Domestic Politics of Asymmetric Wars

by

Ali Sanaei

A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
(Political Science)
in The University of Michigan
2015

Doctoral Committee:

      Professor James D. Morrow, Chair
      Professor Donald R. Kinder
      Professor Arthur Lupia
      Professor Walter R. Mebane, Jr.

In the name of God, the Beneficent, the Merciful.

To my cousins,

Shaheed Alireza Sanaei,
Shaheed Hassan Sanaei,
Shaheed Saeed Sherafat, and
Shaheed Mohsen Tavakkoli.

ACKNOWLEDGEMENTS

In completing this work, I have accumulated more debts than I can ever acknowledge. I would like to sincerely thank all the people who made this dissertation possible.

I would like to thank my committee members, Professors James Morrow, Donald Kinder, Arthur Lupia, and Walter Mebane. I have benefited enormously from their advice. In particular, I wish to offer my thanks to Jim, who helped me figure out what I wanted to do, and then helped me move my research forward from two thousand miles away. I would also like to thank Professor Robert Powell who helped me feel at home at Berkeley and provided much-needed feedback at various points in this project. This dissertation would not exist without the help of Jim and Bob. I wish to thank Professor Allan Stam for helping shape my research agenda. I am grateful to Professor Rocío Titiunik for offering the best advice on research design.

I am grateful to the staff of the Departments of Political Science at the University of Michigan for their kind and untiring support.

I thank my fellow graduate students at Michigan. They have been of tremendous help. I have also benefited from interactions and exchanges with various audiences who have given me feedback after listening to presentations of various parts of this work. In particular, I would like to thank the faculty and students who participated in EITM 2014 at Duke University and faculty and students at Berkeley.

I wish to offer my heartfelt thanks to my family, especially to my parents, who managed to help and inspire me from eleven and a half time zones away, and to my wife, who has marks on every corner of this dissertation and has supported and encouraged my research more than I could ask for.

TABLE OF CONTENTS

LIST OF FIGURES

Figure

LIST OF TABLES

CHAPTER I

Introduction

Most of the military engagements of the developed countries since the end of the
Cold War have been asymmetric wars.[1] Table 1.1 provides a list of the military
engagements by the United States since the end of the Cold War. These conflicts
are characterized by a considerable imbalance of power between the two sides, such
that if the strong side were committed to the war effort, they would have virtually
assured victory. The issues that are at stake in these wars are often not issues of
great national interest to the strong side. If these wars are not won by the strong
side, they usually end because of a withdrawal rather than a military defeat. Since
core national interests of the strong side are not at stake in asymmetric wars, whether
to fight these wars or not, how to fight them, and when to withdraw, are more subject
to domestic politics than in other types of war.

Political calculations about what the electorate is going to think at difference
stages and different contingencies is an essential part of planning for asymmetric
wars. As a prominent recent example, it is instructive to see how the planning for
the 2003 invasion of Iraq seems to have been more influenced by political calculations
(and miscalculations) than by objective military assessments. Testifying before the
Senate Armed Services Committee on February 25, 2003, General Shinseki—Chief
of Staff of the US Army at the time—estimated that "something on the order of
several hundred thousand soldiers" would be required; in the first phase of the war,

---

1. The concept of asymmetric war is defined in Chapter II.

Table 1.1: List of US military engagements since 1990.

Conflict	Years
Persian Gulf War	1990-1991
Somalia: Operation Restore Hope	1992-1994
Bosnian War	1993-1995
Haiti: Operation Uphold Democracy	1994-1995
Kosovo War	1998-1999
War in Afghanistan	2001-2014?
Iraq War	2003-2011
Intervention in Libya	2011-2011
Intervention in Iraq	2014-?

the United States sent 148,000 troops (Shanker, 2007, January 12). Similarly, the United States Central Command (USCENTCOM) had a rough estimate that the engagement would last for ten years, while the war was being "predicted" to be short (Gordon and Trainor 2006, page 30). It is difficult to know for certain why the Bush administration decided to go to war the way it did, but a plausible candidate is that they thought they could outperform the gloomy predictions that prescribed restraint in the use of force.[2] Berger and Borer (2007) write "the Pentagon, in their view, seemed to be more concerned with persuading the US electorate that invading Iraq would not lead to a Vietnam-style quagmire than it was with the vagaries of post-war nation building."

Despite the scholarly interest in the study of asymmetric wars, we lack clear understanding potential limitations imposed by domestic politics on the way asymmetric wars are fought. These limitations have led some scholars to posit that democracies underperform in asymmetric wars, but the causal mechanisms behind this underperformance are quite opaque and this prohibits us from answering important questions.

---

2. The Powell Doctrine is a notable example of recommendations for restraint in the use of force. It asserts, inter alia, that the United States should only use military force when it must, and if forces are to be used, overwhelming force should be used. This doctrine, articulated by General Collin Powell in the lead-up to the Persian Gulf War in 1990, was informed by the history American military involvements after WWII.

When does the strong side withdraw from the war? Why does public opinion shift the way it does, starting up, going down, and stagnating? And why strong states do not do more to guarantee their victory?

These questions affect how wars are fought and wrong answers can lead to disastrous outcomes as alluded to in the case of the Iraq war. The lack of causal mechanisms and the contradictions in the observed correlations have led to obstinate conventional wisdoms—like the idea that public opinion is driven by aggregate casualties. Similarly, attributing the unfavorable outcomes of past wars to minor tactical or even strategic mistakes that can be rectified in the next war, instead of understanding the inescapable forces that have to be taken into account when powerful states go to war for marginal reasons, sets the stage for the next war.[3]

This dissertation is a three part project that examines the link between domestic politics and asymmetric wars from two different angles: how long the strong side continues fighting and how war is supplied. The goal is to study the limitations that domestic politics may impose on the capabilities of democratic states for fighting asymmetric wars. The theories developed here are rooted in the preferences of individual citizens, but provide predictions at the macro level as well.

Chapter II: Rationally Impatient Citizens

Formal models of conflict have provided much insight about conventional wars. But the existing studies are not very helpful in understanding the dynamics of asymmetric wars because they either focus on two-player games, modeling the two adversaries as unitary actors or they model war as a game-ending move. Both of these assumptions are problematic in asymmetric wars. The first assumption is problematic because these wars are subject to the vagaries of domestic politics—much more so than conventional wars—and assuming the two sides to be unitary actors may

---

3. In both Britain and the United States, it was public opinion that prevented a military attack on Syria in the summer of 2013 after the Syrian government was accused of using chemical weapons.

severely limit our understanding of when wars are fought; the second assumption is problematic because these wars often turn into protracted wars, and a one-shot model of war does not provide any insight about how the wars end. In this study, I build a modified war of attrition model that relaxes both of these assumptions.

The model that I present has three players (the weak side, the leader of the strong side, and the citizenry of the strong side); and the war is a process, not a game-ending move. The model allows us to study how citizens learn about the war and to examine the dynamics of their aggregate opinion from a rationalist perspective. An extension of the model adds a multitude of citizens in order to study the changes of aggregate public opinion.

This model provides a number of behavioral and institutional predictions. The more important results are the following. As time elapses, citizens learn about the expected remaining duration of the war, which produces a downward trend in public support for the war. Duration is found to have a causal effect on citizens' opinions: citizens are rationally impatient about asymmetric wars. Interestingly, there are citizens whose opinion will never change. Finally, compared to autocracies, democracies are expected to fight shorter asymmetric wars.

Chapter III: Keep Fighting or Quit

This part is a collection of empirical studies designed to test the hypotheses drawn from my formal model in Chapter II. I use an existing data set of counter-insurgency wars to test the institutional hypotheses. I show that more democratic states fight shorter counter-insurgency wars, when the war happens outside their territory. When counter-insurgency wars are against domestic insurgents, however, there is no observed difference between democratic and non-democratic countries in terms of how long they continue their fight.

For behavioral hypotheses, individual level data are used, which are from survey

experiments that I have administered. I show that even when we keep the total casualties constant, an increase in the duration of war can lead to lower levels of support for war. This is in line with my theoretical prediction and in direct contrast to what theories based on aggregate casualties predict (which is no effect for duration) or theories based on the intensity of casualties predict (which is a positive effect for duration).

Chapter IV: A Two-Tax Model of War Supply

Part of the debate about whether democracies are disadvantaged in fighting asymmetric wars is the puzzle of why strong militaries perform poorly in asymmetric wars. Some scholars have argued that modern armies are disadvantaged in fighting asymmetric wars because they are heavily mechanized and are designed to fight conventional wars. Various explanations are put forward in the literature for why modern armies fail to choose the best strategies in fighting small wars, but these explanations often involve assumptions that require the state to be unable to learn from past mistakes.

I use a standard bargaining model of war with the novel feature that war supply is endogenous and two-dimensional. That is, two elements go into making an army: capital and labor. Both elements are collected as taxes on the population: capital is supplied by income taxes; manpower is supplied by a draft. A modified Cobb-Douglas production function translates these elements into military power, which determines the likelihood of victory for each side. I assume that the society has two strata: the elite, who have higher incomes and can avoid being drafted, but are nevertheless sensitive to casualties; and the masses. I study how, in equilibrium, the masses (in democracies) or the elite (in autocracies) decide how to allocate resources for war.

This model leads to a number of important comparative static predictions. In asymmetric wars, it is predicted that democracies always allocate more capital and

fewer soldiers than autocracies. As the adversary becomes more likely to rely on guerrilla warfare, both democracies and autocracies are weakened, but the effect is larger for democracies. This contributes to the debate in the literature by showing that democracies are not necessarily worse than their autocratic counterparts in an absolute sense. All types of modern states perform worse when they fight guerrilla wars, but democracies underperform more more strongly (compared to when they fight conventional wars). This underperformance is affected by the income gap between the two strata of the society. Higher gaps lead to more capital-intensive militaries in democracies, but lead to less capital-intensive militaries in autocracies. This means that as the income gap grows, the underperformance is worsened in democracies but improved in autocracies.

I also study the bargaining phase of the model to see, on the one hand, the difference between democracies and autocracies, and, on the other hand, the difference between the position of the elite and the masses as various parameters of the model change. In democracies, the masses may be more or less hawkish than the elite, but in autocracies, the masses are almost always more generous and less risk-taking than the elite.

CHAPTER II

Rationally Impatient Citizens

2.1 Introduction

Most of the military engagements of the United States and other developed countries since the end of the Cold War have been asymmetric wars. These wars are characterized by a stark imbalance of power between the two sides and by the fact that the issues at stake are not issues of highest national priority to the strong side. In asymmetric wars, military superiority does not automatically translate into victory as strong states have frequently failed to win these wars.[1] Public opinion is usually in support of these wars but the support diminishes over time. How long can the strong keep fighting these wars? Despite the enormous importance of the asymmetric wars, the existing literature does not provide clear causal mechanisms that would allow us to answer questions like how long a strong state can keep fighting these wars before they have to stop. This chapter is a first attempt in modeling domestic politics of asymmetric wars from a rationalist perspective. The model provides a number of testable hypotheses about the difference between democratic and nondemocratic states, as well as on public opinion dynamics during asymmetric wars.

While there is a general agreement among scholars about the declining public

---

1. This is a common observation that has been attributed to a variety of reasons including inefficient military strategies, norms that limit the behavior of armed forces of democratic states, and domestic politics in democratic states. See Mack (1975), Arreguin-Toft (2001), and Merom (2003).

support for asymmetric wars, we do not have a good understanding of the underlying causal mechanisms of wartime public opinion dynamics (Gartner 2008). Scholars of public opinion have considered four broad categories of factors that affect citizens' opinion about war: primary objectives of wars (Jentleson and Britton 1998); individual predispositions (Federico, Golec, and Dial 2005); elite cues (Berinsky 2009); and direct observation of costs by citizens (Mueller 1973). The first two categories, respectively, explain differences between support for different wars, and different levels of support among citizens with regard to a single war. The latter two categories, elite cue and cost-based argument, are used to explain dynamics of public opinion as a war progresses.

Despite the extent of public opinion research over the past decades, two major problems have yet to be addressed and formalization is one way to address both of these problems. First, there are many competing explanations for why public opinion declines and the empirical literature has not been able to adjudicate among them. Formal models may help us better understand the core causal mechanisms underlying these explanations. Second, there are two strategic components to the story: strategic interaction on the domestic scene between politicians and citizens, as well as on the international scene between adversaries. Each of these strategic components creates situations where players might have incentives to misrepresent their intentions, but, despite assumptions of "rationality" or "somewhat rationality" of the citizenry, neither of these strategic elements play a role in the received theories. In reality, there are strong indications that some strategic calculations enter—or perhaps, trickle down to—the public discourse about war. A prominent example is the discourse in American politics about setting a timetable for the Iraq war, where those supporting the continuation of the war argued that setting a deadline would be tantamount to accepting defeat.[2] If the public can distinguish a fight against a rational adversary from

---

2. Throughout the paper, the Iraq war refers to the American military involvement in Iraq from 2003 to 2011. As an example of the debates about setting a timetable in Iraq, see The Washington

a struggle against nature, not accounting for this distinction in our theories can result in what Tsebelis has called the Robinson Crusoe fallacy (Tsebelis 1989).

The existing formal models of conflict have provided much insight into the causes of initiation and continuation of interstate and civil wars. Most of the intellectual effort, however, has been in modeling classical warfare, which is often studied as a war between two unitary actors who may resort to war as a game-ending move (Powell 2002). With the exception of specific topics like audience cost theory that rely on some specification of domestic politics, the citizenry is completely absent in models of conflict (A. Smith 1998; Schultz 1998). Similarly, most models do not study the dynamics of war, although prominent exceptions are Fearon's study of crisis escalation, and works that consider war as a process rather than a terminal move.[3] Because there is either no citizenry or no war process, the fundamental question of how a rational citizenry would act in war cannot be answered using the existing models. Likewise, given the pronounced effect of domestic politics in asymmetric wars, it is not clear how much of the results of these models hold in asymmetric wars.

I start with a canonical model of war and let the periods of fighting shrink. The model becomes similar to models of war of attrition in continuous time but is different from the classical war of attrition in a few critical ways (Maynard Smith 1974). Most importantly, the war can end in two ways: the usual way, when one side concedes to the other side; or as the result of an exogenous event, which may happen at any time and end the conflict in a stochastically determined outcome. In addition, on the strong side, the public is explicitly present in the model as a player, so there are three players.

In this model, the strong side's costs are assumed to be public knowledge, but the weak's costs are not. One of the results is that this asymmetry of information

Post, 12 April 2007, A1.

3. See Fearon (1994) for a prominent adaptation of the war of attrition model; for works that study war as a process rather than a single stage see Wagner (2000), Smith and Stam (2003), and Powell (2004, 2013).

acts like a lever: a non-zero chance that the weak side is a hothead is enough to force the strong side to effectively have a deadline. If the war is not decided on the battleground, the strong side quits when that deadline is reached. I show that under a broad set of assumptions and so long as the value of victory for the strong side is lower than a threshold, public support for war will decline over time as the public learns about the expected duration of the war. Notably, this pattern is what we can expect even from a purely informational point of view. It is what we will see even with a fixed rate of casualties—regardless of whether or not citizens know fallen soldiers, how they look at the justification for war, and even the role played by the elite as conveyors of information. This is not to say that various mechanisms identified in the literature are not important, or that all citizens are in reality rational actors. But it does suggest that the main pattern observed in the empirical literature is more inevitable than appreciated.

Leaders often lack mechanisms to credibly convey foreign policy information to their citizens. Public opinion regarding 'wars of choice' is at risk of both type I and type II errors: at the outset, the public may support wars it should not support (i.e., it would not support if it had perfect information), and if the war is not won within some period, the public may withdraw support from wars that it should support (i.e., it would support if it had perfect information). The extent of available information changes the length of time that the public supports a war, but if the stakes are low enough, the preponderance of time will eventually trump any prior information and force the public to stop supporting the war.

Holding everything constant, it is predicted that as time goes by, people's expectation of the remaining duration of war goes up and public opinion becomes less and less supportive of war until it reaches a plateau. Also, states with more checks on their leaders are generally expected to quit their wars faster than others.

This chapter is organized as follows: a brief review of some of the most relevant

quantitative works in the literature; presentation of the primary model and the basic machinery needed to analyze it; a study of the equilibrium outcomes of the model; discussion of comparative statics and other results obtained from the models; and conclusions.

2.2   Public Opinion and Costs of War

Research on public opinion support for war can be divided into two by and large complementary branches: one is mostly concerned with citizens' limits and how the elite influence the public, while the other is mostly concerned with how events influence public opinion. The former has its roots in the work of Walter Lippmann, "The American Voter," and other influential mid-century works in American politics, whereas the latter has a pedigree in the work of scholars of international relations, most notably John Mueller (Lippmann 1922; Campbell et al. 1960; Mueller 1973). Notwithstanding the depth and breadth of work in each branch, the micro foundations of both branches remain opaque. Here, I will briefly review some of the main results and highlight outstanding questions that have motivated my research.

Perhaps the strongest finding in public opinion about war is the extent to which people's support for war correlates with their partisanship (also interacting with where they are located on the pyramid of ideological sophistication) and the extent to which public opinion appears to be influenced by elite discourse (Zaller 1994; Berinsky 2009). But, since we know office seeking politicians are themselves influenced by the "latent opinion" of their constituency, elite-based observations are not enough to conclude that the causal arrow of opinion shift is from the elite toward citizens. Alternatively, why do the elite sometimes support war and sometimes not? Recent research on the decisions of members of the House of Representatives shows that the number of casualties in representatives' home districts influence their speeches and their roll-call votes (Kriner and Shen 2014).

In his pioneering work, Mueller put forth the idea that public support for war wanes as the accumulated level of casualties rises.[4] Mueller, however, provided this as one of his empirical observations and did not say "why or how this happens or what the consequences are" (Jennings 1974). Whereas his empirical observations have proved robust, there has been some disagreement about how it should be interpreted. Debates have centered on whether or not the public has a knee-jerk reaction to specific levels of casualties, how sensitive people are to casualties, and whether the American public is "cost-phobic" or "casualty-phobic." (H. Smith 2005).

Recent works generally accept that citizens do not automatically respond to some thresholds of accepted levels of cost, but, rather, do cost-benefit analysis, and their opinion depends on the primary policy objective of war.[5] Gelpi, Feaver, and Reifler (2006) have argued that citizens' sensitivity is governed by the interaction of two factors: how justified they think the war effort is, and their perception of the likelihood of victory. It has also been shown that local casualties, shocks in casualty rates, and trends of casualties also affect public opinion (Gartner, Segura, and Wilkening 1997; Gartner and Segura 1998; Gartner 2008).

The causal chain that connects costs to expressions of beliefs still remains unclear and subject of academic debates (Berinsky and Druckman 2007; Gelpi and Reifler 2008). Moreover, even the most widely accepted elements of the common wisdom have been challenged: while the recent war in Iraq was happening, Berinsky found that correcting citizens' beliefs about the number of American casualties did not change their support for the war (Berinsky 2007). Nevertheless, casualties are still considered the most important source of information. For example, in reviewing Gelpi et al.'s work, Gartner (2010) writes that it "remains unclear how the American public

---

4. Studying the Korean and the Vietnam wars, Mueller found that public support diminished by 15% for every 10-fold increase in total casualties.

5. Jentleson (1992) and Jentleson and Britton (1998) make the case that public support for war depends on primary policy objectives of the war. For studies on how the American public performs cost-benefit analysis in various wars see Larson and Savych (2005).

updates their views on success independent from casualties. Given well-known limits on the public's foreign policy knowledge, what stream of wartime information (other than casualties) generates changes in peoples' perceptions of the probability of success sufficient to explain observed variations in public opinion?" In the following section, I will argue that observed duration of a conflict is such a signal, observed at low cost and available to the public without much possibility of manipulation by the elite.

2.3 A War of Attrition with Exogenous Termination

The war of attrition model is an appealing candidate for modeling the dynamics of asymmetric wars. In terms of the strategy, these wars do not resemble classical warfare and in terms of stakes, these are wars about issues that are existential to the weak side and of marginal importance to the strong side. The critical link between these wars and the war of attrition is that the winner is the one who outlasts the other. But as Agastya and McAfee (2006) have argued, there are a number of mismatches between empirical observations about wars and the theoretical results of wars of attrition. Most relevant to this work is the problem of immediate cessation of hostilities which the typical solution from the classical war of attrition models, which cannot explain why, in asymmetric wars, the weaker side keeps fighting.

Here, I use a canonical model of war in the conflict literature. Two sides are engaged in a multi-period war. In each period, they fight if both sides decide to fight. Each period of war can be decisive or not. If decisive, the war ends with a stochastically determined outcome. If not, it is again up to the adversaries whether they wish to continue the fight or to quit. Figure 2.1 shows one period of this war. Each period of fighting takes Δt units of time. Throughout the paper, I will assume that Δt is infinitesimally small, so we are using continuous time—similar to the war of attrition model. Also similar to other models of war of attrition, issue indivisibility is the reason for the possibility of war between rational actors (Fearon 1995). Unlike

other model of war of attrition, war is not just a staring contest here; actual fighting is assumed between the two sides.

I will assume that the benefits of war and the likelihood of victory for each side are public knowledge and fixed so that we can focus on how players learn about costs. It is not clear how one should model costs. If the stage-game in Figure 2.1 is repeated until one side wins—that is, no one drops out—the expected cost is $\mathrm{E}[\mathrm{cost}] = \frac{c}{1-\rho}$ which shows that the cost depends on both ρ (the chance that a period of war does not end in victory for one side) and c (the per period cost of fighting). Based on this, I will first dissect cost into two elements, namely, intensity (per period costs) and duration, and show that if we assume that these are both fixed, learning about expected duration is much more difficult than learning about expected intensity. Then I will present the modified war of attrition model that is informed by this insight.

Duration and Intensity

We want to study the difference between learning about the rate of accumulation of casualties and learning about the expected duration of conflict. I ask two questions. First, what is the difference between the speed of learning about the intensity of accumulation of costs and the speed of learning about the duration of a process? Second, ex ante, what is the difference between the amount of information that is expected to be learnt throughout a process when the unknown factor is the intensity of accumulation of costs and when the unknown factor is the expected duration of the process.

We assume a war between two adversaries and focus on the available information from the point of view of one of the adversaries. Assume that the war starts at time $t = 0$ and the event of the end of war is exponentially distributed with rate λ. Furthermore, assume that casualties are also generated by a homogeneous Poisson

14
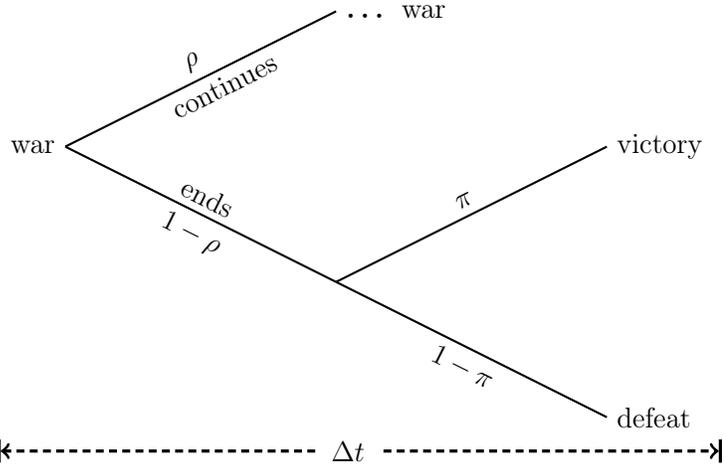
Figure 2.1: One period of fighting from the perspective of one of the players.

process with a rate of μ so the mean of total casualties at time t is μt.[6]

To compare how one learns about duration (λ) and intensity (μ) let us consider two scenarios: In the first scenario, everything is known except μ, which can either be μ_1 or $\mu_2 = \alpha\mu_1$. In the second scenario, everything is known except λ which can either be λ_1 or $\lambda_2 = \alpha\lambda_1$. For simplicity, assume that both events are equally likely (under both scenarios), so that initially there is exactly 1 bit of ambiguity ($h = -\log_2 \frac{1}{2} = 1$).

Using Bayes' rule, posterior probabilities are derived in Appendix II.A. A numerical example is sufficient here to demonstrate the difference between the two scenarios. Assume the unit of time is month and $\alpha = 3$, $\mu_1 = 5$ (average casualty per month in the low-cost war), and $\lambda_1 = \frac{1}{12}$ (average expected length for the long war is one year). Posterior probabilities under the two scenarios are drawn in Figure 2.2. In this example, after three months, given almost any observed level of casualties, an observer is able to form an accurate opinion about the intensity, whereas learning about duration happens much more slowly.

The above comparison informs us about the learning process as the war progresses. Now let us consider the second question: before a war happens, how informative about

---

6. Note that in models that assume a fixed per period random costs and probability that the war ends in each period, the exponential distribution of duration and the Poisson process for casualties arise naturally as the duration of each period shrinks to zero, i.e., $\Delta t \to 0$.
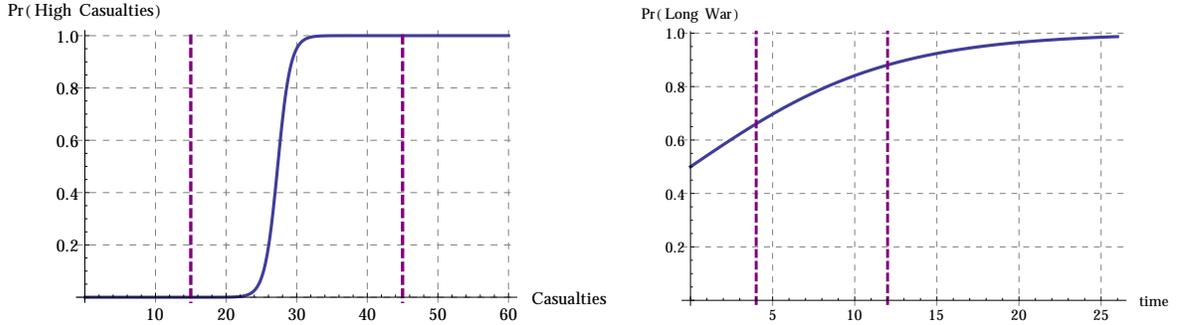
Figure 2.2: Comparing uncertainty about cost and uncertainty about length of war. The expected cost is either 5 or 15 soldiers/month (left) and the expected duration is either 4 or 12 months(right). The left figure is drawn for $t = 3$ months. The dashed vertical lines mark the expected value of the casualties (left) and duration (right).

the unknown parameter is the realization of the war expected to be? Shannon's information measure for each scenario is derived in Appendix II.A (Shannon 1948).

Here, we can again rely on a numerical example to demonstrate the vast difference between the two scenarios. Continuing with the previous example and further assuming $\lambda = \frac{1}{4}$ for the first scenario, we have $I_1 = 0.97975$ bits and $I_2 = 0.47492$ bits. That is to say, in expectation, total casualties will contain almost all of the information about the type of war, whereas the duration of the war (even when the observer waits until a war ends) contains less than half of the information one needs to know the type of the conflict.

There is nothing special about the above numerical example. In the first scenario, casualties provide a constant stream of information about the type of war. This stream is probabilistic, but a very short period of time is enough to allow a very accurate estimate of the unknown random variable. In the second scenario, the only piece of information available at any time is whether the war is still continuing or not. Unless the war continues for a very long time (see Figure 2.2), one cannot infer the type of war with much confidence.

Finally, it is important to note that even a continuous distribution of types of war, as opposed to a high type and a low type as assumed here, essentially yields

the same conclusion. To see this, assume that whatever information one may be able to obtain by observing the war is going to be used to make a judgement about whether the war should be stopped or not. The binary decision forces a partition over the domain of the unknown variable, which makes it comparable to the setting studied here. In other words, when the problem can be reduced to an evaluation of a dichotomous random variable, i.e., whether or not the war is a war worth fighting, the above analysis requires little modification and yields a similar result: learning about expected duration (or its inverse, the hazard rate) is more difficult than learning about intensity. This result, at a minimum, motivates us to pay attention to duration as a possibly important factor in determining how people evaluate whether a war is worth fighting or not.

The setup

Two states are involved in an international crisis: a strong state (A), and a weak state (B). If they go to war and neither side quits, it is common knowledge that A will eventually win with probability π and lose with probability $1 - \pi$, but it is not known how long the war might last. The war can either be a short war, which ends with a constant hazard rate Λ, or a long war, which ends with a constant hazard rate λ. This implies $\Lambda > \lambda$. The model has three players: the leader on side A (L, for leader), the public on side A (M, for the median voter who is representing the public), and a unitary actor on side B (B). The common prior about the war being short is p_0, and p_i is used to distinguish between the beliefs of different players at different times, where $i \in \{B, L, M\}$.

The timing of the events is as follows. At the start, nature decides the hazard rate of the war. Then L and B receive a shared noisy binary signal about whether the war is short (denoted by $\mathcal{S}$) or the war is long (denoted by $\mathcal{L}$). I shall refer to this signal as the international signal and assume that it matches the true state of the

world with probability $1 - \epsilon$, where $\epsilon \in (0, \frac{1}{2})$. M does not observe the international signal.

At $t = -1$, L sends a binary message to M, which I call the domestic signal. This may inform M of the value of the received international signal. Then, starting at $t = 0$, L and B simultaneously decide whether to fight or not. If one side concedes, the prize (with a value of v) goes to the other side.

If the war is initiated, it starts at time $t = 0$ and is fought in continuous time until either one side withdraws from the war conceding the prize to the other side, or when the war comes to a natural conclusion, which results in the winner getting the contested prize. At any time during the war, each of L and B have two actions available to them, which I call 'fight' and 'quit.' For completeness, I assume that if both sides simultaneously withdraw (or neither side play fight at their first chance at $t = 0$), the prize is divided such that both L and B get $v/2$; this assumption does not affect the results.

I assume that M has two actions available during any war: supporting the war or not supporting the war. M's action only changes L's cost of fighting. Differences in domestic institutions only affect how much L's cost depends on M's approval of the war. For uniformity of discussions, M's available actions during war are referred to as 'fight' and 'quit' where fighting means supporting the war and quitting means not supporting the war.

Players have per unit costs of fighting, which are c_L, c_B and c_M for L, B and M respectively. c_B and c_M are assumed to be constant but $c_L(t) = c_\ell + \alpha\, m(t)$, where $m(t) = 0$ if M supports the war and $m(t) = 1$ if M does not support the war. It is assumed that $c_\ell < c_\ell + \alpha < c_M$, so that L's cost of fighting is lower when she has public support for war, but even without public support, her cost is lower than M's cost.

B is assumed to observe the domestic scene in State A. B's own cost, $c_B \in \mathbb{R}^+$,

is private knowledge; L and M only know the cumulative density function F_{c_B}. I assume that F_{c_B} is continuous and differentiable with f_{c_B} being the probability density function of c_B. Finally, I assume that players have a common exponential discount factor $r > 1$.[7]

Some Preliminaries

A strategy profile in this game should assign an action to each player at every history of the game in which that player plays. Given that there is a continuum of information sets, the equilibrium concepts most often used in extended games of imperfect information require some modification. Throughout the paper, I use a refinement of the perfect Bayesian equilibrium concept suitable for the current model. In addition to the two conditions of sequential rationality and consistency of beliefs, it is required that players' strategies during war be such that if a player's strategy is to 'quit' at time $t >= 0$, that player's strategy be to quit at any subsequent time.[8] This refinement is a arguably a less stringent condition than stationarity, which is typically used to limit the set of equilibria in simple timing games (Fudenberg and Tirole 1991). The refinement is discussed in detail in Appendix II.B.

One of the benefits of the refined equilibrium concept is that it allows a pithy description of the strategies: instead of a complete mapping from every $t \geq 0$ to {fight, quit}, we only need to specify the first time each player plays 'quit'—which may be never, denoted by $+\infty$. This means that strategies can be be simply shown as $t_i = \min\{t | i \text{ plays 'quit' at } t\}$.[9]

---

7. Allowing discount factors to be different does not change *any* of the substantive results, at the cost of more complication in the notations, and therefore seems unnecessary unless we want to obtain comparative statics with respect to discount factors.

8. I am following Fearon (1994) in calling this a refinement of the Bayesian equilibrium concept. Equivalently, one might consider this constraint a limit on the set of possible strategies of the game, not a refinement of the equilibrium concept. The results, of course, do not depend on the term used here.

9. Here, min{t} is used with the assumption that the strategy is right-continuous, so that there exists a smallest quitting time in the strategy; we can use the same notation for left-continuous strategies as well, by replacing minimum with infimum and showing a + superscript on the quitting

For B and for M, any possible strategy is completely described by t_M and t_B, which conditioned on their assessment of other parameters, determines when they quit for the first time. For L, we need to specify the domestic signal that L sends at $t = -1$, and also because it is possible for L to fight a war without public support, L's strategy could depend on whether or not there is public support for fighting, and, in principle, on when public support is lost. Notice without public support, L's payoff is independent of the timing of losing public support. I.e., if at time t_2 war is not supported by M, it would not make any difference for L how far in the past M has quit. This implies that if there is a dominant strategy for L, it should not depend on the timing of losing support. I will use letters PS and NPS as subscripts indicate L's strategies with and without public support for war.[10]

We can now discuss how the beliefs are updated. Consider B and L's belief after receiving their signal. If the signal is $\mathcal{S}$, their beliefs about the true length of the war is

$$\underset{i \in \{L,B\}}{p_i} (0|\mathcal{S}) = \frac{p_0(1-\epsilon)}{p_0(1-\epsilon) + (1-p_0)\epsilon} > p_0 \tag{2.1}$$

and similarly if they receive a long signal, $p_i(0|\mathcal{L}) = \frac{p_0\epsilon}{p_0\epsilon + (1-p_0)(1-\epsilon)} < p_0$. So L and B know more about the world than the public knows. At $t = -1$ when L sends her domestic signal to M, M may learn the value of the international signal, in which case her belief about the state of the world is like L's, or M may learn nothing, in which case her belief remains the same as the common prior p_0.

If a war is started, all players obtain additional information about the expected length of the war as time goes by. Using Bayes' rule, when the war reaches any time

time, like $t_B = 5^+$ which means B's strategy is to fight if $t \leq 5$ and to quit otherwise.

10. In theory, L's strategy can depend on when M quits not just whether or not M has quit, but because of payoff equivalence for L, this only leads to a proliferation of pathological strategies with no substantive importance. For example, we could have an equilibrium where if M quits before some time $t < 1$, L must quit at any time $t > 2$, but if M quits at $1 \leq 1 \leq 2$, L should quit at $t \geq 2$: the only difference is what happens at time $t = 2$, because at that point L is indifferent between quitting and fighting for exactly one moment. I eschew such pathologies by assuming that strategies are right-continuous.

t, each player's belief about the likelihood of the rate of the exogenous event being Λ is

$$p_i(t) = \mathrm{P}_i(\text{short war}|\text{war has reached time } t) = \frac{p_i(0)}{p_i(0) + (1 - p_i(0))e^{t(\Lambda-\lambda)}}. \quad (2.2)$$

Notice that (2.2) shows that regardless of the initial belief, players use the same rule to update their beliefs. Moreover, $p_i(t)$ is strictly decreasing in time.

Let t_i^* be the optimal quitting time from player i's perspective if i knew that the other side will never quit. At t_i^*, assuming that the other side is never quitting, i would not prefer continuation of the war to a concession. Since the belief in the war being short is strictly decreasing, it suffices to find the time when i's marginal cost and reward match for the first (and only) time. So we should solve $\pi v\big((p_i(t_i^*)\Lambda + (1 - p_i(t_i^*))\lambda\big) = c_i$, where p_i is obtained from (2.2) and c_i is i's cost After some algebra we obtain $t_i^*(c_i) = \log\left(-\frac{p_i(0)(\pi_i v\Lambda-c_i)}{(1-p_i(0))(\pi_i v\lambda-c_i)}\right)/(\Lambda - \lambda)$ where the time index of c_i is suppressed and π_i is used to mean the probability of victory for player i to obtain a generic notation. Note that $\pi_L = \pi_M = 1 - \pi_B = \pi$. To obtain a range of $[0, +\infty)$ for t^*, the domain should be $(\underline{c}_i, \bar{c}_i]$, where $\underline{c}_i = \pi_i v\lambda$, and $\bar{c}_i(p_i(0)) = \pi_i v(p_i(0)\Lambda + (1 - p_i(0))\lambda)$.

It is helpful to extend the definition of t^* and make it such that it always maps to the $[0, +\infty]$ range regardless of the cost

$$t_i^*(c_i, p) = \begin{cases} 0 & c_i > \bar{c}_i \\ \log\left(-\dfrac{p(\pi_i v\Lambda - c_i)}{(1 - p)(\pi_i v\lambda - c_i)}\right)/(\Lambda - \lambda) & c_i \in (\underline{c}_i, \bar{c}_i] \\ +\infty & c_i < \underline{c}_i \end{cases} \quad (2.3)$$

The optimal time for a player in one side was obtained with the assumption that the other side is never quitting. Now, consider when B knows that L is going to quit at time τ.

OBSERVATION 2.1. *In any equilibrium where L quits at time τ, B cannot quit at any time $t \geq \tau$.*

Given that the war is bound to end at τ regardless of B's action, B cannot find quitting at time τ an optimal decision because it is strictly dominated by not quitting. Furthermore, L's strategy after time τ is always to quit, so even if L deviates at τ, her strategy is to quit at every following history. So in no equilibrium can B's strategy include quitting at τ or any time after that.

Again assume L's strategy is to quit at time τ. When is the latest time that B can quit in an equilibrium?

DEFINITION. Let $\tilde{c}_B(\tau)$ denote the lowest cost that makes B indifferent between never quitting and quitting at some optimal time θ, $0 \leq \theta < \tau$.[11] To make the notation more general, I extend the domain to include $\tau = 0$ and define $\tilde{c}_B(0) = +\infty$. It is shown in Appendix II.C that $\tilde{c}_B(\tau)$ always exists. This quantity will appear in the description of the equilibria of the game.

2.4 Equilibrium Outcomes

Depending on the level of costs and the institutional setting, different equilibria exist. We begin by considering a simplified version of Γ, which we call Γ_w, and has only two players, L and B. Then we study the equilibrium characteristics of the full game.

The Model without the Median Voter

Assume that the game has only two players; citizens are completely absent. This is when $a = 0$ in the autocratic setting so M's actions are without any effect. Remember that $\underline{c}_B = (1 - \pi)\lambda v$, which is the threshold of cost below which fighting is

---

11. $\tilde{c}_B(\tau)$ depends on B's belief about the length of the war. $\tilde{c}_B(\tau, p_B(0))$ is a more accurate representation but the second argument is suppressed as there is no risk of confusion.

always a dominant strategy for B. I assume that $F_{c_B}(\underline{c}_B) > 0$ so that the types of B who regardless of L's strategy prefer fighting to quitting happen with a non-zero probability. I also assume that $c_L > \underline{c}_L = \pi v \lambda$, which means if L had perfect information, L would want to fight short wars but not long wars. The following proposition suggests that there is essentially one equilibrium in which L may quit.

OBSERVATION 2.2. *In any equilibrium of Γ_w in which L quits at some time t_L, B's strategy is to quit at $t_B^*(c_B)$ if $c_B \geq \tilde{c}_B(t_L^*)$ and to never quit otherwise.*

The proof follows from the definition and proof of existence of $\tilde{c}_B$. If L is in equilibrium quitting at every $t \geq t_L$, then B's best response cannot be quitting if B has fought until t_L. The types of B who find quitting at some time before t_L better than waiting until t_L are those for whom $c_B > \tilde{c}_B(t_A)$. For simplicity and without any substantive loss, I assume that the border case of $c_B = \tilde{c}_B(t_A)$ also quits. Furthermore, if B's cost is such that B is going to quit, B must quit at t_B^* obtained from (2.3).

PROPOSITION 2.1. *In any equilibrium of Γ_w we have*

- $t_L = t_L^*$

- $t_B = t_B^*(c_B)$ *if* $c_B \geq \tilde{c}_B(t_L^*)$

- $t_B = +\infty$ *if* $c_B < \tilde{c}_B(t_L^*)$.

Proof. The proposition means that L cannot commit to fighting forever, and more specifically, quits at an exact time. Depending on B's cost, B's strategy may be quitting or fighting until L quits. Figure 2.3 illustrates this equilibrium.

I first show that the proposed strategy is an equilibrium for Γ_w. Then I shall demonstrate that this is the only equilibrium in which L may quit at some time, and that there is no equilibrium where L fights forever.

L's cost is known, and L and B have similar priors about the length of the war. Hence, L's quitting time assuming that B never quits, t_L^*, is known and is obtained
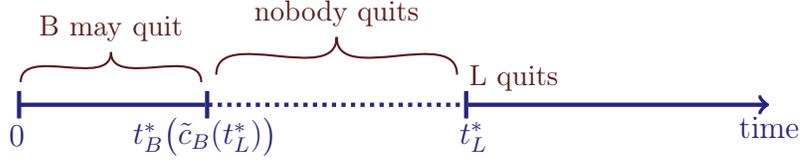
Figure 2.3: The graph illustrates Proposition 2.1.

from (2.3). B cannot profitably deviate from the prescribed strategy, as shown in Observation 2.2. If B does not quit by $t_B^*\big(\tilde{c}_B(t_L^*)\big)$, L becomes certain that B would never quit. This means that L also cannot profitably deviate from this equilibrium.

At the outset, L and B's beliefs about the length of the war is obtained from Bayes' rule shown in (2.1) and updated over time, again using Bayes' rule, as shown in (2.2). L's belief about B's type (B's cost) can also be updated until $t_B^*\big(\tilde{c}_B(t_L^*)\big)$ because, at every moment up to that time, a type of B is expected to drop out with certainty. Therefore, when the war reaches time t, $0 < t \leq t_B^*\big(\tilde{c}_B(t_L^*)\big)$, L's belief about c_B is the original distribution without its tail. That is,

$$
\hat{F}_{c_B}(c|\text{B has not quit before } t) =
\begin{cases}
0 & c \geq t_B^{*-1}(t) \\[2mm]
F_{c_B}(c)/F_{c_B}(t_B^{*-1}(t)) & c < t_B^{*-1}(t)
\end{cases}
\tag{2.4}
$$

where $t_B^{*-1}(t)$ is the inverse of $t^*(c_B)$. This concludes the demonstration of the proposed strategy profile in tandem with the stated beliefs as an equilibrium of the Γ_w.

To show that the proposed equilibrium is unique, notice that from the first part of this proof, if L is quitting at t_L^*, as described, B's unique best response is what is described. So, to have any different equilibrium in which L may quit at some time, L must either quit at some $t_1 < t_L^*$ or at some $t_2 > t_L^*$. I show that neither case can be held in equilibrium.

First, assume that L quits at $t_1 < t_L^*$. This cannot be held, as L can always deviate to quitting at t_L^* and obtain a strictly better payoff. The reason is that, according to Observation 2.2, by the time L reaches t_1, she is certain that B is not quitting and

therefore ought to quit at t_L^*, following the definition of t_i^*.

Second, assume that L quits at $t_2 > t_L^*$. B's best response is to quit at $t_B^*(c_B)$ if $c_B \geq \tilde{c}_B(t_2)$. So types of B keep dropping out until $t_B^*(\tilde{c}_B(t_2))$. There are two possible cases. First assume $t_B^*(\tilde{c}_B(t_2)) \geq t_L^*$. This means that when L reaches $t_B^*(\tilde{c}_B(t_2))$, L becomes certain that B is not quitting and because $t_B^*(\tilde{c}_B(t_2)) \geq t_L^*$, L ought to quit immediately, but we assumed L does not quit until t_2 and we know $t_2 > t_B^*(\tilde{c}_B(t_2))$, hence a contradiction. Alternatively, $t_B^*(\tilde{c}_B(t_2)) < t_L^*$, which again means that by the time L reaches t_L^*, she is certain B is not quitting and should quit immediately, not waiting until $t_2 > t_L^*$.

Finally, assume that there exists an equilibrium where L's strategy is to always fight (i.e., $t_L = +\infty$). It follows that if $c_B > \underline{c}_B$, B must quit at $t_B^*(c_B)$, and if $c_B < \underline{c}_B$, B must never quit. I will show there exists a time after which L would prefer quitting to fighting, contradicting the assumption.

L's expected marginal utility for fighting at time t can be found as

$$\frac{d\text{EU}_L(t, \text{fight})}{dt} = v \left(\frac{f_{c_B}\left(t_B^{*-1}(t)\right)}{F_{c_B}\left(t_B^{*-1}(t)\right)} \left| \frac{\partial t_B^{*-1}(t)}{\partial t} \right| + \pi p_L(t)\Lambda + \pi(1 - p_L(t))\lambda \right) - c_L,$$

which is comprised of three elements. The first term shows expected benefits from the chance that B may quit in the near future, given that B has not quit before time t. The rest of the equation, similar to the derivation of (2.3), shows the payoff that may be obtained if the war ends. We have $F_{c_B}(t_B^{*-1}(t)) > F_{c_B}(\underline{c}_B) > 0$, and $f_{c_B}(t_B^{*-1}(t))$ is bounded. Also, $\left| \frac{\partial t_B^{*-1}(t)}{\partial t} \right|$ goes to zero as time goes to infinity. Since the rest of the payoff is negative for $t > t_L^*$, at some point in time L will have negative marginal utility for continuing the fighting, which implies L's strategy of never quitting is strictly dominated. This contradicts the assumption of $t_L = +\infty$. □

The Full Model

In the full model, the median voter is a third player. M can approve or disapprove the war, but cannot force the leader to stop it ($c_L = c_\ell$ or $c_L = c_\ell + \alpha$). There is no specification of domestic institutions except α which shows how much L's cost of fighting is going to increase if M does not support war. We can assume that more democratic regimes, or regimes with more constraints on their political leaders have larger α.

We are interested in cases where players' costs are low enough that they have some marginal utility for entering the war even if they knew their opponent would never quit. Remember that we assume that L's cost is lower than M's cost; otherwise L would just fight until her own ideal time and then quit, with no need for convincing M to support the war. Furthermore, using $\bar{\Lambda}(p) = p\Lambda + (1-p)\lambda$, I assume

$$F_{c_B}(\underline{c_B}) > 0 \tag{2.5a}$$

$$\frac{c_M}{\pi v} < \bar{\Lambda}(p_0) \tag{2.5b}$$

$$c_L > \pi v \lambda \tag{2.5c}$$

The quitting times are illustrated in Figure 2.4 using t^* as defined in (2.3).[12] Here, 2.5a states that there are types of B who wish to always fight and 2.5b states that when M does not know the international signal, M wishes to fight for some time regardless of B's strategy— although, it is possible for M to not favor war after the long signal.

Whenever M believes that L has received $\mathcal{L}$, M's ideal quitting time is shown in the first row ($t_M^*(p(0|\mathcal{L}))$). However, M's action does not result in any change in L's behavior until $t_{L|\text{NPS}}^*(p(0|\mathcal{L}))$, at which point L's continued fighting is conditioned on

---

12. Note that given the constraints in (2.5), the graphs in Figure 2.4 are not unique representations of the relative locations of t^*s, e.g., the constraints do not inform us about the relative location of $t_{L|\text{PS}}^*$ in the first row and $t_{L|\text{NPS}}^*$ in the third row.
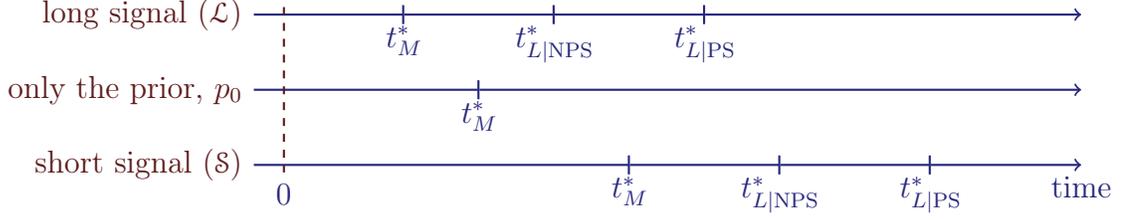
Figure 2.4: Cost constraints translated to optimal quitting times, t^*, as defined in (2.3). Beliefs at $t = 0$ are not shown. These are $p(0|\mathcal{L})$, in the first row, p_0, in the second row, and $p(0|\mathcal{S})$ in the third row.

M's support. So, if M is ever certain that the international signal indicates a long war, $t_M \leq t^*_{L|\text{NPS}}(p(0|\mathcal{L}))$. Similarly, when M is certain that the international signal is the short signal, as shown in the bottom row in Figure 2.4, M must support the war until her ideal time and must not support the war after $t^*_{L|\text{NPS}}(p(0|\mathcal{S}))$.

There are a few differences in the solution depending on the relative location of t^*_M in the middle row in Figure 2.4 (ideal quitting time of the uninformed M), and $t^*_{L|\text{NPS}}$ in the first row (ideal quitting time of the leader after knowing the war is long and without public support). I will discuss these in the following two cases:

Case I: $t^*_M (p(0)) < t^*_{L|\text{NPS}} (p(0|\mathcal{L}))$

Here, the uninformed M prefers to quit before a leader who has received $\mathcal{L}$ wants to quit if the leader does not have public support.

PROPOSITION 2.2. *Given the constraints in (2.5) and Case I, the following hold in every equilibrium:*

- *M ignores L's domestic signal and quits at t_M, where $0 \leq t_M \leq t^*_{L|\text{NPS}}(p(0|\mathcal{L}))$.*

- *L always quits at her optimal quitting time given no public support for war, i.e. $t_L = t^*_{L|\text{NPS}}(p(0|\mathcal{S}))$ after the short signal and $t_L = t^*_{L|\text{NPS}}(p(0|\mathcal{L}))$ after the long signal.*

- *If $c_B < \tilde{c}_B(t_L)$, B never quits, otherwise $t_B = t^*_B(c_B)$.*

27

Proof. The proof follows from Proposition 2.1. First assume L is playing a pooling equilibrium at the outset. This leaves M uninformed about the true value of the international signal which means all the strategies that involve M's support for war after $t^*_{L|\text{NPS}}(p(0|\mathcal{L}))$ are strictly dominated. L's strategy is to fight until her optimal time given the lack of support from M. And B's strategy is similarly determined by Proposition 2.1. The beliefs also can be constructed from (2.1) and (2.2), similar to Proposition 2.1.

Second, L may send an informative domestic signal at the outset but this is only possible if M ignores the signal. Otherwise, L would always send the signal that buys longer support from M. It is possible for M to ignore L's informative signal because M is ambivalent over a wide range of time. □

The set described by Proposition 2.2 includes infinitely many equilibria, but they are essentially identical in terms of prescribed quitting times for L and B. The only source of multiplicity is that M can withdraw support from the war at any time up to the moment when it actually makes a difference.

A suitable refinement on the infinitely many equilibria described by Proposition 2.2 is to select that subset in which M acts truthfully: M stops supporting the war when the war is no longer deemed a worthy option for M. This gives the following corollary.

COROLLARY. *Given the constraints in (2.5), there is a unique truthful equilibrium in which L sends an uninformative domestic signal and* $t_M = t^*_M(p_0)$.

Even when L sends an uninformative domestic signal, if the war continues beyond L's ideal point after $\mathcal{L}$, M becomes certain that L has received $\mathcal{S}$. But M cannot gain information before withdrawing because the separation that informs M happens as a result of M's not supporting the war. Furthermore, M's withdrawal does not affect its own payoff.

Case II: $t^*_{L|\text{NPS}}\left(p(0|\mathcal{L})\right) < t^*_M\left(p(0)\right)$

Under this condition, an uninformed M wishes the war to continue past the point where a leader who does not have public support and has received the long signal wants war. But regardless of whether the war is short or long, the leader wants to fight a longer war than what M would want if M knew the international signal. So, again, M does not have any incentive to support the war past $t^*_{L|\text{NPS}}\left(p(0|\mathcal{L})\right)$ and Proposition 2.2 still holds.

Note, however, that the corollary to Proposition 2.2 does not follow. The reason is that $t^*_M\left(p(0)\right)$ is beyond what Proposition 2.2 prescribes.

In both cases, side A always quits at L's ideal time without public support, which is always past M's ideal point (if M had access to the international signal). But only wars that continue long enough to be ended because of L's concession are going to be fought past M's ideal quitting time. This is more likely to happen for long wars, as short wars are more likely to end before they reach that stage.

Wars with High Stakes

Throughout the discussion thus far, it has always been assumed that the war is a war about matters that are not very important to citizens. What happens if we relax this assumption? We can relax this assumption in full, or in part as shown below. The result in an much simplified solution, and virtually a single equilibrium.

L always Wants to Fight, but not M

Assume $c_M > \pi v \lambda$, but $c_L < \pi v \lambda$. This means that L, regardless of her belief about the length of the war, M's support, and B's behavior, will always find it profitable to continue fighting. As a result, in every equilibrium, B always quits at its $t^*(c_B)$, and L always fights. M's action has no effect on the outcome.

M also always Wants to Fight

Assume $c_M < \pi v \lambda$, which also implies $c_L < \pi v \lambda$. This means that both L and M, regardless of their beliefs about the length of the war and B's behavior, will always find it profitable to continue fighting. As a result, similar to above, in every equilibrium B always quits at its $t^*(c_B)$, and M's action has no effect. But this time there are no agency problems between the L and M, because regardless of the observed international signal, they always prefer the same action.

Note also that due to the assumption of issue indivisibility, if B also has a low cost for fighting (if B is a hothead), the strategy of both sides is to always fight. That is, neither side will ever concede and the war continues until it ends because of military victory for one side.

Adding More Citizens

Having studied the model with one citizen, let us see what happens if we increase the number of citizens. Assume that country A has a continuum of citizens, collectively referred to as M (for masses). Each citizen is a player and can either 'quit' or 'fight' as before. L's cost of fighting at time t is $c_L(t) = c_\ell + \alpha m(t)$, as before, with the only difference that $m(t)$ is interpreted as the proportion of citizens who have quit at or before time t. Also, suppose that every citizen's value for victory is v and the citizens' costs of fighting are distributed by cumulative density function $F_{c_M}(c)$, which is assumed to be continuous.

Similar to, (2.5), assume the following constraints on costs:

$$F_{c_B}(\underline{c}_B) > 0 \tag{2.6a}$$

$$F_{c_M}(\underline{c}_M) > 0 \tag{2.6b}$$

$$c_\ell + \alpha\big(1 - F_{c_M}(\underline{c}_M)\big) > \underline{c}_M. \tag{2.6c}$$

Remember that $\underline{c}_i = \pi_i v \lambda$, is the lowest cost with which there is a possibility that player i may wish to quit at some point. The first two constraints mean that there are some types of B and some citizens in A who value the war so much that they would like their side to continue fighting even if they knew the other side would never quit. The last constraint is similar to (2.5c), and means that, without public support, L does not want to fight forever, if she knows that B is never quitting.

The idea is not to find all the equilibria of this game for almost any outcome can be supported by an equilibrium. This is because no citizen can profitably deviate from any equilibrium. Rather, we want to see if the truthful equilibrium we found in the case of one citizen—under Case I—holds here or not. The answer is affirmative.

Assume that L has sent a truthful domestic signal and both L and the citizens are playing a truthful strategy. When does L quit? The last citizen to quit before the war ends and L must have the same t^*. Since L and citizens have the same belief about the war, this means the last citizen to quit and L have similar costs. Let c_M^* denote this cost. We have

$$c_\ell + \alpha\big(1 - F_{c_M}(c_M^*)\big) = c_M^*. \tag{2.7}$$

Define

$$G(x) = c_\ell + \alpha\big(1 - F_{c_M}(x)\big) - x.$$

From (2.6c), we have $G(\underline{c}_M) < 0$. Also, because F_{c_M} is a cumulative density function we have $\lim_{x\to\infty} G(x) > 0$, and $\frac{dG}{dx} < 0$. Since G is a continuous function, the intermediate value theorem implies that (2.7) is guaranteed to have a unique solution.

Similar to (2.7), we can find L's truthful quitting time if citizens are uninformed about the international signal. In this case, only the quitting times of L and the last citizen are the same, not their costs. Let $c_{M|\mathcal{L}}^*$ and $c_{M|\mathcal{S}}^*$ denote the cost of the last

citizen to quit before L quits in the case that L has received $\mathcal{L}$ or $\mathcal{S}$. We have

$$t^*\left(c^*_{M|\mathcal{L}}, p(0)\right) = t^*\left(c_\ell + \alpha\left(1 - F_{c_M}(c^*_{M|\mathcal{L}})\right), p(0|\mathcal{L})\right) \tag{2.8}$$

$$t^*\left(c^*_{M|\mathcal{S}}, p(0)\right) = t^*\left(c_\ell + \alpha\left(1 - F_{c_M}(c^*_{M|\mathcal{S}})\right), p(0|\mathcal{S})\right), \tag{2.9}$$

which both yield unique solutions again using intermediate value theorem. It suffices to plug in $c_M = \underline{c}_M$ and $c_M = \infty$ in each of the equations and to see that the left-hand sides are decreasing in c_M and the right-hand sides are increasing in c_M.

PROPOSITION 2.3. *Given the constraints in* (2.6), *the following strategies are played in a truthful equilibrium*

- *Citizens ignore L's domestic signal and each of them quits at his or her ideal quitting time $t^*\left(c_M, p(0)\right)$.*

- *If the international signal is $\mathcal{L}$, L quits at $t_L = c^*_{M|\mathcal{L}}$. If the international signal is $\mathcal{S}$, L quits at $t_L = c^*_{M|\mathcal{S}}$.*

- *If $c_B < \tilde{c}_B(t_L)$, B never quits, otherwise $t_B = t^*_B(c_B)$.*

The proof simply follows from Proposition 2.1, the definitions of $c^*_{M|\mathcal{L}}$ and $c^*_{M|\mathcal{S}}$, and the fact that no citizen can profitably deviate from any strategy.

Also, note that as in the single-citizen game, there can be no meaningful separation of types of L. If L plays a separating equilibrium in which the domestic signal informs the behavior of citizens in the correct direction, L always has the incentive to send the wrong signal after receiving $\mathcal{L}$.

2.5 Discussion

The analysis showed that assuming fixed effort levels and fixed average costs, learning about costs happens very fast; I used this insight to build a model with

fixed costs and study how people can learn about expected duration of wars. In reality, war casualties are overdispersed due to a variety of reasons, including seasonal changes, changes in fighting strategies, results of previous battles, and presence of allies. Regardless of the extent to which we can assume that each period of the war is the same as previous periods, the assumption serves us as an analytical tool that allows isolation of the effect of time.

In this section, I will discuss some of the substantive implications that can be drawn from the formal model presented. The main point of the models is that people can make inferences about the type of war that is being fought based on duration. This is conceptually distinct from inference based on costs or based on what the elite say. In the models, citizens stop supporting a war because the war is likely to be a long war not worth fighting. The cost of fighting in each period is part of the calculus, but the source of information in the models is the time that has elapsed since the start of the war.

That the half-life of public support for asymmetric wars only partly depends on the number of fallen soldiers means that ignoring the causal effect of "duration" produces biased estimates of support, with potentially disastrous outcomes. This might be part of the reason that such estimates are seen to have overestimated "casualty tolerance" by as much as a factor of 60 (Larson and Savych 2005, Table 6.1).[13]

When to Fight, When to Quit

To obtain hypotheses about aggregate behavior, we are going to assume citizens are playing the truthful equilibrium in the model with many citizens. To obtain hypotheses about individual behavior, we have to make other assumptions. One of the dependent variables of interest is citizens' strength of support for war. Let us

13. Larson and Savych attribute the error to using mean instead of median and using academic controlled lab experiments as opposed to "actual public opinion data collected during relevant historical episodes.

assume that each citizen's expressed level of support for war—as observed in public opinion polls, for example—is detectably affected by his or her belief about how likely they consider the war being fought to be a war worth fighting.

From (2.2) we obtain $\partial p_i(t)/\partial t < 0$, which means that as time progresses during a war, everybody becomes less confident that the war being fought is a short war. This comparative static prediction holds across all the equilibria.

HYPOTHESIS 2.1. *As time progresses, every citizen's support for war should decline.*

HYPOTHESIS 2.2. *As time progresses, every citizen's expectation of the remaining length of war should increase.*

Another important question is, if everyone's expected benefit from war is going to go down over time, when will citizens stop supporting the war? If we assume that citizens support for war is truthful, we can study t_M^*, defined in (2.3), to obtain the comparative statics of interest.

In the derivation of (2.3) we observed that $\underline{c} = \pi_i v \lambda$ is the threshold of cost below which $t_i^* = +\infty$. Hence, if a citizen's per unit cost of fighting is less than $\pi v \lambda$, that citizen always supports the war, because, for that citizen, even a long war is worth fighting. Nonetheless, as time progresses, the citizen is going to be less optimistic about the war. In other words, these citizens are going to be disenchanted about the war over time, like others, but they value the prize so highly relative to the costs of war that they are willing to support the war ad infinitum.

HYPOTHESIS 2.3. *Citizens whose value for victory with respect to the cost of fighting is more than a threshold will never stop supporting the war.*

Among citizens whose support for war is not eternal, the time they stop supporting the war depends on their costs and their initial belief about the likelihood of the war being a short war. Specifically, we have $\partial t_M^*/\partial c_M < 0$ and $\partial t_M^*/\partial p_0 > 0$. These comparative statics result in the following hypotheses.

HYPOTHESIS 2.4. *Citizens whose value for victory are lower, stop supporting the war sooner.*

HYPOTHESIS 2.5. *The more one is confident that the current war is a short war, the longer one is going to support the war.*

Hypothesis 2.5 may seem illogical at first, but it is straightforward if we look at it from a different perspective. It says that a citizen who initially has a stronger belief that the war is a short war will require more adverse information to rule that the war is indeed a long war.

Putting Hypotheses 2.1, 2.3, and 2.4 together, we realize that citizens will stop supporting the war whenever their ideal quitting times are reached. This means a secular decline in public support for war, but the exact shape depends on the distribution of costs of war among citizens. Note, however, that if there are citizens whose costs of war are lower than a specific threshold, there will be an asymptote in public support: the support will get increasingly close to, but never lower than, the asymptote.

HYPOTHESIS 2.6. *As time proceeds, public opinion in support of war should decline, but it can asymptotically stay larger than zero.*

The model also provides us insight about the strategic behavior of the two adversaries. In particular, Proposition 2.1 showed that as long as there is a non-zero chance that the weak party is a low-cost type who never wishes to stop fighting, the strong side has a time table for quitting. As shown in various equilibrium descriptions, domestic institutions and domestic politics determine whose time table is the time table based on which State A fights and stops fighting, but, State A always has a time table. Note that the weak side can have little chance of victory and still find fighting profitable due to the leverage it gets from the information asymmetry. A side result is that given the importance of being perceived as a likely low-cost type (i.e.,

35

B not being seen as certainly not a low-cost type), it is natural to expect B to carry out ostensibly irrational acts.

Another result of Proposition 2.1 which also showed up in all the equilibria of the models is that for wars that do not end fast, there is a period of fighting during which both sides know that no one is quitting. This is similar in appearance to Fearon's "fighting rather than bargaining", but the underlying reason is different (Fearon 2007).

This discussion also provides a way of looking back at one of the rhetorical battles at the peak of the Iraq war that was alluded to in the introductory passage: supporters of the war maintained that setting a time table, any timetable, was a concession to the enemy. Two notable examples of this rhetoric were the national dialog that followed the release of the report produced by the Iraq Study Group, and the 2008 presidential campaigns (Baker, Hamilton, et al. 2006).

The model confirms part of the logic. If one side has a publicly known deadline, the types of the other side whose quitting times are close to the set deadline are not going to quit (see Figure 2.3). But this does not mean that the strong side can continue playing without an implicit deadline. Therefore, the discussion is not really about whether or not to have a deadline, but when the deadline should be. This question is, as shown above, a question about the expected cost of war, the value of victory, and the expected duration of the war.

These results, of course, depend on the assumptions of the model. In particular, it was assumed that side A's domestic politics happens in public. Undoubtedly there is a conspicuous discrepancy between democratic and autocratic states in this regard, but they both have a more or less public discourse about war compared to, say, a terrorist group.

Finally, it must be emphasized that the novelty in some of the above hypotheses is that they are derived without assuming any irrationality on the part of any of the players.

Domestic institutions

Differences between democracies and autocracies in winning wars and also in the length of their fighting has generated much academic interest (Reiter and Stam 1998; Lyall 2010). We want to compare the results in the two institutional settings studied. In order to gain insight from the models, we have to make further assumptions. Here, I assume that α depends on the regime type and is larger in democracies and that in the model with many citizens, the truthful equilibrium is played.

If the war continues long enough to be ended by side A's withdrawal, L quits fighting due to the pressure of the public. Furthermore, it is clear that higher α implies larger cost and shorter wars (i.e., $\frac{\partial t_L^*}{\partial \alpha} < 0$). To better capture the dependence of α on domestic political institutions, a natural candidate is the size of the winning coalition as defined by Bueno de Mesquita et al. (2003).

HYPOTHESIS 2.7. *Holding everything constant, leaders with larger winning coalition sizes are less likely to fight long asymmetric wars.s*

2.6   Conclusion

Public support for many wars seem to start high and then decline over time. It is often assumed that the public obtains information over time, but the source of this information has been subject to much disagreement. Conventional wisdom holds that aggregate cost of war is the main source of information. But, whereas a citizen concerned about the past may truly care about the total cost of war, a forward-looking citizen uses the available information (including costs) to foresee the likely path of the war in the future. As such, the consequential questions are how costly the war is, how long the war is going to last, and how much victory is worth, not whether a specific threshold for cost has been crossed.

I showed that under usual assumptions of formal models of conflict, learning about

the intensity of wars (the speed with which costs accrue) takes less time than learning about the expected length of wars. Then I presented a model of public opinion dynamics that allows for wars to have a randomly determined expected duration, while holding the intensity of the war and the value of victory constant and publicly known. One of the results is that time itself is a critical source of information about war. The attrition of public support for war is what we can expect to happen even when citizens are forward-looking, rational, and aware of the speed of spending resources in war.

The model also provides a basic comparison between domestic institutions that do not hold the leader accountable (like personal dictatorships) and those that do (like democracies). It is predicted that, holding everything else constant, states with fewer constraints on their political leaders fight longer asymmetric wars. When the stakes are valued above a threshold, however, there is no difference between different institutional settings.

Appendix II.A Intensity versus Duration

Posterior probabilities

Let V and W denote random variables indicating the value of μ and λ of the war and $X(t)$ and Y be the total cost at time t and duration of the war under scenarios I and II, respectively. Assume that the war has lasted until time t. Using Bayes' rule the updated belief about V and W are as follows. Under the first scenario, the conditional probability of the high cost war is

$$P(V = 2|X(t) = k) = \frac{P(X(t)|V = 2)}{P(X(t)|V = 1) + P(X(t)|V = 2)}$$
$$= \frac{(\mu_2 t)^k e^{-\mu_2 t}}{(\mu_1 t)^k e^{-\mu_1 t} + (\mu_2 t)^k e^{-\mu_2 t}} = \frac{\alpha^k e^{-(\alpha-1)\mu_1 t}}{\alpha^k e^{-(\alpha-1)\mu_1 t} + 1}, \qquad (2.10)$$

and under the second scenario, the conditional probability of the long war is

$$P(W = 1|t) = \frac{P(t|W = 1)}{P(t|W = 1) + P(t|W = 2)}$$

$$= \frac{e^{-\lambda_1 t}}{e^{-\lambda_1 t} + e^{-\lambda_2 t}} = \frac{1}{e^{-(\alpha-1)\lambda_1 t} + 1}. \tag{2.11}$$

Expected Information

Let I and H denote Shannon's information and entropy measures. Under the first scenario we have

$$I_1 \equiv E[I(V; X(t))] = E[H(V) - H(V|X(t))]$$

$$= 1 - \int_0^\infty \lambda e^{-\lambda t} H(V|X(t)) dt$$

$$= 1 - \int_0^\infty \sum_{k=0}^\infty \frac{(\mu_1 t)^k e^{-\mu_1 t} + (\mu_2 t)^k e^{-\mu_2 t}}{2\ k!} H(V|X(t) = k)\lambda e^{-\lambda t} dt.$$

We can calculate $H(V|X(t) = k)$ as $H(V|X(t) = k) = -A\log(A) - (1-A)\log(1-A)$, where $A = P(V = 2|X(t) = k)$ given in (2.10). Under the second scenario and using (2.11) we obtain

$$I_2 \equiv I(W; T) = E[H(W) - H(W|T)]$$

$$= 1 - \frac{1}{2} \int_0^\infty \left(\lambda_1 e^{-\lambda_1 t} + \lambda_2 e^{-\lambda_2 t}\right) H(W|T = t) dt$$

$$= 1 - \frac{1}{2} \int_0^\infty \left(\lambda_1 e^{-\lambda_1 t} + \lambda_2 e^{-\lambda_2 t}\right) \left(\log\left(1 + e^{-(\alpha-1)\lambda_1 t}\right) + \frac{(\alpha-1)\lambda_1 t}{1 + e^{(\alpha-1)\lambda_1 t}}\right) dt.$$

Appendix II.B   Equilibrium Concept

Here I will describe the equilibrium concept used in this chapter in more detail. I will present the details for the reduced game Γ_w that was used in Section 2.4. Extension to the full game is trivial.

Recall that there are two players in Γ_w. Nature decides the type of war and then
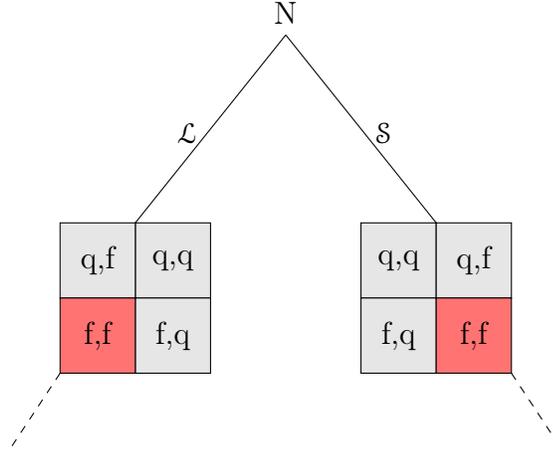
Figure 2.5: Γ_w. The game continues if both players play 'fight' and the exogenous event does not end the war. All the light gray cells are terminal histories. Each cell in the matrices is an information set because nature's decision in selecting the type of war and the type of B (c_B) is not shown in the graph.

sends an identical signal to the players. Then, the players may start fighting at $t = 0$. If there is war, the war is fought in continuous time as the players have to simultaneously choose between 'quit' and 'fight' at each instant. The war continues until either—at least—one side quits, or one side loses on the battlefield.

Let $\mathfrak{I}$ denote all the information sets and let $\mathfrak{I}_j$ be all the information sets in which player j plays. In Γ_w, if the war continues until some time t, both players must have played 'fight' at every information set up to time t (see Figure 2.5). Furthermore, both players should play at every information set. Therefore, we have

$$\mathfrak{I} = \mathfrak{I}_L = \mathfrak{I}_B = \{\mathcal{S}, \mathcal{L}\} \times \mathbb{R}_+ \tag{2.12}$$

For every information set $i \in \mathfrak{I}_j$, let Γ_i denote the subgame that follows i. A belief is a set that assigns for each variable unknown to player j a probability distribution at every information set i in which player j plays. A set that contains a belief for each player is called a belief profile.

In Γ_w, the only possible actions are fight and quit. Therefore, a belief set for player

B should assign a probability distribution about the type of war to every moment

$$b_B(s,t) = p(\Lambda|(s,t)) \ \forall (s,t) \in \{S, \mathcal{L}\} \times \mathbb{R}_+.$$

For L, there is another unknown variable which is the type of B. Therefore,

$$b_L(s,t) = \{p(\Lambda|(s,t)), f_{c_B}(.|(s,t))\} \ \forall (s,t) \in \{S, \mathcal{L}\} \times \mathbb{R}_+.$$

Similarly, a strategy for player j takes the form of a mapping from every information set to an action,

$$\sigma_i(s,t) : \{S, \mathcal{L}\} \times \mathbb{R}_+ \to \{\text{fight}, \text{quit}\}. \tag{2.13}$$

We first need to derive the expected payoffs of the game. Assume that the players follow (σ, b), where σ and b are the strategy profile and belief profile. Given these beliefs and strategies, for every type of every player and every type of signal s let us define $q_j(s) = \min\{\tau > t | \sigma_j(s, \tau) = \text{'quit'}\}$ and

$$q_j(s,t) = \begin{cases} \infty & q_j(s) \text{ does not exist} \\ q_j(s) & \text{otherwise} \end{cases} \tag{2.14}$$

Defined like this, q_j is the first time that each player is expected to quit. Here, it is assumed that strategies are right-continuous but this need not be the case; if a player's strategy includes quitting at some time but is not right-continuous, only the boundary conditions of the following calculations need to be adjusted, and q should be the infimum of quitting times.

q_L and the distribution of q_B are public knowledge. B knows her own cost. There are three possible scenarios in terms of who quits first. (1) If $q_{c_B}(s,t) > q_L(s,t)$, (2) if $q_{c_B}(s,t) < q_L(s,t)$ and (3) if $q_{c_B}(s,t) = q_L(s,t)$. Let us define $V(x)$ such that $V(1) = v$, $V(2) = 0$, and $V(3) = v/2$ where x is the case about q as it is enumerated

above. Also let $q(s,t) = \min\{q_{c_B}(s,t), q_L(s,t)\}$.

Given the belief about the type of war, the probability density of the exogenous event of the end of war is the convex combination of the probability densities of the two types of war

$$w(\tau) = p(\Lambda|(s,t))\Lambda e^{-\Lambda\tau} + (1 - p(\Lambda|(s,t)))\lambda e^{-\lambda\tau}. \tag{2.15}$$

Assume that $W(\tau)$ is the associated cumulative density function. We must have $W(t) = 0$ because the exogenous event has not happened before time t. We can now calculate the expected utility

$$\mathrm{EU}_{c_B}\big(\sigma, b|(s,t)\big) \tag{2.16}$$

$$= \int \mathrm{pr}(\text{exogenous event happening at } \tau) \times \text{ payoff } d\tau$$

$$+ \mathrm{pr}(\text{war lasting until } q) \times \text{payoff}$$

$$= \int_t^{q(s,t)} w(\tau)\left((1-\pi)ve^{-r\tau} - \int_0^{\tau-t} c_B e^{-r\theta}d\theta\right)d\tau$$

$$+ (1 - W(q(s,t)))\left(V(x)e^{-rq(s,t)} - \int_0^{q(s,t)-t} c_B e^{-r\theta}d\theta\right).$$

The inside integral (over θ) is to calculate the discounted cost.

For L, the calculation is similar, except that we have to average over types of B. For notational convenience, define $\zeta(c_B) = q_{c_B}(s,t)$. We have

$$\mathrm{EU}_L\big(\sigma, b|(s,t)\big) \tag{2.17}$$

$$= \int_{c|\zeta(c)<q_L(s,t)} f_{c_B}(c)\left[(1 - W(\zeta(c)))\left(ve^{-r\zeta(c)} - \int_0^{\zeta(c)-t} c_L e^{-r\theta}d\theta\right)\right.$$

$$\left. + \int_t^{\zeta(c)} w(\tau)\left((1-\pi)ve^{-r\tau} - \int_0^{\tau-t} c_B e^{-r\theta}d\theta\right)d\tau\right]dc$$

$$+ \int_{c|\zeta(c)=q_L(s,t)} f_{c_B}(c)\left[(1 - W(\zeta(c)))\left(\frac{v}{2}e^{-r\zeta(c)} - \int_0^{\zeta(c)-t} c_L e^{-r\theta}d\theta\right)\right.$$

$$+ \int_t^{\zeta(c)} w(\tau) \left((1-\pi)ve^{-r\tau} - \int_0^{\tau-t} c_B e^{-r\theta} d\theta \right) d\tau \right] dc$$

$$- \int_{c|\zeta(c)>q_L(s,t)} f_{c_B}(c) \left[(1 - W(q_L(s,t))) \int_0^{q_L(s,t)-t} c_L e^{-r\theta} d\theta \right.$$

$$\left. + \int_t^{q_L(s,t)} w(\tau) \left((1-\pi)ve^{-r\tau} - \int_0^{\tau-t} c_B e^{-r\theta} d\theta \right) d\tau \right] dc.$$

The three possibilities for quitting times (similar to the $V(x)$ before) are explicitly written, and the probability of each possibility is calculated by integrating over f_{c_B}. The payoffs under each possibility are calculated as in (2.16).

A strategy for each player is a complete mapping as seen in (2.13). But it is clear from (2.16, 2.17) that only the players' first quitting time affects the payoffs, represented by q (2.14). Of course, this is happening because the game ends after at least one player quits. I rely on this payoff equivalence and narrow the attention on only one of the strategies with the same q : always quit after q. This appears as the third condition in the definition below.

DEFINITION. A pair (σ^*, b^*) comprising a belief profile and a strategy profile is called an equilibrium if it satisfies the following conditions:

(i) For every player j and every information set i, in which j plays, σ_j^* is a best reply. So $\sigma_j^* = \arg\max_{\sigma_j} \mathrm{E}(U_j(\sigma_j, \sigma_{-j}^*, b^*|i)$, where $\mathrm{E}(U_j(\sigma_j, \sigma_{-j}^*), b^*|i)$ is the expected payoff after the information set i, if j plays σ_j and other players play according to σ^*, and b^* is the belief.

(ii) For every player j, wherever possible, b_j is obtained using Bayes' rule with correct priors, assuming that players follow σ^*.

(iii) If σ_j^* prescribes that j should quit at information set i, it should also prescribe that j should *always* quit in all the information sets that follow i.

The first two conditions are the sequential rationality and belief consistency that are present in all flavors of the perfect Bayesian equilibrium. The last condition,

as discussed before, does not affect equilibrium payoffs. In the example of Γ_w, since information sets are (s, t), the third condition means that if $\sigma_j^*(s, t) = $ 'quit', it should be the case that $\sigma_j^*(s, t) = $ 'quit' $\forall (s, t'), t' > t$.

As mentioned before, the last condition vastly simplifies our descriptions of equilibrium strategies. In the case of Γ_w, we can now describe each player's equilibrium strategy with a single number (and a possible superscript) which shows when player i will quit for the first time. This is the notation used in the body of the paper.

Appendix II.C   Existence of $\tilde{c}_B(\tau)$

I show that $\tilde{c}_B(\tau)$ always exists. If $c_B \leq \tilde{c}_B(\tau)$, B's optimal quitting time is the same as what was obtained in (2.3): when possible, this is the time when B's marginal payoff of fighting is zero. The payoff that a type of B with cost c_B obtains from not quitting until $\tau > 0$, when looking down the game tree at time θ is obtained from the following (nqaob stands for 'not quitting at or before')

$$\mathrm{EU}_B(\theta, c_B, \text{ B nqaob } \tau \mid \text{L quits at } \tau) = \tag{2.18}$$

$$\int_0^{\tau - \theta} \left((1 - p_B(\theta))\lambda e^{-\lambda t} + p_B(\theta)\Lambda e^{-\Lambda t} \right) \left((1 - \pi)ve^{-rt} - c_B(1 - e^{-rt})/r \right) \, dt +$$

$$\int_{\tau - \theta}^\infty \left((1 - p_B(\theta))\lambda e^{-\lambda t} + p_B(\theta)\Lambda e^{-\Lambda t} \right) \, dt \left(ve^{-r\tau} - c_B(1 - e^{-r\tau})/r \right) ,$$

where the first integral is for the chance that the exogenous event happens during (θ, τ), conditioned on its not having happened before θ; the second integral is the probability mass of the tail of the distribution of the exogenous event; and $c_B(1 - e^{-rt})/r = \int_0^t c_B e^{-r\theta} d\theta$ is the aggregated and discounted cost of fighting up to time t.

Setting $\theta = t_B^*(p_B(0))$ which is the optimal quitting time, if B is to quit, gives

$$\Upsilon(c_B, \tau) = \mathrm{EU}_B\left(t_B^*(p_B(0), c_B), c_B, \text{ B nqaob } \tau \mid \text{L quits at } \tau\right).$$

We can now use the intermediate value theorem to show that for all $\tau > 0$, $\widehat{c}$ exists such that $\Upsilon(\widehat{c}, \tau) = 0$. It suffices that $\Upsilon(t_B^{*-1}(p_B(0), \tau), \tau) > 0$, and $\lim_{c \to +\infty} \Upsilon(c_B, \tau) < 0$, where the inverse of t^* with respect to its first argument is assumed to exist because it is strictly decreasing for $\tau > 0$. Hence, we have

$$\tilde{c}_B(t) = \inf\{\widehat{c}, \text{ such that } \Upsilon(\widehat{c}, \tau) = 0\},$$

which gives us $\Upsilon(\tilde{c}_B, \tau) = 0$ because of the continuity of Υ.

CHAPTER III

Keep Fighting or Quit

3.1 Introduction

The models presented in Chapter II had both behavioral predictions about individuals and institutional predictions about states with different regime types. In this chapter I present some evidence corroborating these predictions.

I use two samples of American adults (one of them is a nationally representative sample) to test some of the behavioral hypotheses using a survey experiment. The results corroborate the basic predictions of the model: independent of the effect of aggregate casualties, duration of a war may have a negative effect on public support for war, and the longer a war lasts, citizens' expectation about the remaining duration of the war increases. To test the institutional hypothesis, I use existing data on counterinsurgency wars of the past two centuries. I use domestic versus foreign counter insurgency as a proxy for high and low stakes of wars. The analysis shows that in counterinsurgency wars on foreign land (low stakes), leaders who are more institutionally accountable end their wars more quickly than leaders who are less accountable; in domestic counter insurgencies (high stakes), however, domestic institutions are not correlated with the duration of war.

3.2 The Effect of Duration on Support

The formalization in the previous chapter predicted that duration has an independent causal effect on support for war (see Hypotheses 2.1 and 2.2). But if the main competing hypothesis is that it is aggregate causalities and not duration that is affecting support for war, adjudicating between these two is virtually impossible in observational studies. Time and any other monotonic function of time like aggregate costs are highly correlated. Existing works show that public opinion is correlated with aggregate cost, instantaneous cost, and whether instantaneous costs are increasing or decreasing.[1] Without imposing strict assumptions about underlying functional forms, it is not possible to distinguish the effect of duration from the effect of aggregate cost. To avoid this problem, I conducted a brief survey experiment.

Using experimental manipulation, we can assign hypothetical scenarios to survey respondents and isolate the effects of parameters that vary together. Here, we want to isolate the effect of duration and cost. Suppose that there is an ongoing asymmetric war for the past t months, and we have incurred a specific level of cost (for example, casualties). How does the level of support depend on when we observe this level of cost? In other words, assume the cost is fixed and we can experimentally assign different values of t to different citizens (treatment). How would the level of support (outcome) be affected by t?

How does the level of support depend on t? If we subscribe to the idea that only total casualties affect how we evaluate a war, then there should be no difference. If citizens' opinions only depend on the intensity with which casualties mount up, we should expect support for war to be positively correlated with time. That is, for a fixed level of cost, larger t means smaller rate of increase in casualties (i.e., slope) which should be associated with more support. Moreover, if both aggregate cost and

---

1. See (Larson and Savych 2005) for a focus on aggregate costs, and Gartner 2008 for a focus on recent costs and trends of costs.

rate of accumulation of cost are operative, their total effect is still positive because aggregate cost is fixed and rate of cost is negatively affected by duration. Finally, the model presented in the Chapter II predicts a different relationship between duration and support because the duration itself has also a causal effect. If the model is correct, the result depends on parameters because level of support for war is pulled in two opposite directions: on one hand, longer duration implies lower rate of cost accumulation if the total cost is held constant (which make continuing the war more attractive); on the other hand, longer duration means longer expected remaining duration, which make continuing the war less attractive.

Figure 3.1 illustrates the prediction of the model for different values of total aggregate cost and λ, assuming that $\Lambda = 1/6$, the a priori probability of facing a short war is $p_0 = 0.75$, and v (value of the prize) is randomly distributed among citizens with an exponential distribution with mean 4000. The top row is how the model predicts public opinion changes: given a rate of accumulation of costs, support for war decreases until it reaches a plateau. The bottom row is the prediction in the hypothetical exercise where total cost is fixed and support is estimated at any duration.

Figure 3.1 illustrates that when cost is fixed, depending on the parameters, the independent effect of duration on support for war could be positive or negative and is not necessarily monotonous. The expected duration of a short war is assumed to be 6 months; the result is that for low values of duration (up to about a year), citizens are still optimistic about the length of the war, and longer time means lower rate of costs which increases support. If the expected duration of the long war scenario is in fact very long (which is what public opinion polls suggest), as time progresses, people are going to expect that the war is to be very long and expected duration is large enough that it eclipses a smaller expected rate of cost. Table 3.1 presents a selection of numbers from Figure 3.1 for $\lambda = 1/600$. In this case, the effect of a five-fold increase in duration is slightly larger than the effect of a five-fold increase in casualties.
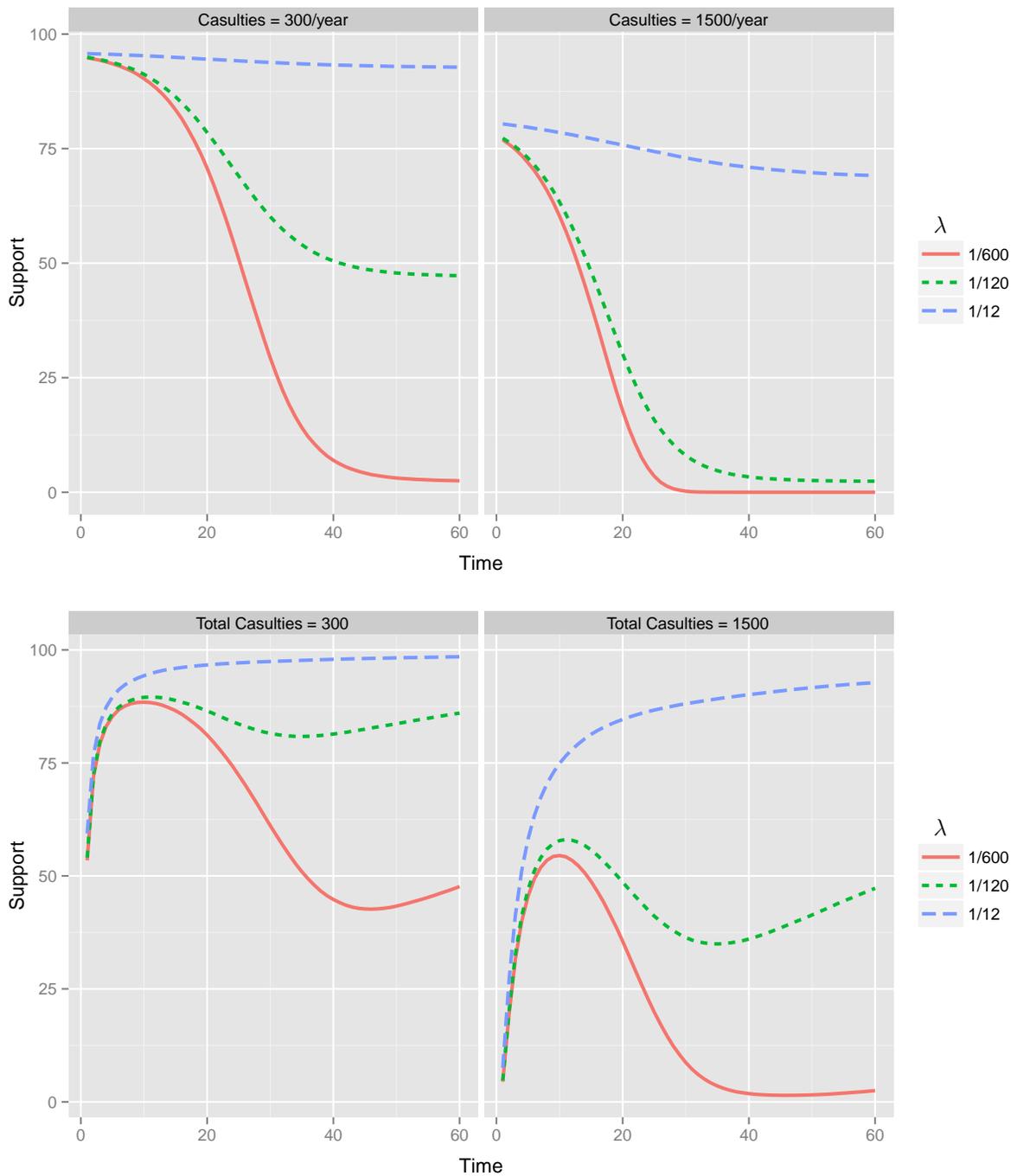
Figure 3.1: Simulation results showing percentage of support for continuation of an asymmetric war for different values of time, predicted by the model in Chapter II. The top figures show how the model predicts aggregate public opinion for different values of λ and casualty rates. The bottom figures show how the model predicts the results of experimental manipulation where total casualties is fixed but respondent are treated with different values of time.

Table 3.1: Duration can have a larger effect on support for war than total casualties. This table is selected from the results in Figure 3.1, with $\Lambda = 1/6$ and $\lambda = 1/600$

Time	Total Casualties = 300	Total Casualties = 1500
12 months	88.1%	53.4%
60 months	47.7%	2.5%

Design

Appendix III.A provides information about the recruitment process as well as other practical details of the survey experiment. The two rounds of surveys are referred to as the first survey (convenience sample fielded in August 2015) and the second survey (nationally representative sample fielded in March 2015). The experiment was designed to provide a difference-in-difference test for a manipulation about the observed length of war. Participants were shown a vignette about a war with the Boko Haram, which is a terrorist group in Central Africa and both surveys were fielded after periods when the name Boko Haram had been in the daily news (August 2014 and March 2015). Participants were told about a hypothetical situation (revealed as such) where prominent members of both the Republican and the Democratic parties, including the president, are in favor of initiating a war against the group. The war has not started yet, but the president is expected to order the start of the war in a few days.

Participants were asked whether they supported this war or not (PRESUPPORT). Then they were provided an update about the war. In the first survey, the update said that the war has been going on for TYEAR years and has had limited success, where the treatment they received was an integer between 1 to 5. They also received another treatment (TKIA $\in \{$NA, 300, 1500$\}$), which was either to see no casualty report, or to see either 300 or 1500 as the number of American casualties. In the second survey, to improve power there were only five treatment groups as follows:

Treatment Group	1	2	3	4	5
TKIA	500	2500	500	2500	2500
TYEAR	2	2	10	10	NA

After this information, respondents were asked about their opinion regarding the continuation of the war (POSTSUPPORT). Then, on the following page, they were asked to estimate how much longer the war would last, if the United States were committed to fight until victory (EXPDURATION). Support was measured using a 4-point Likert scale in the first survey and a 6-point Likert scale in the second survey. Summary statistics of these variables are reported in Table 3.2.

The dependent variable for testing Hypothesis 2.1 is the difference between POST-SUPPORT and PRESUPPORT. This is denoted by ΔSUPPORT. Expected duration of war is directly asked and is used to test Hypothesis 2.2. Given the large variance of expected duration (standard deviations of 22.61 years and 36.33 in the two surveys) a logged dependent variable is used.

Table 3.2: Summary statistics. For the first survey, $N = 514$ and for the second, $N = 956$.

	Varible	Min	Mean	Median	Max	Std. Dev.
Survey 1:						
	TYEAR	1.00	2.94	3.00	5.00	1.40
	TKIA (dropping NA)	300	874.06	300	1500	600.3
	PRESUPPORT	1.00	2.38	2.00	4.00	1.00
	POSTSUPPORT	1.00	2.35	2.00	4.00	1.06
	ΔSUPPORT	-3.00	-0.04	0.00	3.00	0.74
	EXPDURATION	0.00	9.06	5.00	320	22.61
	ln(EXPDURATION+1)	0.00	1.80	1.79	5.77	0.79
Survey 2:						
	TYEAR (dropping NA)	2	5.91	2	10	4
	TKIA	500	1682.01	2500	2500	983.8
	PRESUPPORT	1.00	3.77	4.00	6.00	1.83
	POSTSUPPORT	1.00	3.64	4.00	6.00	1.94
	ΔSUPPORT	-5.00	-0.14	0.00	5.00	1.52
	EXPDURATION*	0.00	∼30e3	5.00	30e6	∼1e6
	ln(EXPDURATION+1)*	0.00	1.96	1.79	17.22	1.02

[*] There are three observations of EXPDURATION larger than 1000 years. The results reported in this chapter are obtained without dropping any observations, but the results do not change if we the drop outliers of EXPDURATION.

Results

Figures 3.2 and 3.3, for each treatment group in the nationally representative sample, respectively show confidence intervals for change in support (ΔSUPPORT) and predicted duration of war (logarithm of EXPDURATION).[2] In Figure 3.2, for those who received the low casualty treatment, the long duration treatment has a large and statistically significant effect. For those who received the high casualty treatment, the long duration treatment has resulted in lower levels of support, but the confidence intervals of the three groups (TYEAR=2, TYEAR=10, and TYEAR not specified) seem to overlap. Interestingly, there is no perceptible difference between the two groups which received TYEAR=10. What is seen in Figure 3.3 is very straightforward. Longer observed duration seems to significantly increase the expected duration of war.

Tables 3.3 and 3.4 show the results from the two rounds of surveys. The first two models in each table show the results of the effect of duration on change in support for war (Hypothesis 2.1). Because of the ordinal dependent variable, an ordered choice model is the appropriate model. Models 3.3 and 3.7 have TKIA as the only independent variable, and Models 3.2 and 3.6 add casualty treatment as another explanatory variable. Because the treatments are randomly assigned, there is no need to control for any other variable. The results corroborate the expectation that an increase in the duration of a conflict has a negative impact on how much citizens support the war. Surprisingly, total casualties has very weak statistical significance (p-value > .10) .

Interpreting the magnitude of the effects seen in Models 3.1, 3.2, 3.5, and 3.6, like any other multinomial choice model, is not straightforward. The results of Figure 3.2 provide a more natural interpretation—albeit, with the assumption that support for war is an interval measure. The difference between the change in support for the groups that had a low casualty treatment of TKIA=500 is -0.55 (s.d. $=$

---

2. In Figure 3.2, respondents who opposed the war before the beginning of the war are dropped.

0.177). Similarly, the difference between the change in support for the groups that had a low casualty treatment of TKIA=2500 is -0.34 (s.d. $= 0.177$). Both of these numbers are statistically significant but to make better sense of their practical significance, let us transform them to a scale of 0 to 100. This gives the effect sizes of -11% (difference between those who received TKIA=500, TYEAR=2 and those who received TKIA=500, TYEAR=10) and -6.8% (difference between those who received TKIA=2500, TYEAR=2 and those who received TKIA=2500, TYEAR=10).

Models 3.3, 3.4, 3.7, and 3.8, reported in Tables 3.3 and 3.4, test Hypothesis 2.2.[3] Table 3.4 shows that in the nationally representative survey, changing TYEAR from 2 years to 10 years, on average has increased expected duration of war by 66%.[4]

The experimental results strongly corroborate the basic behavioral predictions of the formal models. These results encourage subsequent research to fully test the implications of the model.

---

3. The logarithm of expected duration is used due to its large observed variance. The substantive results presented here, however, are not sensitive to whether we use a logarithm transformed values or not.

4. The dependent variable is logged, so we can calculate $\exp(0.063 * (10 - 2)) = 1.6553$.
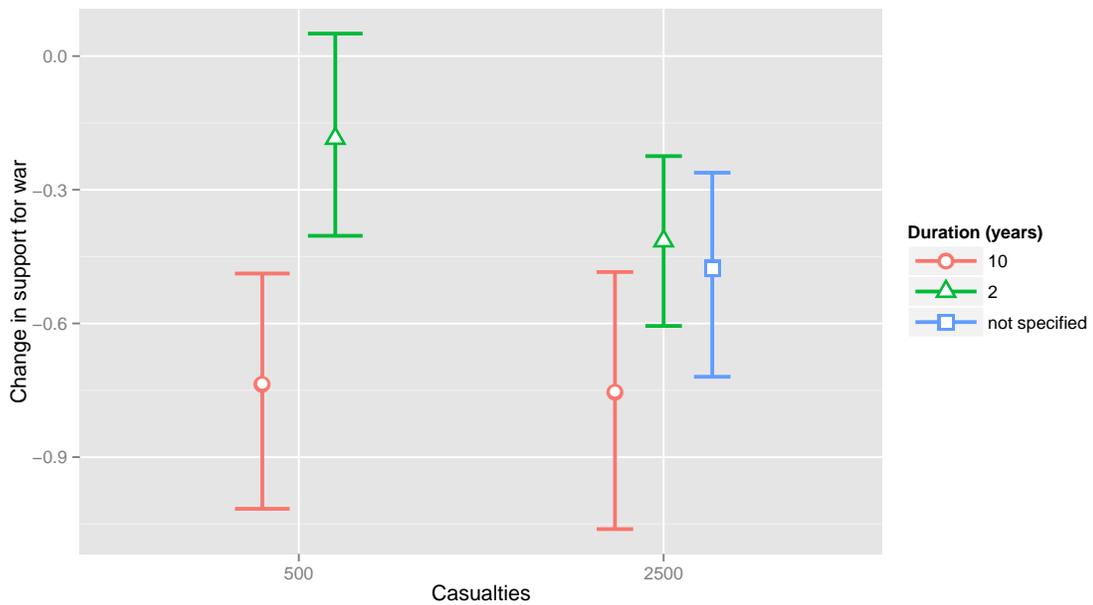
Figure 3.2: Confidence intervals showing changes in level of support for war for the five different treatment groups in the nationally representative sample. The vertical axis is change in the six-point Likert scale measure of support for war. Respondents who opposed the war even before the war was started are dropped.
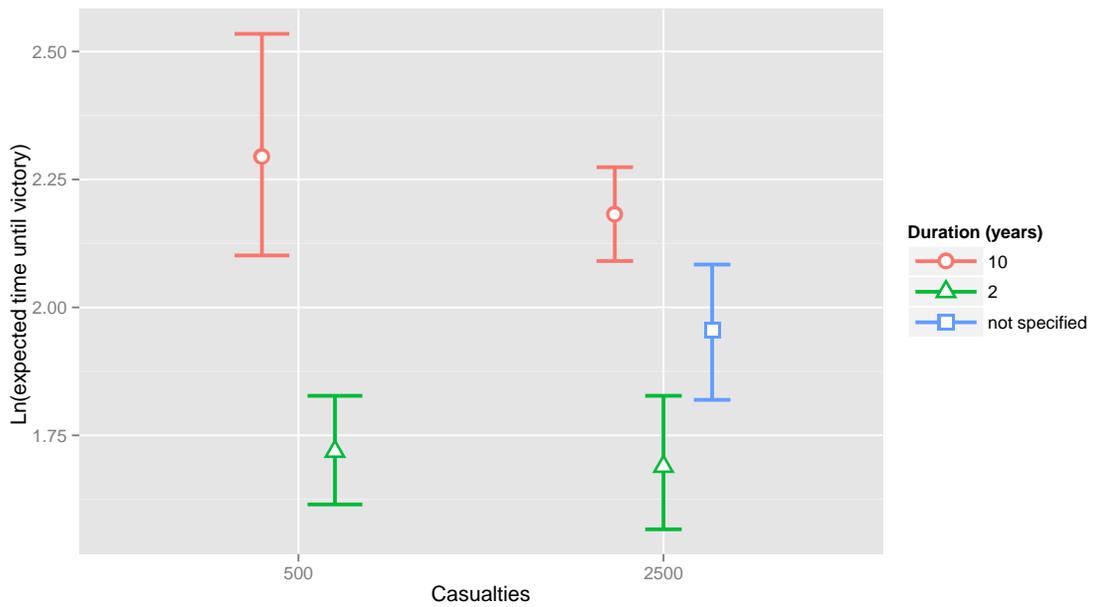
Figure 3.3: Confidence intervals showing expected duration of the remainder of the war for different treatment groups in the nationally representative sample.

Table 3.3: Experimental results show significant and substantively large effects of observed duration of war on the change in support for the continuation of war as well as the expected remaining duration of war.

Variables	ΔSupport		ln(Expected Duration+1)	
	Model 3.1	Model 3.2	Model 3.3	Model 3.4
TYEAR	-0.148 (0.067)	-0.146 (0.067)	0.104 (0.024)	0.104 (0.025)
$T_{KIA}=300$		0.004 (0.226)		0.000 (0.084)
$T_{KIA}=1500$		-0.243 (0.229)		-0.048 (0.085)
Intercept			1.493 (0.080)	1.509 (0.093)
Res. deviance	1043.4	1042.24		
Adjusted R^2			0.032	0.029
N	514	514	514	514

Models 3.1 and 3.2 are ordered logit and models 3.3 and 3.4 are ordinary least squares regressions. Intercepts in the ordered logit models are suppressed.
Standard errors are reported in parentheses.

Table 3.4: Experimental results show significant and substantively large effects of observed duration of war on the change in support for the continuation of war as well as the expected remaining duration of war.

Variables	ΔSupport		ln(Expected Duration+1)	
	Model 3.5	Model 3.6	Model 3.7	Model 3.8
TYEAR	-0.048 (0.017)	-0.048 (0.017)	0.067 (0.009)	0.067 (0.009)
T_{KIA}		-11e-5 (6.9e-5)		-3.6e-5 (3.6e-5)
Intercept			1.566 (0.064)	1.642 (0.085)
Res. deviance	2545.11	2542.40		
Adjusted R^2			0.102	0.101
N	791	791	791	791

Models 3.5 and 3.6 are ordered logit and models 3.7 and 3.8 are ordinary least squares regressions. Intercepts in the ordered logit models are suppressed.
Standard errors are reported in parentheses.

3.3   Duration of Counter-Insurgency Operations

In order to test Hypothesis 2.7, I rely on a data set of counterinsurgency (COIN) wars collected by Jason Lyall.[5] There are two criteria for a war to be included in this data set: (1) there must be at least 1000 battle deaths, with at least 100 battle deaths on each side; (2) the insurgents must rely on guerrilla tactics and seek to obtain the allegiance of at least a portion of the population.

There is not a one-to-one relationship between counterinsurgencies and what is defined here as asymmetric wars: some asymmetric wars are not COIN, and some COINs are not asymmetric. I will rely on a partial remedy for this problem by focusing on COINs where the state is fighting in an occupied territory. The reason is that fighting domestic insurgents is often an important matter of national security, which can hardly be characterized as a low-stakes war. With this added criterion, the sample is the population of asymmetric wars in the past two centuries where the incumbent state is an occupying force. For comparison, I will also provide the results for domestic COINs as well.

The design departs from Lyall's original analysis of this data set in two main ways. First, instead of relying on measures of democracy, I will use size of the winning coalition from the selectorate theory, which, as argued before, better captures the difference between the two institutional settings in my models.[6] Second, as mentioned above, wars are analyzed in two partitions: when the state fights a domestic insurgency, and when the state is an occupier. Hypothesis 2.7 only applies to the latter.

The unit of observation is COIN wars. The dependent variable is duration of wars in months. The failure event is either the end of the war, or the end of the war

---

5. Details of the data collection procedures as well as summary statistics can be found in (Lyall 2010).

6. See Bueno de Mesquita et al. (1999) for an introduction to the selectorate theory and an application to the democratic peace. For a thorough treatment of the subject and a variety of application refer to (Bueno de Mesquita et al. 2003).

only if the state does not win; this distinction is discussed in more detail below. The explanatory variable of interest is W (size of the winning coalition). Both W and S (size of the selectorate) range from 0 to 1. I will control for a number of explanatory variables typically associated with war outcome or war duration (Reiter and Stam 1998; Fearon and Laitin 2003; Lyall and Wilson III 2009; Lyall 2010). POWER is the log of the power of the state as coded by the correlates of war project (Ghosn, Palmer, and Bremer 2004). COLD WAR is a binary variable showing whether the war happens during the Cold War (1946-1989) or not. MECH is a measure of how much an army relies on machines instead of soldiers. The measure is based on the ratio of motorized vehicles to soldiers one year prior to the start of the conflict, and ranges from 1 (lowest mechanization) to 4; the variable is 0 for wars before 1917 (Lyall and Wilson III 2009). SUPPORT measures whether the insurgents had material support from or sanctuary within a foreign state; the variable takes 0 if they had neither, 1 if they had one but not the other, and 2 if they had both material support and sanctuary. DISTANCE is the logged value of the distance between the capital and the primary battle zone (in kilometers). ELEVATION is a the log of average altitude of the battleground (in meters).

Using Schoenfeld residuals, we cannot reject the assumption of proportional hazard, and therefore, I will use Cox proportional hazard estimation for the analysis (Schoenfeld 1982). Robustness checks reported in Appendix III.B show that the substantive results do not depend on this assumption, as, for example, essentially similar results are obtained if we assume a generalized gamma distribution. The empirical models used are variations of the following model.

$$\lambda(t|\text{W}, \text{S}, X) = \lambda_0(t) \exp(\alpha_1 \text{W} + \alpha_2 \text{S} + \beta' X),$$

where $\lambda(t)$ is the hazard function, W and S are sizes of the winning coalition and

selectorate, X is a vector of covariates for each observation, and $\lambda_0(t)$ is the underlying hazard function. The parameter of interest is α_1, which is reported as a hazard ratio, i.e., as $\exp(\alpha_1)$.

Table 3.5 shows the results. There are two models with similar parametric specification. The models differ in how the events are specified. In Model I, I assume that a war lasts until it ends in any possible outcome. In Model II, I assume that a war lasts until it ends in a draw or a loss for the state; if a war ends in victory for the state, I will consider that war right-censored because, one might say, the true end of the support for war has not been observed. It is not clear which model is a better choice for testing Hypothesis 2.7. On one hand, we are interested in how long support for a war lasts, and a war that ends in victory should be treated differently from wars that end before victory is achieved. On the other hand, the concept of victory is fluid and endogenous to the trajectory of the war.[7]

Each model is tested on two subsamples: when the state is fighting a domestic insurgent, and when the state is an occupying force. The result is in clear support of the hypothesis: higher levels of w is associated with shorter COINs only when the wars are in foreign lands. The reported coefficients are proportional hazard rates, which makes the interpretation of the results straightforward: for example, in the right hand column of Model I, at any moment, a state with W= 1 is 3.87 times more likely than a state with W= 0 to observe a war ending event, assuming that everything else is held constant.

A number of different model specifications, hazard distributions, and different ways of calculating standard errors have been tested. Appendix III.B provides some of these robustness checks. Due to the small number of cases and the underlying correlations, the hazard rate varies widely, but the substantive result remains the same.

---

7. For a discussion on the many synonyms of "victory" and different levels of victory see (Martel 2006, Chapter 4).

Table 3.5: Results of the survival time analysis for counterinsurgency war. When fighting as an occupying force, states with a larger winning coalition size (higher W) stop their fights against insurgencies more quickly than others. Models I and II only differ in what is considered a failure event.

Failure event	Model I *any end of war*		Model II *war ends in loss or draw*	
Variables	Domestic	Foreign	Domestic	Foreign
W	1.495	3.865	0.876	7.368
	(0.293)	(0.001)	(0.804)	(0.031)
S	0.804	2.099	0.906	2.028
	(0.550)	(0.105)	(0.813)	(0.297)
POWER	0.886	1.108	0.784	0.914
	(0.005)	(0.119)	(0.007)	(0.460)
SUPPORT=1	0.869	2.945	1.197	7.313
	(0.546)	(0.000)	(0.630)	(0.000)
SUPPORT=2	0.490	1.278	0.689	1.562
	(0.008)	(0.350)	(0.280)	(0.329)
DISTANCE	0.953	0.782	0.941	0.807
	(0.142)	(0.000)	(0.160)	(0.061)
MECH	0.904	0.785	1.114	0.845
	(0.227)	(0.013)	(0.387)	(0.255)
ELEVATION	0.963	0.919	0.889	0.956
	(0.434)	(0.236)	(0.157)	(0.739)
COLD WAR	0.469	0.612	0.396	0.861
	(0.000)	(0.058)	(0.000)	(0.648)
Observations (clusters)	155 (65)	90 (21)	155 (65)	90 (21)
Number of failures	155	90	74	38
Wald χ^2	37.87	65	28.85	59.43
Log Pseudo-Lik	-618.2	-306.9	-267.4	-122.5

Reported coefficients are hazard ratios from the Cox proportional hazard model, with Breslow method for resolving ties. Robust two-tailed p-values, obtained from standard errors clustered on individual country codes, are reported in parentheses.

Finally, note that while the result of Table 3.5 may seem to contradict Lyall's original work, it is a different result to a different question. Lyall's work is concerned with counterinsurgencies per se, and whether democracies, as argued by some scholars, perform worse than non-democraceis in counterinsurgency operations. His results are, as his extensive study shows, remarkably robust. But the focus of my work has been on counterinsurgencies fought on a foreign land, and the institutional feature I am interested in is the size of the winning coalition.[8]

The results provided here improve our confidence in Hypothesis 2.7. Note, however, that the number of observations is very small (especially when failure is assumed to only mean loss or draw), and the analysis probably suffers from omitted variable bias. There is probably little justification for a causal interpretation of the results of duration models presented here, except that the state-level results agree with our theoretical expectations and individual-level results.

3.4   Conclusion

I tested the main institutional and behavioral hypotheses of the model. Since time is highly correlated with any aggregate measure of cost, it is not possible to test the behavioral predictions using available observational data. I relied on a survey experiment to provide a preliminary test of the theory. The results show that as a war continues, citizens' support for the continuation of the war decreases while their estimation about its expected remaining length increases. I used counterinsurgency wars to test the institutional hypothesis. In counterinsurgency wars, leaders with a larger winning coalition (in their domestic institutions) end their wars more quickly

---

8. For a methodological discussion on the differences between size of the winning coalition and other measures of democracy refer to (Clarke and Stone 2008; Morrow et al. 2008). Using polity score's measure of executive constraints (XCONST) yields similar results, but the results are dependent on model specification. Moreover, W is better than XCONST on methodological grounds; one of the reasons is that it is a ratio measure, as opposed to XCONST which is ordinal. Using selectorate theory's W/S measure gives almost exactly the same results as W.

when the war is outside their own state, whereas for domestic counterinsurgency wars (presumably, due to the high stakes of the war), there is no perceptible difference between states with large or small winning coalitions.

Appendix III.A   Survey Design and Recruitment

Survey Flow

The survey flow was as follows: a number of demographic question (gender, age, education, income, and political ideology; only asked in the first survey), a question about participants' ideology (branching Likert scale ranging from 1 to 7), the war vignette (reflected below), a question about their level of support for war (branching Likert scale ranging from 1 to 4 in the first survey and ranging from 1 to 6 in the second survey), information about the war (which provided two types of treatment: length of time since the beginning of the war and casualty information, a question about their level of support for the continuation of the war (branching Likert scale from 1 to 4 in the first survey and ranging from 1 to 6 in the second survey), reminding the information about war, and a question about their expectation for the remainder of the war if the United States decided to fight until the terrorists are completely disarmed. Two trick questions were asked: one in the middle of the demographic question and the other at the end of the survey. Both asked simple arithmetic questions, but instructed participants to choose a specific wrong answer instead of solving the question, to test their attentiveness.

War Introduction Vignette

The following is a hypothetical scenario about a war with a terrorist group that has recently been in the news. Please read the description carefully.

Boko Haram is a terrorist group in Central Africa. They have been re-

cently involved in a number of high profile terrorist activities, including kidnapping schoolgirls. They now control parts of Nigeria and Cameroon and they have also threatened to harm the United States. Some intelligence experts have argued that Boko Haram is trying to acquire the capability to carry out terrorist operations within the United States. The US is going to start a war with this group. The goal of the war is to destroy Boko Haram's military capabilities. The president as well as the leading figures of both Democratic and Republican parties support this war. In a televised speech, the president has informed the nation that he "will do whatever it takes to defeat Boko Haram." It is expected that the president will order the start of the war within a few days.

War Information

Treatment category is randomly selected and TYEAR and TKIA are chosen depending the treatment category.

> The US has been fighting this war for some time now. We want to know how you would think about this war. Here are some critical information about the war. Please read them carefully and spend a moment thinking about the situation. You will be tested on this information.

– [Not shown if TYEAR=NA] The war has been going on for [TYEAR] years.

– [Not shown if TKIA=NA] In this period, [TKIA] American soldiers have lost their lives.

– Boko Haram has been weakened, but they continue to operate a global network of terrorism.

– The war still has bipartisan support in the US Congress.

Recruitment of Participants

The first survey relied on MTurk to recruit respondents. Mturk participants have been shown to be different from a representative sample of the American public.

While this may be worrisome for surveys, it is not necessarily a source of concern for experimental designs. There is a growing body of published research that is relying on MTurk and investigations are showing MTurk to be better than an undergraduate convenience sample in that MTurk results are closer to results obtained from representative samples of the public (Berinsky, Huber, and Lenz 2012).

A task was defined requesting 600 participants (1 per person) and offering $0.30 to each successful participant. Participants were recruited with three conditions: Be inside the United States, have a total approval rating equal or greater than 90%, and have at least completed 50 job requests before. Participants were instructed that they need to be American citizens, connecting from a regular Internet connection, and not connecting from a mobile device. The description said that the survey was for academic research and that geographic information would be collected to make sure participants were within the United States. Participants needed to follow a link to Qualtrics website to take the survey. The first page of the survey informed participants that they should read the questions carefully and that failing to follow instructions may result in early termination of the survey. Participants who reached the last page were given a personal token to enter in MTurk. They were rewarded based on their token.

In total, 722 workers started the survey but 111 either voluntarily dropped out of the survey or were led to the end of the survey because they failed one of the trick questions. Extensive efforts were made to remove participants who did not connect from the United States, connected from a known problematic IP address, connected using a mobile device, or failed to correctly answer manipulation checks. After this cleaning process, 514 rows of data remained. The removal was not based on the values of the variables.

Because drawing the policy-relevant lessons from this research requires the ability to generalize to the American adult population, the second survey relied on Survey

Sampling International (SSI) to field the survey to an existing panel and match the sample to the American adult population on age, gender, race, income, education, and geographic location. The target was set at $N = 1000$ which was reached after 2575 respondents had started the survey. Respondents who failed to correctly answer two trick questions were not able to continue. After removing respondents who had failed to correctly answer manipulation checks, 956 rows of data remained. The removal was not based on the values of the variables.

Appendix III.B   Robustness Checks

Survey Experiment

The results reported in Tables 3.3 and 3.4 reflect the design prior to the fielding of the survey. The model specifications are minimal and no observation has been removed from the data, except for those which were dropped because of geographic location outside the US or those who failed treatment checks.

It may be the case that we are only observing a positive correlation between duration treatment and expected remaining duration because participants are mindlessly repeating the duration treatment they have received as the expected duration. Removing the observations where TYEAR=EXPDURATION is a simple way to check if this is the case. Doing so reduces the correlation, but the result is still substantively large and statistically significant: in the first survey (Model 3.3) we obtain $\hat{\beta} = 0.084$ (s.e.=0.030) and in the second survey (Model 3.7) we obtain $\hat{\beta} = 0.035$ (s.e.=0.012).

There remain important questions about the external validity of the result. Like any experiment, there are questions about the extent to which the observed behavior is representative of actual behavior. There are also questions about how the treatment is provided. What is the difference between actual duration of events—as observed by a person—and the duration of the event that is given as a bite-size piece of informa-

tion. Another concern is the difference between actual wars and hypothetical wars. Previous research in conflict has heavily relied on hypothetical scenarios, because it is possible to manipulate various aspects of the story.[9] But we do not know how much external validity is sacrificed to obtain ease of experimental manipulation. Further research is needed in this area.

COIN Duration

A set of robustness checks are performed to verify the stability of the results reported in Table 3.5. Table 3.6 reports one set of these results. Only the subset of the data where the state is an occupier are reported. As before, the two types of specifying a failure are reported next to each other. The table is estimated with the assumption that the hazard rate has a Weibull distribution, and that there is shared frailty (with a gamma distribution) among different observations of any given state. The last column in the table is clearly misspecified, but reported here as an alternative to a pair-wise correlation. The results are generally in agreement with our theoretical expectation.

Table 3.7 provides a different set of results estimated with the assumption of generalized gamma (and log-logistic) distributions. The reported coefficients in this table are time ratios. For example, the first column means if we hold everything constant, a state with W=1 fights wars that, on average, last 42% of the period of wars that a similar state with W=0 fights.

9. For two examples of hypothetical war scenarios used in survey experiments see (Tomz 2007; Trager and Vavreck 2011).

Table 3.6: Robustness checks for the results on war duration. Higher W is associated with shorter wars. Also, notice that the shape parameter is not significantly different from 1 ($\ln p$ is not different from 0), meaning that if the assumption of the Weibull distribution holds, the hazard rate does not have a monotonic trend.

Variables/Failure	Model III		Model IV		Model V	
	any end	*loss/draw*	*any end*	*loss/draw*	*any end*	*loss/draw*
W	4.052	8.716	2.522	2.040	1.351	1.392
	(0.014)	(0.043)	(0.027)	(0.187)	(0.386)	(0.452)
S	2.184	1.898				
	(0.374)	(0.598)				
POWER	1.108	0.921				
	(0.350)	(0.649)				
SUPPORT=1	3.389	9.035				
	(0.002)	(0.000)				
SUPPORT=2	1.308	1.684				
	(0.546)	(0.398)				
MECH	0.780	0.832				
	(0.088)	(0.353)				
DISTANCE	0.786	0.800				
	(0.011)	(0.089)				
ELEVATION	0.915	0.947				
	(0.377)	(0.706)				
WWII	0.580	0.799	1.378	2.666		
	(0.508)	(0.863)	(0.422)	(0.032)		
COLD WAR	0.590	0.865	0.459	1.101		
	(0.173)	(0.765)	(0.005)	(0.769)		
Constant	0.063	0.007	0.017	0.006	0.022	0.010
	(0.031)	(0.008)	(0.000)	(0.000)	(0.000)	(0.000)
Shape: $\ln p$	0.986	1.085	0.945	0.975	0.928	0.950
	(0.861)	(0.524)	(0.460)	(0.811)	(0.351)	(0.619)
Frailty: $\ln \theta$	0.000	0.000	0.0606	0.000	0.116	0.000
	(0.977)	(0.987)	(0.028)	(0.983)	(0.022)	(0.988)
N (groups)	90 (21)	90 (21)	109 (21)	109 (21)	109 (21)	109 (21)
Wald χ^2	27.11	22.26	9.695	4.729	0.751	0.569
log likelihood	-140.9	-82.67	-177.9	-118	-182.3	-120.1

Reported coefficients are hazard ratios. All models use a Weibull distribution with shared frailty, clustered on individual countries. Robust two-tailed p-values, obtained from standard errors clustered on individual country codes, are reported in parentheses.

Table 3.7: Robustness check for war duration results. Note that the coefficients are time ratios. κ is estimated to be larger than 1 and not significantly different from 0, which means the test does not help us understand the underlying distribution; it could be Weibull, log-logistic, or something else.

Variables/Failure	Model VI		Model VII		Model VIII	
	any end	*loss/draw*	*any end*	*loss/draw*	*any end*	*loss/draw*
W	0.410	0.243	0.315	0.275	0.694	0.765
	(0.049)	(0.091)	(0.009)	(0.112)	(0.223)	(0.510)
S	0.403	0.589	0.933	1.623		
	(0.156)	(0.680)	(0.921)	(0.468)		
POWER	0.871	1.081				
	(0.074)	(0.570)				
SUPPORT=1	0.425	0.190				
	(0.012)	(0.000)				
SUPPORT=2	1.099	0.823				
	(0.772)	(0.686)				
DISTANCE	1.207	1.180				
	(0.007)	(0.255)				
ELEVATION	1.057	1.006				
	(0.574)	(0.955)				
WWII	3.754	2.960	2.512	0.861		
	(0.005)	(0.053)	(0.033)	(0.894)		
COLD WAR	2.613	1.665	3.253	0.901		
	(0.000)	(0.146)	(0.000)	(0.842)		
Constant	22.96	77.25	52.32	191.9	45.40	98.68
	(0.002)	(0.007)	(0.000)	(0.000)	(0.000)	(0.000)
Shape: $\ln\sigma$	1.108		1.172	1.036	1.229	1.259
	(0.215)		(0.011)	(0.961)	(0.000)	(0.111)
Shape: κ	1.729		1.600	2.957	1.713	1.612
	(0.233)		(0.207)	(0.502)	(0.023)	(0.207)
Shape: $\ln\gamma$		0.772				
		(0.108)				
N (clusters)	90 (21)	90 (21)	90 (21)	90 (21)	109 (21)	109 (21)
Log pseudo-lik	-141.4	-85.91	-145.3	-91.43	-182.4	-119.4
generalized gamma	×		×	×	×	×
log-logistic		×				

Reported coefficients are time ratios. Two-tailed p-values, calculated from robust standard errors clustered on individual countries, are reported in parentheses. The second column is estimated using the log-logistic distribution because the estimation using the generalized gamma distribution was numerically not possible.

CHAPTER IV

Why Not Try Harder?

4.1 Introduction

One of the recurring questions in the study of international conflict is why powerful states lose to much less powerful adversaries. Even the best bets may lose from time to time; the puzzle is that strong states, with all their modern weaponry, seem to have become weaker, vis-à-vis their weakest enemies, compared to a century ago. Democracies, in particular, seem poorly equipped to fight their weak adversaries. Moreover, powerful states, especially democracies, sometimes fail to choose strategies that are generally understood to lead to victory and instead opt for strategies that are considered less effective (Mack 1975; Arreguin-Toft 2001; Sullivan 2007; Lyall and Wilson III 2009). In this article, I present a model of military supply that provides a parsimonious explanation for these patterns and intervenes in the debates about democratic disadvantages in small wars.

The puzzles mentioned above are important, both because of their significant policy link and because of their bearing on our understanding of implications of democratic forms of government on international relations. It is, therefore, not surprising that the topic has received much attention from students of international security. There are at least three main lines of explanation offered for the observed phenomena: explanations based on structural factors (including institutions), based

on selection, and based on norms.

The first group of explanations put emphasis on institutions and other structural factors. Mack (1975) famously argues that the balance of power is inversely related to the balance of motivation, which leads to not winning wars by strong states due to a lack in political support for wars. Others have contended that modern military institutions are ill-equipped to fight small wars, either because of their slow adoption of appropriate strategies, or because of their overemphasis on weapons and equipment rather than human interaction with occupied peoples (Krepinevich 1986; Lyall and Wilson III 2009). The second category of explanations focuses on selection effects. Sullivan (2007) argues that powerful states sometimes relinquish victory because they realize they are fighting wars they do not wish to fight, and conflicts with certain objectives are more likely to lead to asymmetries of information and as a result higher chances of such miscalculation. Hence, some types of wars are more likely to be chosen poorly. The third group of explanations have focused on normative reasons arguing that fighting small wars requires a levels of brutality that is prohibited by democratic norms. Thus, democracies are not adept at fighting small wars while these norms do not constrain their non-democratic opponents (Merom 2003).

Perhaps no single factor is going to fully explain the three interrelated puzzles mentioned here and each of the existing theories may have some contribution, but there are a number of ways that existing explanations encourage further work in this area. First, much of the structural explanations assume somewhat irrational decisions, or require the strong state to not learn from its past mistakes. For example, why do armies, in the face of the knowledge about the importance of having human contact with occupied populations, fail to provide that contact? Second, most of the received explanations rely on a narrative that ignores the selection stage (the bargaining phase), and the ones that are based on selection do not provide a satisfactory answer for why these wars sometimes last very long. Arguments based on norms

fail to account for significant episodes of international conflict by democratic states (Reiter and Stam 2003, 149). It may be true that an atomic bomb would have "solved the problem" in Vietnam, but it hardly follows that the American failure in Vietnam was due to democratic values and norms. Moreover, there is a disagreement in the literature about whether or not democratic states are weaker than other states when they fight small wars (Merom 2003; Lyall 2010; Caverley 2014). Lyall points to a major flaw in the literature: works studying the effect of democratic governance on fighting insurgencies often limit their scope to democracies and do not allow variation in their independent variables. Once this flaw is remedied, he finds little difference between democracies and non-democracies.

I consider a simple crisis bargaining model, with the novel feature that military power is assumed to have two components, weapons (or equipment) and soldiers; I shall refer to these as capital and labor. These components are collected from the public as taxes. The importance of each of these components is known for each international crisis, but may be different from one crisis to another. A number of hypotheses are obtained from the model. These hypotheses correspond well with existing qualitative evidence and are corroborated with quantitative tests performed here. Most importantly, I show that as the importance of labor increases, democracies become weaker compared to non-democracies, but not necessarily in absolute terms. That is, a change in the importance of labor affects democracies more than it affects non-democracies. This presents a more nuanced understanding of the debate about whether or not democracies are worse than non-democracies in fighting weak adversaries. I present preliminary empirical evidence in support of this prediction.

The paper contributes to the continuing debates in the literature in a few ways. The idea that military power has different components is not new, but this paper presents the first model where the two basic components of military power are chosen endogenously on a two-dimensional plane. Moreover, as mentioned, the model allows

71

for a parsimonious explanation of why strong states perform worse in some wars, why they fail to choose the optimal strategies, and why democracies are affected more strongly with the type of war they face. Finally, the model also provides new predictions that are borne out by empirical tests. In particular, it is predicted that inequality leads to more capital intensive militaries in democracies and to more labor intensive militaries in non-democracies, a limited test finds supporting evidence for this hypothesis.

The paper is organized as follows: presentation of the theory and the model; a study of the equilibrium outcomes of the model; a discussion of testable hypotheses from the model; preliminary empirical results; and conclusions.

4.2   Capital and Labor

The fact that military forces have different components is perhaps as old as the study of war, but it is often assumed that we can model military power along a single dimension.[1] In empirical studies, military power is usually measured with a fixed combination of various factors such as national wealth, population, and the level of economic development. The Correlates of War project provides the Composite Index of National Capabilities (CINC), which is the most frequently used measure in quantitative studies of militarized conflict (Singer and Small 1994).[2] In the context of asymmetric wars, Lyall and Wilson III (2009) use a distinction between "machine" and soldiers to explain why modern militaries are not well-equipped to fight insurgencies. Similarly, the distributional effects of where these components come from have been used to explain the "new militarism" of democratic states (Bacevich 2013, Chapter 4). In a similar vein, Caverley (2014) presents what he coins "the cost distribution

---

1. For an early attempt in studying arming with the tools of modern economics see (Cooper and Roll 1974).

2. There exist a minority of large-N studies of international conflict that look at components of military power in studying various questions (Mintz and Huang 1991; Scheve and Stasavage 2012).

theory," based on the assumption that the median voter benefits from wars more than they pay for it, and therefor encourage the state to engage in risky behavior.

Game theoretic models that include arming as a decision by one of the players often have a guns-versus-butter tradeoff. Powell (1993) uses such a trade-off to study the dynamics between two states in an anarchic international system. Bueno de Mesquita et al. (1999) use such a trade-off to study states' decision processes about which wars to fight and how to fight them. This trade-off can be implicit in the sunk costs of militarization (Slantchev 2005). Similarly, Caverley (2014, 56) relies on a model where militarization happens in a single dimension. This presents a clear gap between the theoretical claims about components of military power and existing formal models.

I study the behavior of both democratic and non-democratic states in an asymmetric war, meaning that the strong state faces a much weaker adversary, but over an issue of marginal importance to the strong state. Following previous models, I assume that victory is a public good and try to answer how much states take risks that may escalate an existing crisis to war, and when war happens, how do they decide how many soldiers to recruit and how much money to spend. In some wars, which side wins a war heavily depends on which side has more weapons and better weapons, while in other wars, it depends more heavily on the number of soldiers that each side mobilizes.

The strong state is assumed to have two economic classes. Only the poorer class contribute to the draft. In the extreme case, Russian serfs "owed" a military service of twenty five years to the state in 1820's (Bitis 2003), but even when there is a universal draft in a democratic country, the distribution of soldiers is not uniform.[3]

---

3. When forced to join the military for one reason or another, sons of well-connected and well-pocketed individuals rarely see danger. The existence of the so called "Champagne Units" lucidly demonstrates this fact. Even in ancient times when the elite wanted to fight in wars, the likelihood of getting killed was always much higher for the poor, who had less protection, were not mounted, and had subpar weapons.

Poutvaara and Wagener (2006) argue that draft is politically attractive because it can be a targeted tax.

4.3 The Model

Suppose an international crisis happens between two sides and may escalate to war. Suppose there is a considerable asymmetry of power and interest between the two sides: Side A is a state and is much more powerful than side B, which may or may not be a state; and the stakes have existential importance for B while they have marginal importance for A. The goal is to develop a model of war with endogenous military power for the strong side to study how states allocate their resources to fighting asymmetric wars and how this allocation depends on domestic factors.

War ensues if the bargaining process—defined below—breaks down. Before war, players have to decide about the makeup of their military. Since B is fighting for its survival against a much stronger adversary, I assume that it is a unitary actor with a fixed effort level, which means if a war happens, B's military power is fixed.

Domestic setting

Assume that State A has N citizens and that citizens are partitioned into elites (E) and masses (M).[4] All the masses and all the elite are supposed to have the same preferences, so the game has three players: E (the elite in A), M (the masses in A), and B, which is assumed to be a unitary actor.

The elite constitute λ share of the society, where $\lambda < 1/2$, so that they are the minority. The elite earn $(1 + r)$ times more than the masses, $y_E = (1 + r)y_M$. To fix the state income while allowing for inequality to vary, it is easier to work with the mean per capita income which is $\bar{y} = (1 + r\lambda)y_M$, and then define y_M, and y_E as

---

4. The domestic setup used here is based on Acemoglu and Robinson's models of democratic transition. See (Acemoglu and Robinson 2000, 2006).

functions of r and $\bar{y}$. Further assume that the elite are exempt from military service, but they are sensitive to casualties with a factor of ϕ, where $\phi \in [0, 1]$.

To build an army, the state collects two types of taxes: income tax and draft. Let τ and β denote the corresponding tax rates such that the army has Captial (K) and Labor (L) as follows

$$\begin{cases} K = \tau N \bar{y} \\ L = \beta N (1 - \lambda) \end{cases} \tag{4.1}$$

In the event of an imminent war, if A is democratic, I assume that the masses, who are the deciding block in elections, decide (τ, β). If A is not democratic, the elite determine tax rates.

War

I use a take-it-or-leave-it bargaining model of conflict as follows.[5] This assumes that information asymmetry between the two sides is the potential cause of bargaining failure. The bargain is over a prize worth v, and if A's offer is rejected by B, war happens. The winner of the war takes the whole prize. In line with previous work, I assume that the prize of war—or a share of it—is a public good.[6]

If war happens, both sides pay a cost regardless of whether or not they win and the winner gets the entire prize, v. For B, the cost of fighting is c_B, which has a twice differentiable cumulative distribution function $F_{c_B}(c)$ on the range of $[\underline{c_B}, \overline{c_B}]$; suppose $f_{c_B}(c)$ is the probability density function of c_B.

The cost of war for citizens of A are the capital and the human costs. The capital cost is paid through the capital tax which is τy_i. Let Ψ denote a measure of human

---

5. See (Fearon 1995) for a prominent use of this bargaining mechanism. The take-it-or-leave-it bargaining mechanism is attractive because of its simplicity, and allows me to focus on the question at hand. A bevy of variations of the bargaining protocol have been studied in the literature; see (Fey and Ramsay 2011; Slantchev and Tarar 2011) for a recent dialogue and (Powell 2002) for a review of earlier work.

6. The assumption that the stakes of a war are public goods is not challenging if we think of them as security, a shared sense of pride, economic opportunities, etc. In making this assumption I am following the work of Bueno de Mesquita et al. (1999).
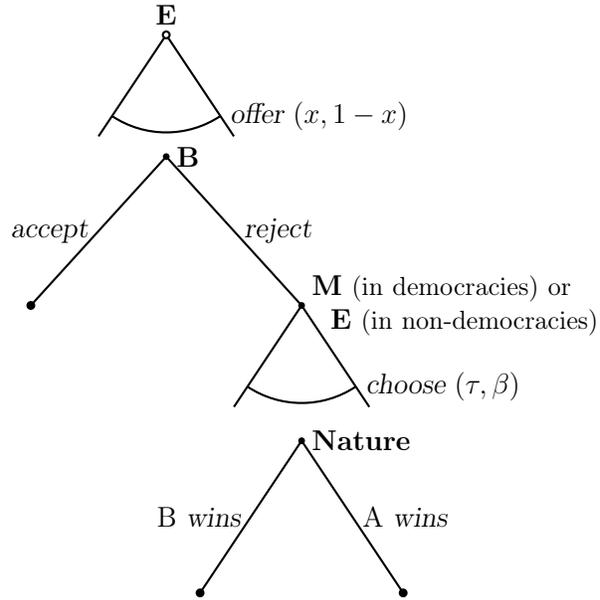
Figure 4.1: Order of player of the game. In democracies, tax rates are chosen by the masses (M) and in non-democracies, they are chosen by the elite (E).

cost of war so that the ex ante expected cost of war is $\beta\Psi$ for the masses and $\phi\beta\Psi$ for the elite. The simplest way of interpreting β and Ψ is to think β is the chance of being drafted and Ψ is the expected human cost for a soldier. But we can also think that Ψ is capturing all the human cost of war: being drafted, getting killed, having a relative who is drafted or killed, etc.

The order of play is as follows. The *elite* in A, the strong side, offer a division of the disputed prize to B. The division is $(xv, (1-x)v)$, where v is the prize and $x \in [0, 1]$ is the share that A keeps for itself. B can accept or reject the offer. If B accepts the offer, the division goes through and war is avoided. In this case, citizens of A each get $xv + y_i$ where y_i is their own income (which is either y_M or y_E), and B gets $(1-x)v$. Everything about A is common knowledge, but A does not know B's cost of fighting. The model is depicted in Figure 4.1.

Production function

The model is based on the assumption that the strong side chooses how much to invest in the war effort but the weak side makes an utmost effort. The capital and the number of soldiers on the strong side are translated into the probability of winning using a production function that is increasing in each component and has diminishing marginal returns.

To get analytical traction, I rely on the following adaptation of the Cobb-Douglas production function. A's military power is

$$\text{power}(K, L) = \max\{\alpha K^a L^b - 1, 0\} \tag{4.2}$$

where K and L are capital and labor, $\alpha > 0$ is a coefficient, and $a > 0$ and $b > 0$ depend on the type of war. Normalizing B's power to 1, and following the convention that probability of winning is one side's power divided by total power, the probability of winning the war by A is

$$\pi(K, L) = \frac{\text{power}(K, L)}{\text{power}(K, L) + 1} = \max\left\{1 - \frac{1}{\alpha K^a L^b}, 0\right\}. \tag{4.3}$$

Finally, to obtain comparative statics as the type of war changes, let us define $d = a + b$, and assume d is fixed so that taking derivatives with respect to b becomes more meaningful.

4.4 Analysis

In this section, I find the equilibrium values of parameters and then use them to study a number of comparative statics. We are interested in a number of outcomes and how their equilibrium values change: how much does State A invest in each component? How likely is State A to win the war? And how hawkish does State A

act (i.e., the size of the offer)? We want to find the difference between these outcomes in democracies and non-democracies, how they change as the income gap between the elite and the masses, how they change as the relative importance of soldiers compared to capital increases, and how they change as the human cost (sensitivity to casualties) increases.

Subgame Perfect Equilibria

We can use backwards induction to find the subgame perfect equilibria of the model. Let w_i denote the expected payoff to each player i in the event of war. We have

$$W_M = \pi^* v - (1 - \tau^*) Y_M - \beta^* \Psi \tag{4.4}$$

$$W_E = \pi^* v - (1 - \tau^*) Y_E - \beta^* \phi \Psi \tag{4.5}$$

$$W_B = (1 - \pi^*) v - c_B \tag{4.6}$$

Throughout this chapter, asterisks are used to indicate equilibrium values of parameters. Here, τ^* and β^* are known, which also determine π^*, because A's information is public knowledge.

Suppose that A's offer in the bargaining phase is rejected by B, so that war is going to happen. Optimal tax rates should satisfy the following first order conditions, where i denotes the player who sets the tax rates, i.e., M in democracies and E in non-democracies.

$$g_1 : \frac{\partial W_i}{\partial \tau} = 0 \tag{4.7}$$
$$g_2 : \frac{\partial W_i}{\partial \beta} = 0$$

In democracies, the first-order conditions are

$$g_1: \quad \alpha\tau\bar{y}(\tau\bar{y}N)^a(\beta(1-\lambda)N)^b - av(1+\lambda r) = 0, \tag{4.8}$$

$$g_2: \quad \alpha\beta\Psi(\tau\bar{y}N)^a(\beta(1-\lambda)N)^b - bv = 0.$$

and in non-democracies, the first-order conditions are

$$g_1: \quad \alpha(1+r)\tau\bar{y}(\tau\bar{y}N)^a(\beta(1-\lambda)N)^b - av(1+\lambda r) = 0, \tag{4.9}$$

$$g_2: \quad \alpha\beta\phi\Psi(\tau\bar{y}N)^a(\beta(1-\lambda)N)^b - bv = 0.$$

The second order conditions are always satisfied, because in both democratic and non-democratic states, the second derivatives are obtained as follows:

$$\frac{\partial^2 W_i}{\partial \tau^2} = -\frac{a(a+1)vK^{-a}L^{-b}}{\alpha\tau^2} < 0$$

$$\frac{\partial^2 W_i}{\partial \beta^2} = -\frac{b(b+1)vK^{-a}L^{-b}}{\alpha\beta^2} < 0.$$

Therefore, there is a unique set of tax rates that will be chosen if war should happen.[7] These tax rates are known to all players. Thus, in the bargaining phase, if A proposes $(x, 1-x)$ to B, B will accept the proposition if $(1-x)v > (1-\pi^*)v - c_B$. Let us define $\widetilde{c_B}$ as the threshold that makes B indifferent between accepting and rejecting an offer, i.e., $\widetilde{c_B}(x) = v(x - \pi^*)$. The elite's total expected payoff from choosing x is

$$U_E(x) = F_{c_B}(\widetilde{c_B}(x))W_E^* + \left(1 - F_{c_B}(\widetilde{c_B}(x))\right)(xv + y_E). \tag{4.10}$$

---

7. The optimal tax rates might not be an interior solution, but given the qualitative assumptions about the "asymmetric war," numerical values of parameters are substantively meaningful only when there are interior solutions for tax rates: both tax rates are bigger than 0 and less than 1, and victory is neither impossible nor guaranteed.

Hence, the elite's equilibrium choice should be a member of

$$X^* = \arg \max_{x \in [0,1]} U_E(x) \tag{4.11}$$

The optimal choices of τ and β are not affected by whether or not X^* has only a single member (i.e., whether or not (4.11) has multiple solutions); but to study comparative statics of the equilibrium value of the offer, let us assume that (4.11) has one solution, to which we shall refer as x^*, and $x^* \in (0,1)$. We are assuming uniqueness of x^* for convenience in analysis and simplicity in presentation, but it is worth highlighting that this is not a demanding assumption: indeed, the most widely used distributions of cost in the literature, namely, the uniform and the exponential distributions, are guaranteed to result in a unique solution for (4.11).

The interior solution of the offer should satisfy the first and second order conditions:

$$1 - F_{c_B}(\widetilde{c_B}(x^*)) - f_{c_B}(\widetilde{c_B}(x^*))\,(x^*v + y_E - W_E^*) = 0,$$
$$- 2v f_{c_B}(\widetilde{c_B}(x^*)) - v f'_{c_B}(\widetilde{c_B}(x^*))\,(x^*v + y_E - W_E^*) < 0.$$

Putting these conditions together implies

$$2 f_{c_B}(\widetilde{c_B}(x^*))^2 \geq -\left(1 - F_{c_B}(\widetilde{c_B}(x^*))\right) f'_{c_B}(\widetilde{c_B}(x^*)).$$

We can assume this constraint to hold for all values of $c \in [\underline{c_B}, \overline{c_B}]$, i.e.,

$$\forall c \in [\underline{c_B}, \overline{c_B}] : \; 2 f_{c_B}(c)^2 \geq -\left(1 - F_{c_B}(c)\right) f'_{c_B}(c). \tag{4.12}$$

It has to be highlighted that the uniform and exponential distributions satisfy (4.12).[8]

---

8. The uniform distribution satisfies (4.12) because it has $f'(.) = 0$. Also, solving $f_{c_B}(c)^2 = -\left(1 - F_{c_B}(c)\right) f'_{c_B}(c)$ yields an exponential distribution with arbitrary shift and rate and solving

Army Buildup

To see how the optimal tax rates change as the income gap grows, we can take implicit derivatives and use Cramer's rule as follows:

$$\frac{\partial \tau^*}{\partial r} = -\frac{\begin{vmatrix} \partial g_1/\partial r & \partial g_1/\beta \\ \partial g_2/\partial r & \partial g_2/\beta \end{vmatrix}}{\begin{vmatrix} \partial g_1/\partial \tau & \partial g_1/\partial \beta \\ \partial g_2/\partial \tau & \partial g_2/\partial \beta \end{vmatrix}}, \quad \frac{\partial \beta^*}{\partial r} = -\frac{\begin{vmatrix} \partial g_1/\partial \tau & \partial g_1/\partial r \\ \partial g_2/\partial \tau & \partial g_2/\partial r \end{vmatrix}}{\begin{vmatrix} \partial g_1/\partial \tau & \partial g_1/\partial \beta \\ \partial g_2/\partial \tau & \partial g_2/\partial \beta \end{vmatrix}} \tag{4.13}$$

In the democratic setting, (4.13) gives

$$\frac{\partial \tau^*}{\partial r} = \frac{\alpha(b+1)\lambda\tau^2\bar{y}K^a L^b}{av(a+b+1)(1+\lambda r)^2} > 0, \tag{4.14}$$

$$\frac{\partial \beta^*}{\partial r} = -\frac{\alpha\beta\lambda\tau\bar{y}K^a L^b}{v(a+b+1)(1+\lambda r)^2} < 0,$$

and in the non-democratic setting, (4.13) results in

$$\frac{\partial \tau^*}{\partial r} = -\frac{\alpha(b+1)(1-\lambda)\tau^2\bar{y}K^a L^b}{av(a+b+1)(1+\lambda r)^2} < 0, \tag{4.15}$$

$$\frac{\partial \beta^*}{\partial r} = \frac{\alpha\beta(1-\lambda)\tau\bar{y}K^a L^b}{v(a+b+1)(1+\lambda r)^2} > 0.$$

Note that the results do not depend on ϕ or Ψ. The following proposition is the result of (4.14) and (4.15).

PROPOSITION 4.1. *In a democracy, as the income gap between the elite and the masses widens, the army takes more capital and recruits fewer soldiers; in non-democracies, regardless of elite sensitivity to casualties, as the income gap grows, the army takes less capital and recruits more soldiers.*

Using the chain rule similar to (4.13), we have the following comparative statics

---

$2f_{c_B}(c)^2 = -(1 - F_{c_B}(c)) f'_{c_B}(c)$ yields a Cauchy distribution for B's cost.

with respect to b. In both democracies and non-democracies we obtain

$$\frac{\partial \tau^*}{\partial b} = \frac{\tau \left(\ln(K) - \ln(L)\right)}{d+1} - \frac{\tau}{a}, \tag{4.16}$$

$$\frac{\partial \beta^*}{\partial b} = \frac{\beta \left(\ln(K) - \ln(L)\right)}{(d+1)} + \frac{\beta}{b} \tag{4.17}$$

The first fractions in both expressions are positive if $K^* > L^*$, so this is a sufficient condition for $\frac{\partial \beta}{\partial b} > 0$, but $\frac{\partial \tau}{\partial b}$ can be positive or negative. If, however, the parameters are such that K^* is much larger than L^*, then an increase in the importance of labor and decrease in the importance of capital will still result in an increased capital tax rate as well as an increase in the rate of draft.

We can use (4.8) and (4.9) to compare the differences between democracies and non-democracies, in terms of their tax rates and also their chance of winning a war in equilibrium. The ratios of equilibrium values of the parameters of democracies (denoted by subscript D) to non-democracies (denoted by subscript ND) are

$$\frac{\tau_{\mathrm{D}}}{\tau_{\mathrm{ND}}} = \sqrt[1+a+b]{\frac{(r+1)^{1+b}}{\phi^b}} \tag{4.18}$$

$$\frac{\beta_{\mathrm{D}}}{\beta_{\mathrm{ND}}} = \sqrt[1+a+b]{\frac{\phi^{1+a}}{(r+1)^a}}$$

Importantly, compared to non-democracies, democracies always tax more and draft less.

Chance of Victory

There are various ways in which we can define "democratic advantage", but one which provides much algebraic ease is the ratio between the probability of failure of nondemocracies to the probability of failure of democracies. Let η denote democratic advantage defined in this way, i.e., $\eta = \frac{1-\pi_{\mathrm{ND}}^*}{1-\pi_{\mathrm{D}}^*}$. Note that η is, by definition, always

positive. Using (4.8) and (4.9) we find

$$\eta = \sqrt[1+a+b]{(1+r)^a \phi^b}.$$

Keeping d constant, we have $\lim_{b \to d^-} \eta = \phi$ and $\lim_{b \to 0^+} \eta = 1 + r$, so that for wars in which power depends only on capital, democracies perform better and for wars in which power depends only on labor, non-democracies perform better . Taking the derivative of η with respect to b (while keeping d constant), we obtain[9]

$$\frac{\partial \eta}{\partial b} = \frac{\eta \left(\ln(\phi) - \ln(r+1) \right)}{1 + a + b} < 0. \tag{4.19}$$

The next proposition summarizes the results of (4.18) and (4.19).

PROPOSITION 4.2. *Holding everything except regime type constant, in equilibrium, a democracy always recruits fewer soldiers and spends more capital for the military compared to a non-democracy. Consequently, as the importance of labor increases compared to the importance of capital, the democratic advantage is reduced and may turn into a disadvantage.*

How does the likelihood of victory change as b changes? In both democracies and non-democracies we obtain

$$\frac{\partial \pi^*}{\partial b} = \frac{(1 - \pi^*)\left(\ln(L) - \ln(K) \right)}{d + 1}.$$

The necessary and sufficient condition for $\frac{d\pi^*}{db} < 0$ is $K > L$, which is satisfied in any realistic set of parameters. Note that $\frac{\partial \pi^*}{\partial b} < 0$ is always more negative for democracies (compared to exactly similar non-democracies) because they always have a higher capital tax and lower draft rate.

---

9. We obtain the same result, i.e., $\frac{\partial \eta}{\partial b} < 0$, whether or not we keep $a + b$ constant.

PROPOSITION 4.3. *If $K > L$, as the importance of labor increases and the importance of capital decreases, both democracies and non-democracies are going to have lower chances of victory.*

In democratic and nondemocratic settings, respectively, we obtain the following comparative statics for how the likelihood of victory changes as the income gap between the masses and the elite changes.

$$\text{democracies: } \frac{\partial \pi^*}{\partial r} = \frac{\lambda \tau \bar{y}}{v(a + b + 1)(1 + \lambda r)^2} > 0, \tag{4.20}$$

$$\text{non-democracies: } \frac{\partial \pi^*}{\partial r} = -\frac{(1 - \lambda)\tau \bar{y}}{v(a + b + 1)(1 + \lambda r)^2} < 0. \tag{4.21}$$

Again, note that this result holds regardless of the values of the parameters, i.e., it holds so long as there is an interior solution to the optimization problem of the tax rates (4.7).

PROPOSITION 4.4. *In a democracy, as the income gap between the elite and the masses increases, the army becomes more likely to win the war; in a non-democracy, higher income inequality leads to lower chances of victory.*

Size of the Offer

To study how the size of the offer, i.e., $1 - x$, changes as other parameters change, I use monotone comparative statics to derive results without assuming a specific distribution of B's cost, c_B.[10]

At the outset, the elite's expected payoff is $U_E(.)$—as obtained from (4.10). As-

---

10. Monotone comparative statics comprise a family of powerful techniques for obtaining comparative statics using qualitative assumptions about complementarity of arguments. For original work, see (Topkis 1978; Milgrom and Shannon 1994), and for a tutorial on the use of these techniques in political science applications see (Ashworth and Bueno de Mesquita 2006).

suming that all parameters except r are fixed we have

$$\frac{\partial^2 U_E}{\partial r \partial x} = v f_{c_B}\left(\widetilde{c_B}(x)\right)\left(\frac{\partial W_E^*}{\partial r} + v\frac{\partial \pi^*}{\partial r}\right) + v^2\left(vx + y_E - W_E^*\right)f_{c_B}'\left(\widetilde{c_B}(x)\right)\frac{\partial \pi^*}{\partial r} \quad (4.22)$$

With some rearrangement and using (4.12), we obtain $\frac{\partial^2 U_E}{\partial r \partial x} < 0$, which means $U(x, r)$ is supermodular and implies the following proposition.

PROPOSITION 4.5. *As the income inequality grows, states become more generous (i.e., demand less) in the bargaining phase.*

Similarly, with respect to b we have

$$\frac{\partial^2 U_E}{\partial b \partial x} = v f_{c_B}\left(\widetilde{c_B}(x)\right)\left(\frac{\partial W_E^*}{\partial b} + v\frac{\partial \pi^*}{\partial b}\right) + v^2\left(vx + y_E - W_E^*\right)f_{c_B}'\left(\widetilde{c_B}(x)\right)\frac{\partial \pi^*}{\partial b} \quad (4.23)$$

In non-democracies, simplifying (4.23) using (4.12), and assuming $K > L$, we obtain $\frac{\partial^2 U_E}{\partial b \partial x} < 0$. In democracies, however, $K > L$ is not a sufficient condition for supermodularity of U_E with respect to x and b. This gives the following proposition.

PROPOSITION 4.6. *As the importance of labor increases and the importance of capital decreases, non-democracies become more generous (i.e., demand less) in the bargaining phase, but democratic states may become more or less generous.*

In the model, the bargaining phase is carried out by the elite, even in democracies. But what is the difference between the position of the masses and the elite before the war breaks out? Do the masses want to appease the enemy more or less than the elite? Let us assume that c_B is distributed uniformly over $[\underline{c_B}, \overline{c_B}]$. Remember that x^* is the share of the prize that A wants to keep for herself, so higher x^* means a more hawkish bargaining position. We denote the difference between the position of the elite and the masses as $\Delta x^* = x_M^* - x_E^*$. The elite's equilibrium value of x, obtained

from solving (4.11) with a uniform distribution, is

$$x_E^* = \frac{1}{2v}\left(\overline{c_B} + 2\pi^* v - \tau^* y_E - \beta^* \phi \Psi\right).$$

Now, suppose that instead of the elite, the masses had the power to propose a settlement in the bargaining phase; they would maximize their own payoff:

$$U_M(x) = F_{c_B}(\widetilde{c_B}(x))W_M^* + \left(1 - F_{c_B}(\widetilde{c_B}(x))\right)(xv + y_M).$$

Solving $\arg\max U_M(x)$ yields

$$x_M^* = \frac{1}{2v}\left(\overline{c_B} + 2\pi^* v - \tau^* y_M - \beta^* \Psi\right).$$

We find $\Delta x^* = (\tau^* y_M r - \beta^*(1 - \phi)\Psi)/2v$. In democracies, optimal tax rates satisfy (4.8), which implies

$$\Delta x_D^* = \frac{1 - \pi^*}{2}\left(ar - b(1 - \phi)\right)$$

In non-democracies, optimal tax rates satisfy (4.9), which implies

$$\Delta x_{ND}^* = \frac{1 - \pi^*}{2}\left(\frac{ar}{r + 1} - \frac{b(1 - \phi)}{\phi}\right)$$

In democracies, the necessary and sufficient condition for the masses being more hawkish than the elite is:

$$ar > b(1 - \phi). \tag{4.24}$$

In non-democracies, this condition is:[11]

$$ar\phi > b(1 - \phi)(r + 1). \tag{4.25}$$

---

11. To obtain (4.24) and (4.25), we assumed c_B is distributed uniformly. Interestingly, we find constraints that are exactly similar to these if we assume an exponential distribution of B's costs.

Remember that $r > 0$ and $\phi < 1$. In democracies, if the gap between the rich and the poor is large enough, i.e., $r > b/a$, the masses become more hawkish than the elite regardless of ϕ. But, in non-democracies, if $\phi < b/a$, the elite are more hawkish than the masses.

Sensitivity to Casualties

How do the quantities of interest change as sensitivity to casualties changes? We find that in both democracies and non-democracies

$$\frac{\partial \tau^*}{\partial \Psi} = \frac{\alpha \beta \tau (\beta(1-\lambda)N)^b \, (N\tau\bar{y})^a}{v(a+b+1)}, \tag{4.26}$$

$$\frac{\partial \beta^*}{\partial \Psi} = -\frac{(a+1)\alpha \beta^2 (\beta(1-\lambda)N)^b \, (N\tau\bar{y})^a}{bv(a+b+1)}. \tag{4.27}$$

As expected $\frac{\partial \tau^*}{\partial \Psi} > 0$ and $\frac{\partial \beta^*}{\partial \Psi} < 0$. Also, in democracies

$$\frac{\partial \pi^*}{\partial \Psi} = -\frac{\beta}{av + bv + v}$$

and in non-democracies

$$\frac{\partial \pi^*}{\partial \Psi} = -\frac{\beta\phi}{av + bv + v},$$

Finally, in both democracies and non-democracies, similar to (4.22), $\frac{\partial^2 U_E}{\partial \Psi \partial x} < 0$. These results are summarized in the following proposition.

PROPOSITION 4.7. *As the cost of casualties increases, both democracies and non-democracies will increase their capital tax and decrease their draft rate, and will become weaker overall, which also results in their more generous bargaining positions.*

Discussion

The comparative static predictions of the model paint a more complicated picture than what a guns-versus-butter or a non-strategic account of funding for armed forces

would provide us. Nevertheless, it is not difficult to make intuitive sense of the results. In democracies, because of the influence of poor voters, there is always more emphasis on capital and less emphasis on labor, compared to non-democracies that are identical in other parameters. As the gap between the rich and the poor grows, democracies will recruit even fewer soldiers and tax more capital, but the overall result will be more powerful armies, meaning higher chances of victory. For non-democracies, the opposite is true: as the income gap grows, they rely more on labor and less on capital, and the overall effect is weaker militaries.

Wars with much weaker adversaries often involves strategies that require more manpower. When the importance of soldiers vis-à-vis capital increases, there will be a larger draft; but the effect on capital tax can be positive or negative depending on other parameters. If the parameters are such that the military is really capital-intensive (i.e., $K >> L$), an increase in the importance of labor leads to not only a larger draft, but also a greater tax on capital.

Importantly, democracies are better than non-democracies when military power is determined more heavily by capital, but democracies lose this advantage as the nature of the war becomes such that the importance of capital is reduced and the importance of labor is increased. It is important to note that the comparison between democracies and non-democracies is valid in a difference-in-difference sense: democratic advantage is the difference between their respective likelihoods of victory, and we are predicting that democratic advantage goes down as the importance of labor goes up.

Also, as the nature of the prospective war shifts such that soldiers become more important and capital becomes less important, non-democracies become more lenient in the bargaining phase, but the effect on the bargaining position of democracies depends on other factors. In the model, it is assumed that bargaining is always performed by the elite, but they look down the game tree and know how powerful their army is going to be. In both democracies and non-democracies, larger income gaps

result in less hawkish stances by the elite in the bargaining phase. In democracies, this happens because the elite are going to contribute more toward the war effort; in non-democracies, this happens because the elite are going to contribute less and make a weaker army. The overall effect is that the elite take lower risks as they become richer compared to the rest of the society.

Finally, let us take a more critical look at the model. First, the model is based on a dichotomy between capital and labor. We are certain that this is a false dichotomy: at a minimum, we know soldiers also need to be paid. Nonetheless, the question is whether or not this is a useful simplification and my contention is that it is. Second, the driving force behind the dynamics that we see are the differences between the elite and the masses. There are two differences: the elite have a higher income and incur a lower human cost (e.g., they are exempt from the draft). Both of these are parameterized so in the extreme—i.e., $r = 0$ and $\phi = 1$—the elite and the masses are indistinguishable. The income difference seems to be more important in arriving at our qualitative predictions than the difference in human costs; for example, it can be seen that hardly any result changes substantively if we assume $\phi = 1$, whereas this is not true for the income difference.[12] It is clear that the results obtained here partly depend on the specific production function used.

4.5   Empirical Results

In this section, empirical tests of two of the main predictions of the model are presented. The first one looks at democratic advantage in different wars and the second test is about how arming decisions are affected by regime type and income inequality. Another piece of empirical evidence, which looks at the relationship between citizens' support for increasing troops in the Iraq war and income is presented

---

12. The empirical tests of the model are also interesting because empirical studies have not corroborated the expected dynamics in a uni-dimensional tax rate (Mulligan, Sala-i-Martin, and Gil 2003) as predicted by Meltzer and Richard (1981).

in Appendix IV.A. This last test is not about a prediction of the model, but about one of the key assumptions of the model: people with lower income support support more capital-intensive armies.

Democratic Advantage

Proposition 4.2 tells us that as the type of war shifts in a way that makes capital more important and labor less important, we should expect democratic states to lose their advantage over non-democratic states.

Ideally, we would want data that cover wars between adversaries with varying levels of power, and measures for a and b which tell us how relevant military power depends on capital and labor. In the absence of the ideal data, I use data from the Correlates of War project (Singer and Small 1994). To remedy the lack of measures for a and b, I use the balance of state power as a proxy for the strategies that are going to be used. As stated before, when strong states face much weaker adversaries, they are more likely to face guerrilla war tactics. Therefore, we expect democratic advantage to go down as the adversaries become weaker.

War is the unit of analysis, and the data are rearranged to accommodate the assumption of the model that State A is the stronger side. Each war appears in the data once for the originators of the conflict (and not "joiners").[13] The dependent variable in the analyses, WDL, is an ordinal variable showing whether State A won the war, ended the war with a draw, or lost it. This is interesting for us, but ultimately we are interested in a difference-in-difference measure which will be calculated in post estimation of our models. I use ordered logistic regression, which is the most widely used model in the literature for trichotomous war outcomes (Stam 1999; Downes 2009; Lyall 2010).

The main explanatory variable for this analysis is the interaction between state

---

13. Version 3.204 of EUGene was used to produce the data set; for details of EUGene and COW refer to (Bennett and Stam 2000) and (Singer and Small 1994).

capacity and democracy. For state capacity I use CINC, as provided in the COW data and generate the balance of national capacities as follows: $\text{BONC} = \frac{\text{CINC}_A}{\text{CINC}_A + \text{CINC}_B}$. For the measure of democracy, I use POLITY, which is a measure of democracy ranging from -10, most dictatorial, to $+10$, most democratic (Marshall and Jaggers 2011).[14]

The analysis is performed on the data from both 1816-2001 and the post-World War II era. COW provides data on various hostility levels which range from 1 (no militarized action) to 5 (a war with a total of at least 1000 battle deaths in a period of one year).[15] The analysis is performed on militarized interstate disputes with hostility levels equal or greater than 4 (use of military force). The analysis is also performed exclusively on hostility level of 5.

A number of other explanatory variables, beside POLITY for both sides and the interaction of the POLITY score of Side A and BONC, are included in the analysis which are explained as follow.[16] REVISION is a categorical variable which is included in the analysis as a set of dichotomous variables that show the goal of war. K_A, K_B, L_A, and L_B are capital and labor for A and B, respectively; these are military expenditure (in thousands US dollars, MILEX) and military personnel (in thousands of people, MILPER) for each side. In some models I control for $\ln(\text{K}/\text{L})$ for each side instead of controlling for each component separately. PEACEYEARS is the number of peace years between the two sides before the start of the dispute. Finally, INIT indicates whether or not Side A initiated the dispute. All the variables are obtained from the COW data through EUGene.

The results of the ordered logit estimations are presented in Table 4.1. Models 4.1, 4.2 and 4.4 have the same specification but are estimated with different samples: 4.1 is estimated on the entire sample, 4.2 is estimated using the post-WWII subset of the

---

14. More accurately, the updated 'polity2' score is used. The analysis can be done with a dichotomous measure of democracy without much change.

15. See Sarkees and Schafer (2000) for more details on COW data.

16. Models presented here include $\text{POLITY}_A \times \text{BONC}$; including $\text{POLITY}_B \times \text{BONC}$ does not change the results and only makes interpretation (with two interactions) more difficult.

Table 4.1: Ordinal logit results showing that democratic states have an advantage when they fight strong opponents but their advantage diminishes as they face weaker opponents. The dependent variable is WDL (win, draw, loss) for the strong state.

| Model | 4.1 | 4.2 | 4.3 | 4.4 |
Variable / Sample	Full Sample	Post WWII	Full Sample	Wars
POLITY$_A$	0.138	0.167	0.135	0.160
	(0.056)	(0.087)	(0.057)	(0.245)
POLITY$_B$	-0.014	-0.003	-0.014	0.014
	(0.012)	(0.018)	(0.012)	(0.047)
POLITY$_A \times$ BONC	-0.163	-0.174	-0.155	-0.085
	(0.069)	(0.109)	(0.070)	(0.301)
BONC	0.188	1.338	-0.012	0.731
	(0.569)	(0.888)	(0.880)	(2.270)
$\ln(\text{K}_A/\text{L}_A)$	0.106	-0.113		-0.014
	(0.062)	(0.115)		(0.290)
$\ln(\text{K}_B/\text{L}_B)$	0.092	-0.004		-0.257
	(0.060)	(0.110)		(0.322)
$\ln \text{K}_A$			-0.011	
			(0.078)	
$\ln \text{L}_A$			0.072	
			(0.111)	
$\ln \text{K}_B$			0.060	
			(0.081)	
$\ln \text{L}_B$			-0.083	
			(0.096)	
INIT	0.353	0.260	0.322	0.833
	(0.169)	(0.264)	(0.171)	(0.719)
PEACEYEARS	0.008	0.025	0.008	0.021
	(0.004)	(0.006)	(0.004)	(0.026)
COLDWAR	0.195	-0.684		0.739
	(0.182)	(0.329)		(0.711)
YEAR			0.011	
			(0.004)	
Observations	1,189	917	1,174	59
Log-Likelihood	-639.1	-288.5	-628.5	-54.68
Wald χ^2 (df)	53.01 (12)	33.38 (12)	59.69 (14)	15.85 (12)
Prob χ^2	4.11×10^{-7}	8×10^{-4}	1.33×10^{-7}	0.198

–Constants and fixed effects for revision type (territory, policy, regime change, other) are included in all models but suppressed in the table.
–Standard errors are reported in parentheses

sample, and 4.4 is estimated on a subsample that only includes wars (only hostility levels of 5 are included). Model 4.3 is only different in that it includes a number of other control variables. Theoretically, we expect the interaction of POLITY$_A$ and BONC to be negative, which is the case in all models. In model 4.4, however, the interaction is not statistically significant. It is important that the statistical significance of this interaction may be misleading. We are interested in the marginal effect of POLITY$_A$ for various values of BONC, and not able to directly make sense of the numbers reported in Table 4.1.

Before we interpret the size and meaning of the coefficients in Table 4.1, note that Model 4.4 performs very poorly; there is roughly a 20% chance that we get the same level of predictive power from noise. This is, in part, the result of a far smaller sample than other estimations (59 versus 1189). Still, for a well-specified model, 59 observations are not too few. Remember that the explanatory variables for military expenditure and military personnel are not those that are allocated to the war; they are national levels of military capacity. When we are studying military engagements that are stopped early, focusing on general military capacity (as opposed to deployed forces) is reasonable. When a militarized dispute rises to the level of war, however, there is more information regarding military mobilization, draft, and deployment specifically for that war. As such, it is harder to justify the use of national-level capabilities for our empirical studies when we only look at wars.

Figure 4.2 shows the difference between the likelihood of winning (i.e., WDL=1) for a fully democratic state (POLITY$_A$ = 10) and a fully non-democratic state (POLITY$_A$ = −10) at different levels of BONC; other explanatory variables are left at their means except REVISION which is set to REGIME. The shadow shows 95% confidence intervals and is obtained through bootstrapping. The figure shows that democracies have a sizable advantage—over non-democracies—in fighting powerful adversaries, but their advantage shrinks as the adversaries become weaker. In the figure, for adversaries that

are roughly equal in power, democracies are 16% more likely than non-democracies to win; for adversaries whose national capacity is 1/100 of the powerful state, democracies are on average 6% *less* likely to win.

Figure 4.2 provides a hint about why some studies have failed to see a difference between democracies and non-democracies in fighting small wars: while democratic advantage is positive and statistically significant for lower values of BONC, it is not significant for higher values of BONC.

The model suggests that we should look for the difference-in-difference measure. This is another way to interpret estimations reported in Table 4.1 by taking the difference between democratic advantage for low values of BONC (relatively equally powerful adversary) and comparing it to democratic advantage in high values of bonc (much weaker adversary). The results are reported in Table 4.2. DID shows the difference in difference estimation: the difference in the likelihood of victory between a democracy and a non-democracy (POLITY scores of $+10$ and -10) when balance of state capacity goes from $\frac{1}{2}$ to $\frac{100}{101}$ (from equal state capacity to having 100 times more state capacity). For predictions, COLDWAR $= 0$ and all other variables are set at their means. Standard errors are obtained from bootstrapping.

The results warrant some skepticism both because of the leap from the theory to the empirical evidence—using measures of national armed forces in lieu of actual troops and capital dedicated to the conflict—and (possibly, as a result of this shortcoming) there was no statistically significant finding for militarized disputes that COW has coded as war. Nonetheless, the results corroborate the theoretical expectation that the "democratic advantage" is attenuated and may even turn into a disadvantage when the powerful side faces a much less powerful adversary.
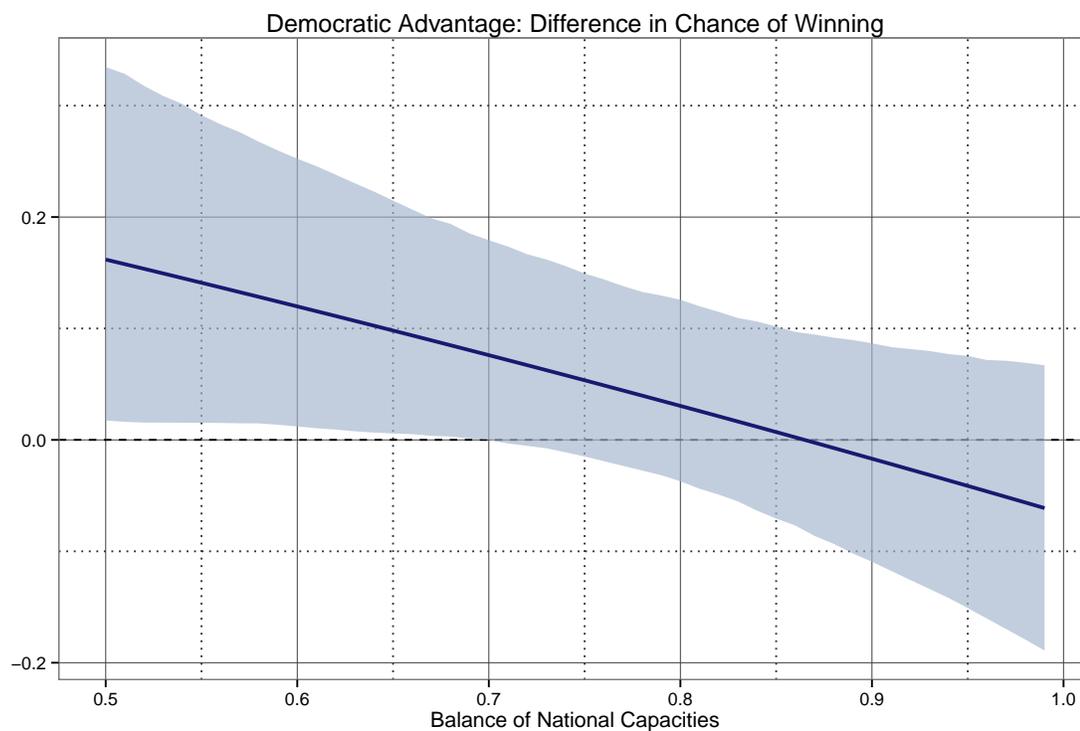
Figure 4.2: Democratic (Dis)Advantage

Table 4.2: Difference in difference estimations: the difference in the likelihood of victory between a democracy and a non-democracy (POLITY scores of $+10$ and -10).

Model	Revision Type	DID	(Std. Error)
4.1	Territory	-0.147	(0.076)
4.1	Policy	-0.071	(0.037)
4.1	Regime	-0.189	(0.109)
4.1	Other	-0.105	(0.055)

The Effect of Inequality

One of the new predictions of the model is how inequality affects military buildup. As Proposition 4.1 suggested, the model predicts that higher economic inequality leads to more capital intensive militaries in democracies, and to less capital-intensive militaries in non-democracies for fighting asymmetric wars.

Because of data availability problems, I test this hypothesis using total military expenditure and personnel for each country. The unit of analysis is country-year. For each observation, as before, K and L show military expenditure (in thousands of US dollars) and military personnel (in thousands of people), which correspond to K (capital) and L (labor) components of power in the model. As the dependent variable, two different measures are used. The first one is a simple ratio: $\kappa = \ln\left(\frac{\text{K}}{\text{L}}\right)$. Figure 4.3 shows the distribution of κ. Another way is to use the balance of K and L for each country by measuring how much of their power comes from each. For this purpose we must first make the scales comparable. Let us divide each component by its average in all the available observations (denoted by a bar) and then let $\tilde{\kappa}$ denote the balance of components. We have

$$\tilde{\kappa} = \ln\left(\frac{\overline{\text{L}} \times \text{K}}{\overline{\text{L}} \times \text{K} + \overline{\text{K}} \times \text{L}}\right).$$

As a measure of democracy, I use the polity score;[17] For income gap between the rich and the poor, I use the Gini coefficient, as measured by the World Bank. Gini is theoretically bound between 0 and 1; higher values show more inequality. In our data, GINI is measured in percentage and ranges from 16.23 to 74.33. Unfortunately, GINI is available only very sparsely. All the tests performed here are performed twice: once on the available data, and once more after imputing Gini (and also Gross National Income, which also has some missing values) 100 times and averaging over results and correcting for the ambiguity resulting from variability in the imputation.[18] Other

---

17. Using w from the selectorate theory yields similar results.
18. World Bank data are obtained from the World Development Indicators by using the WDI tools

Distribution of ln(Military Expenditure/Personnel)
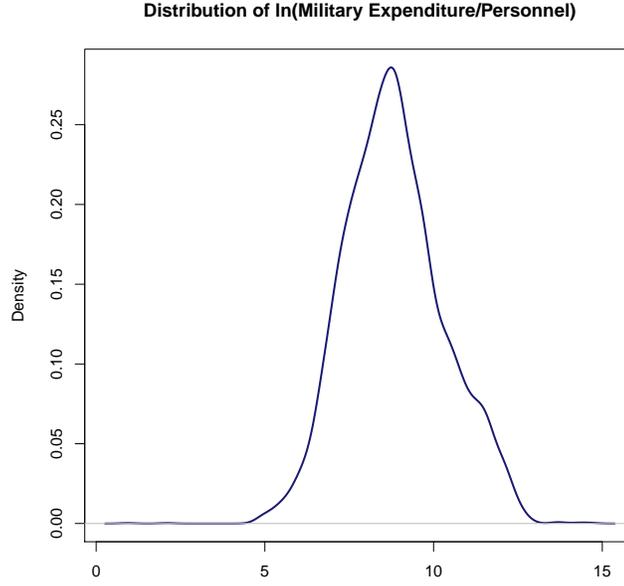
Figure 4.3: Kernel density of κ before imputation. The figure is drawn with a bandwith of 0.222.

variables used in the analysis come from the Correlates of War project and compiled by EUGene. The intersection of the available data ranges from 1960 to 2001.

The theoretical prediction is that higher Gini should lead to higher values of κ in democracies and to lower values of κ in non-democracies. Accordingly, our main explanatory variable is GINI × POLITY, and we are interested in the marginal effect of GINI on κ at different levels of POLITY. The model used here is

$$\kappa_{i,t} = \beta_1 \text{GINI}_{i,t} + \beta_2 \text{GINI}_{i,t} \times \text{POLITY}_{i,t} + \beta_3 \text{POLITY}_{i,t} + \sum_j b_j x_{j,i,t} + \alpha_i + \epsilon_{i,t} \;,$$

where i and t indicate country and year, x_js are other explanatory variables and α_is are country fixed effects. One set of explanatory variables used are indicators of maximum hostility levels. For each country-year, HOSTILITY is 0 if the country did not have any militarized interstate dispute in that year, or the maximum level of hostility that the county experienced in that year. The variable ranges from 0

in R (Arel-Bundock 2013). For multiple imputations see (Rubin 1996).

(no militarized conflict) to 5 (war).[19] We also control for POPULATION and Gross National Product, GNI, as they probably affect how each country allocates resources to its military and are correlated with our main explanatory variables. Finally, the results reported here are obtained from models including country fixed effects. This makes the estimation less likely to suffer from omitted variable bias and also helps with temporal independence of observations. Doing the analysis with regional fixed effects produces similar results, but without fixed effects, the results are brittle and easily change depending on small changes in the specification of the model.

Tables 4.3 and 4.4 show the results of the analysis using the original and imputed data, respectively. Models 4.5 and 4.9 use κ as the dependent variable; Models 4.6 and 4.10 use $\tilde{\kappa}$ as the dependent variable. These models show substantively strong—interpretation is presented below—and statistically significant positive values for the interaction of GINI and POLITY. An alternative set of tests is also presented where the dependent variable is K or L (Models 4.7, 4.8, 4.11 and 4.12). Again, in line with the prediction of Proposition 4.1, we see positive coefficients for the interaction of GINI and POLITY when the dependent variable is military expenditure and negative coefficients when the dependent variable is military personnel.

Interpretation of the results of our estimation requires calculating marginal effects of GINI. Figure 4.4 shows the marginal effect of GINI on κ for different values of POLITY for the original and the imputed data (based on Models 4.5 and 4.9). The intercept in the two marginal effects are different: The original data show negative and significant effects for GINI in non-democracies and no significant effect for it in democracies, while the imputed data show no significant effects for GINI in non-democracies and positive and significant significant effect for it in democracies. Despite this difference, the substantive interpretation is essentially the same.

Intuitive interpretation of the results of Tables 4.3 and 4.4 are difficult even with

---

19. This is the maximum 'hostility' value reported for each country in each year in Correlates of War data.

Table 4.3: Ordinary least squares regressions on the original data using different dependent variables. K and L are measures of military expenditure and military personnel. κ and $\tilde{\kappa}$ are the raw and normalized versions of $\ln(\text{K}/\text{L})$.

Model Variables	4.5 κ	4.6 $\tilde{\kappa}$	4.7 $\ln(\text{K})$	4.8 $\ln(\text{L})$
GINI	-0.0153	-0.0110	-0.0119	0.00641
	(0.00873)	(0.00657)	(0.00849)	(0.00638)
GINI×POLITY	0.00227	0.00159	0.00204	-0.000582
	(0.000603)	(0.000456)	(0.000593)	(0.000445)
POLITY	-0.0898	-0.0589	-0.0874	0.0139
	(0.0242)	(0.0183)	(0.0237)	(0.0201)
ln(GNI)	0.993	0.662	0.865	-0.290
	(0.111)	(0.0838)	(0.109)	(0.0731)
ln(POPULATION)	-0.458	-0.358	0.0436	0.728
	(0.322)	(0.255)	(0.336)	(0.258)
ln(L)			0.344	
			(0.0917)	
ln(K)				0.119
				(0.0403)
HOSTILITY=1	-0.137	-0.0849	-0.145	0.00449
	(0.104)	(0.0798)	(0.101)	(0.0630)
HOSTILITY=2	0.221	0.0595	0.0151	-0.303
	(0.0843)	(0.0555)	(0.0741)	(0.104)
HOSTILITY=3	0.0777	0.0585	0.0693	-0.0206
	(0.0843)	(0.0615)	(0.0762)	(0.0496)
HOSTILITY=4	0.105	0.0834	0.0737	-0.0548
	(0.0856)	(0.0630)	(0.0783)	(0.0482)
HOSTILITY=5	-0.0465	-0.0687	0.0157	0.0892
	(0.139)	(0.120)	(0.139)	(0.103)
Country FE	✓	✓	✓	✓
Observations	479	479	479	479
R^2	0.890	0.851	0.969	0.981

Robust standard errors are reported in parentheses.

Table 4.4: Ordinary least squares regressions on the imputed data using different dependent variables. K and L are measures of military expenditure and military personnel. κ and $\tilde{\kappa}$ are the raw and normalized versions of $\ln(\text{K}/\text{L})$.

Model	4.9	4.10	4.11	4.12
Variables	κ	$\tilde{\kappa}$	$\ln(\text{K})$	$\ln(\text{L})$
GINI	0.00401	0.00120	0.00259	-0.00300
	(0.00333)	(0.00326)	(0.00324)	(0.00229)
GINI×POLITY	0.00106	0.000860	0.00105	-0.000254
	(0.000200)	(0.000195)	(0.000192)	(0.000120)
POLITY	-0.0499	-0.0329	-0.0638	-0.00938
	(0.00890)	(0.00857)	(0.00862)	(0.00533)
$\ln(\text{GNI})$	0.805	0.528	0.811	-0.173
	(0.0179)	(0.0158)	(0.0167)	(0.0159)
$\ln(\text{POPULATION})$	-0.220	-0.0472	0.374	0.933
	(0.0691)	(0.0599)	(0.0713)	(0.0384)
$\ln(\text{L})$			0.479	
			(0.0235)	
$\ln(\text{K})$				0.226
				(0.0141)
HOSTILITY=1	0.00562	0.00279	0.0175	0.0164
	(0.0389)	(0.0328)	(0.0369)	(0.0213)
HOSTILITY=2	0.228	0.101	0.168	-0.141
	(0.104)	(0.0811)	(0.0935)	(0.0593)
HOSTILITY=3	0.0640	0.0307	0.0676	-0.00918
	(0.0323)	(0.0260)	(0.0309)	(0.0200)
HOSTILITY=4	0.141	0.0887	0.157	-0.00915
	(0.0270)	(0.0240)	(0.0251)	(0.0167)
HOSTILITY=5	0.266	0.157	0.358	0.0756
	(0.0489)	(0.0410)	(0.0465)	(0.0334)
Country FE	✓	✓	✓	✓
Observations	5,213	5,275	5,213	5,213

Robust standard errors are reported in parentheses.
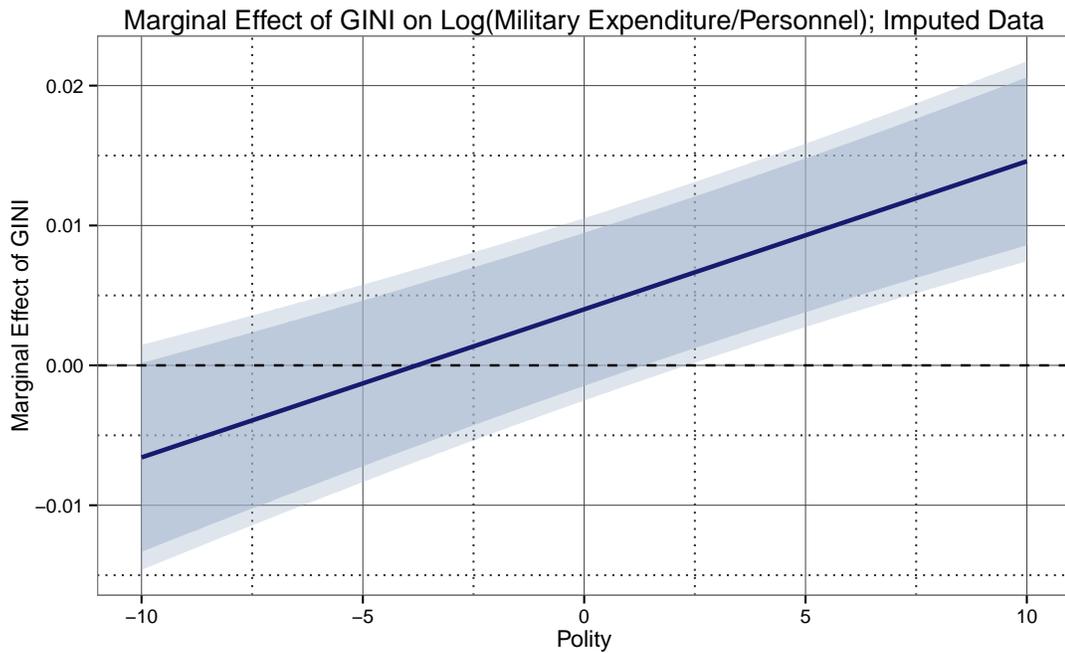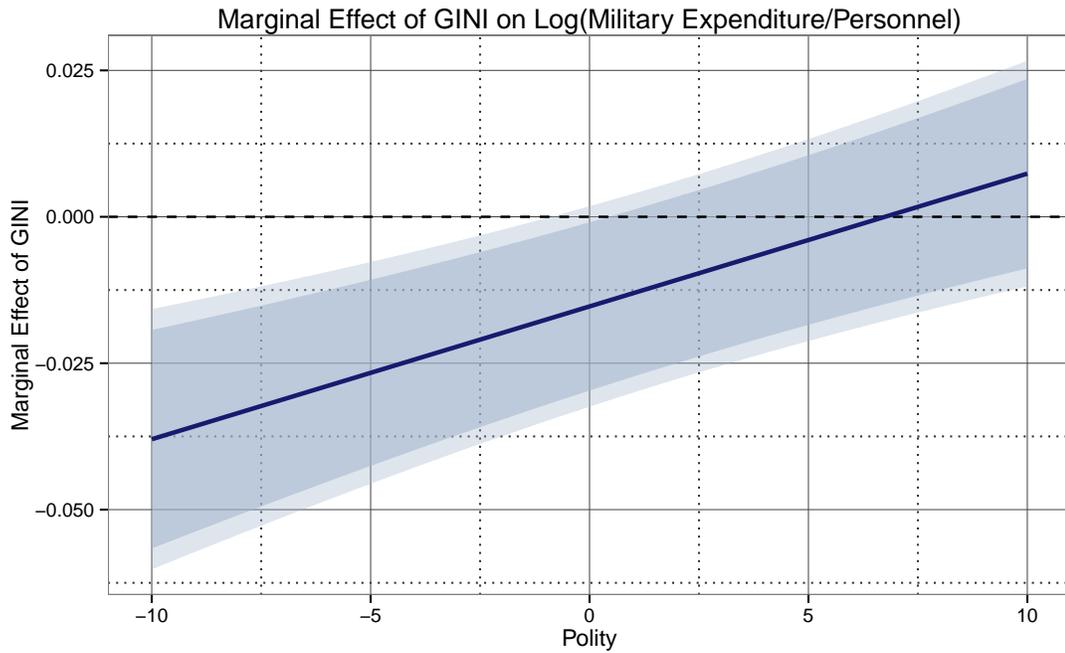
Figure 4.4: Marginal effect of Gini on log(military expenditure/military personnel) for different values of the Polity score. The top graph is produced by analysing the original data with listwise deletion and the bottom graph is produced by analyzing data after multiple imputations. The shodows show one-tailed and two-tailed statistical significance at 5%. level.
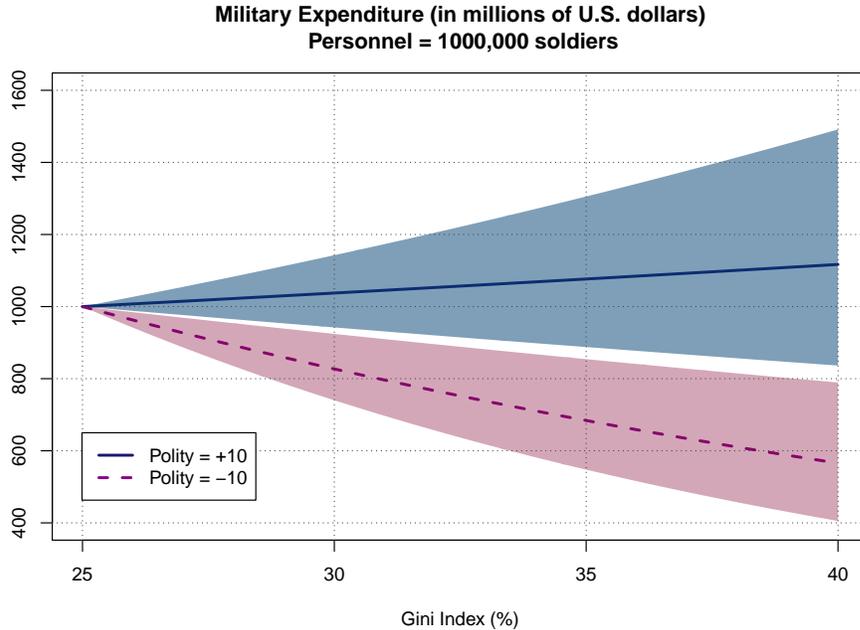
Figure 4.5: Numerical example showing changes of expenditure as Gini changes in Model 4.5. The solid and the dashed lines are the expected values of military expenditure for a democratic and an authoritarian state, respectively. Shaded areas show 95% confidence intervals. For Gini=0.35, the difference between the lower limit of the confidence interval for the democratic state and the upper limit of the autocratic state is 47 million dollars.

estimated marginal effect of GINI on κ, because κ is the logarithm of a ratio. To see the actual impact of a change in the independent variables, let us calculate the associated effects for a numerical example. Suppose there is a democratic and a non-democratic state (POLITY of $+10$ and -10) with similar characteristics and suppose they both have a Gini coefficient of 0.25 (income distribution like Denmark) and they each have an army of 1 million soldiers and each spend 1 billion dollars for their military. How would their expenditure change if their Gini coefficient rose to 0.40 (income distribution like the United States)? Figure 4.5 illustrates the change in military expenditure assuming that military personnel is held constant. It is clear that for high and low values of POLITY, small changes in GINI are associated with very large expected changes in the makeup of the armed forces.

Overall, we see that the null hypothesis of no correlation between income inequal-

ity and how much capital and labor is allocated to armed forces is rejected. This improves the credibility of the theoretical predictions of the model, but there are two shortcomings here that should be taken into account in order not to overread the results. First is the gap between the exact theoretical prediction and the model, where, for data availability reasons, I replaced capital and labor allocated to a war with national level military expenditure and personnel. Second, the reported results clearly do not warrant any causal interpretation.[20]

4.6   Conclusion

I have presented a model of how states supply their militaries to fight asymmetric wars. The critical innovation of the model was that the players, instead of the usual guns-vs-butter trade-off, face a two-dimensional trade-off: how many soldiers should be recruited (labor) and how much money (capital) should be spent for war. I showed that both democracies and non-democracies become weaker as sensitivity to casualties rises. As the outcome of a war depends more on labor and less on capital, all capital-intensive militaries become less powerful, but democracies are more strongly affected; whereas democracies enjoy an advantage compared to non-democracies in fighting wars using conventional strategies, they lose their advantage when they face insurgencies (which require more labor). Interestingly, this result is obtained even when they know exactly what type of adversary they face. It was also predicted that income inequality makes democracies rely more on capital and non-democracies rely more on labor. I have also taken a step in testing the predictions of the model. The predictions regarding democratic advantage and military recruitment and spending were tested using Correlates of War and World Bank data and were borne out by the empirical evidence.

---

20. In fact, a somewhat similar correlation has been interpreted in the opposite causal direction before: Ali (2007) finds a positive correlation between military expenditure and inequal pay and suggests that increasing military spending increases pay inequality.

Appendix IV.A   Who Wants More Troops?

A key assumption of the model presented in this chapter is that economic status affects how costs of war are distributed. As a result, one's economic status affects one's view about how the army is best equipped: poorer citizens support more capital intensive armies and richer citizens support the opposite. Here, I will rely on a panel study conducted by the American National Election Study in 2008-2009 where respondents were asked whether or not they supported an increase in the number of American troops fighting in Iraq.[21] This study is particularly suitable for our analysis because it has good timing: whereas the early phase of the Iraq war was not necessarily an asymmetric war—as it was perceived to be a necessary "preventive war" by a majority of the American electorate—the latter half of the war can be characterized as an asymmetric war.

Five rounds of the ANES panel study have asked respondents about their position on whether U.S. troops in Iraq should be decreased or increased.[22] I use these to construct the dependent variables for this study, TROOPS, which show participants' support for increase or decrease of troops fighting in Iraq and range from 1 (decrease a lot) to 8 (increase a lot). I define $\overline{\text{TROOPS}}$ as the average of all recorded responses for each participant.[23] The explanatory variable of interest here is INCOME, which is self-reported income by respondents. It is measured based on income bracket and is an ordinal variable ranging from 1 to 19.

Figure 4.6 shows the results of semi-parametric linear regressions of the dependent variable on income (Ruppert, Wand, and Carroll 2003).[24] The dependent variable in

---

21. DeBell, Krosnick, and Lupia 2010.

22. The question was asked in a branching Likert scale. The exact wording of the question is: "Compared to the number of U.S. troops in Iraq now, should the number of troops in Iraq three months from now be more, less or about the same?"

23. Different participants were asked the question of troop increase in different rounds, so we have more observations for $\overline{\text{TROOPS}}$ than for single observations of TROOPS.

24. I have used the `spm` function from the `SemiPar` package in R. This package accompanies the Ruppert, Wand, and Carroll's book.
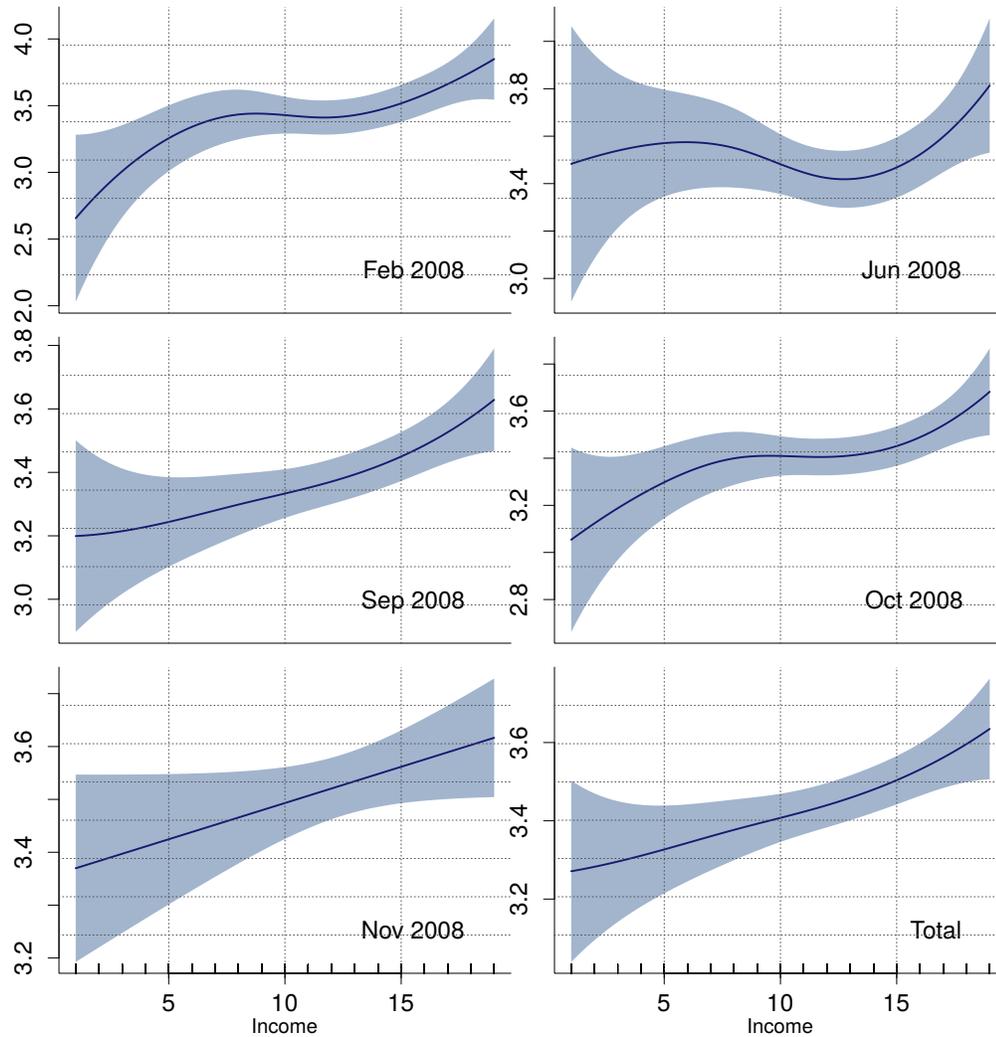
Figure 4.6: Support for increase in troop levels in Iraq as a function of respondents' income category. Results are obtained by semiparamteric regression.

the bottom-right panel is $\overline{\text{TROOPS}}$. It appears that income is positively correlated with a support for increase in the number of troops, although this is weaker in some surveys than others.

Tables 4.5 and 4.6 reflect more extensive evidence in support of the correlation between income and support for increase in the number of troops by controlling for a range of other explanatory variables. The basic equation used is the following:

$$\text{TROOPS} = \beta_1 \text{INCOME} + \boldsymbol{\beta X} + \boldsymbol{\epsilon}.$$

Table 4.5: Ordinal logit regressions show that an increase in respondents' income levels is associated with an increase in their support for deployment of more troops in Iraq. The dependent variable ranges from 1 to 8, and it was asked in February 2008.

Variables / Model	Dep. Var: Troops (Feb 2008)			
	4.13	4.14	4.15	4.16
INCOME	0.0407	0.0322	0.0272	
	(0.0129)	(0.0133)	(0.0146)	
$T(\text{INCOME})$				0.0719
				(0.0275)
IDEOLOGY	-0.451	-0.153	-0.142	-0.143
	(0.0331)	(0.0441)	(0.0442)	(0.0442)
PARTY		0.143	0.144	0.141
		(0.0379)	(0.0379)	(0.0378)
IRAQINVASION		1.413	1.415	1.414
		(0.157)	(0.158)	(0.158)
EDUCATION			-0.0182	-0.0268
			(0.0538)	(0.0527)
FEMALE			-0.499	-0.504
			(0.107)	(0.107)
Observations	1,256	1,256	1,256	1,256
Log likelihood	-1974.7	-1894.4	-1883.5	-1881.8

Standard errors reported in parentheses.

Ordinal logit cutoff points are omitted from the table.

$\boldsymbol{X}$ represents other explanatory variables, and our expectation is that β_1 should be positive. First, this estimation is performed using ordinal logistic regressions and taking TROOPS from the second round of the panel study (February 2008) as the dependent variable; the results are reported in Table 4.5. Then the same analysis is performed using ordinary least squares regression and $\overline{\text{TROOPS}}$ as the dependent variable; the results are reported in Table 4.6.

Other explanatory variables used are defined as follows. IDEOLOGY is the average of all available measurements of ideology for the respondent, and ranges from 1 (very liberal) to 7 (very conservative). PARTY is the average of all available measurements of partisanship for the respondent and ranges from 0 (strongly favoring the Republican

Table 4.6: Ordinary least squares results showing support for increase in troops (averaged for each respondent) is positively correlated with income.

Variables / Model	Dep. Var: Troops (average)			
	4.17	4.18	4.19	4.20
INCOME	0.0162	0.00688	0.00427	
	(0.00587)	(0.00571)	(0.00605)	
$T(\text{INCOME})$				0.0219
				(0.0112)
IDEOLOGY	-0.281	-0.0907	-0.0859	-0.0868
	(0.0128)	(0.0172)	(0.0171)	(0.0171)
PARTY		0.1000	0.0975	0.0950
		(0.0159)	(0.0158)	(0.0158)
IRAQINVASION		0.828	0.835	0.835
		(0.0638)	(0.0639)	(0.0639)
EDUCATION			0.00338	-0.00499
			(0.0221)	(0.0219)
FEMALE			-0.188	-0.187
			(0.0433)	(0.0431)
CONSTANT	4.291	2.162	2.274	2.201
	(0.0938)	(0.139)	(0.154)	(0.157)
Observations	2,585	2,584	2,584	2,584
R^2	0.146	0.260	0.266	0.267

Robust standard errors in parentheses

party) to 6 (strongly favoring the Democratic party). EDUCATION, similarly, is ordinal and ranges from 1 to 5. FEMALE is a dichotomous variable, taking 1 if the respondent is a female and 0 otherwise. Finally, IRAQINVASION is how strongly the respondent thinks the United States should have invaded Iraq in 2003 and ranges from 1 to 2. This is obtained by averaging over all dichotomous responses in answer to the question of whether "the United States should or should not have sent troops to fight the war in Iraq in 2003?"

As mentioned above, INCOME only shows the income bracket, hence there is no reason to include it in our model in a linear way. Figure 4.6 suggest a flattened tilde

$(_{/}-^{/})$ shape. In Models 4.4 and 4.8, I use $T(\text{INCOME})$, where T is defined as

$$T(x) = \begin{cases} x; & x < \frac{20}{3} \\ \frac{20}{3}; & \frac{20}{3} \leq x \leq \frac{40}{3} \\ x - \frac{40}{3}; & x \geq \frac{20}{3} \end{cases}$$

Using $T(\text{INCOME})$ provides a slightly better fit, satisfying conventional thresholds of statistical significance in models that include all explanatory variables.

Both sets of results support the idea that higher income is associated with stronger support for more troops. To provide exact numbers, it is easier to consult Figure 4.6 or Table 4.6. Overall, we can see that going from the bottom category to the top category is on average associated with roughly one quarter of one category increase in $\overline{\text{TROOPS}}$. For example, Model 4.17 shows $0.0162 \times (19 - 1) = 0.292$ unit change and model Model 4.20 shows $0.0219 \times (19 - 20/3 - 1) = 0.2482$ unit change when everything is held constant and INCOME goes from 1 to 19.

CHAPTER V

Conclusion

Asymmetric wars comprise the majority of military engagements of developed countries. These wars are subject to the vicissitudes of domestic politics. "Success for the insurgents [arises] not from a military victory on the ground—though military successes may [be] a contributory cause—but rather from the progressive attrition of their opponents' political capability to wage war" (Mack 1975).

The goal of this dissertation has been to provide parsimonious theories that allow us to answer two important questions: How long does the strong side continue fighting? And how does the strong side fight the war?

In Chapter II, I predicted that public support for asymmetric wars diminishes as time passes. This prediction does not rely on any assumption of irrationality of citizens. It also shows that while much attention, both in the academic literature and in policy circles, has been given to various manifestation of costs, duration of a war is equally, if not more, important in shaping public support for the war. Moreover, it is predicted that states that are more democratic fight shorter asymmetric wars.

Chapter III put these predictions to test. At the micro levels, a survey experiment on two samples (one of them a nationally representative sample of the American electorate) corroborated the prediction that in asymmetric wars, duration of a war may be a more detrimental factor than total casualties suffered in that war. At the

macro level, analyzing duration of counter-insurgency wars showed that democracies and non-democracies are not significantly different from each other when they fight domestic counter-insurgencies, but democracies fight shorter counter-insurgency wars when they fight in foreign lands. This is in line with the theoretical prediction that democracies fight shorter wars only when the stakes are low.

Chapter IV provided an explanation for the poor performance of developed states, especially democracies, in asymmetric wars. This was the result of a two-tax model of war supply, which distinguished between the human cost (labor) and the monetary cost (capital) of fighting a war. In equilibrium, we see an overreliance on capital, which produces unfavorable outcomes in missions where soldiers are needed more than machines. Critically, this overreliance does not require an assumption of irrationality of the players or assuming that they do not know what type of war they face; it is produced because of the way the costs of war are distributed. It is predicted that the gap between the likelihood of victory in conventional and asymmetric wars is greater for democracies than for non-democracies. The model also yields a number of other comparative static predictions. In particular, it is predicted that greater levels of income inequality should result in more capital-intensive militaries in democratic states, and, in less capital-intensive militaries in nondemocratic states. Empirical tests based on the Correlates of War data and World Bank's World Development Indicators supported the theory.

Reiter and Stam (2002) called democracies' apparent upper hand in winning conventional wars "democracy's fourth virtue." That optimism vanishes when we look at asymmetric wars. Different pieces of this work together provide a pessimistic view of democratic states' capabilities to wage successful asymmetric wars and continue fighting until they reach victory. This is, however, not to say that democracies—or powerful states—lose most of the asymmetric wars they fight. But it does emphasize two of their major shortcomings when fighting asymmetric wars. Moreover, there is

no simple solution for the shortcomings of democratic states when they fight wars that are not deemed worthy of much human sacrifice by their electorate.

One of the caveats of the research in this dissertation is that the two questions of 'how the strong side fights' and 'how long the strong side fights' are addressed separately. Chapters II and III assumed that the effort level, and hence costs, as well as the probability of victory, were fixed throughout the war, while Chapter IV modeled war as a single stage lottery but the war effort was chosen by the strong side. An important avenue for future investigation is combining the two models and studying the robustness of these results.

Finally, it deserve emphasis that the results of this work are only valid insofar as the assumptions hold. For any policy lesson to be drawn from the present work, we have to also assess what is absent from the models. The most important elements absent from my models are long term strategic calculations. A natural conclusion to the limits in fighting asymmetric wars that are enumerated here may be that strong states ought to either get others to fight their wars (proxy wars), or fight remotely, with drones and missiles but without soldiers on the ground. This way, the human cost is so low that the electorate would not notice the war and the war can in theory continue in perpetuity. But, even if we ignore the real human cost to both sides and assume that these engagements provide actual tactical benefit, the blowback from these wars and the long term hostilities that they may foment must be taken into account before one rushes to prescribe proxy wars or joystick wars as ideal ways to circumvent the limiting forces of democratic politics. Vivid reminders of these long term strategic miscalculations abound. The attacks of September 11, 2012 in Benghazi, Libya, or the attacks of September 11, 2001 in New York suffice as examples of when these remedies go astray. The case of Libya was in the aftermath of a 'successful' remote war, and the case of New York was, in part, the result of years of support for rogue groups which fought a proxy war in Afghanistan.

Bibliography

Acemoglu, Daron, and James A. Robinson. 2000. "Why Did the West Extend the Franchise? Democracy, Inequality, and Growth in Historical Perspective." *The Quarterly journal of economics* 115 (4): 1167–1199.

———. 2006. *Economic Origins of Dictatorship and Democracy.* Cambridge University Press.

Agastya, Murali, and R. Preston McAfee. 2006. "Continuing wars of attrition." *Available at SSRN 935970.*

Ali, Hamid E. 2007. "Military expenditures and inequality: empirical evidence from global data." *Defence and Peace Economics* 18 (6): 519–535.

Arel-Bundock, Vincent. 2013. *WDI: World Development Indicators (World Bank).* R package version 2.4.

Arreguin-Toft, Ivan. 2001. "How the weak win wars: A theory of asymmetric conflict." *International Security* 26 (1): 93–128.

Ashworth, Scott, and Ethan Bueno de Mesquita. 2006. "Monotone comparative statics for models of politics." *American Journal of Political Science* 50 (1): 214–231.

Bacevich, Andrew J. 2013. *The new American militarism: How Americans are seduced by war.* Oxford University Press.

Baker, James A., Lee H. Hamilton, et al. 2006. *The Iraq study group report.* United States Institute of Peace.

Bennett, D. Scott, and Allan C. Stam. 2000. "EUGene: A conceptual manual." *International Interactions* 26 (2): 179–204.

Berger, Mark T., and Douglas A. Borer. 2007. "The Long War: insurgency, counterinsurgency and collapsing states." *Third World Quarterly* 28 (2): 197–215.

Berinsky, Adam J. 2007. "Assuming the costs of war: Events, elites, and American public support for military conflict." *Journal of Politics* 69 (4): 975–997.

———. 2009. *In time of war: Understanding American public opinion from World War II to Iraq.* University of Chicago Press.

Berinsky, Adam J., and James N. Druckman. 2007. "The polls–Review public opinion research and support for the Iraq War." *Public Opinion Quarterly* 71 (1): 126–141.

Berinsky, Adam J., Gregory A. Huber, and Gabriel S. Lenz. 2012. "Evaluating online labor markets for experimental research: Amazon. com's Mechanical Turk." *Political Analysis* 20 (3): 351–368.

Bitis, Alexander. 2003. "Reserves under Serfdom? Nicholas I's Attempts to Solve the Russian Army's Manpower Crisis of 1831–1832." *Jahrbücher für Geschichte Osteuropas:*185–196.

Bueno de Mesquita, Bruce, James D. Morrow, Randolph M. Siverson, and Alistair Smith. 1999. "An Institutional Explanation of the Democratic Peace." *American Political Science Review* 93 (4): 791–807.

Bueno de Mesquita, Bruce, Alistair Smith, Randolph M. Siverson, and James D. Morrow. 2003. *The logic of political survival.* The MIT Press.

Campbell, Angus, Philip E. Converse, Warren E. Miller, and Donald E. Stokes. 1960. *The American voter.* John Wiley.

Caverley, Jonathan D. 2014. *Democratic Militarism: Voting, Wealth, and War.* Cambridge University Press.

Clarke, Kevin A., and Randall W. Stone. 2008. "Democracy and the logic of political survival." *American Political Science Review* 102 (3): 387–392.

Cooper, Richard V. L., and Charles R. Roll. 1974. *The Allocation of Military Resources.* RAND Corporation.

DeBell, Matthew, Jon A. Krosnick, and Arthur Lupia. 2010. *Methodology report and user's guide for the 2008–2009 ANES Panel Study.* Palo Alto, CA, and Ann Arbor, MI: Stanford University and the University of Michigan.

Downes, Alexander B. 2009. "How smart and tough are democracies? Reassessing theories of democratic victory in war." *International Security* 33 (4): 9–51.

Fearon, James D. 1994. "Domestic political audiences and the escalation of international disputes." *American Political Science Review:*577–592.

———. 1995. "Rationalist explanations for war." *International Organization* 49 (3): 379–414.

———. 2007. "Fighting rather than Bargaining." In *Annual Meetings of the American Political Science Association.*

Fearon, James D., and David D. Laitin. 2003. "Ethnicity, insurgency, and civil war." *American Political Science Review* 97 (1): 75–90.

Federico, Christopher M., Agnieszka Golec, and Jessica L. Dial. 2005. "The relationship between the need for closure and support for military action against Iraq: Moderating effects of national attachment." *Personality and Social Psychology Bulletin* 31 (5): 621–632.

Fey, Mark, and Kristopher W. Ramsay. 2011. "Uncertainty and Incentives in Crisis Bargaining: Game-Free Analysis of International Conflict." *American Journal of Political Science* 55 (1): 149–169.

Fudenberg, Drew, and Jean Tirole. 1991. *Game theory. 1991.* MIT Press.

Gartner, Scott S. 2008. "The multiple effects of casualties on public support for war: An experimental approach." *American Political Science Review* 102 (1): 95.

———. 2010. "Paying the Human Costs of War: American Public Opinion and Casualties in Military Conflicts. By Christopher Gelpi, Peter D. Feaver, and Jason Reifler.(Princeton University Press, 2009.)" *The Journal of Politics* 72 (3): 910–911.

Gartner, Scott S., and Gary M. Segura. 1998. "War, casualties, and public opinion." *Journal of Conflict Resolution* 42 (3): 278–300.

Gartner, Scott S., Gary M. Segura, and Michael Wilkening. 1997. "All Politics Are Local Local Losses and Individual Attitudes toward the Vietnam War." *Journal of Conflict Resolution* 41 (5): 669–694.

Gelpi, Christopher, Peter D. Feaver, and Jason Reifler. 2006. "Success matters: Casualty sensitivity and the war in Iraq." *International Security* 30 (3): 7–46.

Gelpi, Christopher, and Jason Reifler. 2008. "The Polls–Review Reply to Berinsky and Druckman: Success Still Matters." *Public Opinion Quarterly* 72 (1): 125–133.

Ghosn, Faten, Glenn Palmer, and Stuart A. Bremer. 2004. "The MID3 data set, 1993–2001: Procedures, coding rules, and description." *Conflict Management and Peace Science* 21 (2): 133–154.

Gordon, Michael R, and Bernard E Trainor. 2006. *Cobra II: The inside story of the invasion and occupation of Iraq.* Random House Digital, Inc.

Jennings, M. Kent. 1974. "War, Presidents and Public Opinion. by John E. Mueller." *The Journal of Politics* 36 (3): pages.

Jentleson, Bruce W. 1992. "The pretty prudent public: Post post-Vietnam American opinion on the use of military force." *International studies quarterly:*49–73.

Jentleson, Bruce W., and Rebecca L. Britton. 1998. "Still Pretty Prudent Post-Cold War American Public Opinion on the Use of Military Force." *Journal of Conflict Resolution* 42 (4): 395–417.

Krepinevich, Andrew F. 1986. *The army and Vietnam.* Johns Hopkins University Press (Baltimore).

Kriner, Douglas, and Francis Shen. 2014. "Responding to War on Capitol Hill: Battlefield Casualties, Congressional Response, and Public Support for the War in Iraq." *American Journal of Political Science* 58 (1): 157–174.

Larson, Eric V., and Bogdan Savych. 2005. *American public support for US military operations from Mogadishu to Baghdad.* Rand Corporation.

Lippmann, Walter. 1922. *Public Opinion.* The Macmillan Company.

Lyall, Jason. 2010. "Do Democracies Make Inferior Counterinsurgents? Reassessing Democracy's Impact on War Outcomes and Duration." *International Organization* 64 (1): 167–192.

Lyall, Jason, and Isaiah Wilson III. 2009. "Rage against the machines: Explaining outcomes in counterinsurgency wars." *International Organization* 63 (1): 67–106.

Mack, Andrew. 1975. "Why big nations lose small wars: The politics of asymmetric conflict." *World Politics* 27 (2): 175–200.

Marshall, Monty G., and Keith Jaggers. 2011. *IV Project Polity: Political Regime Characteristics and Transitions, 1800-2010.* [Online; http://www.systemicpeace.org/polity/polity4.htm, accessed 20-November-2011].

Martel, William C. 2006. *Victory in war: Foundations of modern military policy.* Cambridge University Press.

Maynard Smith, John. 1974. "The theory of games and the evolution of animal conflicts." *Journal of Theoretical Biology* 47 (1): 209–221.

Meltzer, Allan H, and Scott F Richard. 1981. "A rational theory of the size of government." *The Journal of Political Economy:*914–927.

Merom, Gil. 2003. *How democracies lose small wars: state, society, and the failures of France in Algeria, Israel in Lebanon, and the United States in Vietnam.* Cambridge University Press.

Milgrom, Paul, and Chris Shannon. 1994. "Monotone comparative statics." *Econometrica: Journal of the Econometric Society:*157–180.

Mintz, Alex, and Chi Huang. 1991. "Guns versus butter: The indirect link." *American Journal of Political Science:*738–757.

Morrow, James D., Bruce Bueno De Mesquita, Randolph M. Siverson, and Alastair Smith. 2008. "Retesting selectorate theory: separating the effects of W from other elements of democracy." *American Political Science Review* 102 (3): 393–400.

Mueller, John E. 1973. *War, presidents, and public opinion.* Wiley New York.

Mulligan, Casey B, Xavier Sala-i-Martin, and Ricard Gil. 2003. *Do democracies have different public policies than nondemocracies?* Technical report. National Bureau of Economic Research.

Poutvaara, Panu, and Andreas Wagener. 2006. "The economic costs and the political allure of conscription."

Powell, Robert. 1993. "Guns, butter, and anarchy." *American Political Science Review* 87 (1): 115–132.

———. 2002. "Bargaining theory and international conflict." *Annual Review of Political Science* 5 (1): 1–30.

———. 2004. "Bargaining and learning while fighting." *American Journal of Political Science* 48 (2): 344–361.

———. 2013. "Monopolizing Violence and Consolidating Power." *The Quarterly Journal of Economics* 128 (2): 807–859.

Reiter, Dan, and Allan C. Stam. 1998. "Democracy, war initiation, and victory." *American Political Science Review* 92 (2): 377–389.

———. 2002. *Democracies at war.* Princeton University Press.

———. 2003. "Identifying the culprit: Democracy, dictatorship, and dispute initiation." *American Political Science Review* 97 (2): 333–337.

Rubin, Donald B. 1996. "Multiple imputation after 18+ years." *Journal of the American Statistical Association* 91 (434): 473–489.

Ruppert, David, Matt P. Wand, and Raymond J. Carroll. 2003. *Semiparametric regression.* 12. Cambridge university press.

Sarkees, Meredith Reid, and Phil Schafer. 2000. "The correlates of war data on war: An update to 1997." *Conflict Management and Peace Science* 18 (1): 123–144.

Scheve, Kenneth, and David Stasavage. 2012. "Democracy, War, and Wealth: Lessons from Two Centuries of Inheritance Taxation." *American Political Science Review* 106 (1): 81–102.

Schoenfeld, David. 1982. "Partial residuals for the proportional hazards regression model." *Biometrika* 69 (1): 239–241.

Schultz, Kenneth A. 1998. "Domestic opposition and signaling in international crises." *American Political Science Review* 92 (4): 829–844.

Shanker, Thomas. 2007, January 12. "New Strategy Vindicates Ex-Army Chief Shinseki." *The New York Times,* A5–A13.

Shannon, Claude E. 1948. "A note on the concept of entropy." *Bell System Technical Journal* 27:379–423.

Singer, J. David, and Melvin Small. 1994. *Correlates of war project: International and civil war data, 1816-1992.* Inter-university Consortium for Political / Social Research.

Slantchev, Branislav L. 2005. "Military coercion in interstate crises." *American Political Science Review* 99 (4): 533–547.

Slantchev, Branislav L., and Ahmer Tarar. 2011. "Mutual optimism as a rationalist explanation of war." *American Journal of Political Science* 55 (1): 135–148.

Smith, Alistair. 1998. "International crises and domestic politics." *American Political Science Review* 92 (2): 623–638.

Smith, Alistair, and Allan C. Stam. 2003. "Mediation and peacekeeping in a random walk model of civil and interstate war." *International Studies Review* 5 (4): 115–135. ISSN: 1468-2486.

Smith, Hugh. 2005. "What costs will democracies bear? A review of popular theories of casualty aversion." *Armed forces & society* 31 (4): 487–512.

Stam, Allan C. 1999. *Win, lose, or draw: Domestic politics and the crucible of war.* University of Michigan Press.

Sullivan, Patricia L. 2007. "War Aims and War Outcomes." *Journal of Conflict Resolution* 51 (3): 496–524.

Tomz, Michael. 2007. "Domestic audience costs in international relations: An experimental approach." *International Organization* 61 (4): 821.

Topkis, Donald M. 1978. "Minimizing a submodular function on a lattice." *Operations research* 26 (2): 305–321.

Trager, Robert F., and Lynn Vavreck. 2011. "The Political Costs of Crisis Bargaining: Presidential Rhetoric and the Role of Party." *American Journal of Political Science* 55 (3): 526–545.

Tsebelis, George. 1989. "The abuse of probability in political analysis: The Robinson Crusoe fallacy." *The American political science review:*77–91.

Wagner, R. Harrison. 2000. "Bargaining and war." *American Journal of Political Science:*469–484.

Zaller, John. 1994. "Elite leadership of mass opinion." In *Taken by storm: The media, public opinion and US foreign policy in the Gulf War,* edited by W. Lance Bennet and David L. Paletz. University of Chicago Press.