Military Coercion in Interstate Crises

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Abstract. Military mobilization has a dual role in crisis bargaining: it simultaneously sinks costs (because it must be paid for regardless of the outcome), and ties hands (because it increases the probability of winning should war occur). Existing studies neglect this dualism and cannot explain signaling behavior and tacit bargaining well. I present a model that incorporates both functions and show that many existing conclusions about crisis behavior have to be qualified. General results that relate the probability of war to an informed player's expected payoff from war do not extend to this environment. The model questions the meaning of state strength, the role of arms races in crisis instability, and the widespread assumption of a costless status quo. I also provide a new two-step rationalist explanation for war that addresses some shortcomings of existing ones.

In an international crisis, states make demands backed by threats to use force. While these threats can be explicit in diplomatic communications, they will not generally carry much weight unless substantiated by some show of force—military measures designed to convey the commitment to resort to arms if one's demands are not satisfactorily met. To have an impact, this commitment must be credible; it must be in one's interest to carry out the threat if the opponent refuses to comply. In an environment where states possess private information about their valuations, capabilities, or costs, credibility can be established by actions that a state unwilling to fight would not want, or would not dare, take. Military activities that states undertake during a crisis simultaneously entail immediate costs and increase their chances of prevailing in war. While the positive impact these activities have on the expected utility of fighting should make then a tempting instrument in a crisis, their very costliness may inhibit incentives to bluff.

This article presents a dynamic crisis bargaining model in which actors are asymmetrically informed about the value of the disputed issue and make military mobilization choices before deciding whether to attack or not. While mobilization is costly, the mobilization levels also determine the probability of military victory if the crisis breaks down in war. This empirically motivated construction departs significantly from all existing models that treat this probability as exogenously fixed. Such models cannot investigate the consequences of state crisis behavior without seriously distorting the incentives actors face. Perhaps not surprisingly, the analysis leads to several modifications of theoretical generalizations produced from such models. The benefits of this formalization are also substantive as the findings offer an explanation for war that may overcome some of the weaknesses in our existing rationalist accounts.

First, the formalization brings together two distinct mechanisms for credible signaling. In economic models, reliable information transmission can be established by sinking costs—actors essentially burn money to reveal that they value the disputed issue even more. In contrast, theories of interstate crisis bargaining usually rely on choices that increase the difference between backing down and fighting—actors essentially tie their hands by running higher risks of war to reveal their resolve. While the first mechanism involves costs that actors pay regardless of outcome, the second involves costs that actors pay only if they fail to carry out some threat or promise.

As I shall argue, military actions have *both* cost-sinking and hands-tying effects, and hence it is imperative that our theories account for that. Focusing only on the cost-sinking role has lead scholars to dismiss mobilization as a useful signaling device (Jervis 1970, Fearon 1997, Rector 2003), shifting the focus to mechanisms that have hands-tying effects. Audience costs are the most prominent example of such a signaling mechanism (Fearon 1994) and much work has been done on exploring the role of public commitments.[1] Because open political contestation is a feature of democratic polities, democratic leaders are said to be better able to signal their foreign policy preferences, which in turn provides an explanation of the democratic peace.

This analysis corroborates the conclusion that tying hands can be an effective (but limited) way of establishing the credibility of one's commitments. This is in keeping with the

[1] See Smith (1998) on the microfoundations of the audience cost mechanism, and Schultz (2001*b*) for another critique of its shortcomings.

audience costs argument. However, contrary to this argument, the analysis demonstrates that such commitments can be established with purely military means. This casts doubt on the popular notion that one can distinguish between regime types by their capability to reveal information credibly. In fact, the conclusion clearly points to an alternative that in no way depends on regime type and as such undermines the logic of democratic peace theories that rely on credible signaling.

Second, the model shows that some of the general monotonicity results from Banks (1990) will not extend to an environment where the probability of victory is endogenous to state crisis decisions.[2] Banks finds that the probability of war is increasing in the expected benefits from war of the informed actor. If military mobilization did not influence the probability of winning, then his results would extend to this model as well: actors that value the issue more would have higher expected utilities from war. However, mobilization decisions do influence the probability of winning, and through it, the expected utility of war. Therefore, actors that value the issue more may or may not have higher expected utilities from war, depending on their relative preparedness to wage it, the level of which they choose while bargaining.

I show that the equilibrium probability of war can be non-monotonic in the valuation of the informed player: low-valuation types do not mobilize (probability of war is zero), middle-range valuation types mobilize optimally and attack with certainty (probability one), and high valuation types mobilize sufficient forces to induce the opponent to quit (again, probability zero). Studies generally define a strong state as one with a high expected utility of war. This analysis questions whether thinking about rivals in terms of their value for war is even meaningful given that they can, at least in part, determine that value through their crisis decisions. It also shows that maintaining a peaceful status quo can become rather expensive, contrary to the widespread assumption in formal models.

Third, the model may shed light on an important puzzle in the causes of war literature. It is generally accepted now that there are two main rationalist explanations for war (Fearon 1995). The first relies on asymmetric information, and the second on commitment problems. I will argue that as they stand, these explanations are incomplete and unsatisfying. In particular, the breakdown of bargaining under incomplete information has trouble accounting for persistent fighting. The model shows a different logic operating in a two-step fashion: at the outset, uncertainty may cause actors to tie their hands successfully by overcommitting military resources. However, this entails a risk of painting oneself into a corner against an opponent prepared to fight while simultaneously failing to commit enough to compel him to back down. As the crisis evolves, the two opponents can find themselves with formidable military mobilizations that are just enough to render them willing to fight but not quite enough to induce the opponent to capitulate. In this situation, war becomes the optimal choice for both, and states fight with complete information. In other words, the model points to a dynamic that explains war as the rational choice under complete information given the crisis situation actors create themselves because of asymmetric information. In this, the results substantially confirm Count Witte's assertion:

[2] Banks (1990) establishes results that must be shared by all models with one-sided private information about benefits and costs of war regardless of their specific game-theoretic structure. These generic results turn out to need the additional assumption that while the expected payoff from war cannot be manipulated by the actors directly, the very assumption this article questions.

> Preparation for war does not make war inevitable. On the contrary, prudent preparation for war, accompanied by a wise policy, provides a guarantee that war will not break out except for the gravest of reasons (Harcave 1990, pp. 308-09).

When mobilization fails as a deterrent, war does not occur by mistake. By the time fighting begins, informational issues that have played a role during the crisis become essentially irrelevant.

1 Coercive Effects of Militarized Crisis Behavior

Perhaps the main problem that leaders face in a crisis is credibility: How does a leader persuade an opponent that his threat to use force is genuine? That he would follow up on it should the opponent fail to comply with his demands? The decision to carry out the threat depends on many factors, some or all of which may be unobservable by the opponent. The leader has to communicate enough information to convince her that he is serious. If the opponent believes the message and wants to avoid war, she would be forced to make concessions. However, if there exists a statement that would accomplish this, then all leaders—resolved and unresolved alike—would make it, and hence the opponent would have no reason to believe it. The problem then is to find a statement that only resolved leaders would be willing to make.

Jervis (1970) studies *signals*, which do not change the distribution of power, and *indices*, which are either impossible for the actor to manipulate (and so are inherently credible) or are too costly for an actor to be willing to manipulate. In modern terms, he distinguishes between "cheap talk" and "costly signaling," even though he prefers to emphasize psychological factors that influence credibility.

It is well-known that the possibilities for credible revelation of information when talk is cheap are rather limited and depend crucially on the degree of antagonism between the actors (Crawford and Sobel 1982).[3] Following Schelling (1960), most studies have explored tacit communication through actions instead of words. Schelling (1966) noted that tactics that reveal willingness to run high risks of war may make threats to use force credible. In general, such willingness results in better expected bargains in crises (Banks 1990), although it does not necessarily mean that the actor willing to run the highest risks would get the best bargain (Powell 1990).

One can think of such tactics in terms of expected benefits from war and expected costs of avoiding it: anything that increases one relative to the other could commit an actor by *tying his hands* at the final stage. Fearon (1994) noted that domestic political audiences can generate costs for leaders who escalate a crisis and then capitulate, creating an environment in which a leader could tie his hands, and thus signal resolve to foreign adversaries. Even though leaders pay the costs only if they back down, their willingness to risk escalation to a point where each of them would be irrevocably committed to not backing down can reveal their resolve.

[3]Reputational concerns due to continuing interaction with domestic (Guisinger and Smith 2002) or foreign (Sartori 2002) audiences may lend credibility to cheap talk. Ramsay (2004) shows that cheap talk signaling may occur when there are multiple audiences even in the absence of ongoing relationships. When both cheap talk and costly messages are available, costly signals can improve the precision of communication (Austen-Smith and Banks 2000).

This contrasts with another signaling mechanism that relies on *sinking costs*, that is incurring expenses that do not directly affect the expected payoffs from war and capitulation (Spence 1973). Only actors who value the issue sufficiently would be willing to pay these costs, turning them into a credible revelation of resolve by separating from low-resolve actors through their action. When the last clear chance to avoid war comes, these costs are sunk and cannot affect the decision to attack, hence they cannot work as a commitment device and their function is purely informational.

What is the role of military actions, such as mobilization, in a crisis? Fearon (1994, p. 579) notes that the "informal literature on international conflict and the causes of war takes it as unproblematic that actions such as mobilization 'demonstrate resolve'," and argues that 'if mobilization is to convey information and allow learning, it must carry with it some cost or disincentive that affects low-resolve more than high-resolve states." He then goes on to dismiss the financial costs of mobilization as being insufficient to generate enough disincentive to engage in it, and concludes that we should focus on an alternative mechanism—domestic political costs—that has a tying hands effect.

While one may quibble with the notion that mobilization is not costly enough, the more important omission is that the argument treats mobilization (and similar militarized crisis activities) as costly actions that are unrelated to the actual use of force. However, one can hardly wage war without preparing for it, and the primary role of mobilization is not to incur costs but rather to prepare for fighting by increasing the chances of victory. But improving one's prospects in fighting increases the value of war relative to peace, and can therefore have a tying hands effect. In fact, it is difficult to conceive of pure sunk costs in this context. Perhaps military exercises away from the potential war zone could qualify as such, but almost anything countries can do in terms of improving defenses or enhancing offensive capability affects the expected payoff from fighting quite apart from the costs incurred in doing it. Even though he does not analyze it, Fearon (1997, fn. 27) does recognize this and notes that "insofar as sunk-cost signals are most naturally interpreted as money spent building arms, mobilizing troops, and/or stationing them abroad,… the probability of winning a conflict… should increase with the size of the signal."

Underestimating mobilization's role as a commitment device beyond its immediate costliness leads one influential study to conclude that "the financial costs of mobilization rarely seem the principal concern of leaders in a crisis" (Fearon 1994, p. 580), implying that these costs are insufficient to generate credible revelation of resolve. As I will show, this is true only if mobilization functions solely as a sunk cost; if we consider its tying hands function, mobilization does acquire crisis bargaining significance.[4] It affects not only signaling behavior of the potential revisionist, but also the defensive posture of the status quo power.

Empirically then, it seems that military actions states take during a crisis—mobilizing troops, dispatching forces—entail costs that are paid regardless of the outcome, and in this sense are sunk; however, they also improve one's expected value of war relative to peace, and in this sense they can tie one's hands. While *militarized coercion* involves actions with these characteristics, existing theories of interstate crisis bargaining have not analyzed their

[4]Rector (2003) analyzes the impact of mobilization on crisis bargaining but only considers it as partial prepayment of war costs. Because it ignores the hands-tying impact, the study concludes that mobilization has no signaling effect.

consequences properly.

In the formal literature, the issue has been completely side-stepped in favor of models that incorporate only one of the two functions: The probability of winning is exogenously fixed instead of being determined endogenously by the decisions of the actors.[5] This class of models is nearly exhaustive: very few admit endogenous probability of victory. I am aware of three exceptions. Brito and Intriligator (1985) study resource redistribution as alternative to war under incomplete information, but analyze Nash equilibria that may not be sequential (so threats may not be credible) and assume military allocations are made simultaneously (and so one cannot react to the mobilization of the other). Powell (1993) studies the guns versus butter trade-off but because he analyzes the complete information case, we cannot use the results to study signaling issues. The most closely related approach is that of Morrow (1994), who models the effect of an alliance as having a dual role: increasing the expected value of war, and decreasing the value of the status quo. However, in that model actors are unable to choose the level of commitment, which seems to be an important feature of crises because of its potential signaling role.[6]

In other words, nearly all existing models cannot seriously investigate the impact of military moves in crisis situations because they ignore the tying hands effect they may have. This is a crucial shortcoming because in these models, the probability of winning determines the expected payoff from war, which in turn determines the credibility of threats, and hence, the actor's ability to obtain better bargains. As Banks (1990) demonstrates, the higher the informed actor's expected payoff from war, the higher his payoff from settling the dispute peacefully, and the higher the probability of war in equilibrium. All crisis bargaining models that treat the probability of winning as exogenous would produce this dynamic. However, as I argued, this crucial variable that essentially generates optimal behavior in crisis bargaining models should be part of the process that depends on it. If deliberate actions influence its value, which in turn affects the informational content of these actions, how are we to interpret mobilization decisions? To what extent are costly military actions useful in communicating in crisis: do they make crises more or less stable? What levels of military mobilizations should we expect and what is the price of peace in terms of maintenance of military establishment by defenders?

To answer such questions, the model must have the following features: (a) both actors should be able to choose the level of military mobilization as means of tacit communication; (b) an actor's mobilization should be costly but should increase its probability of winning if war breaks out; (c) mobilization may not necessarily increase the expected utility from war (even though it makes victory more likely, a positive impact, its cost enters negatively); (d) at least one of the actors should be uncertain about the valuation of the other; and (e) actors should be able to make their deliberate attack decisions in light of the information provided by the mobilization levels. Consequently, the model I construct in the next section incorporates all of these.

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[5] This also holds for models where the power distribution changes independently of the choices of the actors, as in Powell (1996) and Slantchev (2003*b*).

[6] Although the economic analysis of contests is closely related to the optimal resource allocation issue (Hirshleifer 1988), the contest models do not allow actors to make their war initiation decisions in light of the new information furnished by the mobilization levels, an important feature of sequential crisis bargaining (Morrow 1989).

2 The Model

Two players, S_1 and S_2, face a potential dispute over territory valued at $v_1 \in (0, 1)$ by the status quo power S_1, who is currently in possession of it. While this valuation is common knowledge, the potential revisionist S_2's valuation is private information.[7] S_1 believes that v_2 is distributed on the interval [0, 1] according to the cumulative distribution function F with continuous strictly positive density f, and this belief is common knowledge.

Initially, S_1 decides on his military allocation level, $m_1 \geq 0$. Choosing $m_1 = 0$ is equivalent to relinquishing the claim to the territory, and ending the game with payoffs $(0, v_2)$. Otherwise, the amount $m_1 > 0$ is invested in possible defense. The costs of mobilization are sunk and incurred immediately. After observing his choice, S_2 either decides to live with the status quo or makes a demand for the territory by starting a crisis. S_2 can escalate by choosing a level of mobilization, $m_2 > 0$, or can opt for the status quo with $m_2 = 0$, ending the game with the payoffs $(v_1 - m_1, 0)$. After observing S_2's level of mobilization, S_1 can capitulate, ending the game with payoffs $(-m_1, v_2 - m_2)$; preemptively attack, ending the game with war; or resist, relinquishing the final choice to S_2. If he resists, S_2 decides whether to capitulate, ending the game with payoffs $(v_1 - m_1, -m_2)$, or attack, ending the game with war.

If war occurs, each player suffers the cost of fighting, $c_i \in (0, 1)$. Victory in war is determined by the amount of resources mobilized by the players and the military technology. Defeat means the opponent obtains the territory. The probability that player i prevails is: $\frac{\lambda m_i}{\lambda m_i + m_{-i}}$, where $\lambda > 0$ measures the offense-defense balance.[8] If $\lambda = 1$, then there are no advantages to striking first. If $\lambda > 1$, then the offense dominates and for any given allocation (m_1, m_2), the probability of prevailing by striking first is strictly larger than the probability of prevailing if attacked. Conversely, if $\lambda < 1$, then the defense dominates, and for any given allocation it is better to wait for an attack instead of striking first. If i attacks first, the expected payoff from war is $W_i^a(m_1, m_2) = \frac{\lambda m_i v_i}{\lambda m_i + m_{-i}} - c_i - m_i$, and, if i is attacked, it is $W_i^d(m_1, m_2) = \frac{m_i v_i}{m_i + \lambda m_{-i}} - c_i - m_i$. It is easy to show that $\lambda < 1 \Leftrightarrow W_i^d > W_i^a$. If defense dominates, then the expected value of war is higher when one is attacked than when one attacks first.[9] For the rest of this paper, assume $\lambda < 1$. The central claims do not change when $\lambda > 1$, but the statement of the results is quite a bit more involved (Author).

The solution concept is perfect Bayesian equilibrium (or simply "equilibrium"), which requires that strategies are sequentially rational given the beliefs, and that beliefs are consistent with the strategies, and derived from Bayes rule whenever possible (Fudenberg and Tirole 1991). The model incorporates the empirically motivated features I identified in the

[7] Since S_1 has the territory, it is natural to assume that his valuation is known to everyone. The labels "status quo power" and "potential revisionist" identify which actor would be in possession of the territory if a crisis does not occur. This has nothing to do with the degree of satisfaction with the status quo that determines these labels in classical realism. For ease of exposition, I refer to S_1 as a "he" and S_2 as a "she."

[8] The ratio form of the contest success function is undefined at $m_1 = m_2 = 0$, but since the game ends with $m_1 = 0$, how we define it is immaterial.

[9] This offense-defense balance depends on military technology, and differs from the ease of conquest concept that goes under the same name in offense-defense theory (Quester 1977, Jervis 1978, Glaser and Kaufmann 1998). According to that theory, "offense-defense balance" refers to whether it is easier to take a territory than to defend it. Since the territory belongs to S_1 in this model, a defensive advantage means that S_1 would defend it more easily given the same distribution of power than S_2 could acquire.

previous section. It is complicated by the continuum of types and actions, so it trades an ultimatum "bargaining" protocol for rich mobilization possibilities in letting both actors to choose the level of forceful persuasion.

3 The Mobilization of the Revisionist State

It will be helpful to analyze the signaling game beginning with S_2's allocation decision given some allocation $m_1 > 0$. In any equilibrium, the strategies would have to form an equilibrium in this continuation game, and since S_1 is uninformed, his initial decision reduces to choosing (through his allocation) the equilibrium that yields the highest expected payoff.

By subgame perfection, S_2 would attack at her final decision node if, and only if, her expected payoff from war is at least as good as capitulating: $W_2^a(m_1, m_2) \geq -m_2$, or:

$$v_2 \geq c_2 + \frac{c_2 m_1}{\lambda m_2} \equiv \gamma(m_1, m_2) > 0, \tag{1}$$

where $\gamma(m_1, m_2)$ is the highest type that would capitulate if resisted at the allocation level (m_1, m_2). All types $v_2 < \gamma(m_1, m_2)$ capitulate, and all types $v_2 \geq \gamma(m_1, m_2)$ attack when resisted. Note that $\gamma(m_1, m_2) > 0$ implies that the lowest-valuation types never attack. In particular, types $v_2 \leq c_2$ will never attack even if they are sure to win. For any posterior belief characterized by the distribution function $G(\gamma(m_1, m_2))$ that S_1 may hold, resisting at the allocation level (m_1, m_2) yields S_1 the expected payoff:

$$R_1(m_1, m_2) = G(\gamma)(v_1 - m_1) + (1 - G(\gamma))W_1^d(m_1, m_2). \tag{2}$$

If S_1 attacks preemptively, he would get $W_1^a(m_1, m_2)$. Since $W_1^d(m_1, m_2) < v_1 - m_1$, it follows that $\lambda < 1 \Rightarrow W_1^a(m_1, m_2) < R_1(m_1, m_2)$ regardless of S_1's posterior belief. Therefore, if defense dominates, then in equilibrium S_1 never preempts; he either capitulates or resists.

Suppose that S_1 capitulates for sure if he observes an allocation $\overline{m}_2(m_1)$. There can be at most one such **assured compellence level** in equilibrium. To see that, suppose that there were more than one. But then all S_2 types who allocate the higher level can profit by switching to the lower one. Obviously, $\overline{m}_2(m_1)$ is an upper bound on any equilibrium allocation by S_2. Further, S_2 would never mobilize $m_2 \geq 1$ in any equilibrium. This is because the best possible payoff she can ever hope to obtain is $v_2 - m_2$ if S_1 capitulates, and this is non-positive for any $m_2 \geq 1$, for all $v_2 \leq 1$.

Let $\beta(m_1)$ denote the type that is indifferent between optimal war and assured compellence; that is $W_2^a(m_1, m_2^*(m_1, \beta(m_1))) = \beta(m_1) - \overline{m}_2(m_1)$, where:

$$m_2^*(m_1, v_2) = \sqrt{\frac{m_1 v_2}{\lambda}} - \frac{m_1}{\lambda} > 0 \tag{3}$$

is the optimal allocation by type v_2 if she expects to fight for sure some m_1. That is, $m_2^*(m_1, v_2)$ maximizes $W_2^a(m_1, m_2(v_2))$ subject to the constraint that $m_2^* > 0$. Substituting and solving for $\beta(m_1)$ yields:

$$\beta(m_1) = \frac{\Big(m_1 + \lambda\big[\overline{m}_2(m_1) - c_2\big]\Big)^2}{4\lambda m_1}. \tag{4}$$

The following lemma establishes the S_2's preference between optimal war and assured compellence (all proofs are in the appendix).

LEMMA 1. *All $v_2 > \beta(m_1)$ strictly prefer assured compellence to optimal war, and all $v_2 \leq \beta(m_1)$ prefer the opposite.*

Let $\alpha(m_1)$ denote the type that is indifferent between capitulation and assured compellence at $\overline{m}_2(m_1)$; that is, $\alpha(m_1) - \overline{m}_2(m_1) = 0$. Since the payoff from assured compellence strictly increases in type, all $v_2 < \alpha(m_1)$ prefer capitulation to assured compellence, and all $v_2 \geq \alpha(m_1)$ prefer assured compellence to capitulation.

Let $\delta(m_1)$ denote the type that is indifferent between capitulation and optimal war. That is $W_2^a(m_1, m_2^*(m_1, \delta(m_1))) = 0$, or:

$$\delta(m_1) = c_2 + 2\sqrt{\frac{c_2 m_1}{\lambda}} + \frac{m_1}{\lambda}, \tag{5}$$

where we used the maximizer from (3). Since the payoff from optimal war is strictly increasing in type, all $v_2 < \delta(m_1)$ prefer capitulation to optimal war, and all $v_2 \geq \delta(m_1)$ prefer optimal war to capitulation.

I now establish the possible configurations of these cut-points. With slight abuse of notation, I suppress their explicit dependence on m_1.

LEMMA 2. *If $\alpha \leq \delta$, then all $v_2 < \alpha$ capitulate and all $v_2 \geq \alpha$ mobilize at the compellence level $\overline{m}_2(m_1)$ in equilibrium, provided $\overline{m}_2(m_1)$ is feasible.*

Lemma 2 shows that when $\delta \geq \alpha$, optimal behavior can take only one form if $\overline{m}_2(m_1)$ is feasible.[10] Hence, we need not worry about the location of β. The following lemma establishes that only one configuration remains for the other case.

LEMMA 3. *If $\delta < \alpha$, then $\alpha < \beta$.*

These lemmata imply that we should look for solutions for just two cut-point configurations: $\alpha \leq \delta$, and $\delta < \alpha < \beta$. Optimal behavior depends on the relationship between these points and S_2's highest valuation (unity).

3.1 Assured Compellence

Suppose $\alpha \leq \delta$ and $\alpha < 1$. By Lemma 2, S_2's optimal strategy must take the following form: all $v_2 < \alpha$ capitulate immediately, all $v_2 \geq \alpha$ mobilize at the compellence level $\overline{m}_2$. By definition, $\alpha - \overline{m}_2 = 0$, and therefore $\alpha = \overline{m}_2$. If $\overline{m}_2 < 1$, then the assured compellence level is feasible because there exists a type of S_2 that could choose to allocate $\overline{m}_2$ optimally, and so S_1 is *potentially compellable*. Otherwise, he is *uncompellable*.

Subgame perfection and (1) imply that if $\alpha \leq \gamma(m_1, \overline{m}_2)$, all types $v_2 < \gamma(m_1, \overline{m}_2)$ capitulate if resisted (bluffers), and all $v_2 \geq \gamma(m_1, \overline{m}_2)$ fight if resisted (genuine challengers).

[10] Technically, any $m_2 > 0$ is feasible because there is no budget constraint. However, since S_2 would never spend more than her highest possible valuation in equilibrium, this valuation functions as an effective constraint. The results remain unchanged if we allow for an arbitrary upper bound on valuations except we would have to restate the theorems in terms of that bound.

If $\alpha > \gamma(m_1, \overline{m}_2)$, only genuine challengers mobilize in equilibrium. Given S_1's prior belief $F(\cdot)$, his posterior belief that S_2 would capitulate when resisted conditional on $\overline{m}_2$ is:

$$G(\gamma(m_1, \overline{m}_2)) = \begin{cases} \frac{F(\gamma(m_1,\overline{m}_2)) - F(\overline{m}_2)}{F(1) - F(\overline{m}_2)} & \text{if } \overline{m}_2 \leq \gamma(m_1, \overline{m}_2) \\ 0 & \text{otherwise.} \end{cases}$$

S_1's strategy is to resist any allocation $m_2 < \overline{m}_2$ and capitulate otherwise. S_1 would capitulate in equilibrium if doing so is at least as good as resisting, or whenever $-m_1 \geq R_1(m_1, m_2)$ from (2). Since $\gamma(m_1, m_2)$ is strictly decreasing in m_2, it follows that the set of types that would attack if challenged increases in m_2, and so the probability of keeping the territory without war decreases. Further, S_1's expected payoff from war decreases in m_2, and therefore overall $R_1(m_1, m_2)$ is strictly decreasing in m_2. On the other hand, S_2's payoff from S_1 capitulating is strictly decreasing in m_2. It follows then, that in equilibrium S_2 must be selecting the smallest allocation that would cause S_1 to quit. In other words, $\overline{m}_2$ must solve $R_1(m_1, \overline{m}_2) = -m_1$, or:

$$G(\gamma(m_1, \overline{m}_2))v_1 + \left[1 - G(\gamma(m_1, \overline{m}_2))\right]\left[\frac{m_1 v_1}{m_1 + \lambda\overline{m}_2} - c_1\right] = 0. \tag{6}$$

To see that (6) has a unique solution, let: $\widehat{m}_2 \equiv \frac{1}{2}\left[c_2 + \sqrt{c_2\left(c_2 + \frac{4m_1}{\lambda}\right)}\right]$, and note that $m_2 \leq \widehat{m}_2 \Leftrightarrow m_2 \leq \gamma(m_1, m_2)$. This, in turn implies that for all $m_2 \geq \widehat{m}_2$, $G(\gamma(m_1, m_2)) = 0$. Note now that (6) is strictly decreasing in $\overline{m}_2$, and that for all $\overline{m}_2 \geq \widehat{m}_2$, it reduces to $m_1 v_1/(m_1 + \lambda\overline{m}_2) - c_1$, which itself converges to $-c_1 < 0$ in the limit as $\overline{m}_2 \to \infty$. In other words, for high enough $\overline{m}_2$, the expression is strictly negative. Because it is also continuous in $\overline{m}_2 > 0$, it follows that (6) has a unique solution.[11] Take $\alpha = \overline{m}_2$ to be that solution.

PROPOSITION 1. *If, and only if, $\alpha < \delta$, and $\alpha < 1$, the following strategies constitute the* ***assured compellence*** *equilibrium: All $v_2 < \alpha$ capitulate, and all $v_2 \geq \alpha$ allocate $\overline{m}_2$; if resisted, all $v_2 < \gamma$ capitulate, and all $v_2 \geq \gamma$ attack. S_1 resists after any $m_2 < \overline{m}_2$, and capitulates after any $m_2 \geq \overline{m}_2$.*

There is no risk of war in this equilibrium because whenever a positive mobilization occurs the crisis is resolved with S_1's capitulation. Since for very low initial allocations m_1, S_1 is always potentially compellable, this equilibrium exists. If S_1 allocates too little to defense, he can expect that S_2 will challenge him with strictly positive probability and he will capitulate. This does not necessarily mean that S_1 immediately gives up the territory in equilibrium: as long as the probability of a challenge is not too high, S_1 is still be better off spending on defense and taking his chances that S_2's valuation would not be high enough to challenge him. This equilibrium involves bluffing whenever $\overline{m}_2 < \widehat{m}_2$, which cannot be eliminated with an appeal to any of the refinements like the intuitive criterion (Cho and Kreps 1987), universal divinity (Banks and Sobel 1987), or perfect sequentiality (Grossman and Perry 1986). Although non-genuine challengers may be present, their bluff is never called.

[11] If F is the uniform distribution, (6) defines a cubic that can be solved analytically.

3.2 Risk of War

The next case to examine is $\delta < \alpha$. By Lemma 3, only one possible configuration exists: $\delta < \alpha < \beta$. Since all $v_2 > \delta$ prefer optimal war to capitulation, all challenges in this equilibrium are genuine, and $G = 0$ simplifies (6) yielding an analytic solution to the compellence level $\alpha = \overline{m}_2 = m_1(v_1 - c_1)/(\lambda c_1)$. This is also the solution to (6) for the assured compellence equilibrium when $\overline{m}_2 > \gamma(m_1, \overline{m}_2)$. Substituting for $\overline{m}_2$ in (4) yields $\beta = \frac{1}{4\lambda m_1}\left(\lambda c_2 - \frac{m_1 v_1}{c_1}\right)^2$.

PROPOSITION 2. *If, and only if, $\delta \le \alpha$ and $\delta < 1$, the following strategies constitute the **risk of war** equilibrium: All $v_2 < \delta$ capitulate, all $v_2 \in [\delta, \beta)$ allocate $m_2^*(m_1, v_2)$, and all $v_2 \ge \beta$ allocate $\overline{m}_2$; if resisted, all $v_2 < \gamma$ capitulate, and all $v_2 \ge \gamma$ attack. S_1 resists after any $m_2 < \overline{m}_2$, and capitulates after any $m_2 \ge \overline{m}_2$.*

All challengers in this equilibrium are genuine. The outcome depends on whether S_1 is potentially compellable, and whether there exists a type of S_2 that is willing to allocate at the assured compellence level.

If $\alpha < \beta < 1$, the ex ante probability of war is $\Pr(\delta \le v_2 < \beta) = F(\beta) - F(\delta) < 1$. While the risk of war is strictly positive, war is not certain. If S_2 has a high enough valuation $v_2 > \beta$, then she would allocate at the assured compellence level and S_1 would capitulate. The most dangerous revisionists are the mid-range valuation types $v_2 \in [\delta, \beta)$, the ones who do not value the issue sufficiently to spend the amount necessary to ensure S_1's peaceful concession. Even though S_1 is potentially compellable, these types are unwilling to do it, and they go to war choosing their optimal attack allocation. It is worth noting that since they separate fully by their optimal allocation, S_1 infers their type with certainty and knows that resistance would mean war because all all challenges are genuine. If the revisionist happens to be of such a type, then war occurs with complete information following her mobilization.

If $\alpha < 1 \le \beta$, then even though S_1 is potentially compellable, no type is willing to do it, and war is certain conditional on a challenge. Because δ is strictly increasing in m_1, it follows that higher allocations by S_1 never increase the risk of war. (If F has continuous and strictly positive density, then increasing m_1 strictly decreases the risk of war.) Unlike the previous case, the most dangerous revisionists here are always the ones with higher valuations $v_2 \ge \delta$ because they cannot be deterred from challenging. S_1 infers the revisionist's type with certainty and war occurs with complete information conditional on a mobilization by S_2. I shall refer to this as the risk of war, type 1 equilibrium.

Finally, if $1 \le \alpha$, then S_1 becomes uncompellable and S_2's choice reduces to capitulation or optimal attack. From S_1's ex-ante perspective, the situation is identical to the previous case where no type was willing to compel him, except that now no type is able to do so. Higher allocations by S_1 never increase the risk of war in this case, and the most dangerous types are the high valuation ones. I shall refer to this as the risk of war, type 2 equilibrium.

3.3 Assured Deterrence

The last configuration to examine is $1 \le \delta$ and $1 \le \alpha$. S_1 is uncompellable and no types are willing to challenge him given that war is certain to occur. The following proposition states the necessary and sufficient conditions for this equilibrium.

PROPOSITION 3. *If, and only if, $\alpha \geq 1$ and $\delta \geq 1$, the following strategies constitute the* ***assured deterrence*** *equilibrium: all v_2 capitulate; if resisted, all $v_2 < \gamma$ capitulate, and all $v_2 \geq \gamma$ attack. S_1 resists all allocations.*

The probability of war is zero and the outcome is capitulation by S_2. To understand the conditions, note that when $\alpha > \delta$ (as would be in transitioning from the risk of war equilibrium), $\delta \geq 1$ is sufficient. However, it is possible to transition from the assured compellence equilibrium directly. To see this, note that since $\alpha < 1$ and $\alpha < \delta$ are necessary and sufficient for that equilibrium, then $\alpha \geq 1$ is sufficient for it to fail to exist, and $\alpha < \delta$ further implies $\delta > 1$, and so it is also sufficient for deterrence to exist as long as $\alpha < \delta$. In other words, the configurations $1 \leq \delta < \alpha$, and $1 \leq \alpha < \delta$ both result in deterrence.

4 The Defense of the Status Quo State

Collectively, the three mutually exclusive equilibria exhaust all possible configurations of the cut-points, and therefore provide the solution for the continuation game for any set of the exogenous parameters and any $m_1 > 0$. I now turn to S_1's initial mobilization decision. Since S_1 is the uninformed actor, his choice boils down to selecting which type of equilibrium will occur in the continuation game. It is not possible to derive an analytic solution to this problem because of the non-linearities involved in the optimization at the second stage. Still, because we can generally establish the order in which the continuation game equilibria occur as function of m_1, we can say what type of choices S_1 will face if he increases his mobilization level. With the help of computer simulations, we can derive precise predictions for interesting ranges of the exogenous variables too.

The compellence equilibrium always exists regardless of the values of the exogenous parameters because for m_1 small enough, the necessary and sufficient conditions from Proposition 1 are satisfied. What happens once m_1 begins to increase? As the derivations in the previous section suggest, two cases are possible. First, as m_1 increases, the conditions for deterrence can be satisfied, and the continuation game has only two possible solutions, both involving peace. Second, as m_1 increases, the existence conditions can satisfy successively the risk of war and deterrence equilibria.

To see how S_1 would choose his initial mobilization, if any, we must consider his expected payoffs in each of the possible continuation game equilibria. In order to conduct comparative statics simulations and analyses, I impose the additional assumption that F is the uniform distribution. This also allows me to reduce the expected payoffs for S_1 to manageable expressions.

In the compellence equilibrium, S_1 obtains the prize with probability $\Pr(v_2 \leq \alpha) = \alpha$ by the distributional assumption, and concedes it without fighting with complementary probability. His expected payoff is: $EU_1^{\text{COMPEL}}(m_1) = \alpha v_1 - m_1$. In the risk of war equilibrium, S_1 obtains the prize with probability $\Pr(v_2 \leq \delta) = \delta$, fights a war with probability $\Pr(\delta < v_2 \leq \beta) = \beta - \delta$, and concedes the prize with probability $\Pr(v_2 > \beta) = 1 - \Pr(v_2 \leq$

$\beta) = 1 - \beta$. His expected payoff is:

$$EU_1^{\text{RISK}}(m_1) = \delta(v_1 - m_1) + \int_{\delta}^{\beta} W_1^d(m_1, m_2^*(x)) f(x)\,\mathrm{d}x - (1-\beta)m_1$$
$$= \left[\delta + 2\sqrt{\frac{m_1}{\lambda}}\left(\sqrt{\beta} - \sqrt{\delta}\right)\right] v_1 - (\beta - \delta)c_1 - m_1,$$

where we used $W_1^d(m_1, m_2^*(v_2)) = \frac{v_1}{v_2}\sqrt{\frac{m_1 v_2}{\lambda}} - c_1 - m_1$. Finally, in the deterrence equilibrium, S_1's payoff is: $EU_1^{\text{DETER}}(m_1) = v_1 - m_1$. In equilibrium there can be only one assured deterrence allocation level by S_1 because if there were two, then S_1 could profitably deviate to the lower one.

Informally, the intuition behind the ordering of equilibria in the continuation game is as follows. If S_1 mobilizes very few forces, then he is easy to compel cheaply, and he should expect the assured compellence outcome in the continuation game. There will be many bluffers but because S_1 is relatively weak, he would not dare call their possible bluff and risk facing a genuine revisionist. Increasing m_1 decreases the proportion of bluffers until only genuine revisionists are expected to mobilize. At a price, then, S_1 can eliminate demands by low-valuation challengers. However, he should still expect to capitulate conditional on mobilization by S_2.

Further increases in his mobilization level make S_1 even more difficult to compel, and assured compellence requires ever increasing levels of mobilization by S_2. At some point, the price for ensuring peaceful capitulation by S_1 becomes too high for mid-range types, who instead prefer to allocate optimally and fight. The risk of war equilibrium obtains: if the opponent happens to value the issue highly, she would mobilize enough to compel S_1 to capitulate (peace), but if she finds this allocation too high, she mobilizes optimally for war, and the two actors fight. This is reminiscent of war in Powell's (1993) complete information guns-versus-butter model.

If S_1 increases his mobilization further, the proportion of types willing to respond at the assured compellence level drops to zero, and the risk of war type 1 equilibrium obtains. Even though S_1 is potentially compellable, he has tied his hands too successfully and no type of genuine challenger will bother with peace. Conditional on S_2's mobilization, war is certain. Higher mobilization levels eventually render S_1 uncompellable. This risk of war type 2 equilibrium is quite similar to the previous one. It involves a perfectly credible equilibrium commitment by S_1 to fight if challenged. However, such commitment comes at the cost of a high risk of war: should S_2 happen to value the issue highly enough, war is certain.

Finally, S_1 may increase his mobilization even further, not only tying his hands irrevocably, but also doing so in a way that would deter the potential revisionist from challenging. This is the assured deterrence equilibrium, where the probability of war drops to zero again: S_1 has armed himself so much that he is unchallengeable.

These dynamics clearly demonstrate that *establishing a credible commitment by tying one's hands can avoid war only if it also makes fighting sufficiently unpleasant to the opponent. A credible threat to fight cannot buy peace by itself, and a perfect commitment can virtually guarantee war if the opponent's valuation is misjudged.* It is worth noting that *crises that are peacefully resolved tend to involve higher military allocations than those* *that end in war:* either S_1 mobilizes a large enough force to deter S_2, or S_2 mobilizes a large enough force to compel S_1. These allocations are higher than the optimal war allocations that either state would make if they expect to fight for sure. In other words, arms buildups are not necessarily destabilizing in a crisis. In fact, they appear positively related to peace when it comes to threatening the use of force.

I now provide two numerical examples that will facilitate the substantive discussion. Assume the uniform distribution for S_2's valuations, and set the parameters $v_1 = 0.6$, $c_1 = 0.2$, and $\lambda = 0.99$. In the simulation in Figure 1(a), S_2's costs of fighting are high, $c_2 = 0.35$, and in the simulation in Figure 1(b), her costs of fighting are low, $c_2 = 0.01$. The solid line shows the range of values for m_1 for which the various equilibria exist. The dotted vertical line shows S_1's valuation for reference, and the solid vertical line shows S_1's equilibrium mobilization level.

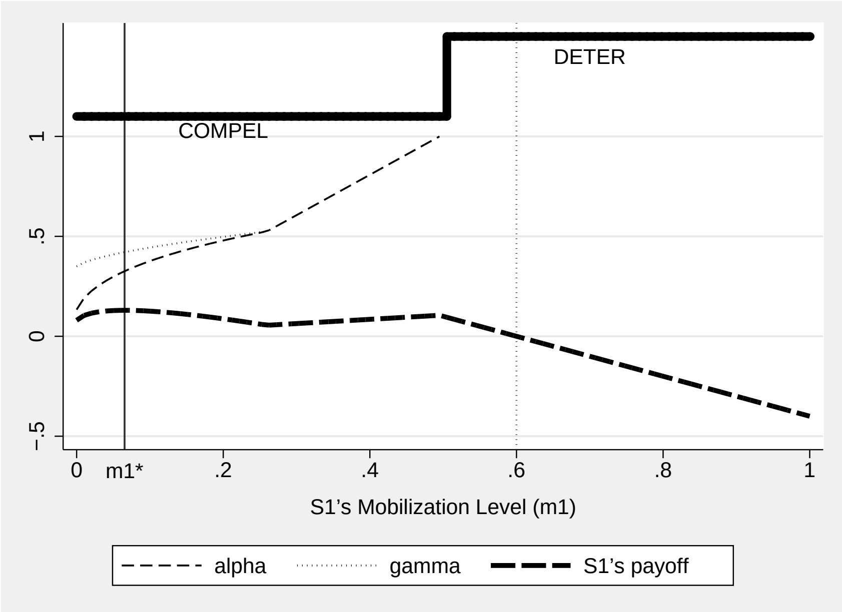
In the first example, the equilibrium outcome is peace: one of the actors will capitulate. S_1 mobilizes $m_1^* = 0.07$, and takes his chances that S_2 may be a high-valuation type that would compel him to capitulate. The assured compellence level is $\overline{m}_2 = \alpha = 0.33$. The probability that S_1's low mobilization level would be able to deter S_2 is $\Pr(v_2 < \alpha) = 33\%$, so the risk of having to concede is 67%. All types $v_2 < \alpha$ quit and S_1 gets to keep the territory. On the other hand, all types $v_2 \geq \alpha$ allocate $\overline{m}_2$, after which S_1 relinquishes the territory without a fight.

In the second example, the outcome can be either capitulation by one of the actors or war. S_1's optimal mobilization increases to $m_1^* = 0.25$. What follows depends on just how high the challenger's valuation is. If it is $v_2 < \delta = 0.36$, then S_2 would be deterred from mobilizing, and the outcome would be peace. If it is $v_2 \geq \beta = 0.55$, then S_2 would mobilize at the assured compellence level $\overline{m}_2 = \alpha = 0.50$, S_1 would capitulate, and the outcome would be peace again. However, if $v_2 \in [0.36, 0.55)$, then S_2 would allocate her optimal fighting level $m_2^*(v_2) < 0.50$, and the outcome would be war. The ex ante probability of war is 19%, but conditional on S_2's mobilization it is 30%, with war being certain if S_2's mobilization level is less than $\overline{m}_2$.

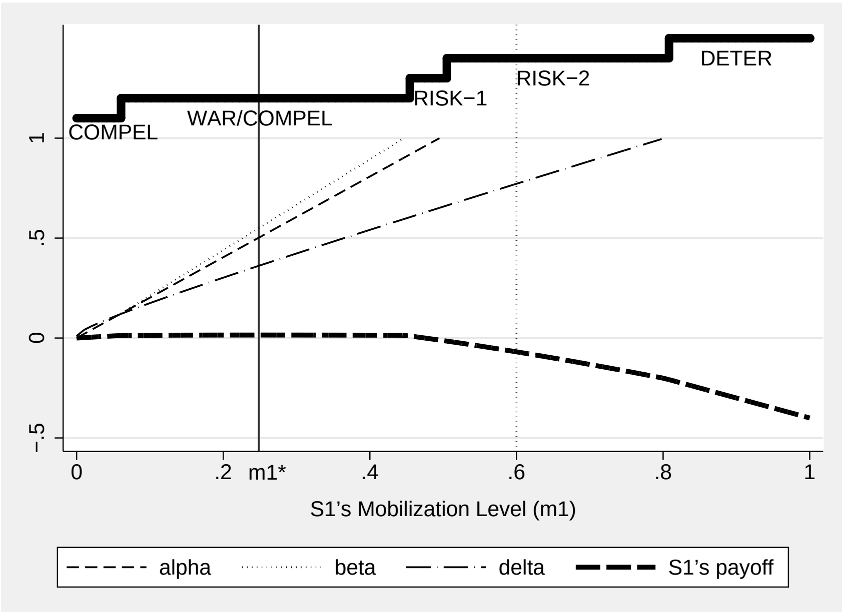
S_1's expected payoff in this equilibrium is 0.02, which is much less than the 0.13 he would expected in the previous example. This is not surprising, as S_2's costs of fighting decrease, so does S_1's equilibrium payoff: to wit, his opponent is able to extract a better deal because going to war is not as painful, and so the threat to do it is much more credible.

5 Discussion

Fearon (1997) nicely brackets the analysis presented here. He analyzes the two polar mechanisms for signaling interests: through actions that involve sunk costs only, and actions that tie hands only. My model essentially encompasses everything in between, that is, actions that both tie hands and sink costs, and so it is worth comparing the results.



(a) Assured Compellence Equilibrium with Bluffing, High-cost S_2.



(b) Risk of War Equilibrium, Low-cost S_2.

Figure 1: Examples of Equilibria as Function of S_1's Mobilization.

5.1 Bluffing with Implicit Threats

The most obvious difference that is of great substantive interest is that actions involving each mechanism separately result in equilibria where bluffing is not possible.[12] As it turns

[12]That is, no equilibria that survive the Intuitive Criterion (Cho and Kreps 1987) involve bluffing. Fearon (1997, p. 82, fn. 27) notes that it is unrealistic to assume that "sunk-cost signals have no military impact," and

out, this result is unstable.

Take, for example, the assured compellence equilibrium in Figure 1(a). There are bluffers here: all $v_2 \in [\alpha, \gamma) \equiv [.33, .42)$ would not attack should S_1 decides to resist. The ex ante probability of a bluffer is $\Pr(\alpha \leq v_2 < \gamma) = 9\%$, which increases to 13% after S_2 mobilizes. However, even though now S_1 is far more likely to be facing a bluffer, he is also far more likely to be facing a genuine challenger (87% versus an initial 58%), and so he chooses not to resist. The small mobilization has successfully screened out low-valuation types and S_1 is unwilling to run a risk of war at this stage. Note that S_1 could have eliminated all bluffers if he wished to do it by allocating approximately $m_1 = 0.28$ (this is where $\gamma = \alpha$), but doing so is not optimal. Hence, not only is bluffing possible in equilibrium but S_1 would not necessarily attempt to weed out such challengers.

On the other hand, bluffing is impossible in equilibria that involve genuine risk of war. Consider Figure 1(b): there can be no bluffing here, for a bluffer would have to mobilize at the assured compellence level—otherwise she would be forced to back down when S_1 resists and suffer the costs of mobilization—and this level is too high given S_1's initial mobilization.

Hence, bluffing is possible only in equilibria that do not involve much revelation of information and no danger of war. This corresponds to results in Brito and Intriligator (1985) who also find that in the pooling (no signaling) equilibrium bluffing is possible but the probability of war is zero. Preventing bluffing involves pre-commitment to a positive probability of war, and the willingness to run this risk does transmit information.

The model demonstrates a subtle distinction in the conditions that permit bluffing. Bluffing is only optimal when S_1 is expected to capitulate, but his willingness to do so depends on how likely S_2 is to fight, which in turn depends on S_2's costs of fighting and S_1's mobilization level. *Paradoxically, bluffing by S_2 is possible only when her costs of fighting are relatively high (she is "weak").* The reason is the effect this has on S_1's decision: because S_2 is weak, and therefore not very likely to be willing to mobilize at a high level, S_1 reduces his own costly allocation and thereby exposes himself to the possibility of having to concede. *It is this low mobilization that makes bluffing an option: one must choose to expose oneself to bluffing. It is always possible to eliminate that possibility by making it too dangerous a tactic.* When S_2 has relatively low costs of fighting (a "strong" actor), S_1 knows that low mobilization would virtually ensure his capitulation, so he ups the ante, eliminating bluffing possibilities in the process. Essentially, bluffing becomes too expensive even if it is certain to succeed. For this result to obtain, mobilization must both be inherently costly and increase probability of victory.

Fearon buttresses his no-bluffing results by quoting an observation by Brodie (1959, p. 272), who states that "bluffing, in the sense of deliberately trying to *sound* more determined or bellicose than one actually felt, was by no means as common a phenomenon in diplomacy… it tended to be confined to the more *implicit* kinds of threat." I have emphasized the distinction between verbal threats and implicit threats because it is very important. Reputational concerns may eliminate the incentives to bluff with words (Sartori 2002, Guisinger and Smith 2002), but may not work for implicit threats like the ones in this model. As Iklé (1964, p. 64) observes, "whether or not the threat is a bluff

conjectures that the strong no-bluffing result would obtain even when we relax that assumption.

can be decided only after it has been challenged by the opponent's noncompliance." But probing an implicit threat is too dangerous because by its very nature, and unlike words, it influences the expected outcome of war. In equilibrium, these types of bluffs are never called, and hence S_2 is never revealed as having made an incredible threat. As Powell (1990, p. 60) concludes, "sometimes bluffing works."

5.2 Militarized Coercion

Many scholars have argued that mobilization is exceptionally dangerous, and in fact some have gone so far as to claim that the interlocking mobilizations in the summer of 1914 made the First World War practically inevitable (Tuchman 1962, Taylor 1969). However, historically this contention rests on dubious foundations—mobilizations have occurred numerous times before and since without war breaking out.[13] As Count Witte's quote illustrates, statesmen may not necessarily view mobilization as a prelude to war. Then what is mobilization supposed to accomplish?

The answer suggested in this study is that *while mobilization can be a form of militarized coercion, it also may simply be a preparatory step on the road to war utterly devoid of informational content that is of any use for the peaceful resolution of the crisis.* For mobilization to succeed as a signaling device, it has to accomplish two objectives: it has to (a) persuade the opponent that one is extremely likely to attack if one's demands are not met, and (b) render fighting sufficiently unpleasant for the opponent.

It is worth emphasizing that peace does not depend only on the credibility of threats. In fact, when war occurs in equilibrium, both actors possess perfectly credible threats and both know it. However, their prior actions have created an environment where neither finds war sufficiently unpleasant compared to capitulation. This illustrates the danger of committing oneself without ensuring that the opponent is not similarly committed (Schelling 1966). While this may happen easily when actors move simultaneously, it is perhaps surprising that it can also happen when they react sequentially and seemingly have plenty of opportunity to avoid it.[14]

Again, the reason is the costliness of the military measure. While high mobilization levels tie one's hands, their inherent costliness means that an actor is not free to choose the highest commitment level possible. This contrasts with the results from the model where such commitments are not inherently costly and actors can therefore generate arbitrarily large audience costs (Fearon 1997, p. 82). There may exist circumstances where although peace is, in principle, obtainable, the cost of guaranteeing it is so high that the actors are unwilling to pay it.

Peace in this model requires the successful compellence of S_1 or deterrence of S_2. In a situation where the value of war is determined endogenously, each actor can potentially be coerced into capitulation. The interesting question becomes why sometimes one or both of them choose not to do it. There are, of course, the trivial cases where the cost of doing that

[13]Trachtenberg (1991) criticizes the mobilization causes of the First World War.

[14]For example, consider the game of Chicken and suppose each player could pre-commit to remaining firm. If one of them manages to pre-commit first, the other has no choice but avoid such commitment and yield. If they choose whether to pre-commit simultaneously, then they may easily end up in a situation where they both pre-commit to stand form, and so disaster is certain.

exceeds one's valuation so it is not worth it (assured deterrence), but, more intriguingly, there are the cases where the necessary allocation costs less than one's valuation. In the second example, all types $v_2 \in (\alpha, \beta)$ fight optimally even though allocating $\overline{m}_2 = \alpha$ would ensure S_1's capitulation.

Mobilization can be exceedingly dangerous even without making war certain. After a point, signaling becomes useless because even convincing the opponent that one would fight is not enough to get him to quit. *The greatest danger of war is when the informed party has enough wealth to adopt a separating strategy but not enough wealth to adopt a strategy that pools on the higher assured compellence level,* a result that parallels a finding in Brito and Intriligator (1985).

Military coercion is a blunt instrument because its intent is not to reveal the precise valuation of the informed party but rather to communicate one's willingness to fight. While much nuance is possible if actors had in mind the former goal, the latter is of necessity rather coarse. That one must resort to tacit bargaining through implicit threats cannot improve matters. Historians have emphasized the difficulty in clarifying "the distinction between warning and intent" (Strachan 2003, p. 18). Perhaps it was precisely because mobilization has a rather limited bargaining role that is hard to disentangle from simple preparation for war, that mobilization has traditionally been considered very dangerous.

5.3 What Makes a Strong Opponent?

Military coercion has a somewhat peculiar dynamic completely lost to models that ignore the war-fighting implications of military measures. For example, it is now generally accepted that the "stronger" the actor, the more willing he is to risk war in order to obtain a better bargain. The risk-return trade-off then resolves itself in higher equilibrium probability of war and a better expected negotiated deal (Banks 1990, Powell 1999). When crisis behavior cannot influence the expected value of war, it is unproblematic to define an actor ex ante as "stronger"—the label simply refers to an actor with a larger expected war payoff. Costs of fighting (low), probability of winning (high), military capabilities (large), all these factors can be lumped together to produce an aggregate expected payoff from fighting (high), which in turn defines the actor's type (strong). Even before the crisis begins, potential opponents can be indexed by their war payoff, and bargaining reduces to attempts to discern just how strong the opponent really is.

Things are not that simple in a crisis environment where strength is, at least in part, endogenously determined by the mobilization decisions of the actors. Keeping all other variables equal, an actor can render himself relatively stronger if he mobilizes more, or weaker if he fails to do so. This now implies that it may be quite difficult indeed to predict the outcome of any particular crisis before it actually unfolds, which may help explain why states end up creating so many of these.

The model shows that the expected payoff from the crisis does increase in the actors' valuation of the issue, but not necessarily at the cost of a higher risk of war. In other words, the risk-return trade-off does not necessarily operate in this context, where the relevant trade-off is between signaling cost and expected return, which subsumes the risk of war. To see that, consider the risk of war equilibrium. All low-valuation types capitulate immediately, and so face zero probability of fighting. All mid-valuation types mobilize their optimal fighting allocations, and the probability of war jumps to one. On the other hand, high-valuation types manage to scrape together the assured compellence level, which resolves the crisis with S_1's capitulation, and the probability of war drops back to zero. In other words, while these types do spend more during the crisis, they obtain the surrender of their opponent without risking war. The possibility to compel S_1 arises out of the latter's initial decision: he could have mobilized enough resources to make himself uncompellable by even the highest valuation type but because of uncertainty, it is not optimal to do so. This is not to say that technology, war costs, and capabilities are not important—indeed, the two examples show the impact of S_2's war costs—but rather that the commonly accepted crisis dynamic may not hold in these situations.

Further, *S_1's optimal mobilization is not monotonically related to either his fighting costs or those of his opponent.* For example, recall that when $c_2 = 0.01$, $m_1^* = 0.25$ in the risk of war equilibrium in Figure 1(b). Increasing S_2's costs to $c_2 = 0.25$ produces $m_1^* = 0.50$ in a assured compellence equilibrium with no bluffers (figure not shown). Increasing them further to $c_2 = 0.35$ produces $m_1^* = 0.07$ in the compellence equilibrium with bluffers in Figure 1(a). Note the distinction between the last two outcomes. When S_2's costs are intermediate, S_1 eliminates all bluffers and practically ensures that he would obtain S_2's capitulation (the probability of him having to concede instead is less than 1%). When S_2's costs increase further, S_1 responds by drastically slashing his own military spending, even exposing himself to bluffing by doing so. While he is now quite likely to concede (67%), his loss in this case is not too drastic because of the savings from the low allocation. In the previous case, on the other hand, while he was nearly certain to win, the cost of doing so was quite high, making this tactic no longer profitable. In expectation, S_1's payoff does increase in c_2, and he obtains 0.13 in the latter case as opposed to 0.11 for the intermediate costs case. Perhaps counter-intuitively, *the status quo power is more likely to concede when his opponent is weaker (has higher costs of fighting) but equilibrium mobilization levels will be lower.*

5.4 The Price of Peace

Figure 2 illustrates the impact of varying S_1's costs. It shows the ex ante probability of war, S_1's optimal allocation, and his payoff in equilibrium for various values of c_1. The parameters are set to $v_1 = .999$ (so high costs do not become immediately prohibitive), $\lambda = .99$, and $c_2 = 0.10$.

The non-monotonicity is again evident. Because of his extremely high valuation S_1 cannot be compelled if his costs are relatively low. It is only at intermediate costs ($c_1 > 0.30$) that compellence becomes feasible again. However, S_2 will not attempt it in equilibrium, and hence up to $c_1 \approx 0.35$, war is certain if S_2 mobilizes. The ex ante probability of war declines across this range but m_1^* increases. That is, seemingly aggressive mobilization behavior can be seen as S_1 compensating for the relative weakness in war occasioned by somewhat high costs: since war is more painful, he is prepared to pay more to decrease the chances of having to fight it. Nothing, of course, can help S_1 overall in the sense that the costlier the fighting, the less must he accept in expectation.

Continuing the increase of c_1 makes assured compellence not just feasible but also desirable, and from $c_1 \approx 0.35$, no equilibrium outcome will involve war because S_1's high costs

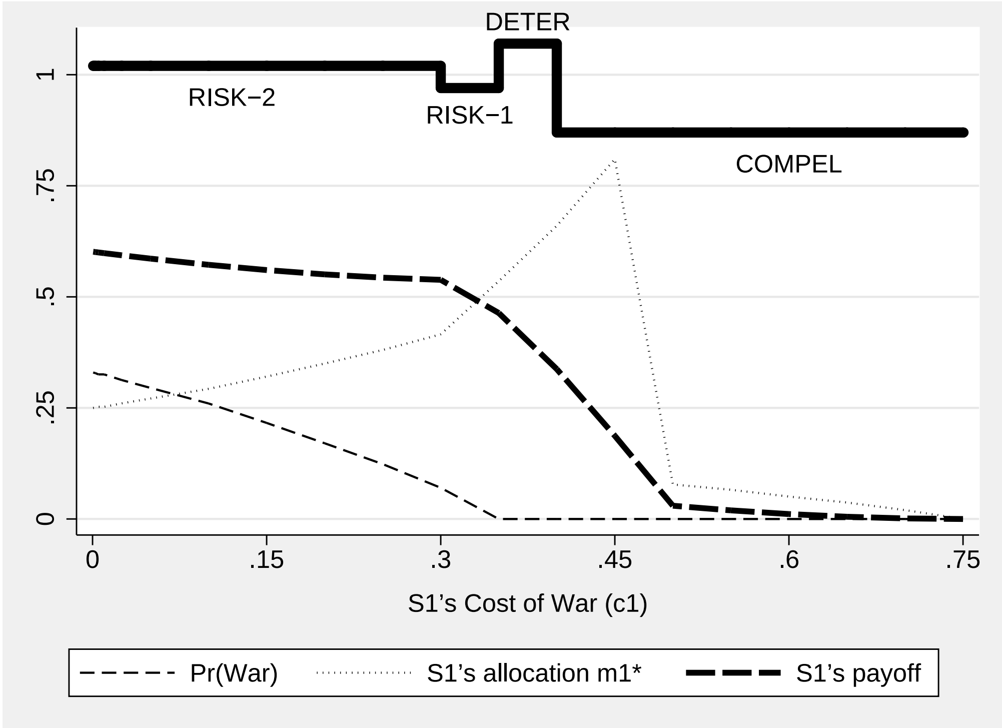


Figure 2: Probability of War and Optimal Allocations by S_1.

make fighting quite unattractive for him. Peace can be had in two ways: either S_1 can deter his opponent, or S_2 can compel her opponent. S_1's behavior in the intermediate cost range is rather intriguing. While he can afford it, his strategy is to deter S_2 or, failing that, ensure that the probability of a challenge (to which he will surely concede) is relatively low. Note that until $c_1 \approx 0.45$, the outcome is either assured deterrence or assured compellence but with extremely high mobilization levels by S_1. Even after it becomes impossible to deter all types of S_2, the status quo power persists in very high allocations that minimize the probability of having to concede in the compellence equilibrium (less than 0.1%). This is where peace can be very expensive.

Finally c_1 becomes prohibitively high, and S_1 drastically revises his strategy: maintaining a low probability of concession becomes too expensive. The trade-off between the costs of mobilization and expected concessions kicks in, and S_1 precipitously decreases his allocation, exposing himself to ever increasing possibilities for bluffing as his costs go up.

As Figure 1(b) made clear, S_2 types with high valuations must spend substantially more to compel S_1 to capitulate than to fight him. This is, perhaps, not very surprising: given the initial mobilization by the status quo power, it may take a lot of threatening to persuade him to relinquish the prize peacefully. Still, it does go to show that peace can be expensive. This conclusion receives very strong support once we investigate the initial decision itself, as we did above. *Peace may involve mobilizations at levels that are substantially higher than mobilizations that precede the outbreak of war. The price of peace can be rather steep either for the status quo state or for the potential revisionist.*

As war becomes costlier, S_1 minimizes the probability of having to wage it, even when this requires skyrocketing mobilization costs. The goal of avoiding war transforms into the goal of avoiding concessions, and S_1 spends his way into successful deterrence until that, too, becomes too expensive. When this occurs, S_1 simply "gives up" and switches to having a permanent, but small, military establishment. That is, he mobilizes limited forces he does not expect to use, and whose impact on the potential revisionist's behavior is rather minimal. These "useless" mobilization levels do serve to weed out frivolous challenges, but generally do not work as a deterrent to genuine revisionists or to bluffers.

The peace need not be expensive if either actor has very high costs of fighting. The price of peace raises steeply, however, when these costs go down. Powell (1993) finds that the peaceful equilibrium in a dynamic model where states redistribute resources away from consumption toward military uses also involves nonzero allocations, which sometimes can be quite substantial. The results here underscore his conclusions and provide a subtle nuance to their substantive interpretation and empirical implications. These findings further imply that *the common assumption of a costless status quo outcome in formal models may be quite distorting because it fails to account for the resources states must spend on mutual deterrence to maintain it.*

5.5 Rationalist Explanations of War

Blainey (1988) argues that war must be explained in terms of deliberate choices by state leaders. The formal literature generally offers two such explanations (Fearon 1995). One reason bargaining can end in war relates to the simple fact that leaders possess private information about their expected payoffs from war and peace, and they have incentives to misrepresent this knowledge to extract bargaining advantage. War can break out when actors bargain in the shadow of power, engaging in the risk-return trade-off: they run a slightly higher risk of war in return for obtaining slightly more at the bargaining table (Powell 1999). When private information exists, actors may press their opponents beyond their tolerance thresholds. When this happens, bargaining breaks down in war. In this explanation, war is a sort of mistake: without uncertainty, actors could agree on a bargain mutually preferable to war. So the puzzle is: why would they not immediately terminate hostilities once they realize they have demanded too much? Slantchev (2003*b*) provides a partial answer to this by extending the persistence of uncertainty from the crisis into the war. However, this is still not a particularly satisfying explanation for wars that last a long time, and wars that are supposedly caused by the risk-return dynamic.

It is crucial, therefore, that we understand incentives for conflict under complete information. Slantchev (2003*a*) analyzes one possibility where fear of early settlement drives fighting. While the model does produce war in equilibrium, it is not clear why actors would choose such a bad equilibrium given the presence of efficient peaceful ones. One good approach is to examine conditions that ensure that alternative peaceful equilibria do not exist. Powell (2004) shows such a sufficient condition for a class of stochastic games. Still, the puzzle is not quite resolved because this condition generates a type of commitment problem that relies on an exogenous shift in the distribution of power between the actors, and, as I have argued above, this is not a realistic assumption in our environment because the actors do possess some ability to influence this shift. We should, therefore, expect them to behave in a way that would ameliorate or eliminate this type of commitment problem.

We thus come back to our original puzzle: why would rational actors fight when war is inefficient? The model provides one possible answer that overcomes some of the shortcomings of our existing explanations. It is a two-step explanation: *actors fight with complete information because they create a situation where they have incentives to do so, and this situation arises because of the actors' crisis behavior under uncertainty.* In other words, asymmetric information causes actors to risk committing too much (so they would not want to back down if resisted) but not quite enough to force their opponent to back down (and so the opponent resists). While the lock-in occurs because actors have private information and incentives to misrepresent, war occurs because actors simply find it the better option in the new environment where all information has been revealed. *The tragedy of crisis bargaining in the shadow of power is that actors may end up creating the circumstances that make war the best choice, circumstances they would have loved to avoid, and ones they would have avoided had they possessed complete information from the very beginning.*

To see how this logic operates, let's examine the example in Figure 1(b) with complete information. Suppose $v_2 = 0.5$, i.e. she is one of the types that would end up in a war under incomplete information. As the subgame perfect solution in the appendix shows, war does not occur now. Instead, S_1 allocates $m_1^* \approx 0.37$, and S_2 capitulates immediately. The outcome is successful deterrence by S_1. What is especially striking about this result is that S_1 achieves deterrence even though his best war fighting payoff (-0.02) is worse than immediate capitulation (0). Why does this work? Because sinking the mobilization cost makes capitulation costlier than before: if S_2 resists, the new choice S_1 has is between quitting (which now yields a payoff of -0.37, the sunk cost of mobilization), and fighting. The payoff from fighting at $m_1 = 0.37$, assuming S_2 mobilizes at her optimal level $m_2^*(0.37)$, would be at least -0.05. Thus, S_1 has tied his hands by sinking the mobilization costs at the outset, and he will certainly fight if challenged now even though he would have capitulated rather than fought at the outset. Because of S_1's rather high mobilization level, fighting becomes too painful for S_2 and so she capitulates.

Contrast this with the results under asymmetric information, where S_1 allocates $m_1^* = 0.25$. First, this is less than what is required to get S_2 with valuation $v_2 = 0.5$ to capitulate ($m_1 \geq 0.37$). Second, it is more than the maximum mobilization at which S_2 would bother getting S_1 to capitulate ($m_1 \leq 0.23$). In other words, S_1's mobilization level is too high for him to backtrack once S_2's valuation is revealed given what S_2 is willing to do, but it is too low to get S_2 to capitulate either. The outcome is war: S_1's actions have now created a situation where neither opponent is prepared to back down. This situation arises because of uncertainty and would not have occurred had S_1 known his opponent's valuation from the beginning. Signaling for S_2 is pointless even though it perfectly reveals her valuation, and so her mobilization is simply preparation for war, not a warning.

The immediate reaction to this conclusion would be to ask the original question once again, this time applying it to the final stage prior to the outbreak of war: after all information has been revealed, shouldn't the actors strike a bargain? There are three ways to approach this. First, one can argue that certain situations involve threats to use force if one oversteps some boundary or fails to comply with a particular demand, and as such may not be open to negotiations about distribution of benefits. For example, following U.S. mobilization to eject Saddam Hussein from Kuwait, there were some last-minute attempts to compel Iraq to withdraw without a war. One of them was a proposed meeting Foreign Minister Tariq ‘Aziz of Iraq and Secretary of State James A. Baker III. On January 3, 1991, President Bush described the intent as follows:

> This offer is being made subject to the same conditions as my previous attempt: no negotiations, no compromises, no attempts at face-saving, and no rewards for aggression. What there will be if Iraq accepts this offer is simply and importantly an opportunity to resolve this crisis peacefully.[15]

While it is possible that the President was making this claim for strategic purposes, the events that followed demonstrated that in January, the U.S. was in no mood to negotiate anything but the unconditional liberation of Kuwait. The decision to cross the 38th parallel in Korea was also about overstepping a limit set by the opponent with the two-step logic explaining why America and China clashed in October, 1950 (Author). Hence, such a model can apply in certain situations but perhaps not in others.

Second, one can argue that eleventh-hour negotiations may be impossible either because of risks of preemptive attack or because of inability to maintain combat readiness for too long. For example, since mobilization cannot be maintained indefinitely, there is a risk that if one fails to strike and has to disengage, the process of demobilization would leave one vulnerable to attack. A combination of mobilization pressure and fear of surprise attack was the main contributing factor to Israel’s decision to strike Egypt preemptively in 1967 even against the vociferous opposition of the Americans (Oren 2002).

The third, and perhaps best, option would be to resolve this theoretically by incorporating a richer bargaining framework into the model. However, this would overburden the present model and detract from the main points I would like to make in this article. As such, I prefer to open a venue for further research, and provide a tentative answer with appropriate qualifications and caveats.

6 Conclusion

Verbal threats to use force are neither inherently costly nor do they improve one’s chances of victory should war break out. In militarized bargaining threats are implicit in the crisis behavior where actual costs are incurred in activities that could contribute to the success of the military campaign should one come. Hence, military actions can sink costs and tie hands at the same time. I argued that most existing theories of crisis bargaining neglect this dual effect, and consequently their conclusions need to be modified, some substantially, others more subtly. Many empirical hypotheses can be drawn from the preceding analysis. In lieu of summarizing these again, I offer one interesting implication of the overall results.

Fearon (1994, p. 71) argues that “a unitary rational actor question (how can states credibly signal their foreign policy intentions despite incentives to misrepresent?) proves to require an answer with a nonunitary conception of the state.” This claim is correct if one assumes that military measures involve only sunk costs. However, such an assumption is difficult to sustain on empirical grounds, and I have shown that once it is relaxed, unitary actors do recover their signaling abilities, along with equilibrium possibility for bluffing. Therefore,

[15] http://bushlibrary.tamu.edu/research/papers/1991/91010300.html.

there is no *a priori* reason to believe that domestic politics are necessary to explain crisis bargaining.

If actors are capable of signaling foreign policy through military means, the relative importance of audience cost and other domestic politics mechanisms becomes an open question. In particular, even if such mechanisms operate differently across regime types, there is no reason to expect that they would translate into crisis behavior that would itself depend on regime type. For example, even if democracies are able to generate higher audience costs than autocracies (Fearon 1994), or even if domestic political contestation enables them to reveal more information than autocracies (Schultz 2001*a*), it does not necessarily follow that democracies would be able to signal their resolve any better in a crisis in which military means are available to autocracies as well. One immediate consequence is that unless they specify why autocracies forego these signaling possibilities, theories that explain the democratic peace on signaling grounds face a serious difficulty.

Of course, the model also demonstrates that mobilization serves as an implicit threat, and its role as a purely signaling device to warn the opponent of the dangers of escalation may be quite limited. Military coercion can be exceptionally dangerous business because it alters the strategic environment, and may change it to such an extent that war becomes a necessity. Empirically, then, it may not be clear whether mobilization is a warning or a preparatory step to war, a fact that helps explain why it is regarded nervously by crisis participants.

A Proofs

Proof of Lemma 1. It suffices to show that the maximum expected payoff from fighting is increasing in S_2's type at a slower rate than the payoff from assured compellence: $\frac{\partial W_2^a(m_1, m_2^*(m_1, v_2))}{\partial v_2} = 1 - \sqrt{\frac{m_1}{\lambda v_2}} < 1 = \frac{\partial[v_2 - \overline{m}_2(m_1)]}{\partial v_2}$. Since $\beta(m_1) - \overline{m}_2(m_1) = W_2^a(m_1, m_2^*(\beta(m_1)))$, these derivatives imply that $v_2 - \overline{m}_2(m_1) > W_2^a(m_1, m_2^*(m_1, v_2))$ for all $v_2 > \beta(m_1)$. $\square$

Proof of Lemma 2. Suppose $\delta \geq \alpha$. The payoff from assured compellence equals zero for type α while the payoff from optimal war equals zero for type δ. Since the expected payoff from assured compellence is strictly increasing in type, $\delta > \alpha$ must strictly prefer compellence to war. By Lemma 1, it follows that all types $v_2 \geq \alpha$ strictly prefer assured compellence to both optimal war and capitulation. Hence, if $\alpha \leq \delta$, then all $v_2 < \alpha$ capitulate in equilibrium, and all $v_2 \geq \alpha$ mobilize at the compellence level. $\square$

Proof of Lemma 3. Suppose $\delta < \alpha$. There are three possibilities, depending on where β is located. Suppose $\delta < \beta < \alpha$. This implies that all types $v_2 \geq \beta > \delta$ prefer compellence to optimal war, and war to capitulation, which implies they must prefer compellence to capitulation. But $v_2 < \alpha$ implies that capitulation is preferred to compellence, a contradiction for all types $v_2 \in [\beta, \alpha]$. Suppose $\beta < \delta < \alpha$. This implies that all types $v_2 \geq \delta > \beta$ prefer compellence to war and war to capitulation, and so they must prefer compellence to capitulation. However, all types $v_2 \in [\delta, \alpha]$ prefer capitulation to compellence, a contradiction. Suppose $\delta < \alpha < \beta$. This is the only possibility that is consistent with the preferences signified by these cut-points. All $v_2 < \delta$ prefer capitulation to both compellence and war, all $v_2 \in [\delta, \beta]$ prefer war to both compellence and capitulation, and all $v_2 > \beta$ prefer compellence to both war and capitulation. □

Proof of Proposition 1. The on and off-the-path beliefs can be specified as follows: if any $m_2 < \overline{m}_2$ is observed, update to believe that v_2 is distributed by F on $[0, \overline{m}_2]$, and if any $m_2 \geq \overline{m}_2$ is observed, update to believe that v_2 is distributed by F on $[\overline{m}_2, 1]$. With these beliefs, if some type $v_2 < \alpha$ deviates and allocates $0 < m_2 < \overline{m}_2$, then S_1 responds by resisting. Since $\delta \geq \alpha$, war is worse than capitulation for this type, so she would capitulate and get $-m_2 < 0$, so such a deviation is not profitable. Allocating $m_2 \geq \overline{m}_2$ and ensuring capitulation by S_1 is not profitable for this type by construction. Suppose that some type $v_2 \geq \alpha$ deviated to $m_2 < \overline{m}_2$, to which S_1 responds by resisting. Since $\delta \geq \alpha$, Lemma 2 implies that such war would be worse than assured compellence. Finally, by the argument in the text, deviation to $m_2 > \overline{m}_2$ cannot be profitable for any type. □

Proof of Proposition 2. Assume $\delta \leq \alpha$ and $\delta < 1$. The three cases to consider are $\alpha < \beta < 1$, $\alpha < 1 < \beta$, and $1 \leq \alpha$. On the path beliefs are updated via Bayes rule. In particular, for any allocation $m_2 \in [m_2^*(m_1, \delta), \overline{m}_2)$, S_1 infers S_2's type with certainty. The off-the-path beliefs can be specified as follows: if any $m_2 < m_2^*(m_1, \delta)$ is observed, update to believe that v_2 is distributed by F on $[0, \delta]$, and if any $m_2 \geq \overline{m}_2$ is observed, update to believe that v_2 is distributed by F on $[\beta, 1]$ or, if $\beta > 1$, any beliefs would work. □

Proof of Proposition 3. All information sets are off-the-path but any beliefs that S_1 might hold would sustain this equilibrium. Since $\alpha \geq 1$, no $m_2 \leq 1$ can induce S_1 to quit even if he is sure war would occur. Hence, he would resist all such allocations. If any type deviates to such m_2, war is certain, but $\delta \geq 1$ implies that even optimal war is worse than capitulation for all types. If any type deviates to some $m_2 \geq \overline{m}_2 > 1$, then S_1 would quit for sure but the payoff is strictly negative for all types, and hence such deviation is not optimal. □

B Complete Information Example

With complete information, S_2 would never mobilize in equilibrium unless she is certain to attack if resisted. The choice then is among fighting S_1, compelling him, or quitting—bluffing is not an option. S_1 will capitulate if $W_1^d(m_1, m_2) \leq -m_1$, or when $m_2 \geq \frac{m_1}{\lambda}\left(\frac{v_1}{c_1} - 1\right) \approx 2.02m_1$. Hence, if S_2 gets S_1 to capitulate, her payoff would be $EU_2^C(m_1) = 0.5 - 2.02m_1$. If S_2 allocates $m_2 < \overline{m}_2(m_1)$, then fighting is certain if S_1 has allocated m_1. The best S_2 could obtain from fighting is: $EU_2^W(m_1) = W_2^a(m_1, m_2^*(m_1)) \approx 0.49 + 1.01m_1 - 1.42\sqrt{m1}$. S_2 would prefer fighting to compelling whenever: $m_1 \geq 0.23$ (all numbers rounded to second digit). Since S_2 can always obtain $EU_2^Q(m_1) = 0$ by quitting immediately, she would prefer compelling to quitting whenever $EU_2^C(m_1) \geq 0$, or whenever $m_1 \leq 0.25$. Similarly, S_2 would prefer fighting to quitting whenever $EU_2^W(m_1) \geq 0$, or whenever $m_1 \leq 0.37$.

In equilibrium S_1 will never allocate $m_1 < 0.23$ because he will capitulate for sure, and any such positive allocation is just a cost. He would never allocate more than $m_1 = 0.37$ because S_2 is certain to quit for all such values, and so he would be paying more unnecessarily. Hence, S_1's choice boils down to $m_1 = 0.37$, which would lead to S_2's capitulation, or some $m_1 \in [.23, .37)$ that would lead to certain fighting. If S_1 allocates the assured deterrence level, his payoff is $0.60 - 0.37 = 0.23 > 0$, so in equilibrium S_1 would never quit immediately. What would he get if he allocates less than that and fights? For any such allocation, S_2 responds with her optimal fighting allocation $m_2^*(m_1)$, and so S_1's best possible fighting payoff is: $\max_{m_1} \left\{ W_1^d(m_1, m_2^*(m_1)) \right\} = \max_{m_1} \left\{ \frac{v_1}{v_2}\sqrt{\frac{m_1 v_2}{\lambda}} - c_1 - m_1 \right\}$. Taking the derivative and setting it equal to zero yields: $v_1 = 2\lambda\sqrt{\frac{m_1 v_2}{\lambda}} \Leftrightarrow m_1^* \approx 0.18$. This means that the best S_1 can do if he is going to fight would be to allocate $m_1^* = 0.18$, in which case his expected payoff would be -0.02, that is, worse than quitting immediately. Of course, we know that for any $m_1 < 0.23$, no fighting will actually occur because S_2 would allocate at the assured compellence level, and so using $m_1 = 0.18$ yields S_1 an expected payoff of -0.18, even worse.

Therefore, optimal fighting is strictly worse than immediate quitting for S_1, but quitting is strictly worse than deterrence. In the subgame perfect equilibrium, S_1 would allocate $m_1 = 0.37$, and S_2 would capitulate immediately. War never occurs with complete information between the adversaries with valuations $v_1 = 0.6$ and $v_2 = 0.5$.

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