they could not be recouped.

Kennedy's address also clear that one of the purposes of mobilization was as a signal to keep allied access to Berlin open. Before calling for more military resources in his 1961 address Kennedy stated:

> "We must meet our often-stated pledge to the free peoples of West Berlin and maintain our rights and their safety, even in the face of force in order to maintain the confidence of other free people in our world and our resolve...We will at all times be ready to talk, if talk will help. But we must also be ready to resist with force, if force is used upon us. Either alone would fail (Kennedy 1961).

The elements of a traditional sunk cost signal are apparent in Kennedy's address. Through it the US allocated scarce resources in a manner observable to the Soviet

[1]Roughly $26,600,966,050 adjusted for inflation in 2017

Union with the intent of deterring aggression in Berlin. Kennedy's stated intent to use mobilization as a signal of resolve to the USSR, was also echoed in US strategic thought. The logic of the Kennedy address can be seen in declassified military planning documents, substantiating that Kennedy's publicly stated intention of using mobilization as a costly signal was truly a reflection of US strategic thought rather than bravado on the international stage. The US viewed military mobilization, even mobilized resources that were not directly allocated to the defense of Berlin, as a signal of resolve inthe crisis. During the height of the crisis in June 1961, a confidential US State Department Memorandum on military expenditures stated:

> There is no doubt that the Soviet leaders would relate any such increases in defense expenditures over the original estimates directly to the development of the Berlin crisis...they would be considered to demonstrate the Administrations ability to make shifts and the population's willingness to accept them (US Department of State 1961).

US military mobilization during the Berlin Crisis fits well with the traditional definition of sunk cost signaling, actions with ex-ante costs, observable to the challenger with the intent of signaling resolve. However, the Kennedy address also shows that US strategic logic not only fit this traditional definition, but the more expansive definition demonstrated by my model, in which states use sunk costs both as a deterrent signal and simultaneously a preparation for war. Kennedy's address clearly articulates both the preference for peaceful acquiescence to maintain allied access to West Berlin, but also acknowledges deterrence may fail, necessitating preparation for war. This follows the logic of using sunk costs as a hedged bet against deterrence, as both a signal and a safeguard.

While skeptics could claim that Kennedy's public statements may be posturing, and may not have accurately reflected US strategic logic, military planning documents that have since been declassified align with Kennedy's public statements. An August 8th memorandum from the US delegation to the North Atlantic Council explained the

military build-up for the Berlin contingency measures in a similar vein as Kennedy's public statements:

> The military measures discussed by the Four Foreign Ministers have a dual purpose. First, they form an integral and essential part of our effort toward peaceful solution of the Berlin problem...They are essential because our present military posture in clearly has not deterred Khrushchev from embarking on a highly dangerous course. To let him see our unity and to understand his own hazards in pressing along that course, together with cool and realistic vigor to strengthen all Alliance armed forces. The second purpose is to improve our readiness in case the Russians - who, despite our efforts, can block our access when they choose - do nonetheless continue, and conflict results. (NATO 1961a)

Much like the model treats sunk cost signals, US military build-up in Berlin was both used to demonstrate to the USSR that the US was capable and prepared to defend its interests in Berlin, and increase its capability to defend those interests should deterrence fail. In this case, the US's sunk cost signal, military mobilization, follows the logic of sunk costs being both a signal and a safeguard. The relevant question, is now that the assumptions of the model have been met, does the predicted behavior from the equilibrium conditions follow? The US's underlying strategic logic follows the model's assumptions, and as such make the Berlin Crisis a good case to evaluate equilibrium behavior from the model.

This logic was echoed throughout NATO. The declassified NATO item C-M(61)104 illustrates that though the NATO allies hoped that a military buildup would deter the Soviets from blocking access to West Berlin, but they must be prepared to use force. As such it was necessary that the allies bolster their military capabilities. The document states that if deterring the Soviets failed:

> [The NATO allies] are therefore determined-to improve allied military posture as a clear indication of their capability and will to apply appropriate

> military measures if need be. They have agreed to undertake individually and collectively comparable programmes to build added military strength for Europe" NATO (1961b).

This acknowledges that NATO understood that military force might be necessary to defend its interest in Europe, and it would be in a better position to exercise this force if they were to bolster their European capabilities.

Evidence suggests that not only did the US employ signaling logic in sinking costs toward mobilization, but that it was interpreted as a signal to the USSR as well. Evidence suggests that although Khrushchev was not resolved to resort to war over West Berlin, he started the crisis with little belief of Kennedy's resolve. Kennedy's June 1961 mobilization announcement were a pivotal moment in changing Khrushchev's beliefs about US resolve. In an April 1961 interview with Walter Lippmann, Khrushchev appeared to think there was little risk of war coming from the US over the Berlin issue:

> In my opinion there are no such stupid statesmen in the West to unleash a war in which hundreds of million would perish just because we would sign a peace treaty with the GDR that would stipulate a special status of 'free city' for West Berlin with its 2.5 million population ... There are no such idiots or they have not yet been born.Zubok (1993)

However, shortly after the ultimatum, the tone of Khrushchev's statements about his beliefs in US resolved changed. In a June 1961 meeting with US disarmament negotiator John McCloy Khrushchev stated, "Kennedy in his speech declared war on us and set down his conditions" Zubok (1993). Several days later in a meeting with the Italian Prime Minister Khrushchev confided that:

> "Hence everything is possible in the United States...War is also possible. They can unleash it. There are more stable situations in England, France, Italy, Germany." Zubok (1993)

While it is difficult to say with certainty that the USSR perceived Kennedy's announcement as a signal and updated its beliefs accordingly, absent declassified Soviet documents, the tone of Khrushchev's statements before and after the announcements markedly changed. Before the announcement Khrushchev stated that he would not think there would be serious escalation as a result of signing a peace treaty with the GDR. However, once Kennedy had made his announcement Khruschev viewed it as an act of aggression and took much more seriously the potential that the US may escalate the Berlin Crisis to the use of force.

While the events of the Berlin Crisis seem obviously to be a deterrent signal, substantiating that the US was resolved and preparing for war if deterrence failed is a more arduous task. Declassified Berlin contingency planning documents, however, provide evidence to suggest that the US was not only resolved to use force, but preparing for the use of force by bolstering its military resources. In the following section I will use examine these documents to define the parameters of the model and show that the US's signaling behavior is consistent with the model.

Since these documents were originally classified, they can provide more insight into the thought process and motivation behind military strategy than public statements can. The contents of the documents demonstrate that the United States was confident in its ability to use limited force to re-open access to Berlin in the event that deterrence failed. Additionally, Khruschev's statements before and after Kennedy's announcements, show a change in tone, suggesting that he perceived the Kennedy's announcement as a signal and updated his beliefs about US resolve accordingly.

4.4 Equilibrium Conditions and Parameters

Kennedy's response to Khrushchev fits the traditional definition of a sunk cost signal. Under the prevailing logic of signaling, Kennedy's decision to signal resolve through mobilization, consuming scarce resources, may seem confusing, as a public threat from a democratic leader should be sufficient to convey resolve. This section

will make sense of the decision by analyzing the case using a model that treats sunk costs as a military investment. I will define the parameters from the model in terms of the case, and assess whether the behavior of the players matches that of Equilibrium 1.

The defining characteristics of equilibrium 1 are that there are sufficient expected benefits from mobilization to make D prefer it to a tied hands signal, and that these benefits are not great enough to commit D to fighting. To sustain the parameters for this equilibrium two conditions must be met. The first is that the expected benefits from mobilization offset the signaling cost. For this to occur there must be sufficient benefits in preparing for war through mobilization, and sufficient beliefs that D will reap these benefits through the use of force. The second condition is that the choice to mobilize does not impact D's decision to follow through with force if challenged. Low cost D is already committed to fighting and the expected benefits of mobilization are not great enough to make it decide to fight.

As discussed earlier in the chapter the US was resolved from the onset of the crisis, so the second condition is satisfied. Therefore, this section will demonstrate how the first condition was met in the Berlin Crisis. I will show that the US had a high expected value for military mobilization in Berlin and that this mobilization helped the US create a commitment to keep allied access to Berlin open.

4.4.1 Condition 1: Making Sunk Costs Worth the Investment

The first parameter I will examine is D's, or the US's, initial level of power. This is operationalized as the probability of the US winning if the crisis were to escalate into war without any access preparation from mobilization. In terms of overall military strength, it may seem odd to suggest that the US was at a military disadvantage versus USSR over the time period of the Berlin Crisis. In terms of raw military strength the US was the stronger power. However, the US's capability to defend West Berlin was a separate issue.

While the US was a greater military power, it had the disadvantage of having to project that power over the Atlantic Ocean. The Soviet Union had the advantage of projecting its power on the same continent. The USSR also had an advantage in conventional capabilities in Europe, making it difficult for the US to project its power further East in Europe. To further compound the issue, West Berlin, while formally West German territory, was isolated from the mainland of West Germany, surrounded by East German territory. This would make it difficult to supply in the face of East German/Soviet aggression and even more difficult to defend. Despite that the US was overall a greater military power than the USSR, the USSR's home field advantage and conventional capabilities in Europe, as well as West Berlin's difficult position made it unlikely that the US would be able to credibly defend Berlin in the face of Soviet aggression. This imbalance was acknowledged in NATO contingency planning and was obvious to both sides:

> "[NATO military capability] is subject to several severe limitations, the most limiting being that it is obvious to the Soviets that our shortage of conventional strength handicaps any execution of non-nuclear options" (NATO 1961a).

The US had limited ability to keep allied access to West Berlin open in the face of military force at the beginning of the crisis because of its conventional imbalance and relative disadvantage projecting power in Europe. For these reasons the US's initial level of power should be considered relatively low in the case of the Berlin Crisis.

The next parameter that must be defined is D's, the US's, increase in power as a result of mobilization. The model assumes that through costly preparation, the signaling state's military capabilities increase as a result of mobilization. Therefore, for the model's conclusions to be applicable there must have been significant military advantages to early preparation in the case of the Berlin Crisis to satisfy the model's assumptions. Admittedly, this parameter is difficult to define as it measures the US's ability to defend West Berlin in the event of a hypothetical invasion after it

had mobilized. However, declassified documents from the era suggest that the US believed sinking costs could meaningfully alter their ability to keep access to Berlin open. While an imperfect measure of p_H, these documents show how the US took into account not just the signaling efficiency of force deployments to Berlin, but their military capability as well. The US's memorandum to the North Atlantic Council on military buildup demonstrates that the US was attempting to secure a more favorable balance of power versus the Soviet Union through mobilization:

> "In becoming stronger [through military buildup in Berlin], we seek to change [The USSR's] political judgments about the relative strength of East and West, about the way those relative strengths are changing, about the usefulness of our force in a Berlin situation, and about the determination of the West" (NATO 1961a).

This clearly demonstrates that US strategists were not merely interested in signaling their willingness to fight, but increasing their ability to do so through mobilization. The memorandum explains that more military options would be available in Berlin as result of increasing conventional forces in Berlin. US strategic thought suggests that there were significant military benefits to mobilization, which would also suggest that the assumption that $p_H > p_L$ is met in the case of the Berlin Crisis.

The US was under no delusion that their forces in Berlin could hold out against the full force of the USSR, even with significant military buildup, contingency planning documents show that the US thought additional forces would increase time they could hold out in Berlin. Even though US conventional forces could not hold out on their own against the USSR, their capabilities were critical to the US strategy of maintaining access to Berlin. If the Berlin Crisis were to escalate to the use of force the US believed the longer they they could hold onto West Berlin, the greater the chance of capitulation by the USSR because the risks of general war would increase. NATO contingency planning acknowledged the need to bolster conventional capabilities through mobilization. Kennedy had worried about the imbalance of conventional

capabilities in Europe, and believed that US initial capabilities hampered the range of unconventional responses. The threat of escalating a gradual encroachment on US interests immediately with nuclear force was not likely to be taken credibly. Therefore, the Kennedy administration focused on bolstering its conventional forces in Europe, so that the US could credibly issue threats of force. There was an acknowledgement that NATO forces in Europe might not be able to reopen access to Berlin by force with the resources it had available in Europe. This can be seen in SHAPE's 1962 contingency plans,

> "The foundation offered by our present forces posture is not strong enough to support satisfactorily the [Berlin contingency] operations. Because of deficiencies in force level, deployments and support facilities–deficiencies that can and must be corrected–the present Allied Command Europe forces in a case of a major attack, deploy to selected defensive positions a considerable distance West of the Iron Curtain" (NATO 1962).

The acknowledgement that the existing NATO force levels would have not been enough to defend Eastern positions was followed by stating the necessity that engagement with Soviet aggression be viable much closer to the Iron Curtain. This document shows US strategists acknowledging their inability to defend Berlin through force, but the potential to commit itself to its defense by increasing its capabilities through mobilization. This demonstrates that the US believed that there were significant military benefits to these sunk costs, meaning they believed that their ability to defend Berlin would increase though mobilzation, satisfying the assumption of the model.

While the US understood it could not reopen access to Berlin by force if it were shut off with the full force of GDR and USSR military capability, the US prepared itself for limited uses of force in Berlin and for war in the event the Soviets would still not back down. The documents show that NATO did not believe this to be an ideal situation, and had set goals of enhancing their capabilities in Europe so that it would be able to achieve more extensive military goals and push its influence further

eastward. Berlin contingency planning relied on gradual escalations of force by the US to increase the costs of Soviet aggression and the risks of a general war. Contingency planning document Item C-M(61)104 states:

> Appropriate military measures in case of interference with access to Berlin should be graduated but determined. There should be available a catalog of plans from which appropriate action could be selected by political authorities in the light of circumstances and with the aim of applying increasing pressure which would present with unmistakable clarity to the Soviets the enormous risks in continued denial of access. At the same time the way these plans would be implemented should leave the Soviet Government as many opportunities as possible to pause and re-assess the desirability of continuing on a dangerous course of action. (NATO 1961a)"

However, the ability of the US to escalate further was dependent on its capabilities in Berlin. Several documents state the need of capable forces in Berlin, but to fend off potential GDR forces and successive levels of USSR force. The capability of US forces in Berlin was important. If US forces were defeated too quickly it gave less time for the USSR to alter their calculus on the issue and risked a higher probability of a nuclear strike on the part of the US. Capability enhancement in Berlin had a high ROI because it bought time for the US to avoid a nuclear alternative and would make successive uses of force more costly to the USSR. These documents demonstrate that the US saw potential returns on investment for mobilization, and were sufficiently concerned that the Soviet Union would try to close access to Berlin. For these reasons the US pursued a sunk cost signaling strategy, hoping to deter the USSR, but ultimately preparing itself for the use of force.

The third parameter that must be defined is the US's, D's, belief that the USSR, C, was resolved to use force to block allied access to West Berlin. While beliefs can be difficult to measure, the surrounding circumstances suggested that the US took Khrushchev's threats seriously. One reason the US was likely to believe that USSR

was resolved was that they were interstate rivals. It is well documented that the risk of war is elevated when dealing with rival power (Goertz & Diehl 1992), and meditation is unlikely to be able to decrease the likelihood of war between rivals (Bercovitch & Diehl 1997). Diplomatic crises between enduring rivals are eight times more likely to result in war compared with crises between non-rivals (Goertz & Diehl 1992). As Khrushchev's rhetoric toward Berlin became more belligerent, this likely heightened fears in the US that Khrushchev would block access to Berlin, given the tense relationship between the two superpowers.

Given the conditions of the crisis, it would seem reasonable that the US would be concerned over Khrushchev's resolve to block allied access to Berlin. These fears were not only reasonable, but recorded in US contingency planning documents. A declassified memorandum from June 12th 1961 on negotiable solutions in Berlin demonstrates this logic, showing the pessimism the US had toward solving the crisis through negotiation with the USSR. It states:

> A short- or medium-term arrangement [on the status of Berlin] on terms which the Western Power could accept on Berlin is thus unlikely unless Khrushchev is not serious about signing a peace treaty with the "G.D.R" and needs the optical illusion of a verbal victory to mask an about-face. There is no evidence to support this position...(*MEMORANDUM: The Berlin Crisis, US Military Expenditures, and Soviet Allocation Problems* 1961)

Fear of Soviet resolve, as the model would suggest, incentivized the US to pursue a sunk cost strategy, which would demonstrate not only its willingness to defend Berlin, but its ability to do so as well. This fear was demonstrated in Dean Acheson's classified June 1961 memo to Kennedy. Acheson did not believe verbal commitments alone along with forces stationed in Berlin and were enough to have fruitful negotiations with the USSR. Acheson stated:

> The only way of changing the [Russians'] purpose is to demonstrate that...what they want to do is not possible. Until that demonstration is made, no negotiation can accomplish more than to cover with face-saving devices submission to Soviet demands (Acheson 1961).

Contingency planning documents echoed Acheson's sentiments, suggesting that Khrushchev felt comfortable escalating the crisis because of the initial weakness of NATO's force posture in West Berlin. The US memorandum to the North Atlantic Council stated:

> We believe that Khrushchev started this crisis because he was not deterred by our present posture. We believe he does not want general war. If he can be brought to see the trail of powder leading toward general war, he may not strike the match (NATO 1961a).

This suggests that US beliefs of Soviet resolve were high, and the memo shows how this belief shaped strategic thought. The US believed the USSR to be a credible threat to Berlin, and as such sought to bolster US capabilities to potentially alter the USSR's calculus.

While the US may or may not have feared a general war between the US and the USSR, they believed there was the potential for the Soviet Union to attempt to cut allied access to Berlin off. In any case, the documents show that there was uncertainty whether the situation could escalate to the use of force. While the US sought a diplomatic solution to the Berlin issue, quotes from the documents suggest that there was a great deal of uncertainty whether diplomacy would be possible. US did not see unilateral action as the first move, but acknowledged its possibility further down the road (CIA 1961)

From the definition of the parameters, the return on investment, or the difference between US's initial level of power and its post-mobilization level of power, from mobilization should be relatively large. It is at least positive, as contingency plans suggested mobilization would allow the US to put up meaningful resistance with the

potential to change Soviet calculus regarding Berlin. The initial level of power was made low by the disadvantageous position of West Berlin and the US's conventional disadvantage in Europe. As discussed earlier the US expected its military capabilities in Berlin to be significantly expanded through mobilization. The magnitude of these expanded capabilities was quite large. Not only would it allow US conventional forces to defend West Berlin longer, but perhaps more importantly expanded the US's range of nuclear responses. Even minor improvements, which could lengthen the time of conventional fighting for a matter of weeks or days, could increase the risk of general war between the two powers. The longer and costlier a hypothetical crisis in Berlin would last, the more the Soviet Union would risk a nuclear response from the US, putting pressure on the USSR to back down or risk a costly general war. The US memorandum to the North Atlantic Council argues:

> Lacking [increased conventional forces], we might not convince Khrushchev of the dangers he risks until he has passed the point of no return...we get more instruments to use, should conflict occur, to persuade him toward negotiation before a nuclear decision arises. Such a decision would be a political one shifting the conflict from the level of a Berlin operation to that of a much larger general confrontation(NATO 1961a).

The increase of conventional forces in Berlin was more than a marginal increase of conventional capability that would allow the US to hold the city for a matter of weeks rather than a matter of days. Mobilization gave the US a wider array of nuclear responses to Soviet aggression, in the face of which Khrushchev would be much more likely to capitulate to in the event of conflict. Moving from the US initial position in Berlin, with few forces and a disadvantageous position, to its post mobilization position, in which it would be able to hold the city for a longer period of time and present a US with a viable nuclear threat suggests that the return on investment for mobilization was high.

Additionally, the US had sufficient fears that the USSR was resolved. As mobilization's expected value vs. tied hands signaling is a function of both return on

investment and D's beliefs about C's resolve, we should expect that mobilization had a high expected value in the Berlin Crisis. The US had a high return on mobilization and had sufficient beliefs that the Soviet Union would cut off allied access to West Berlin by force. The high expected value from mobilization makes it likely that the first condition of Equilibrium 1, that the signaling cost is offset by mobilization's expected value, was satisfied.

4.5 Discussion

The strategic environment and contingency planning documents support the parameter space for equilibrium 2. Condition 1 was satisfied as there mobilization expanded US military capabilities in Berlin and the US had sufficient fears that the Soviet Union would try to forcibly block allied military access. Condition 2 was met, showing that the US would need to increase its conventional force posture in Berlin if so that it could credibly commit itself to fighting if allied access were blocked. Whats left to determine is whether the US's behavior reflected the predictions of equilibrium 2. In equilibrium 2 the defender, in this case the US, should sink costs as a signaling strategy and fight should the Soviet Union escalate the situation.

Military mobilization is a frequently cited example of sunk cost signaling Fearon (1997); Slantchev (2005). The US strategy of mobilization in response to the Berlin Crisis would, therefore, seem to obviously fit a sunk cost signaling strategy. However, alternative explanations for US mobilization must be addressed. The first is that the US was not interested in the capability of its forces in Berlin, but that its forces were used as a tied hands signal that would pull the US into war should the USSR use force to take Berlin. A well renown interpretation in this vein was advanced by Thomas Schelling. He argued that the US staked its reputation in Berlin, rather than showcased its military capabilities:

> What can 7,000 American troops do, or 12,000 Allied troops? Bluntly, they can die. They can die heroically, dramatically, and in a manner

> that guarantees that the action cannot stop there. They represent the pride, the honor, and the reputation of the United States government and its armed forces; and they can apparently hold the entire Red Army at bay(Schelling 1966).

There is some validity in this statement, however, in the years since Schelling's argument documents have been declassified, allowing us to take a direct look at US strategic thought rather than developing hypotheses about it based on strategic logic. Upon review of contingency planning documents there is validity to Schelling's argument in that part of the US strategy was to increase the risk of general war should the Soviet Union attempt to block access to Berlin through force. However, the documents did not describe the strategy so bluntly. Capabilities of US forces were integral to ensuring that the strategy worked. If Berlin fell in a matter of days, the US worried about its ability to escalate the crisis further. One of the expressed intentions of mobilization was to increase force capability to hold out in Berlin longer, making it increasingly costly for the USSR to take by force and increasing the risk for general war. By holding out longer was meant to increase the likelihood of capitulation by the Soviet Union by expanding conventional capabilities, and should the conflict escalate enough the range of nuclear responses available to the US. US contingency plans go into great detail about how to keep allied access in Berlin open through the use of force, rather than planning for general war in the event the Soviets attacked. This would suggest that the conventional understanding of US forces in Berlin does not capture the whole picture. The US focus on capabilities in their contingency plan suggests that they were realistically planning their forces for battle in Berlin, rather than relying on the death of their forces to commit them to general war. This focus on both deterrence and capabilities through mobilization suggests that US forces were in Berlin as a sunk cost signal, rather than a tied hands tripwire.

Establishing what the US would have done in a hypothetical situation of the USSR blocking access to Berlin is a more difficult task, however, evidence does suggest that the US would have been resolved. Contingency planning documents all spoke to the

strategic and symbolic value of West Berlin, and the importance of keeping open even in the face of Soviet aggression. In none of the documents did it discuss the point at which the costs of holding on to Berlin would be too high forcing the US to acquiesce to Soviet demands. The only discussion of the US losing access to Berlin was if the USSR took the city by force, in which case the documents discussed the countermeasures that would be taken to reassert access. These countermeasures went as far as the use of nuclear weapons against the USSR. While it is impossible to rerun history to determine the US's strategy had the USSR blocked allied access, the documents suggest that the US were willing to resort to severe uses of forces even if it were to be pushed out of Berlin entirely.

US strategy in the Berlin Crisis closely follows the signaling model presented in this dissertation. This is important because it demonstrates the model is a scientific development, capable of explaining a wider array of signaling behavior than prior signaling models. The model also helps us better understand the Berlin Crisis, as prior interpretations of sunk cost signaling acting as a tied hands signal do not capture the whole picture of US strategic thought. The Berlin Crisis shows that sinking costs has value outside of signaling resolve, as it can be used to increase military capabilities in the event deterrence failed or possibly even alter the Soviet calculus on Berlin. Through the allocation of resources and force mobilization the US attempted to signal its resolve over allied access in Berlin, while simultaneously trying to bolster its capabilities so that it could undertake more extensive military operations in Europe in the event deterrence failed. Not only was the logic consistent with the model, but the conditions were as well. Superpower rivalry and the conventional imbalance between the US and USSR meant that US capabilities would be significantly bolstered through mobilization. The superpower rivalry also contributed to fears of Soviet resolve over Berlin, and declassified documents demonstrate that this fear was a motivating factor in US mobilization strategy in Berlin.

5. KOSOVO (1999)

The primary contribution of the model is to illustrate when sunk investments are preferable to tied hands signals. Therefore, for a robust comparative case study analysis, cases should include both those that theoretically incentivize sunk costs and those that incentivize tied hands. Including cases that both incentivize sunk costs and tied hands provides variance among the independent variables. If changes in signaling behavior are observed in line with the theoretical predictions we can be more confident in the model. One case that is particularly illustrative of the tied hands incentives is NATO intervention in Kosovo in 1999.

This case study will also follow the Goemans and Spaniel methodology (2016). The first section will give a brief historical overview of US involvement in crisis. The second section will assess the US's signaling behavior in the crisis, and whether it is a valid example of tied hands signaling. The third section will define the parameters and equilibrium conditions of the tied hands equilibrium, and assess their fit to the case of Kosovo. Finally, the case study will conclude by exploring the causal mechanisms of the case of Kosovo and seeing if they are consistent with the predictions of the model. Ultimately, the study finds the case of Kosovo is well explained by the model. The US opted for cheaper deterrent options because its lopsided initial power, intent on using an air campaign, insistence on multilateral efforts through NATO, and assets and European allies in the region meant there would be little return on an investment from mobilization. This behavior is consistent with the the tied hands equilibrium from the model.

The US's insistence on only using an air campaign to coerce the FRY hampered any potential benefits mobilization could provide. Missiles could be launched at strategic targets within the FRY from far outside its borders. Additionally, a few aircraft sent from outside the FRY could use precision guided munitions to hit several

strategic targets within the country within a matter of hours. The ability to conduct strikes from a distance decreases the returns from mobilization compared to a ground campaign, which requires time consuming and logistically challenging movement of forces and equipment.

Additionally, any potential ground campaign, which would increase the benefits of mobilization, was complicated by the US's insistence on multilateral action. The US's allies in NATO were generally opposed to a ground campaign, and the US feared that the possibility of a ground campaign would endanger allied support for the use of force. Any potential US gains in power from early mobilization for a ground campaign would threaten NATO's willingness to provide additional support for the operation.

Finally, there were few benefits to mobilization because much of resources necessary for the US to conduct a limited air campaign were already in the European theater. The bulk of the US's NATO allies were on the continent, and the US had air bases within a short flight of Kosovo. Additionally, the US already had ships in the Mediterranean capable of firing missiles at the FRY. With the resources already available for the US to conduct the limited operation it was willing to take, there was no benefit to moving additional resources into the region.

The US's insistence on an air campaign in Kosovo limited potential military benefits from mobilization. In addition, the US (and several of its NATO allies individually) had the balance of power already heavily lopsided in its favor. This meant there was a low return on investment for mobilization, making it unlikely that the US would undertake any significant sunk cost in its signaling strategy. The low return on investment from mobilization incentivized the US to rely on comparatively cheaper tied hands public threats to deter Milosevic from committing further human rights violations in Kosovo.

5.1 The Road to NATO Intervention in Kosovo

During the 1990s a civil war raged in Yugoslavia, with ethnic violence dissolving the country into several smaller political units. By the late 1990's several of the Yugoslav republics had already broken away from the country, leaving Slobodan Milosevic, President of the Federal Republic of Yugoslavia (FRY), Yugoslavia's successor state, in control of the republics of Serbia, Montenegro, and the semi-autonmous region of Kosovo. Milosevic had a history of stoking ethnic conflict and increasingly faced the potential secession of more territory throughout the decade.

Tensions and ethnic violence had been building in Kosovo, a region within Serbia throughout the Yugoslav civil war. Kosovo, with an ethnic majority of Albanians, had considerable autonomy from Serbia during the majority of its existence within Yugoslavia. However, after Milosevic rose to power as the President of Serbia in 1989 he moved to curtail much of Kosovo's autonomy. Catering to feelings of Serbian nationalism Milosevic stoked ethnic violence in Kosovo in an attempt to consolidate more control over the region.

NATO had already intervened in the Yugoslavian conflict earlier in the decade in its mission in the newly independent Bosnia-Herzegovina. In 1995 NATO undertook a precision bombing campaign against Serbia, Operation Deliberate Force, that lasted less than one month. Milosevic had initially not complied with NATO, but eventually capitulated after a more extensive bombing campaign was threatened. Although NATO was somewhat reluctant to launch this campaign, Operation Deliberate Force ultimately proved successful within three weeks.

US involvement in the Kosovo conflict begins in earnest of February of 1998, in response to the killings of ethnic Albanians by Serbian police forces. This incident led to the first US special envoy to put an end to the crisis. Milosevic, however, continued to stoke the ethnic violence in Kosovo. As international attention toward the crisis grew the UN Security Council (UNSC) passed UNSCR 1199, which condemned the FRY for the violence but did not endorse any military intervention on the part of

the UNSC in September 1998. UNSCR 1199 was quickly backed up by a September 24th NATO warning to FRY to implement the resolution, or face air strikes (Bytyci 2015). The demands of the FRY were clearly set out by UNSCR 1199 and included a stop to security force repression of the civilian population, allowing for continued international monitoring of the situation in Kosovo, an agreement for the safe return of refugees and humanitarian supplies into Kosovo, and make a meaningful timetable with the Kosovo Albanian community to a political resolution to the conflict in Kosovo (UNSC 1998).

With the first expressed ultimatum of military force on the table diplomatic efforts continued. On October 2nd the US sent a second special envoy, which ultimately made no progress on diplomatic efforts toward a peaceful solution to the conflict. The lack of progress towards a diplomatic solution led NATO to explore raising the spectre of carrying out the airstrikes. On October 8th NATO authorized the use of airstrikes to compel Milosevic to withdraw forces from Kosovo. While Milosevic pushed NATO to the brink of airstrikes he would eventually capitulate, once NATO secured an activation order for airstrikes on October 11th and clearly stated it was ready to commence airstrikes within 96 hours (Manulak 2011). Hours later Milosevic signed an agreement with Holbrooke, which included a ceasefire and withdrawal of additional forces from Kosovo. In exchange for the signing of the agreement, NATO temporarily took airstrikes off the table, however, Holbrook warned FRY that if the agreement were not implemented NATO was still willing to intervene militarilyBytyci (2015).

While NATO's threats initially showed success in getting Milosevic to capitulate, this success was short lived. In early 1999 Serbia undertook more attacks against Albanians. This gave impetus to the Rambouillet Conference in February 1999. This conference was an ultimately unsuccessful diplomatic effort to broker an agreement on the status of Kosovo between the Serbians and the Albanians. The Serbian delegation rejected the agreement that came out of Rambouillet, putting more pressure on NATO to intervene in the conflict.

After NATO had authorized airstrikes in Kosovo, one last effort was made to broker a deal peacefully. On March 10th 1999, Richard Holbrooke, US Special Envoy to Serbia, was sent to Belgrade to offer Milosevic an ultimatum: agree to a peace accord or suffer NATO airstrikes. While there were hopes that the imminent preparations for airstrikes would compel Milosevic to broker a last minute agreement, as they were able to get in October 1998, these hopes never materialized. NATO's demands were not met, and on March 24th airstrikes began. The airstrikes would ultimately end in June 1999 when Milosevic acquiesced to a peace agreement.

5.2 Players and Types

The definition of the players in the case of Kosovo are relatively straight forward. The US is D, the signaling state, in conflict over a foreign policy objective with C, the FRY. The foreign policy objective they are each trying to maximize was zero-sum or at the least could be considered a non-cooperative game; the US wanted to end the humanitarian disaster which was the result of Milosevic trying to consolidate more control over Kosovo. As part of the US's strategy to maximize its foreign policy goals it issued ultimatums to FRY in an attempt to signal its resolve. As the US chose a signal, the FRY observed the signal and had to make a decision to challenge or acquiesce, and the US ultimately had to choose whether to follow through with force or back down on its threat after the FRY resisted, the case aligns well with the structure of the model with the US assigned to D and the FRY assigned to C.

Resolve is also pretty straight forward in this case as well. In hindsight, we can infer that the US was willing to undertake its bombing campaign, as evidenced by the US following through with the bombing campaign. However, the historical record also shows that the US was resolved from the onset of the crisis. The US understood in its strategic planning for the initial ultimatum in October that if they were to threaten Milosevic, they needed to be prepared to make good on their threat. A September 1998 memorandum, which Clinton approved, planning to push NATO on issuing an

ultimatum backed by force showed that the US understood that it must use force if it involved itself in the conflict and Milosevic did not comply. The memorandum reads:

> For the ultimatum to be credible, we and our Allies would need to be ready to conduct limited cruise missile strikes should Milosevic fail to comply. If he persists in noncompliance, we would need to be ready to escalate to wider air strikes with the objective of impeding his ability to conduct military and security operations in Kosovo.

US planning shows that the US was resolved from the onset of the crisis. This is an important distinction for classifying the equilibrium, as under certain conditions in the model, initially unresolved states can commit themselves to disadvantageous wars if they ratchet up the cost of backing down. The planning documents affirming the need to back up threats with real military action and planning for airstrikes suggest that the US was indeed initially resolved in the crisis before it issued the ultimatum, rather than an unresolved type which committed itself to fighting through ratcheting up signaling costs.

The FRY's resolve is pretty straight forward. As it is not the signaling state in this model it has no lever to commit or not commit itself to fighting in this crisis. Therefore, Milosevic's resolve was demonstrated by his willingness to endure NATO strikes. While one could argue that Milosevic could have been unresolved, but did not find the signal credible and tried to call the US's bluff, this would not make sense given the long duration between the beginning of Operation Allied Force and Milosevic's capitulation. This may have been a feasible argument had the campaign lasted a matter of weeks, as in Operation Deliberate Force. However, it is unlikely that Milosevic would endure three months of bombing if he was just testing the US. Much of the war termination literature suggests that as wars are fought information is revealed about each side's capabilities and beliefs about victory converge (Ramsay 2008; Reiter 2009). Therefore, It would not take long for Milosevic to realize US resolve after force had been consistently applied.

Based on the sequence of events in Kosovo, the case is well suited to the structure of the model. There is a signaling state, the US, which makes a signaling choice, an ultimatum. The challenger observes this signal, and chooses to comply with the signaler's demands, ceasing ethnic violence, or challenging the signal, continuing ethnic violence. Finally, when the FRY did not comply with the US ultimatum, the signaling state had to choose to fight, through the use of airstrikes, or to back down by continuing to allow Milosevic to stoke ethnic violence. Both the players are resolved in this case, and while they have beliefs about the other's type, they do not know it with certainty.

5.3 Clinton's Response as a Tied Hands Signal

The Clinton Administration's ultimatum(s) to Milosevic fit the definition of a tied hands signal. Clinton made a public demand on a foreign policy issue, staking the reputation and international credibility of the United States on acquiescence to these demands. The ultimatum was intended to articulate the US's demands and convey the US's resolve to use military force for non-compliance with these demands. The US understood this logic when they pressed for NATO to issue an ultimatum. This can be seen in the declassified memorandum in which Clinton approved the recommendation to issue the initial October 1999 ultimatum to Milosevic. The memorandum reads:

> With winter approaching and Milosevic still defiant, Principals agreed that the time has come to back up international demands for a political solution and end to violence against civilians with a credible threat of military action. This would entail pressing NATO to issue an ultimatum demanding that Milosevic take concrete steps to resolve the humanitarian and political crisis, or face a military response (Samuel Berger 1998).

The approved recommendation demonstrates that the ultimatum to Milosevic fit the definition of a tied hands signal. The US was resolved to use force over the humanitarian crisis in Kosovo, and would later act on the advice in the memorandum

by pressing NATO and the UNSC to issue ultimatums. The recommendation also noted that Milosevic was unlikely to resolve the crisis absent a threat of military intervention. As such the ultimatum was intended as a signal of US resolve, hoping to have Milosevic acquiesce to its demands through the threat of intervention.

While this ultimatum was delivered by NATO, the US took responsibility for its execution both implicitly and explicitly. Implicitly, the US took on responsibility as the de-facto leader of NATO and its strongest member. Explicitly, it was well publicized at the time that the US was taking a leading role in issuing the directive and NATO member hardest pushing the alliance toward issuing the directive (Walker 1999b; Perlez 1999). By pushing for a NATO ultimatum publicly the not only was NATO's credibility on the line, but the US's specifically as well.

A key factor of tied hands ultimatums is that leaders stake their own credibility and the credibility of their state in the international system to increase the costs of backing down. Clinton suggested that this was the case in the Milosevic ultimatum during the March 18th press conference when he announced that NATO would commence with military action in Kosovo. This announcement came after the October 1998 ultimatum and in conjunction with the March 1999 ultimatum. Clinton provided several justifications for military actions including:

> If [the crisis in Kosovo] continues...It will undermine the credibility of NATO on which stability in Europe and our own credibility depend.

Clinton understood that the international reputation of the US and NATO was at stake as they became involved in the conflict, and public statements would put this reputation further at risk should they back down from the conflict. Credibility was a key theme in the justification for the use of force and Clinton understood that their would be reputational costs for inaction on the crisis. The quote also demonstrates that Clinton understood that NATO and the US's credibility were intertwined in this crisis. As the de-facto leader of NATO ultimatums issued by NATO put the US's credibility in particular at stake. In addition to the US's de-facto position, the US

had also taken a leading role in NATO's response to the crisis and had pushed the alliance toward issuing the ultimatum in a very publicized fashion. While NATO's ultimatum, Clinton understood that as the leading player in the response, the US's credibility was on the line.

Several US leaders further took ownership for the ultimatum by their public statements. This was especially true as the US took a key role in last minute negotiations with Milosevic in March 1999. As the bombing campaign drew near in late March, US Vice President Al Gore stated:

> "If Milosevic does not call off his attack and stop the slaughter of innocent men, women and children, we are determined to act to diminish the military power that he has turned ruthlessly toward the Kosovo people and help the Kosovar Albanians win the safety, security and self-government they deserve." (Blitzer et al. 1999)

On March 22nd, the day before NATO airstrikes commenced, it was US ambassador Holbrooke, not a NATO representative that went to deliver Milosevic a final ultimatum. He let the press know that he was going to Serbia to inform Milosevic that bombings were "just a few hours away" if he did not change course (Walker 1999a). Clinton also publicized this meeting at a White House Press conference once again reaffirming the ultimatum:

> "As part of our determined efforts to seek a peaceful solution, I asked Ambassador Holbrooke to see President Milosevic and make clear the choice he faces. That meeting is either going on now or should start in the next few minutes. If President Milosevic continues to choose aggression over peace, NATO's military plans must continue to move forward." (Clinton 1999)

While the ultimatum was ultimately NATO's statements by Clinton administration show the US taking a leadership role in issuing and enforcing the ultimatum.

The Clinton administration did not take a back seat and let NATO solely stake its own credibility with the ultimatum, but instead doubled down and entangled its own credibility with NATO's. Clinton administration officials publicly echoed the same message as NATO to Milosevic, stop the humanitarian crisis or force will be used.

Finally, while applying the logic of tied hands signaling can be difficult in practice, because threats on the international stage can be vague, NATO's signal in this case was clear and unmistakable. NATO articulated a demand, that Milosevic agree to a ceasefire and international monitoring. Additionally, NATO was very clear with how they would respond to non-compliance, with military force that was specifically limited to an air campaign and publicly distanced itself from the possibility of a ground invasion (Stigler 2003). In being both clear about the demands and response for non-compliance NATO clearly set the terms on what constituted as acquiescing to NATO demands and what constituted as following through on their threat.

5.4 Equilibrium Conditions

The Clinton Administration's response to Milosevic fits the traditional definition of a tied hands signal. Additionally, as I will show in this section, there was no expected return on mobilization so the prevailing logic that a tied hands signal is preferable held. Therefore, the Clinton administration chose to stake its reputation as a less costly signal, rather than burn through resources. However, unlike older signaling models, my model explains this behavior as a strategic choice under a narrower set of conditions, rather than a dominant strategy. This analysis provides a coherent explanation about why public threats were chosen in relation to other signals. This case will illustrate that US intervention in Kosovo was consistent with the parameter space that supports the tied hands equilibrium outlined in Chapter 3. Military mobilization offered few preparatory benefits to the US, so it relied on public threats as a cheap form of deterrence. I will define the parameters from the model in terms

of the case, and assess whether the behavior of the players matches that of the tied hands equilibrium.

The defining characteristic of the tied hands equilibrium is that military benefits from sunk costs are not large enough to make it worthwhile for D to choose to mobilize. The tied hands equilibrium requires that the sunk cost from mobilization is too great relative to mobilization's expected benefits. These expected benefits are a function of D's belief about C's resolve and the added military power that comes from mobilization. As these variables decrease, the parameter space in which the tied hands equilibrium is supported expands, as the signaling cost has to decrease to be worth the investment. If either of these variables are near zero the likelihood mobilization will be worth its cost approaches zero as well.

This section will demonstrate how these conditions were met in the 1999 NATO intervention in Kosovo. I will first show that the US had a low expected value for military mobilization, as power was lopsided toward the US and its allies from the outset, the US wanted to avoid a ground campaign, and intervention had to remain limited to keep its NATO allies on board. These negligible gains from mobilization made it so the expected value of mobilization was still low despite moderate beliefs in Milosevic's resolve.

The first parameter that will be defined is the initial level of power. In this case it will be defined as US military capabilities in Kosovo vis a vis Serbia at the onset of the crisis. The parameter space supporting a tied hands equilibrium expands with the initial capability of signaling state. This is because as power become more lopsided, and victory for the signaling state becomes more probable, there is little to gain from hedging bets against deterrence. When power is lopsided in favor of the signaling state, the advantage will be in its favor with or without preparation. The initial level of power constrains how large the return on mobilization can be, as the probability of victory is theoretically capped at 100%. Therefore, it would be difficult to find situations in which a state would be willing to use scarce resources to go from a

99.8% chance of victory to a 99.9% chance of victory when there are cheaper modes of deterrence available.

It should come as no surprise that in the case of the US versus Kosovo, the US's initial level of military power relative to Kosovo was very high. The US was the global hegemonic power and the FRY was a minor European power on the verge of dissolution. The power differential was very lopsided in favor of the US. In the CINC dyad-year for 1999 the US has 99% of the total military capability between the US and FRY. In fact, according to the CINC score the US was approximately 70 times more powerful than FRY. In terms of military personnel, the US had 7 times more personnel than the FRY (Singer et al. 1972). The available quantitative data would suggest that the initial power level of the US, was very high, and in fact probably somewhere near its theoretical limit of certain military victory.

While the CINC can be an imperfect measure of military power a qualitative assessment of capabilities would still suggest to any reasonable person that the US was far superior to the FRY. The US was experiencing its unipolar moment as it had become the hegemonic power after the collapse of USSR, while the FRY was a small European state that had been mired in a bloody civil war for the better part of the last decade(Singer et al. 1972).

Even if US military preponderance on its own were not convincing enough of the lopsided nature of this conflict, the combined forces of NATO should be. The US spearheaded intervention in Kosovo, providing the bulk of the the airpower, however, the mission was conducted through a NATO coalition. Several NATO members standing on their own would be more than a match for the FRY. The United Kingdom alone was had a CINC score roughly 11 times higher than FRY in 1999. US strategic thought understood this as well, and believed the NATO allies would largely be reliable, further increasing the imbalance of power between the US and Serbia. This can be seen in the ultimatum planning document:

> "Although we believe we will ultimately be successful in gaining the Alliance agreement to use force with or without another resolution, some may seek to "opt out" of contributing forces"(Samuel Berger 1998).

This shows that US strategists believed NATO force would be largely reliable, even if there were some abstainers, and even if the US did not exhaust every political option available before resorting to the US of force. Taken together the initial level of power for the US was high in the case of Kosovo because of its lopsided military capabilities and the reliability of its allies. Unlike the Berlin Crisis, in which planning documents show US skepticism that its European allies will make meaningful contributions to increasing their forces, the US had confidence in the cohesion between the NATO allies and the contributions they would be willing to make. All else equal this would expand incentives for the US to use tied hands signaling because there was little sense in hedging against deterrence failure when they were fully capable of resorting to force.

The next parameter that will be defined is the post-mobilization level of power. In the case of Kosovo this parameter is somewhat difficult to assess because, unlike the Berlin Crisis, the US never undertook a large scale mobilization as a signal, nor are there contingency plans that have yet been declassified for Kosovo. While defining the post-mobilization level of power for the US may be difficult, historical evidence exists that can help make inferences. I will make three inferences that suggest there was little mobilization could do to aid the US in conducting its planned air campaign. The first is that the US already had the necessary assets in the region to conduct a limited air campaign. Since the US could undertake a bombing campaign immediately mobilization could not allow the US to commence the campaign any quicker. The second, and most telling piece of historical evidence, is that fact that a large scale ground campaign was never entertained by the US or NATO allies. The third is that the US commitment to multilateral action through NATO made it very unlikely that the US could mobilize quick enough for a ground campaign to reap the benefits of early mobilization without driving a wedge in the alliance.

Kosovo was the first war to be won with the use of airpower alone (Shimko 2010). While the historical record shows that NATO limited itself to airstrikes during the intervention itself, for an effective test of the model decision makers in the US would have had to have been confident at the time of the ultimatum that a ground campaign was unlikely. This is because air campaigns, which can be conducted at a distance, require less in terms of mobilization than ground campaigns, which require the logistical capacity to move a massive amount of personnel and equipment. NATO was already sufficiently prepared for a campaign that would only be composed of air and missile strikes in FRY. Bombers were already stationed in Italy, as was the sixth American fleet already stationed in the Mediterranean (Bytyci 2015).

Additionally, the US had sufficient bases and aircraft in the region, as well as the support of NATO allies in the region with available assets. In 1999 the US Air Force had six bases in Europe with 174 aircraft in the theater. By the beginning of the air campaign in March the US had aircraft stationed in ten bases across Europe, and by the end of the campaign 78 days later, US aircraft were spread across 22 European bases (GAO 2001). The US's existing presence in Europe meant that the US was already prepared to an extent to conduct a small scale air campaign in nearby Kosovo. Additionally, the fact that the US had allies in the region with existing bases, willing to station US aircraft for the operation allowed the US to scale its presence quickly. Available assets in the region decreased the value of mobilization because several aircraft were already prepared and spare capacity made it easy to scale during the operation, decreasing the value of preemptively mobilizing.

Even had the US and its NATO allies not already had assets in the region, the plan to stick to an air campaign on its own would decrease the returns on mobilization. While preparing ground forces for an invasion would have taken an immense amount of time and resources, thus providing advantages for preemptive mobilization during crisis bargaining, moving aircraft into the region is a comparatively easier task. This means there is comparatively little to gain by burning resources mobilizing aircraft as a signaling strategy. This is evidenced by the rate at which the US and its allies

were able to mobilize aircraft during the short duration of the bombing campaign. When the bombing commenced on March 24th the US and its allies had 207 aircraft in theater. Yet, they were able to over double that number to over 1000 aircraft in theater by the time the conflict ended less than three months later on June 10th (GAO 2001). Clearly, the US's lack of ready-to-go mobilized aircraft had little influence on the US's ability to achieve a decisive and lopsided victory against the FRY.

If US decision makers believed that airpower was the first step into what could potentially escalate into a ground campaign this would increase the benefits of mobilization. Comparatively, it would have been a greater logistical feat to move thousands of troops and equipment into the Balkans, than it would be to simply fire cruise missiles and fly bombers at strategic targets. The time it would take to begin an air campaign would have been a matter of hours or days, the time it would take to begin a ground invasion would be a matter of months.This can be seen in the speed that the US was able to get aircraft into the theater in the lead up to the campaign.

If a ground campaign were necessary the US could prepare for it beforehand mobilization. However, the historical record and declassified documents suggest that the Clinton Administration was confident that there would be no ground campaign, and took efforts to ensure both the American public and the NATO allies that was the case.

The memorandum on preparing the ultimatum for Milosevic does not mention any ground campaign, even as a potential military option. The only uses of force mentioned specifically involve strikes that can be carried out largely from a distance. The memorandum states:

> "If [Milosevic] persists in noncompliance, we would need to be ready to escalate to wider air strikes with the objective of impeding his ability to conduct military and security operations in Kosovo(Samuel Berger 1998)"

The memorandum also notes Congress' aversion to intervention in Kosovo, especially on a large scale. The memorandum suggests that the US take steps to avoid

moving a large military presence to the region, even in a non-combat post conflict capacity:

> "Securing Congressional support will also require significant effort. Most members and the public have limited interest in Kosovo and we are already having difficulty in maintaining support for participation in SFOR. Congress will be concerned about any military action that is seen as putting U.S. forces at risk or leading to a long-term military commitment in support of "Kosovar autonomy."...Using air power now could also commit us later to playing a role in implementing a settlement once one is agreed (another issue on which .Congress is likely to focus). NATO planning for this contingency foresees a force of 36,000 troops, including 8,000 in Albania. NATO has conducted neither the detailed planning nor the force generation for this option, and it is questionable whether allied countries (including our own) would be willing to make the necessary contributions. We are now exploring other options for implementing a settlement which place greater reliance on building local police and other institutions and less on a large international and in particular, U.S. military presence" (Samuel Berger 1998).

While the possibility of a ground campaign was discussed, it did not get significant attention until well into the bombing campaign, months after the threat was issued and Milosevic had not capitulated. Even still, the closest threat of a ground invasion came from Clinton publicly stating that all options were on the table, while his administration firmly restated their commitment to an air campaign (Stigler 2003). Additionally, there were significant political hurdles that the US would have to surmount if it wanted a ground campaign, most notably a skeptical Congress that blocked any ground invasion without congressional approval in April of 1999 (**?**). If one were to cede that the US had serious ambitions to conduct a ground campaign, which historical evidence suggests against, it does not appear to have been on the radar of US

strategic thought at the time the threat was issued. Nor did the threat of a ground campaign appear to have influenced Milosevic's decision to capitulate (**?**).

Part of the US's strategy was relying on NATO allies to help with the war effort. As Congress was ambivalent toward military intervention, US strategists saw it as vital to ensure a multilateral effort that did not have the appearance of the US bearing a disproportionate share of the burden of military operations. This need for multilateral action can be seen in the memorandum authorizing US preparation for issuing a NATO backed ultimatum to Milosevic. The document states:

> Congress will be particularly wary if it appears that the United States has a stronger commitment to military action than do its European allies. Some in Congress will seize on any perception of allied reluctance or of inadequate legal authority as the basis for their criticism (Samuel Berger 1998).

This shows the delicate balance the Clinton Administration had to strike in order to successfully use force in Kosovo. If the US was unable to obtain solid support from its NATO allies, it could jeopardize its own ability to do so. This would ultimately limit any potential advantages to mobilization, as it would either come with the cost of time consuming consensus building, or unilateral action which could drive a wedge in the alliance and/or take the US use of force off the table because of lack of congressional support.

Even if the US had a definite preference towards the use of ground forces, which it did not, it would need to convince its NATO allies, which were extremely hesitant if not outright opposed, to follow course. This would take time, time that would erode many of the advantages of rapid mobilization. Even as some began to raise the remote possibility of a ground campaign towards the end of Operation Allied force, US Secretary of Defense Cohen highlighted how the coalition operation would have eroded the benefits of a ground campaign:

> "We are not about to take unilateral action. We have to have a consensus of NATO... There was no consensus for the application of ground forces in a nonpermissive environment... You saw just a few weeks ago, once the element of whether ground forces would go into a nonpermissive environment [was raised], you suddenly saw some question of division within the alliance itself. Had that taken place at the very beginning, we would have seen Milosevic carrying out his campaign of ethnic terror and purging at the same time that NATO countries would have been still debating the issue of who would participate and who would not... Ultimately [the air campaign] has proved successful" (Stigler 2003).

The US interest was not vital enough to commit it to unilateral action on Kosovo. Since US strategy relied on NATO support, post-mobilization power was kept low given any potential path the US could proceed on with allied support. Sticking to an air campaign for the sake of allied unity and the ability to rapidly respond meant that there would be no need for ground forces, which would take the most time to get mobilized in the theater. If the US were to push for a ground campaign it would take considerable time to get a consensus among its allies, which were primarily ambivalent at most to the idea of a ground campaign. If the US was successful in achieving a consensus it would take considerable time, which would erode the advantages that early mobilization would have conveyed, ultimately making the post-mobilization level of power little different than the pre-mobilization level of power. If the US was unsuccessful in achieving a consensus several, if not all, members of the alliance might abstain from the use of force. This would have made the campaign much more burdensome for the US as non-US NATO allies provided roughly half of all airstrikes by the end of the conflict (**?**). Therefore, alienating allies would once again erode the advantages of early mobilization, if not create a disadvantage, as the US would have to bear a greater portion of the campaign's costs. Since the US was averse to unilateral action on Kosovo a ground campaign would have been either infeasible or likely to create a wedge in the alliance. Either way the US was likely to gain little

advantage, and potentially a disadvantage from mobilizing ground forces. The US commitment to multilateral action decreased potential returns from mobilization by taking a ground campaign off the table, as mobilization for an air campaign would have been unnecessary and mobilization for a ground campaign would come with additional costs in terms of public support and burden sharing.

The Clinton administration's planning showed that it was not just signaling a limited intervention to sell it to the public, but it truly did not believe a large scale intervention involving a ground campaign was feasible for the US. There was little interest amongst the public, skepticism in Congress, and concerns that NATO allies would not participate. This all led to the US only considering missile and airstrikes, operations that required comparatively little costly mobilization. Preparation through mobilization would have done little for the US in conducting its air campaign, and for this reason, the post mobilization power level should be considered relatively low.

While assessing beliefs is more difficult in the case of Kosovo compared to the Berlin Crisis, in which more documents have been declassified, there is still some information pointing to the US having moderate beliefs that Melosevic would capitulate under credible military pressure. Earlier in the negotiation process the threat of the use of force gained a little traction with Milosevic. After the NATO activation order Holbrooke and General Michael Short, of the US Air Force, met with Milosevic. According to Holbrooke, during the meeting Short told Milosevic:

> "Mr. President, I have B52s in one hand, and I have U2s in the other. It's up to you which one I'm going to have to use" (Boyer 2000).

Holbrooke attributed this ultimatum to the initial concession Milosevic made in October (Boyer 2000). This initial success suggested that though Milosevic would attempt to hold out in negotiations, he had very little ground to resist a credible threat of force.

Another consideration in the US's belief about the ability to coerce Serbia was Milosevic's behavior in his most recent diplomatic conflict with NATO, the crisis in

Bosnia during 1995. During this crisis Milosevic displayed his brinksmanship, but ultimately capitulated to NATO's demands. NATO had issued increasingly more broad authorizations for the use of airstikes to end attacks in the UN defined safe area in Bosnia, and followed through with a limited bombing campaign in 1995. Within weeks Milosevic capitulated to NATO demands to end its seige and remove heavy weapons from the UN safe zone (Walker 1999a).

Milosevic's reputation for cracking under NATO military pressure played into the calculus of the US when they issued an ultimatum. NATO had demonstrated to Milosevic that it was willing to follow through on its threats, and Milosevic had shown that he would buckle under limited military pressure. After an unsuccessful January 19th meeting between NATO Supreme Allied Commander Wesley K. Clark and Milosevic, Clark suggested that Milosevic was susceptible to the threat of military pressure. In an interview following the meeting Clark said:

> The international community has learned through long years of dealing with Mr. Milosevic that he is the most compliant when threatened directly with heavy military pressure (Perlez 1999).

This quote suggested that key decision makers in NATO had been conditioned to believe from the Yugoslavian conflict that Milosevic would capitulate if threatened. Admittedly, it is plausible that over the duration of the conflict beliefs may have changed. For example, while the US may have early on believed that Milosevic would capitulate due to initial success with coercive diplomacy in October 1998, Milosevic's subsequent actions reneging on the agreement could have elevated beliefs about his resolve by the time the final ultimatum was given in March.

With the parameters about initial power, post-mobilization investment power, and US beliefs about Milosevic's resolve defined we can now evaluate whether or not the costs of mobilization would offset the expected return on investment for mobilization. The US's initial level of power was very high, it was the global hegemonic power, it was backed up by its NATO allies, which included several other powerful

countries, and had demonstrated its ability to project that power globally through recent air campaigns in Iraq and Bosnia. Its opponent, FRY, was a small country embattled in conflict throughout the 90s. Since the US intended on carrying out force through airstrikes, there was little benefit to large scale mobilization. Taken together a high initial level of power and a low level of mobilized power would suggest that mobilization would do little to change the already lopsided probability that the US prevail in military conflict. This would make any return on investment for mobilization negligible.

Additionally, there is some evidence to suggest that the US and NATO believed Milosevic would concede to their terms. Several US decision makers had stated that Milosevic was more likely to understand the threat of military force than diplomacy. Additionally, NATO had demonstrated its willingness to follow through with limited bombing campaigns, and Milosevic had demonstrated that it only took very limited military force for him to capitulate and that he was willing to push negotiations to the brink only to concede in the final hour. This suggests that the US believed that any investment from mobilization would unlikely be put to use.

Taking return on mobilization and beliefs into account it is hard to argue that large scale mobilization would be worth the investment. Military resources are scarce and expensive, and there was little benefit to mobilization and a significant chance that even if the US mustered these resources they may not be used. Admittedly, there are not as many declassified documents on Kosovo as there are with the Berlin Crisis, making it more difficult to make claims to US/NATO beliefs about Milosevic's resolve. However, even if one were to argue that claims could not be made to US beliefs, the value of sunk costs are a multiplicative function of return on mobilization and beliefs, therefore, both factors would have to be non-negligible for mobilization to have value.

5.5 Discussion

Based on the prior definitions the model parameters in the case of Kosovo support the tied hands equilibrium. There is little evidence to suggest that a large scale mobilization, the likes of which were seen in the Berlin Crisis, were expected by the US to offset the cost. The most convincing piece of evidence to this condition being satisfied is the lack of military advantage to mobilization. The US was already far stronger than FRY and in addition was convincingly backed up in an air campaign with several military powers in NATO, meaning there was little room to turn the lopsided probability of US victory further in favor of the US. The availability of US assets in the region, the insistence on an air campaign, and the desire for multilateral action all severely hampered expected returns on US mobilization.

The US, at least at the time of issuing Milosevic ultimatums, was committed to the use of force exclusively through airpower, as many feared a ground campaign would drag the US into a deeper commitment in the region. Given that the US intended on conducting an air campaign, there was little mobilization could do to increase the probability it would win in war. The US had bases on the European continent close enough to to send aircraft into Serbia and strategic targets were within the range of its ships already in the Mediterranean. All necessary resources to conduct the limited air campaign the US was planning were already present, therefore, further mobilization would not allow the US to conduct the campaign any quicker than with the available assets. As air campaigns can be conducted at a distance and can be prepared for in much shorter time compared to a ground campaign, there are fewer benefits in general for mobilization for an air campaign. Additionally, the US was also committed to multilateral action through NATO, meaning that the time spent building the consensus for a ground invasion would erode potential benefits from early mobilization, or a deviation to unilateral action make allies reject the use of force and decrease military capabilities.

Beliefs that Milosevic would capitulate in the face of so many military powers that had previously followed through on their threat to use force in 1995 were likely sufficient. However, these fears may have increased after Milosevic reneged on his deal with Holbrooke. Even if one were to assume that fears were high that Milosevic would not capitulate throughout the crisis, sunk cost equilibria would not be supported. This is because of the value of sunk costs depends on both the value of the military investment, which in this case is negligible, and beliefs about the challenger's resolve. While there is some evidence to infer that the US believed Milosevic would capitulate, it is not a necessary condition to incentivize tied hands signaling given that there were no benefits to large scale mobilization.

In addition to the US lacking an expectation of return on mobilization, the US's risk preferences likely incentivized it toward tied hands signaling. The US had no vital security interests in the region or existential threats to its hegemony, as it did in the Berlin Crisis. This allowed it to behave in a more risk acceptant fashion regarding the outcome of the crisis, relying on coercive diplomacy rather than preparations for an extensive military campaign. Overall, both the equilibrium parameters and the risk preferences of the US support the tied hands equilibrium.

Ultimately, the signaling behavior that should be incentivized according to the model was carried out by the US. The US was resolved to prevent further human rights abuses in Kosovo. As such, the US tied its hands by offering ultimatums to Milosevic, concede or face military action. As stated by the Clinton Administration, the credibility of NATO was on the line with respect to taking action against FRY for non-compliance. This fits the model's assumption that tied hands can be used as a signal of resolve. The US's threat generated a potential audience cost, Milosevic was given the opportunity to concede or challenge, and the US had to make a decision on the use of force once Milosevic decided not to capitulate. Additionally, the US and NATO offered terms to Milosevic on what constituted as capitulation and what form of retaliation would occur for non-compliance, removing potential ambiguity that can occur in the practice of foreign policy versus clear-cut simplified models. The case of

US signaling to Milosevic in Kosovo appears to follow the logic of the model in cases where sunk cost signals have little value, offering further support to the model.

6. CONCLUSION

The case studies of the Berlin Crisis and Kosovo demonstrate the empirical validity of the model. Given the strategic context in both cases the model provides an explanation of the signaling decisions undertaken in each crisis. In the Berlin crisis there was a high expected return on mobilization. This was driven by the comparative disadvantage the US had in projecting its military power in Europe compared to the USSR, the belief that additional US forces would meaningfully alter the probability of Soviet acquiescence in the event of combat, and significant beliefs about Soviet resolve. These factors combined made it so that mobilization would have a meaningful impact in the event combat were to occur, and there was an expectation that combat would be likely. This incentivized the US to undertake upfront sunk costs to mobilize in West Berlin as a hedged bet against deterring the Soviet Union.

Through mobilization the US bolstered its forces in West Berlin. These forces were not intended as a mere trip-wire as previous scholars have suggested, but their capability was integral to US strategy if the Berlin Crisis escalated to the use of force. The longer the US could hold out in Berlin, the greater the likelihood it could force the USSR to capitulate in the event of a hypothetical invasion by the USSR through the risk of general war. While the US would have preferred to settle the conflict diplomatically, mobilization allowed it to both send a credible signal of its resolve to the USSR, while simultaneously preparing for war. This was the US's optimal strategy given the large advantages to early mobilization and its uncertainty about Khrushchev's resolve.

Conversely, the case of Kosovo had a very low expected return on mobilization. The US's military preponderance versus the FRY, and its own and NATO as a whole's preference for a strictly air campaign made the return on mobilization negligible at best. Regardless of US beliefs about Milosevic's resolve, which evidence suggests was

pretty low, without a considerable return on mobilization in the event of war, the US was incentivized to avoid the sunk cost of mobilization and opt for the cheap option of a public threat.

In Kosovo the US only intended on conducting a limited air campaign, and already had many of assets necessary for Operation Deliberate Force already in the region. The US already had several bases in Europe and aircraft stationed at them. The US also could rely on its NATO allies in the region to provide aircraft and allow for the stationing of US aircraft at its bases. Further mobilization of ground forces would have taken significant time and expense, however, the US had no interest in undertaking a ground campaign and doing so would drive a wedge in the NATO alliance. The availability of military assets to the US in Europe to conduct the limited scope of its mission made benefits to early mobilization negligible. Therefore, the US's optimal strategy was to rely on tying hands, which was comparatively cheaper than preemptive mobilization.

These cases demonstrate the utility of mobilization. It is most valuable when it could significantly alter the balance of military power and the use of force is believed to be likely. This is because it is both a deterrent signal, undertaking costs to demonstrate resolve, and a hedged bet, increasing the likelihood the state will prevail in war if the signal goes unheeded. As NATO suggested during the Berlin Crisis mobilization is "a clear indication of...capability and will to apply appropriate military measures if need be". These cases show, unlike the literature suggests, that mobilization is not an inefficient signal only to be used by states unable to generate audience costs, but a strategy that's value fluctuates according to the strategic context.

The Berlin Crisis and Kosovo, not only highlight that the model's insights are empirically valid, but that it can make empirical contributions to the literature as well. Prior theoretical constructs would have difficulty explaining the Berlin Crisis, a case in which a democratic state, capable of generating audience costs, undertook significant upfront costs as a deterrent signal. The model provides a coherent theory capable of encompassing both the Berlin Crisis, and cases that fit into the prior

theoretical framework, such as in Kosovo. Even with the case of Kosovo, which could be incorporated into the prior framework, the model provides a more nuanced explanation to why a public threat was used, in which the state considers the military benefits of mobilization and the likelihood of war.

A final empirical contribution of the model is its ability to encompass prior studies, even though they have suggested that mobilization is an inefficient strategy. The the point that mobilization is no more informative than a tied hands signal, this finding is still sustained in the new model. Both mobilization and tied hands signals can inform with certainty that a state is resolved.

In addition to making an empirical contribution this model also makes a theoretical contribution, the largest of which is dispelling the misconception that mobilization is an inefficient strategy. The model suggests that inefficiencies in signaling can be offset by expected material benefits in war. Since these benefits are only actualized if war occurs, mobilization's value is like the value of a hedged bet or insurance. When states mobilize they pay an upfront premium upfront for a better outcome in the event deterrence fails. This is a novel theoretical contribution that goes beyond Fearon's model, which suggested that mobilization was purely a sunk cost, and Slantchev's model, which only showed the ability of mobilization to create commitments. While prior theoretical models examined how the dynamics of mobilization changed when assumptions were changed, none examined under which conditions mobilization would be an effective strategy.

The model's theoretical developments have implications for future research as well. The equilibria serve as a starting point for hypothesis tests on when we should expect mobilization in crisis bargaining. Additionally, with distinct conditions under which mobilization has value, more focus could be brought back to sunk cost signals and signals with sunk cost components. Empirical work on signaling is heavily skewed towards tied hands signals and audience costs compared with sunk cost signals and mobilization. Additionally, much of the empirical work on sunk costs and mobilization is comparing these signals to tying hands. In the introduction to Slantchev's model,

he suggested the lopsided focus was the result of the Fearon model putting mobilization largely into the realm of irrationality. While the Slantchev model provided a theoretical advancement for how we view the mechanics of mobilization, without a competing theory of when mobilization was optimal the bias toward tied hands signaling in empirical work continued. New theoretical constructs can potentially bring a renewed focus on empirical work on mobilization.

A final contribution of this dissertation is that it brings the frequently abstract world of game theory closer to the practical world of foreign policy. Prior models, while informative and generalizable because of their simplicity, sacrificed practical application as a trade-off. There are rare examples of pure sunk costs in crisis bargaining, as most cited examples have a sunk cost element but also increase military power. By making more realistic assumptions and using them to revisit old models, we can obtain game theoretic insights that are more applicable to informing foreign policy decision making.

Using the insights from this model, we now can explain why the United States spends billions on forward deployments around the globe. Additionally, these equilibria give us the ability to evaluate where mobilization and forward deployments would be better advised. By looking at where preparation could significantly alter the balance of power between states and determining where conflict is more likely to occur, states can make more informed decisions about where to mobilize and where to cut back to optimize their military resources.

The foreign policy implications of the model are timely as the US grand strategy of deep engagement is being reassessed in public debate. Increasingly, there are more calls from politicians to scale back US global military engagement. However, the model suggests that the debate itself needs reframing. Instead of the constant focus on more or less US military deployment we should be focusing on how efficient our deployments are. When considering whether to deploy/call back forces, we should think about them as investments in securing US interests.

The mobilization of scarce military assets should consider how likely is combat to break out in the region in which these assets are deployed? If intelligence suggests that it is unlikely that adversaries are resolved, then combat is unlikely to occur and the mobilization loses its bet hedging value. If this is the case cheaper methods of tied hands signaling can be used as a signal of resolve. However, suppose there are adversaries in the region that intelligence suggests have higher probabilities of being resolved. In this case there is also the question of whether deploying assets in the region preemptively would yield significant benefits in the event of military conflict. If there is both an elevated probability of conflict and significant benefits to preemptive mobilization, then the region becomes a candidate for forward deployment. Should the costs of mobilization be reasonable, then mobilization should occur.

These criteria give us a tool to reframe the debate around US global military engagement. The public debate often oscillates between hawkishness, promoting ever inflating military budgets, and isolationism, promoting pull back at the expense of US military capability. By focusing on mobilization and forward deployment as investments we can open the door to a discussion on how to create optimized global military engagement, focusing resources on areas with the highest impact. Focusing on a leaner more efficient form of global military engagement the US would be able to signal resolve, be adequately prepared for military intervention in critical regions, and conserve resources in the process.

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APPENDICES

A. EQUILIBRIUM CHARACTERIZATIONS

Note: SC =Sunk Cost, TH =Tied Hands, NS =No Signal, CL =Challenge

Equilibrium 1

Equilibrium corresponds with constraint set 1. Separating equilibrium in the signal only space. D_L sinks costs and D_H does not signal. C_L, always challenges and C_H, only challenges when it does not observe a signal.

D_L^* =SC, D_H^* = NS
$C_L^*|$ SC=CL, $C_H^*|$ SC=$No\ CL$, Beliefs: $\mu_{D2}|SC$=1,
$C_L^*|$ TH=CL, $C_H^*|$ TH=CL, Beliefs: $\mu_{D2}|TH \in \{\frac{1}{p_L+\overline{c_D}}, 1\}$
$C_L^*|$ NS=CL, $C_H^*|$ NS=CL, Beliefs: $\mu_{D2}|NS$=0,
$D_L 2^*|$=$Fight$
$D_H 2^*|$=$No\ Fight$

Constraints:

- $1-\mu_C < m < \mu_c p^*$, Signal cost prohibits high cost D but satisfies CT condition
- $m < \overline{c_D} - p_L$, TH does not commit D

Equilibrium 2

Equilibrium corresponds with constraint set 5. Separating equilibrium in the commitment creation space. D_L sinks costs and D_H does not signal. C_L, always challenges and C_H, only challenges when it does not observe a signal.

D_L^* =SC, D_H^* = NS
$C_L^*|$ SC=CL, $C_H^*|$ SC=$No\ CL$, Beliefs: $\mu_{D2}|SC$=1,
$C_L^*|$ TH=CL, $C_H^*|$ TH=CL, Beliefs: $\mu_{D2}|TH \in \{\frac{1}{p_L+\overline{c_D}}, 1\}$
$C_L^*|$ NS=CL, $C_H^*|$ NS=CL, Beliefs: $\mu_{D2}|NS$=0,
$D_L 2^*|$=$Fight$
$D_H 2^*|$=$No\ Fight$

Constraints:

- $\mu_C(p_H - \overline{c_D}) + 1 - \mu_C < m < \mu_C p^*$, D_H chooses NS & D_L chooses SC
- $m < p_L - \overline{c_D}$, TH does not commit D

Equilibrium 3

Equilibrium is a pooling equilibrium in the de-commitment space. D sinks costs regardless of type. C's initial beliefs about D's resolve are such that it does risk calling a bluff by challenging.

$D^* = SC$
$C_L^*|\ SC{=}CL$, $C_H^*|\ SC{=}No\ CL$, Beliefs: $\mu_{D2}|SC{=}\mu_{D1}$,
$C_L^*|\ TH{=}CL$, $C_H^*|\ TH{=}CL$, Beliefs: $\mu_{D2}|TH \in \{\frac{1}{p_L+\overline{c_D}}, 1\}$
$C_L^*|\ NS{=}CL$, $C_H^*|\ NS{=}CL$, Beliefs: $\mu_{D2}|NS \in \{\frac{1}{p_L+\underline{c_D}}, 1\}$
$D_L 2^*|{=}Fight$
$D_H 2^*|{=}No\ Fight$

Conditions:

- $m < \mu_C - \mu_C(p_L - \underline{c_D})$, D_L prefers SC over TH
- $m < 1 - \mu_C$, D_H prefers SC
- $\frac{1}{p_H+\underline{c_C}} < \mu_D$, C_L prefers no CL
- $m < p_L - \overline{c_D}$, TH does not commit D

Equilibrium 4

Equilibrium corresponds with constraint set 12. SCSC4 is a pooling equilibrium in the de-commitment/commitment space. D sinks costs regardless of type. C does not challenge because C_L and C_H both have negative payoffs for war, and D will fight given a sunk cost no matter is type.

$D^* = SC$
$C^*|\ SC{=}No\ CL$, Beliefs: $\mu_{D2}|SC{=}\mu_{D1}$,
$C_L^*|\ TH{=}CL$, $C_H^*|\ TH{=}CL$, Beliefs: $\mu_{D2}|TH \in \{\frac{1}{p_L+\overline{c_D}}, 1\}$
$C_L^*|\ NS{=}CL$, $C_H^*|\ NS{=}CL$, Beliefs: $\mu_{D2}|NS \in \{\frac{1}{p_L+\overline{c_D}}, 1\}$
$D^*|{=}Fight$

Conditions:

- $m < \mu_C - \mu_C(p_L - \underline{c_D})$, D prefers sunk costs
- $m < p_L - \overline{c_D}$, TH does not commit D