War, Uncertainty, and Leader Tenure∗

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October 7, 2016

Abstract

How do new leaders impact crisis negotiations? We argue that opposing states know less about such a leader’s resolve over the issues at stake. To fully appreciate the consequences, we develop a multi-period bargaining model of negotiations. In equilibrium, as a proposer becomes close to certain of its opponent’s type, the duration and intensity of war goes to 0. We then test whether increases to leader tenure decrease the duration of Militarized Interstate Disputes. Our estimates indicate that a crisis involving new leaders is 25.3% more likely to last one month than a crisis involving leaders with four years of tenure. Moreover, such conflicts are more likely to result in greater fatalities. These results further indicate that leader tenure is a useful proxy for uncertainty.

∗We are grateful to Phil Arena for helpful discussion. Comments and suggestions are welcome.
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1 Introduction

On September 22, 1980, Iraq invaded Iran, hoping to expand its borders. The war lasted years, with casualty counts only surpassed by World War I and World War II. But conflict between the countries was nothing new—disputes between these countries were frequent in the decades prior. Iraq had long sought control of the Khuzestan Province, an oil-rich region in southwest Iran (Shemirani, 1993), while Iran disputed access to waterways near their shared border (Karsh, 2002). However, those previous conflicts ended comparatively quickly. The Iran-Iraq War was unique in its length and intensity.

One potential explanation for the duration discrepancy is turnover in leadership in Iran. During those previous conflicts, Iraq had dealt with a known entity—Shah Mohammad Reza Pahlavi reigned from 1941 to 1979. By 1980, though, Ayatollah Khomeini had replaced the Shah. Thus, throughout the war, all the accumulated knowledge about the Shah’s preferences and tolerance to run risks were rendered irrelevant. History was no longer as powerful a guide. Information problems correspondingly ran deeper. Iraq in turn spent the better part of a decade learning that the Islamic Republic would not easily concede its territorial possessions.

Of course, by only looking at one case, it is not possible to draw general conclusions about the relationship between the length of a leader’s tenure and the duration of disputes. It nevertheless suggests that newer leaders bring greater uncertainty to a dyad, causing wars to last longer as their opponents filter out potentially less resolved types. We consequently ask whether this mechanism holds on a larger scale. Our strategy is two-fold. While many scholars have previously theorized about leader tenure and the initiation of conflict (Gaubatz, 1991; Gelpi and Grieco, 2001; Chiozza and Goemans, 2003; Potter, 2007; Bak and Palmer, 2010), discussion of tenure and duration of conflict is notably absent. Thus, we develop a simple game of bargaining and fighting, which borrows heavily from the literature on wartime convergence. Comparative static analysis shows that as uncertainty about a leader’s resolve disappears, the expected duration of war goes to 0. This result suggests that the case might not be unique but rather is reflective of an underlying trend.

Second, we investigate the relationship between leader tenure and duration with a large-n empirical analysis of all militarized interstate disputes between 1816 and 2007. Drawing from the comparative static, we hypothesize that more uncertainty leads to longer and more

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1 Indeed, Weisiger (2013, 152-158) and Hiro (1989, 36-37) argue that Iraq sought to exploit a temporary weakness in Iranian military power following the revolution. While large-N quantitative analysis cannot discriminate causal mechanisms for a single case, we investigate this potential confounder in the empirical discussion.

2 These models investigate how proposers might screen out less powerful adversaries over the course of fighting and bargaining. Our setup is closest to Filson and Werner’s (2002) model, though our interest is in uncertainty over resolve, something intrinsic to leaders rather than a country’s military power. Only Powell’s (2004) allows for uncertainty over resolve in his model.
violent conflicts. Borrowing from Thyne (2012), Rider (2013), Spaniel and Smith (2015) and Uzonyi and Wells (2015), we proxy for uncertainty using leader tenure. The results are striking, statistically significant, substantively important, and robust to multiple alternative specifications. We estimate that disputes involving new leadership are 25.3% more likely to last longer than a month than a crisis involving leaders with four years of tenure. Further, while there are many cases of long disputes involving newer leaders, dyads with long-serving leaders virtually never initiate disputes against one another.

Overall, our paper contributes to a growing literature on leaders, uncertainty, and inefficient conflict. Specifically, we use the theoretical results from the model to clarify the causal mechanism linking leader tenure to international conflict. Led by Wolford (2007), this literature argues that leadership change acts as an exogenous shock to the geopolitical information structure. Faced with greater uncertainty, an opposing party is more likely to miscalculate its optimal offer, leading to war. As such, newer leaders are more likely to experience militarized disputes.

While this informational mechanism has strong theoretical support, a number of other mechanisms that tie leadership turnover to international conflict have been proposed in the literature. These alternative causal mechanisms all lead to the same conclusion: leaders who have recently entered office are more likely to be involved in the initiation of a conflict than longer-tenured leaders. Perhaps newer leaders, having not yet consolidated power, face greater political constraints which prevent them from credibly committing to conflict and make them more attractive targets of aggression (Gelpi and Grieco, 2001). Alternatively, if diversionary incentives (Chiozza and Goemans, 2003) are more prevalent at the beginning of a leader’s tenure, then initiations may result from this mechanism instead. Under yet another mechanism, new leaders may be perceived as especially weak targets (Bak and Palmer, 2010), again leading to the expectation that shorter tenure durations to be correlated with crisis initiation.

As this survey of recent work indicates, regardless of the causal mechanism specified, a negative relationship between the tenure of a leader and the likelihood of conflict initiation is expected. Thus, when the outcome of interest is the initiation of conflict, existing work has not provided evidence differentiating the informational, diversionary, leader-vulnerability, and other mechanisms that each predict this relationship. Because analyzing these mechanisms in the context of initiation results in a lack of clarity as to whether one of these mechanisms dominates, we shift focus to analyze the duration of disputes to allow for such a test.

By focusing on the duration and intensity of conflict, rather than its initiation, we help

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3 Origins of theoretical mechanism date back further to connections between new leaders and incentives to build reputations for toughness (Dallek, 2003, 413-414).
INTRODUCTION

distinguish among these mechanisms. This is because with respect to conflict duration, the informational mechanism implies a different effect of leader tenure than each of the alternative mechanisms outlined above. Our theoretical results, presented in section 2, indicate that as uncertainty decreases, the duration of a conflict decreases. In contrast, if leader tenure influenced conflict duration because new leaders are military weaker, we might expect the enfeebled party to lose more quickly than an average state. Similarly, if newer leaders’ diversionary incentives render the bargaining range empty, we would expect the parties to settle once the leader captures the private benefit; further fighting risks revealing the domestic conflict of interest (Weisiger, 2013, 48-51). Moreover, if commitment problems with new leaders caused crises, such a conflict should end once that leader consolidates his or her power, the commitment problem subsides, and the states can strike a deal within the stable bargaining range. These cases would all suggest that newer leaders under some conditions ought to fight shorter wars. Thus, the informational mechanism carries a different implication than competing mechanisms, allowing for an evaluation of the relative merits of these explanations.

Focusing on conflict duration also allows us to draw theoretical expectations about the destructiveness of conflict. Our theoretical results indicate that as uncertainty diminishes, the number of costly battles also diminishes. Drawing upon this, we expect a negative relationship between leader tenure and the number of fatalities resulting from an interstate dispute. If our focus were on the initiation of disputes, rather than their duration, we would be unable to draw this implication about conflict intensity from our theoretical framework. We believe this provides an additional justification for our focus on conflict duration as an outcome of interest. By focusing on this outcome rather than initiation, we both allow ourselves to distinguish among proposed causal mechanisms as well as draw additional empirical expectations related to duration.

On this front, we find that newer leaders correlate with higher casualty rates. This empirical finding is what we would expect in environments with greater uncertainty, as opposing states have greater incentive to screen out less resolved opponents under such circumstances. Our paper thus contributes by providing further evidence indicating that uncertainty has a substantively important effect by testing a hypothesis that would hold for the uncertainty mechanism but might not hold for others.

We also indirectly contribute to the civil war literature. Uzonyi and Wells (2015) show that longer-tenured leaders correlate with shorter civil wars but only when the state features constraining domestic institutions. They theorize that long-tenured leaders in unconstrained environments have solidified reputations and thus are more likely to face the post-war commit-

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4Thyne (2012) finds this effect for tenure but does not check for interactive effects with institutional constraints.
ment problems that cause civil conflicts to drag on (Walter, 1997). But long-tenured leaders in constrained environments can more easily make credible commitments, thereby allowing the informational mechanism to properly work. The issues of post-civil war commitment do not apply to interstate wars. Therefore, if Uzonyi and Wells’ theory is correct, the length of interstate wars should decrease in leader tenure, and this effect should not be conditional on institutional constraints. We find evidence for this in the data.

The remainder of the paper proceeds as follows. In section 2, we develop a simple game-theoretic model in order to formalize the logic tying leader tenure to the duration of disputes. The purpose of the model is to develop a transparent empirical implication: as disputants become more certain about their opponents, the expected duration and intensity of conflict diminishes to nothing. With this hypothesis obtained from our formal theoretical results, we turn to statistical analysis in section 3. Using leader tenure as a proxy for uncertainty, we evaluate the implication of our theoretical model. The findings are consistent with our expectation that leaders with shorter tenures, because they introduce greater uncertainty, beget lengthy disputes. In the remainder of section 3, we discuss the robustness of the results. Finally, in section 4, we conclude with a discussion of the results in the context of the broader literature, considering the implications of our results for both academic and policy communities.

2 Theory

The game consists of two states, A and B, engaged in a crisis over an object worth 1. Failure to reach an agreement leads to a series of costly battles that randomly awards the object to one of the parties. Nature begins by drawing state B’s type as “unresolved” with probability $q$ and “resolved” with probability $1 - q$. State B sees its own type but state A only observes the common prior distribution. State A then demands a portion of the good $x_1 \in [0, 1]$. State B chooses whether to accept or reject that amount. Accepting ends the game and implements the division, with state A receiving $x_1$ and state B receiving $1 - x_1$. If state B rejects, the parties fight a battle. The battle costs state A $c_A > 0$ and state B $c_B > 0$.

To model the uncertainty over resolve, the two types of B internalize this cost differently. Explicitly, the resolved type functionally pays $\frac{c_B}{r'}$ and the unresolved type pays $\frac{c_B}{r}$, where $r' > r$. Dividing B’s cost for war in this manner means that the resolved type is more willing to spend blood and treasure to win the good at stake. As such, the resolve term parameterizes a leader’s sensitivity to the costs of war. Following the literature on resolve and leaders, such differences in costs might be because one type of leader (compared to the other) has a constituency that is more insulated from the costs of war (Bueno De Mesquita
et al., 2005), personally finds violence to be a useful alternative to diplomacy (Goemans, 2000; Chiozza and Goemans, 2003; Horowitz and Stam, 2014), fears the consequences of a foreign policy failure to a greater extent (Goemans, 2008; Debs and Goemans, 2010; Croco, 2011; Weeks, 2012), or places greater value on the good at stake due to private benefits from war (Chiozza and Goemans, 2011).

Whereas standard bargaining models of war treat combat as a game-ending costly lottery, we consider a more complex scenario where military victory requires multiple successful battles for state B.\(^5\) In particular, state A wins the battle with probability \(p_A\), eliminating state B, and securing the good for itself. With probability \(1 - p_A\), state B wins the battle, and both parties survive to a second round of bargaining. Here, state A offers a division \(x_2 \in [0, 1]\). If state B accepts, the parties implement that division. If state B rejects, they fight one more battle. This time, the battle ends the game. State A prevails with probability \(p_A\), state B wins with complementary probability, and the both states pay the costs as before.

2.1 Equilibrium

Because this is an extensive form game of incomplete information, we search for perfect Bayesian equilibria. Proposition 1 states that one of three outcomes occur depending on state A’s prior belief that state B is the unresolved type:

Proposition 1. The duration of war depends on A’s prior belief about B’s type:

- If state B is sufficiently unlikely to be the unresolved type, state A demands a small amount in the first stage. Both types accept, and they fight no battles.

- If the probability state B is the unresolved type falls in a middle range, state A demands a moderate amount in the first stage. Only the unresolved type accepts. State A then demands an amount in the second stage, and the resolved type accepts. The states fight only one battle and only if A is facing the resolved type.

- If state B is sufficiently likely to be the resolved type, state A demands a large amount in the first stage. The unresolved type sometimes accepts and sometimes rejects, while the resolved type always rejects. State A then demands a large amount in the second stage. Only the unresolved type accepts. The states fight two battles if B is the resolved type and one battle with positive probability if B is the unresolved type.

\(^5\)This is most similar to Filson and Werner (2002). One could interpret this setup as state A having two military divisions that state B must defeat whereas state B only owns one. Like Filson and Werner, we choose the two stage because it is sophisticated enough to allow us to draw comparative statics on war duration but simple enough to solve with an explicit solution. See Slantchev (2003) and Powell (2004) for similar models.
2.1 \textit{Equilibrium}

The appendix contains a full proof and derivation of the cutpoints on $q$. However, the intuition is as follows. State A faces a risk-return tradeoff. Smaller demands induce greater rates of acceptance but generate worse terms for state A. In contrast, larger demands lead to higher peaceful payoffs but greater rates of rejection. In the process, state A must worry about the unresolved type's incentive to reject an initial demand, bluff strength by fighting a battle, and attempt to obtain a greater share of the good in the second period. However, because the unresolved type pays a greater cost to fight, well-calculated offers from state A can induce the unresolved type to separate—although bluffing will lead to a greater offer, the differentially greater battle cost outweighs the potential gain. This permits information revelation despite the apparent incentives to misrepresent.

Whether state A wishes to screen types in this manner depends on its prior belief about state B's type. If state A believes state B is sufficiently likely to be the resolved type, screening out the unresolved type with high demands is too costly. Indeed, any attempt to screen results in battles against the more abundant resolved type. Because war is costly and state B is likely the resolved type in this case, state A prefers buying off both types immediately and guaranteeing itself some amount of the surplus. As such, no battles occur here.

Now consider situations where the likelihoods of the resolved and unresolved types are relatively balanced. Here, the frequency of unresolved types is high enough that state A prefers gambling to making the safe demand. That said, state A must be careful in its demand strategy. As previewed above, the unresolved type could reject an initial offer, mimic the resolved type by fighting, and achieve greater concessions in the second period. Nevertheless, state A can develop a demand strategy that credibly separates the unresolved from the resolved types. As the appendix details further, the unresolved type has a greater overall war payoff than the resolved type because each battle costs $\frac{c_B r}{r'}$ for it rather than $\frac{c_B r}{r''}$. Consequently, state A can demand just enough that the unresolved type prefers accepting that to fighting and obtaining the resolved type's share in the second stage. Meanwhile, the resolved type rejects; it earns strictly more because its war cost is smaller. As such, state A fights a battle against just the resolved type in the first stage and settles with certainty in the second stage.

Lastly, consider situations where the unresolved type is sufficiently likely. If state A pursues a demand strategy that induces separation, it must pay a premium to the unresolved type in the first stage so as to disincentivize bluffing. While that premium is acceptable when the unresolved type is not particularly likely, it becomes further unacceptable as state A becomes increasingly certain that it is facing the unresolved type. State A's alternative involves offering an amount in the first stage equal to the unresolved type's payoff for war. Yet the unresolved type cannot accept with certainty here—if it did, state A would demand
an amount to appease the resolved type in the second stage, and so the unresolved type could profitably bluff.

Instead, the unresolved type mixes between accepting and rejecting in the first stage. Then, in the second stage, state A again tailors its demand to appease only the unresolved type. The resolved type rejects throughout. Although state A suffers its war costs against that resolved type, it willingly accepts that inefficiency because the likelihood it is facing the resolved type is sufficiently low. Overall, these strategies imply some war in the first stage and less war in the second.

2.2 Empirical Implication

While Proposition 1 explains the outcome of the game, it lacks empirical clarity. Consequently, we turn to Proposition 2, which generates a straightforward comparative static with empirical implications:

**Proposition 2.** As state A becomes certain about state B’s type (i.e., as \( q \) goes to 0 or 1), the expected duration of war goes to 0.

Note that \( q \) is a measure of uncertainty. As \( q \) approaches 0, state A becomes increasingly certain that it is facing the resolved type; and as \( q \) approaches 1, state A becomes increasingly certain that it is facing the unresolved type. Thus, Proposition 2 states that if state A can accurately identify whether it is facing the resolved or unresolved type, the expected duration of war eventually reaches 0.

To see why, consider two cases. First, suppose \( q \) is approaching 0 from the right side. Then we must investigate the duration of war for when \( q \) falls in the first range from Proposition 1. But under such conditions, state A demands the safe amount and avoids war entirely. Consequently, the duration of war equals 0.

Second, suppose \( q \) is approaching 1 from the left side. This case falls in the third range from Proposition 1. Discussions of convergence models often overlook this type of semi-separating equilibrium, which actually features greater conflict than the more commonly-known separating equilibrium in which the proposer skims the various types. Nevertheless, we can still obtain a relationship between uncertainty and length of war. The appendix shows that the unresolved type fights a battle with probability \( \frac{(1-q)(c_A+c_F)}{qC_B(\frac{1}{r'}-\frac{1}{r})} \) here, while the resolved type fights both battles. Multiplying each of these probabilities by the prior distribution of types, the overall expectation of one battle fought equals:

\[
q \left( \frac{(1-q)(c_A + \frac{c_F}{r_v})}{qC_B(\frac{1}{r'} - \frac{1}{r})} \right) + 1 - q
\]
(1 − q) \left( \frac{c_A + \frac{c_B}{c_B}}{c_B\left(\frac{a}{r} - \frac{b}{r'}\right)} \right)

Note that this value is strictly decreasing in \( q \). Indeed, as \( q \) goes to 1, the probability of observing one battle goes to 0.

Meanwhile, note that the probability of observing two battles in this case is simply the probability of drawing the resolved type, or \( 1 − q \). This value is strictly less than the probability of observing one battle and is also strictly decreasing in \( q \) and goes to 0 as \( q \) goes to 1.\(^6\)

All told, the key takeaway from Proposition 2 is that we ought to expect the duration of fighting to decrease when uncertainty about a state’s resolve disappears. We test two empirical implications of this comparative static below.

3 Empirical Analysis

Before turning to the data, we must first reformulate Proposition 2’s comparative static into a testable hypotheses. The model shows that great amounts of uncertainty over resolve should not only lead to dispute initiation but longer conflict as well. This result translates naturally to a discussion of leader tenure. Although an individual leader’s characteristics do not alter the determinants of military strength, she can influence when the state wields that power. Further, opposing states cannot easily identify a leader’s bottom line in crisis bargaining because less resolved leaders have incentives to misrepresent themselves as resolved (Fearon, 1995).

However, as Wolford (2007) argues, uncertainty is not static over time. Whenever a new leader enters office, opposing intelligence organizations must discard their files on the previous leadership and begin their research process again. Meanwhile, as a leader progresses in tenure, she cannot help but make publicly observable actions. Put together, these two factors indicate that opposing states should have stronger beliefs about a leader’s preferences as tenure progresses. Stated differently, leader tenure is an effective proxy for uncertainty. Previous studies have uncovered such a relationship in arms races (Rider, 2013) and sanctions (Spaniel and Smith, 2015).

We can now directly translate this to Proposition 2’s comparative static. As tenure increases, the belief regarding an opposing leader’s resolve should converge to a particular expectation. In turn, the expected duration of conflict ought to decrease, either because the

\(^6\)Beyond Proposition 2’s limit result, it is also true that decreasing the difference in type space (that is, reducing the variance of types by decreasing \( \frac{a}{r} - \frac{b}{r'} \)) monotonically reduces the size of the parameter space under which long wars occur (that is, wars in which the parties fight two battles). This is an alternative conceptualization reducing uncertainty because shrinking \( \frac{a}{r} - \frac{b}{r'} \) to 0 converges to the complete information case (Spaniel and Smith, 2015, 740).
proposer demands a safe amount and guarantees the peace or because the proposer demands an aggressive amount but chances of guessing incorrectly goes to 0. Regardless, this provides us with our first hypothesis:

**Hypothesis 1.** The expected duration of conflict is decreasing in leader tenure.

While duration is our primary outcome of interest, our theoretical results also carry testable implications with respect to combat fatalities. In the context of our theoretical model, as uncertainty vanishes, the number of rounds of fighting diminishes to 0. From this, we draw a second testable implication from the comparative static in Proposition 2. Specifically, more rounds of fighting should be associated with higher fatality levels. This can be seen in Proposition 2 by considering how, as uncertainty vanishes, so too does the number of times that each state pays the cost of war in equilibrium. Interpreting the cost of war as the loss of both material resources and human lives as the result of combat, this means that as uncertainty is resolved, the number of fatalities resulting from a militarized dispute should decrease. Thus, as leader tenure increases, we also expect the number of fatalities resulting from extended periods of destructive conflict to decrease.

An alternative way to think of this is as follows. Cheap talk signaling does not work under normal circumstances because less resolved types have incentive to bluff strength. In contrast, the war mechanism we study in the model above permits meaningful communication because the two types pay differential costs for fighting. Because the more resolved type suffers a smaller cost, it is willing to fight under a larger set of circumstances than the unresolved type. As a result, the costliness of war screens types. However, when little uncertainty exists, there is less of a need to pay costs to credibly reveal information. Operationalizing these costs as casualties from war gives us the following hypothesis:

**Hypothesis 2.** The expected number of fatalities resulting from conflict is decreasing in leader tenure.

We find support for these hypotheses below.

### 3.1 Data

To test our hypothesis, we investigate the duration of militarized interstate disputes (MIDs). Thus, our units of observation are all dyadic MIDs from 1816 to 2010. We draw the bulk of our data from two sources: the Correlates of War (COW) for conflict data and Archigos (Goemans, Gleditsch and Chiozza, 2009) for data on leader tenure. In the following sections, we first

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describe the data used in this study.\textsuperscript{8} Next, we detail our use of an appropriate statistical model, the well-known Cox proportional hazards estimator for duration analysis, and ordinary least-squares regression for our analysis of fatality levels. Then we report the results and provide some substantive interpretation to demonstrate the relevance of our findings. Finally, we describe various checks on the robustness of these results before concluding.

3.1.1 Dependent Variables

Our first dependent variable of interest is the duration of conflict. To measure this, we turn to the Correlates of War data. The specific dataset that we use is the Militarized Interstate Dispute data, which collects information at the conflict and participant level. Fortunately for us, this data contains the start and end date of each conflict included. From this, we calculate the number of weeks that a given conflict lasted and utilize this measure as our dependent variable.\textsuperscript{9}

The second dependent variable in our analysis is battle deaths resulting from militarized conflict. For a measure of fatalities, we again turn to the Correlates of War data. We use the fatality level variable for our main analysis, which is an ordinal measure of fatalities taking on values of 1 through 6. Because of issues with missing data, we defer use of the Correlates of War’s precise measure of fatalities for the main analysis. While the precise value would provide an ideal measure for present purposes, of the 447 militarized interstate disputes with a positive fatality level in our sample, 403 have missing values for the precise fatality measure. In contrast, there is no missingness in the precise measure among disputes that involved zero fatalities. Thus, we avoid use of this measure due to the clearly non-random missingness. We believe that the ordinal measure, while not ideal, is the best among all available alternatives.

3.1.2 Independent Variables

\textbf{Tenure: } Our independent variable of interest in this analysis is leader tenure. We measure this by taking the minimum tenure among the conflict’s originators in each observation. To maximize the precision of the measurement, we calculate this tenure as the number of days that leader has been in office at the time the dispute was initiated and then take the common logarithm of this value.\textsuperscript{10}

\textsuperscript{8}We utilize the EUGene data generating software to obtain all relevant COW data (Bennett and Stam, 2000)

\textsuperscript{9}Note that we also performed the analysis with days and months and the substantive results are unchanged. We opt for weeks because it is the most fine-grained measure that we can use without having to discard too many observations due to missingness in the days variable.

\textsuperscript{10}See (Weisiger, 2015) for an analysis of leadership turnover during a conflict.
Note that we use a logged variable for theoretical reasons. Specifically, we expect that there are decreasing returns to information acquisition. In this way, the marginal influence of each additional day of a leader’s behavior decreases over time. Put differently, the first day in office provides more information than the second, the second provides more information than the third, and so forth. Logging the number of days in office ensures that our measure has this property.

Because the unit of observation in this study is a militarized interstate dispute, it is necessary to make choices about how to measure tenure among many possible alternatives. The primary difficulty arises because each conflict included in the data we utilize includes a number of participants. As such, we must incorporate leader tenure into our empirical analyses with care. In the absence of strong theoretical priors, a number of these measures appear valid. However, our theoretical argument from section 2 provides us with a compass with which to navigate these competing options. We allow theory to be our guide here based on the notion that more theoretically grounded statistical models fare better at uncovering existing relationships in the data (Arena and Joyce, 2011).

The informational logic of our theory rules out many alternative measures. One such option would be to simply sum the tenure of all leaders involved in a conflict (or all originators of a conflict). We believe that this is theoretically inappropriate for a number of reasons. First, per Proposition 2, militarized conflict is a costly form of information transmission; it ends when beliefs about the actors converge to the realized type. Consequently, even if one side has converged its beliefs about the second, conflict might continue until the second converges its beliefs about the first. This indicates that the least tenured leader is the critical case and that the sum of leader tenure is not. As such, we use the minimum tenure among all leaders coded as originators of a given conflict by the COW coding rules.

Second, summing tenure leads the model to treat highly unrelated cases as statistically identical. For example, with unlogged data, two leaders with 10 years of experience each would be identical to a dyad with a fresh leader and a leader with 20 years experience. Our theoretical model leads us to expect the second dyad to be far more fragile and require substantially more learning than the first dyad. All told, these two points indicate that we should opt for the minimum tenure length in the dyad.

The analysis also includes a number of control variables to account for other factors that are likely also related to the duration of conflict. We describe these control variables below:

- **Polity:** To control for regime type, we include the POLITY score of the leader corresponding to our measure of minimum tenure. This allows for us to control for the possibility that regime type might influence a leader’s incentives for standing firm versus backing down during a conflict, as Debs and Goemans (2010) argue.
3.1 Data

- **Capability Ratio:** Following existing work on power preponderance and the duration of conflict, we expect that the distribution of capabilities among each side in a militarized interstate dispute should be related to its duration (Slantchev, 2004; Reed, 2003). To control for this, we include a capability ratio measure that indicates whether there is relative parity or a preponderance of power between each side in a conflict. We use the Correlates of War’s Composite Index of National Capability (CINC) scores to construct this measure, summing these scores within each side of a dispute as identified by the MID data. Then, the measure is constructed by taking the maximum of these scores and dividing by the sum. As such, this variable takes on values between 0.5 and 1, with lower values indicating power parity and higher values indicating a preponderance of power on one side.

- **Issue Dummies:** Perhaps the issue under dispute is related to the willingness of states to incur the costs of conflict. If this is true, then our estimation must account for these differences. Accordingly, we include a set of dummy variables indicating the primary issue under dispute in each militarized interstate dispute contained in our data. The base case that we omit are the set of disputes classified as “other” by the Correlates of War coding rules. The indicators we include are as follows:
  - **Territory:** Indicator for territorial disputes.
  - **Policy:** Indicator for international policy disputes.
  - **Regime:** Indicator for disputes over issues related to a target’s regime.

To establish the plausibility of our results, Figure 1 presents a scatterplot of leader tenure measured in days against the duration of conflict as measured in weeks. The plot colors points by the Polity score of the leader with minimum tenure. We include this to obtain a first-pass idea of whether the influence of leader tenure might be distributed differently for different regime types.

Looking to Figure 1, we find initial support for our theoretical expectation. This scatterplot demonstrates that the relationship that we expect is plausible. In particular, no data points lie in the upper-right quadrant (long tenure/long length) of the graph. This is consistent with our expectation that the duration of conflicts should be decreasing in leader tenure. Further, the scatterplot does not reveal any clear relationship between regime type and this influence. With the exception of extremely long tenures, regime types appear to be distributed throughout the observations fairly evenly. Nevertheless, this only provides initial evidence in favor of our claims, and so we will turn to regression analysis to further solidify our empirical findings.
Figure 1: Scatterplot of leader tenure and conflict duration. This plot provides initial evidence in favor of our theoretical expectations. In particular, no points inhabit the upper-right area of the plot, indicating that the duration of conflicts initiated against leaders who have been in office for a long period of time tends to be shorter than conflicts involving new leaders.
3.2 Results

Figure 2: Scatterplot of leader tenure and fatality level. No points inhabit the upper-right quadrant. This is suggestive of a negative relationship between tenure and fatality level. Note that the y-axis is jittered to aid in visual interpretation of the data.

Next, we perform a similar exercise for our fatality variable. Figure 2 presents a scatterplot of leader tenure and fatality. The distribution appears similar to that of duration: the upper-right quadrant (long tenure/high fatalities) is empty. Again, at first pass, this gives us confidence that the expected relationship exists.

Before moving on to any analysis, we also present scatterplots of our control variables against duration to get a better feel for the relationships in the data. These graphics are presented in Figure 3. As the figure demonstrates, neither Polity nor capability ratios appear to have a strong relationship with duration. Additionally, each of these scatterplots demonstrate that our controls are well distributed across the range of possible values.

3.2 Results

The first of our hypotheses relates to the duration of interstate crises. As such, we require a statistical model designed to handle duration data. To avoid distortions of the underlying hazard rate that may arise from parametric assumptions, we take a semiparametric approach, utilizing a Cox proportional hazards model.

In Table 1, we report the results of our duration analysis. Note that across each of the model specifications, the coefficient on our measure of leader tenure indicates that an increase
3.2 Results

Figure 3: Scatterplot of control variables and conflict duration.
### 3.2 Results

#### EMPIRICAL ANALYSIS

<table>
<thead>
<tr>
<th>Dependent variable:</th>
<th>Conflict Duration (Weeks)</th>
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<tbody>
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<td></td>
<td>(1)</td>
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<tr>
<td>Tenure (Logged)</td>
<td>0.177***</td>
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<td></td>
<td>(0.034)</td>
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<td>Polity</td>
<td>0.005</td>
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<td>(0.003)</td>
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<tr>
<td>Cap. Ratio</td>
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</tr>
<tr>
<td></td>
<td>(0.145)</td>
</tr>
<tr>
<td>Territory</td>
<td>−0.660***</td>
</tr>
<tr>
<td></td>
<td>(0.064)</td>
</tr>
<tr>
<td>Policy</td>
<td>−0.255***</td>
</tr>
<tr>
<td></td>
<td>(0.055)</td>
</tr>
<tr>
<td>Regime</td>
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</tr>
<tr>
<td></td>
<td>(0.112)</td>
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</tr>
<tr>
<td>Log Likelihood</td>
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</table>

*Note:* *p<0.1; **p<0.05; ***p<0.01

Table 1: Cox Proportional Hazards Model Results

in tenure corresponds to an increase in the hazard. Furthermore, in all of the models, this coefficient obtains statistical significance at at least the 95% level. Thus, the results of our estimation provide evidence in favor of our hypothesis that leader tenure should be associated with shorter conflict durations.

In Figure 4, we graphically represent the influence of shifts in leader tenure on the estimated hazard ratio. As this graphic demonstrates, our model predicts that an increase in leader tenure is associated with an increase in the estimated hazard ratio. Substantively, this means that the probability of conflict termination at any given point is greater for conflicts involving longer-tenured leaders versus leaders who have only recently entered office. As the plot indicates, shifting across the interquartile range results in a ten percentage-point shift in the estimated hazard ratio.
3.2 Results

Figure 4: Estimated hazard ratios obtained by varying leader tenure across its interquartile range. The lower bound of this range is 7 months and the upper bound is 4 years and 3 months.

Alternatively, we can interpret the results using predicted survival probabilities based on substantively interesting values of our independent variables. Holding all other variables at their medians, we calculate the probability that a conflict lasts at least one month for a leader that has only spent one day in office versus a leader that has held office for four full years. We find that this probability is 0.475 for the new leader, while it is only 0.355 for the leader that has been in office for four years. Thus, conflicts involving a new leader are 25.3% more likely to sustain past one month than a conflict in a dyad with the leader having held office for four years. This indicates that the influence of leader tenure on the duration of conflict is not only statistically significant, but that it also holds substantive weight.

Next, we turn to our analysis of leader tenure’s influence on the fatality level of disputes. As discussed in the previous section, our measure of fatality level is an ordinal value of the estimated number of fatalities according to the COW project’s coding rule. While this is not a precise measure, it does allow us to sidestep the problematic non-random missingness present in the precise fatality measure included in the COW data.

The statistical model we use for this analysis is standard OLS regression. Upon first glance,
### 3.2 Results

#### 3 EMPIRICAL ANALYSIS

**Dependent variable:** Fatality

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
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<tr>
<td>Tenure (Logged)</td>
<td>$-0.222^{***}$</td>
<td>$-0.252^{***}$</td>
<td>$-0.222^{***}$</td>
<td>$-0.181^{***}$</td>
<td>$-0.206^{***}$</td>
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<td></td>
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<td>(0.047)</td>
<td>(0.045)</td>
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<td></td>
<td>(0.004)</td>
<td></td>
<td>(0.004)</td>
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</tr>
<tr>
<td>Cap. Ratio</td>
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<td>$-0.395^{**}$</td>
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<td>(0.191)</td>
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<tr>
<td>Territory</td>
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<td>0.780^{***}</td>
<td>0.678^{***}</td>
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<tr>
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<td>(0.086)</td>
<td></td>
</tr>
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<td>Policy</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>(0.067)</td>
<td>(0.074)</td>
<td></td>
<td></td>
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<tr>
<td>Regime</td>
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<td>0.921^{***}</td>
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</tr>
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<td></td>
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<td></td>
<td>(0.148)</td>
<td>(0.168)</td>
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<tr>
<td>Constant</td>
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<td>1.186^{***}</td>
<td>1.541^{***}</td>
<td>0.736^{***}</td>
<td>1.161^{***}</td>
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<tr>
<td></td>
<td>(0.122)</td>
<td>(0.134)</td>
<td>(0.196)</td>
<td>(0.127)</td>
<td>(0.212)</td>
</tr>
</tbody>
</table>

| Observations | 1,978 | 1,733 | 1,911 | 1,978 | 1,676 |
| R²           | 0.013 | 0.021 | 0.017 | 0.092 | 0.089 |
| Adjusted R²  | 0.012 | 0.020 | 0.016 | 0.090 | 0.086 |

*Note:* $^*p<0.1; ^{**}p<0.05; ^{***}p<0.01$

Table 2: OLS Results for Fatality Level
our use of this statistical approach may appear inappropriate given the ordinal nature of our outcome variable. Often when using ordered categorical data, analysts use a model designed to uncover the latent dimension from which the categories were generated. However, in this case we do not believe that the use of such a model is appropriate given our knowledge of the data collection process. Specifically, models such as ordered probit posit that the observed outcome variable $y$ is the result of some underlying but unobserved continuous measure $y^*$. As such, ordered probit estimates, along with regression coefficients, a series of cutpoints that describes the relationship between $y$ and $y^*$. For our data, however, the underlying dimension used to generate $y$ is known. To be precise, each fatality category is associated with a specified range of battle deaths as outlined in the Correlates of War coding manual. As such, we believe that a statistical technique that would estimate these cutpoints when they are known is inappropriate. This leads us to our use of standard OLS regression.

Turning to the results presented in Table 2, we see that across all models, our measure of leader tenure has a negative and statistically significant relationship with fatality level. This finding is consistent with Hypothesis 2. We also note that this finding carries substantive weight. In particular, holding all other variables at their median values, a shift from a brand-new leader to one that has held office for four years is sufficient to shift the expected number of fatalities down a full category under the MID coding scheme.

In addition to our results on leader tenure, the results on the control variables across the models deserve some attention. Our duration results suggest that democracy does not have a significant effect on the duration of conflict. However, consistent with Valentino, Huth and Croco (2010), we find that democratic states incur significantly fewer casualties during periods of interstate conflict. The effect of democracy depends upon whether the outcome variable is conflict duration or fatality level. A similar pattern emerges with respect to the relative capability of states. We find that asymmetric wars tend to be longer, but result in fewer fatalities. Depending upon whether the outcome variable is duration or fatality level, we find disparate effects. In contrast, the influence of leader tenure is consistent across the two outcome measures. This provides a further justification for our focus on both duration and fatality level. Consistent with our theory, the influence of tenure is consistent across the two outcome measures.

### 3.3 Robustness

While the results presented above provide evidence in favor of our hypothesis, it is still important to consider how sensitive these results are to alternative specifications of the model. In this section, we describe the findings obtained from various robustness checks.

In the results reported in Table 1, we control for the issue under dispute in each observation
3.3 Robustness

using dummy variables. However, this scheme only allows us to determine how these issue areas compare to the base category, as described in the data section. One concern arising from this is that the relationship between leader tenure and conflict duration might only be relevant to some types of conflicts. Accordingly, we dig deeper into how the issue under dispute influences the relationship between leader tenure and conflict duration by subsetting the data by issue, then running separate regressions with all other controls included. We find that in each of these regressions, our findings from Table 1 remain unchanged both substantively and statistically.

Weisiger (2013) argues that particularly chaotic leader turnovers lead to a shifting power commitment problem (Fearon, 1995; Powell, 2006) in which rivals fight wars to capture bargaining goods before the new leader can reestablish their military posture. Because these commitment problems are not easily solved short of complete military defeat of one side, this mechanism would generate the same empirical implication. We thus ran two series of subsetted models to differentiate the mechanism. First, the commitment problem suggests that such wars must start particularly early in a leader’s tenure to forestall the power shift. We thus ran models subsetting out leaders with up to 90, up to 180, and up to 365 days in office. Consistent with the informational story, longer tenures are associated with shorter fights. Second, because democratic turnovers ought to have comparatively smooth bureaucratic transitions, we looked at conflicts where the new leader’s country has a Polity score of at least 1, 6, and 8. Again, in each of these subsetted models, the informational mechanism held up.

Another potential concern is that outliers in the data, involving leaders of autocratic states who are involved in very short, low-level conflicts might be driving the results. To account for this possibility, we discard all observations for which either the duration of the conflict or our measurement of leader tenure is an outlier.\textsuperscript{11} When we remove these observations, the results remain unchanged.

Uzonyi and Wells (2015) find that the effect of leader tenure on civil wars depends on constraining institutions of the executive. In particular, they theorize that constrained leaders can overcome commitment problems that plague civil wars (Walter (1997)), allowing the informational mechanism to work. Because these domestic commitment issues do not affect interstate conflicts, we would not expect a conditional effect here. To test this, we interacted tenure with the W score of that state (Bueno De Mesquita et al. (2005)).\textsuperscript{12} Both duration and fatalities models fail to reject the null hypothesis. Even though our paper is on interstate

\textsuperscript{11}Here, we deem any observation that lies more than three times the distance spanned by the interquartile range above the 75th percentile as an outlier.

\textsuperscript{12}W is a five-point scale coded from Polity that increases when the state has a non-military regime, competitive and open executive recruitment, competitive political participation, and competitive party systems.
wars, these results increase our confidence in Uzonyi and Wells’ mechanism regarding civil wars, as their theory would predict the null findings here.

Finally, in studying sanctions, Spaniel and Smith (2015) find an interaction effect between tenure and democracy. We tested this by interacting our a leader’s tenure with the polity score of his or her state and found null results. However, this is not surprising given the differences between the cases. Whereas sanctions often target specific leaders and their supporters, states cannot target regimes in this manner as easily during wars. As such, uncertainty about a winning coalition’s tolerance to bear costs—which Spaniel and Smith argue is critical to explain sanctions—does not apply as strongly here. Indeed, for many wars, individuals outside the coalition suffer the costs of fighting while those inside enjoy the benefits of victory (Bueno De Mesquita et al., 2005; Goemans, 2000).

4 Discussion and Conclusion

Our main contribution connects leader tenure to the duration of interstate crises. If a state is relatively certain of an opponent’s resolve, we formally showed that the duration of a crisis should be short; the proposer ought to make conservative demands or will rarely be wrong when it chooses an aggressive amount. The paper then investigated whether this connection held broadly. Sure enough, we estimated that going from a newly entered leader to a leader with four years of tenure leads to a 25.3% decrease in the chances that a conflict sustains past one month.

Additionally, we drew upon our theoretical expectations about duration to derive an additional empirical implication; as uncertainty vanishes, so too should the number of casualties resulting from conflict. Our use of leader tenure as a proxy for uncertainty again allowed us to evaluate this finding. We find broad support for this expectation, noting that a shift from one to four years in office can result in a substantial reduction in the expected number of fatalities.

These results help discriminate among the many theories of leader tenure. Multiple mechanisms explain why states are more likely to enter conflict earlier in a leader’s tenure. The information hypothesis predicts that uncertainty will linger through fighting, causing wars to last longer and be more deadly for newer leaders. This matches the empirical results. In contrast, the other mechanisms are ambiguous about duration expectations or imply the opposite result. All told, this gives us further confidence that leader tenure is an effective proxy for uncertainty as other scholars have used it.

We conclude with several implications of our results. First, longer tenured leaders provide positive externalities to other states; because it is easier to understand their motivations, rivals
can more easily make the correct demands and avoid war. In contrast, long-term leaders may find themselves in a tougher situation. With more publicly known about them, their ability to bluff diminishes. In turn, they lose their ability to secure concessions exceeding what they would expect to win through conflict.

Next, from a policy perspective, our results indicate that states ought to be especially careful when negotiating with newer leaders. Greater uncertainty implies that proposing states will have to spend more time sorting through their opposition. Given that war is costly, they may wish to instead buy off their opposition immediately or decrease their demands to accelerate the negotiation process. This implication is especially important in light of our findings on fatalities. By ignoring the informational consequences of leader tenure, policymakers risk not only engaging in wasteful and lengthy diplomatic disputes, but also in the loss of human life.

5 Appendix

5.1 Proof of Propositions 1

Consider the game in its two stages. Let \( s \) be state A’s posterior belief at the beginning of stage 2 that B is the unresolved type. Further, let \( s^* = \frac{c_A + c_B r}{c_A + c_B r'} \). The following lemma about stage 2 will prove useful throughout:

Lemma 1. In stage 2, state A’s optimal demand strategy is:

\[
    x_2^* = \begin{cases} 
    p_A + \frac{c_B}{r} & \text{if } s \geq s^* \\
    p_A + \frac{c_B}{r'} & \text{if } s \leq s^* 
    \end{cases}
\]

Afterward, the unresolved type accepts iff \( x_2 \leq p_A + \frac{c_B}{r} \) and the resolved type accepts iff \( x \leq p_A + \frac{c_B}{r'} \).

We proceed backward. Consider the accept/reject decision of state 2 in the second stage. This is the terminal node of the game regardless of its decision. Thus, it simply maximizes its payoff regardless of what type of signal a decision sends. If the resolved type rejects, it earns \( 1 - p_A - \frac{c_B}{r} \). Therefore, it is willing to accept any demand such that \( 1 - x \geq 1 - p_A - \frac{c_B}{r} \), or \( x \leq p_A + \frac{c_B}{r} \). Analogously, the unresolved type earns \( 1 - p_A - \frac{c_B}{r'} \) if it rejects. As such, it is willing to accept any demand such that \( 1 - x \geq 1 - p_A - \frac{c_B}{r} \), or \( x \leq p_A + \frac{c_B}{r} \).

\(^{13}\)For convenience, we assume that state 2 accepts when indifferent here. Due to the standard reasons, no other equilibria exist here if we permit rejection in the case of indifference here.
Now consider state A’s decision. State A strictly prefers demanding \( p_A + \frac{c_B}{r} \) if:

\[
s \left( p_A + \frac{c_B}{r} \right) + (1 - s)(p_A - c_A) > p_A + \frac{c_B}{r}
\]

\[
s > \frac{c_A + \frac{c_B}{r}}{c_A + \frac{c_B}{r}}
\]

By analogous argument, state A strictly prefers demanding \( p_A + \frac{c_B}{r} \) if \( s < \frac{c_A + \frac{c_B}{r}}{c_A + \frac{c_B}{r}} \) and is indifferent between the two when \( s = \frac{c_A + \frac{c_B}{r}}{c_A + \frac{c_B}{r}} \). This proves Lemma 1.

Next, consider stage 1. Note that regardless of the posterior, the resolved type earns a payoff of \( 1 - p_A - \frac{c_B}{r} \) in the second stage.\(^1\) Further, the resolved type will only reach that second stage with probability \( 1 - p_A \) if it fights, which also costs the resolved type \( \frac{c_B}{r} \).\(^1\) All told, the resolved type accepts \( x_1 \) if:

\[
1 - x_1 \geq (1 - p_A) \left( 1 - p_A - \frac{c_B}{r^1} \right) - \frac{c_B}{r^1}
\]

\[
x_1 \leq \bar{x} \equiv 2p_A - p_A^2 - \frac{p_A c_B}{r^1} + \frac{2c_B}{r^1}
\]

By analogous argument, the resolved type rejects if \( x_1 < 2p_A - p_A^2 - p_A \frac{c_B}{r^1} + 2\frac{c_B}{r^1} \).

Meanwhile, if the unresolved type rejects \( x_1 \), the best it can possibly hope for in the second stage is that state A demands \( p_A + \frac{c_B}{r} \), leaving the unresolved type with \( 1 - p_A - \frac{c_B}{r} \). After factoring in the probability of losing a battle and the cost to fight, the resolved type therefore accepts:

\[
1 - x_1 \geq (1 - p_A) \left( 1 - p_A - \frac{c_B}{r^1} \right) - \frac{c_B}{r}
\]

\[
x_1 \leq \bar{x} \equiv 2p_A - p_A^2 - \frac{p_A c_B}{r^1} + \frac{CB}{r^1} + \frac{c_B}{r}
\]

There are two cases. First, suppose \( q < s^* \). In words, this condition implies that state A will offer the larger amount in stage 2 if any or all of the unresolved types reject an offer. Consequently, the unresolved type accepts here if \( x_1 \leq \bar{x} \) and rejects if \( x_1 > \bar{x} \). Under these conditions, only two demands could possibly be optimal: \( \bar{x} \) and \( \bar{x} \). All others either make an unnecessary bargaining concession or result in unproductive war against all types. Demanding \( \bar{x} \) induces immediate acceptance from both types. Demanding \( \bar{x} \) means the unresolved type accepts immediately while the resolved type rejects initially. State A pays the battle cost and

\(^1\)This is either because state A makes an offer of that size or the resolved type rejects an insufficient offer and initiates a war instead.

\(^2\)With probability \( p_A \), it loses the battle and receives none of the good.
wins the whole prize if it emerges victorious from the battle. If it loses, the parties settle according to Lemma 1 in the second stage. Therefore, state A demands $x$ if:

$$x > q(\bar{x}) + (1-q)[p_A(1-p_A)(p_A + \frac{c_B}{r}) - c_A]$$

$$q < \frac{c_A + \frac{c_B}{r}}{c_A + \frac{c_B}{r}}$$

This holds. Thus, if the probability state B is unresolved is low, state A makes the conservative demand guaranteed to be accepted.

Second, suppose $q > s^*$. Now if the unresolved type pools on rejecting with the resolved type, state A’s posterior is greater than $s^*$ and thus it demands $p_A + \frac{c_B}{r}$. In turn, the weak type ultimately receives its absolute war payoff of $1 - 2p_A + p_A^3 + \frac{p_A c_B}{r} + 2c_B$. Thus, because the unresolved type’s best response remains the same in all other cases, it now cannot reject as a pure strategy if state A demands an amount between $\bar{x}_1$ and $2p_A - p_A^3 - \frac{p_A c_B}{r} + 2c_B$. It also cannot accept as a pure strategy. If it did, state A’s posterior belief in the second stage would be that it is facing the resolved type with probability 1. As such, state A would demand $p_A + \frac{c_B}{r}$ in the second stage, which in turn means that the unresolved type could profitably deviate to rejecting in the first stage.

Since this subgame has an equilibrium, the unresolved type must semi-separate in response to such an offer. Rather than solve for the equilibrium of this subgame fully, we instead show that it any demand in that range cannot be optimal for state A. To see this, note that the indifference conditions for the unresolved type mean that state A must mix between demanding $p_A + \frac{c_B}{r}$ and $p_A + \frac{c_B}{r}$ in the second stage. Lemma 1 states that this is only possible if $s = s^*$. Let $\sigma_R$ represent the unresolved type’s probability of rejecting a demand between $\bar{x}_1$ and $2p_A - p_A^3 - p_A \frac{c_B}{r} + 2c_B$. Then state A’s posterior belief equals $s^*$ if:

$$\frac{q\sigma_R(1-p_A)}{q\sigma_R(1-p_A) + (1-q)(1-p_A)} = \frac{c_A + \frac{c_B}{r}}{c_A + \frac{c_B}{r}}$$

$$\sigma_s^* = \frac{(1-q)(c_A + \frac{c_B}{r})}{q(\frac{c_B}{r} - \frac{c_B}{r})}$$

Consequently, if state A makes such an offer, the expected probability of acceptance equals $q(1-\sigma_s^*)$. State A keeps $x_1$ in this case. With the remaining probability, state A pays the cost of a battle $c_A$, captures the good with probability $p_A$, and advances to the second stage with probability $1 - p_A$, where it is indifferent between its two demands. Noting that demanding $p_A + \frac{c_B}{r}$ guarantees state A that exact value, we can write state A’s payoff as:
\[ q(1 - \sigma^*_s) x_1 + [1 - q(1 - \sigma^*_s)][p_A + (1 - p_A) \left( p_A + \frac{c_B}{r'} \right) - c_A] \]

Note that \( \sigma^*_s \) is not a function of \( x_1 \). As such, state A’s payoff is strictly increasing in \( x_1 \). Thus, if making a demand in this range is optimal, state A must demand \( 2p_A - p_A^2 - \frac{p_A c_B}{r'} + 2c_B \). State A’s best alternative is to demand \( \bar{x} \), have the unresolved type accept with certainty, and demand \( x_2 = p_A + \frac{c_B}{r'} \) if the resolved type survives into the second period. Demanding \( 2p_A - p_A^2 - \frac{p_A c_B}{r'} + 2c_B \) is preferable if:

\[ q(1 - \sigma^*_s)(2p_A - p_A^2 - \frac{p_A c_B}{r'} + 2c_B) + [1 - q(1 - \sigma^*_s)][p_A + (1 - p_A) \left( p_A + \frac{c_B}{r'} \right) - c_A] > q(\bar{x}) + (1 - q)[p_A + (1 - p_A) \left( p_A + \frac{c_B}{r'} \right) - c_A] \]

Substantial algebraic manipulation yields:

\[ q > \frac{(c_A + \frac{c_B}{r'}) (c_A + \frac{2c_B}{r'} - \frac{c_B}{r'})}{(c_A + \frac{c_B}{r'})^2} \]

Therefore, state A demands \( \bar{x} \) if \( q \in \left( \frac{c_A + \frac{c_B}{r'}}{c_A + \frac{c_B}{r'}}, \frac{(c_A + \frac{c_B}{r'}) (c_A + \frac{2c_B}{r'} - \frac{c_B}{r'})}{(c_A + \frac{c_B}{r'})^2} \right) \). The resolved type rejects and the unresolved type accepts. If \( q > \frac{(c_A + \frac{c_B}{r'}) (c_A + \frac{2c_B}{r'} - \frac{c_B}{r'})}{(c_A + \frac{c_B}{r'})^2} \), state A demands \( 2p_A - p_A^2 - \frac{p_A c_B}{r'} + 2c_B \). The resolved type rejects and the unresolved type semi-separates as described above. \( \square \)

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