

NEGOTIATING POWER

by

Thomas Chadeaux

A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
(Political Science)
in The University of Michigan
2009

Doctoral Committee:

Professor James D. Morrow, Co-Chair
Professor Robert Axelrod, Co-Chair
Professor Tilman M. Börgers
Professor Allan C. Stam
Associate Professor Barbara Koremenos

© Thomas Chadeaux 2009
All Rights Reserved

À mes parents,
Annie-France et Claude Chadeaux

ACKNOWLEDGEMENTS

This dissertation would not exist without Jim Morrow and Bob Axelrod. They have supported my work for the past five years with insightful comments and encouraging feedback. In particular, I thank Jim for introducing me to the elegance of game theory and for his concise, but invaluable, comments and guidance throughout. Bob has systematically provided careful, honest and highly constructive comments and has, from the start, patiently accompanied my progress. I also warmly thank Barb Koremenos for her enthusiasm and support. She has helped me get things done, and has encouraged me consistently. Tilman Börgers has contributed his time more than generously by carefully reading each model and providing very detailed and useful comments. Allan Stam has also generously contributed to this work. Finally, I am also grateful to Bill Clark, Rob Franzese, Ken Kollman, Skip Lupia, Kenneth McElwain, Rob Salmond, Jana von Stein, and George Tsebelis for their comments or help at some point or another of this process.

Among the staff, I particularly thank Lili Kivisto, Michelle Spornhauer and Joann Nemeth for their outstanding support and help in navigating some administrative intricacies. More generally, I thank the Department of Political Science at the University of Michigan for its generous support during these past five years.

My fellow graduate students have also been of tremendous help. I would like to thank Michelle Allendorfer, Matias Bargsted, Aaron Bramson, Papia Debroy, Andrea Jones-Rooy, Nam Kyu Kim, Shanna Kirschner, Jennifer Miller, Yoshikuni Ono, Paul Poast, Jonson Porteux, Leanne Powner, Neill Mohammad, Khuram Siddiqui, Kharis

Templeman, and Michio Umeda. A particular thanks goes to Jonson, Michio and Papia.

Outside the Department, I am also grateful to Stephen Biddle, Cédric Dupont, Romain Gallais, Yusufcan Masatlıođlu, Catalin Nicolau, Branislav Slantchev, and Ratha Tep.

The final word goes to my family, Claude, Annie-France and Pierre, who have never failed to support me, even though this ‘theory of games’ still strikes them as a bit frivolous.

Ann Arbor, MI

April 28, 2009

TABLE OF CONTENTS

DEDICATION	ii
ACKNOWLEDGEMENTS	iii
LIST OF FIGURES	vi
CHAPTER	
I. Introduction	1
II. Negotiating Over Power: When Do Shifts in Power Lead to War?	10
III. Fighting Over Power: War as an Investment	42
IV. Misrepresenting Power: The Right to Remain Silent?	69
V. Allocating Power: The Value of Capabilities	91
VI. Conclusion	107
BIBLIOGRAPHY	112

LIST OF FIGURES

Figure

1.1	The Bargaining Problem	5
1.2	Power, Capabilities and Benefits	7
2.1	Sample Growth Path and the Concessions it Implies	24
2.2	Path of Concessions as Δ Becomes Smaller.	25
3.1	Nonconvexities	56
3.2	Short term losses, long term gains	64
4.1	Lying	80
4.2	The Problem of Dimensionality	87
5.1	First Round of the Allocation Game	96
5.2	Sets of achievable distributions of benefits after a gain of power . . .	103

CHAPTER I

Introduction

Power is the fundamental determinant of international outcomes. It affects who gets what and at what cost, who is most likely to win a war, and what decisions are adopted in international negotiations. The powerful—those able to inflict pain and to offer benefits—tend to obtain what they want, whereas the weak often struggle to survive.

As a result, states and their leaders go to great lengths to alter their power relationship. They negotiate over their armament (e.g., Iran's nuclear weapons) or their ability to launch an offensive attack (e.g., the Cuban missile crisis); they fight to increase their future strength (e.g., Hitler's invasion of Poland); and they sometimes pretend to be stronger than they actually are (Saddam Hussein in the late 1990s).

When do states fight to increase their power? When, on the contrary, do they tame it down to alleviate the fears of their neighbors and avoid war? How do they misrepresent their strength? And how do they allocate their scarce means of coercion to different fronts? This dissertation is about power, how valuable it is, and when and why its pursuit leads to war. It is about long-term strategic interactions and the steps that states take to manipulate the determinants of their power. In short, it is about power as an object of strategic behavior.

1 Before the Negotiation

The defining feature of international relations is the absence of an overarching government that regulates the relations between states. Countries must rely on their own means to secure the outcomes they desire most and to avoid losing their existing benefits. This state of ‘anarchy’ implies that control over territory, access to raw commodities and other benefits are not determined by the law or some supranational institution, but rather by states’ relative power—their ability to impose costs and offer benefits. This contrasts with the domestic arena, in which private property is (usually) clearly defined and guaranteed by the state, and in which courts of law have the power to settle disputes and impose their decisions. In the relations between nations, powerful countries tend to impose their views and to obtain a larger share of the pie, whereas weak ones often struggle to survive.

Power, in other words, is the central determinant of international outcomes. Who gets what and at what price is not determined by the law or market prices, but by who can impose its will—by force if necessary. Powerful countries often bully weaker ones into giving up parts of their territory; they bribe smaller countries for their support at the UN; or they impose their preferences at the WTO. They do so by threatening painful consequences such as war or ostracism; or by offering rewards such as foreign aid or military protection.

Given that power—the ability to impose costs and offer benefits—determines how well states fare, then, we should expect them to behave strategically with respect to their power. In particular, they should try to manipulate its determinants in order to maximize their chance of securing a favorable outcome at the negotiation table. In other words, states should *prepare* for the negotiation stage by adopting strategic moves—negotiate or fight—to modify their relative power or the perception thereof. In this sense, international interactions are comparable to a boxing match. Boxers prepare for their combat—they lift weights, participate in other fights to increase their strength, and attempt to intimidate their opponent before the fight even begins. Similarly, to increase their strength, states negotiate over their relative

power or fight to increase their strength.

More generally, power is not an immutable attribute that states take as given. Rather, it is an object of strategic behavior itself. For example, states negotiate, explicitly or not, over their armament (e.g., the recent crisis with Iran, or the SALT agreements); they sometimes create demilitarized zones or withdraw troops from the border, de facto limiting their ability to launch successful offensive attacks (e.g., the Cuban missile crisis); they fight to acquire capabilities (Hitler's invasion of Poland); and they often take costly actions to misrepresent their true power (e.g., reputation in the American war in Vietnam).

Unfortunately, scholars have typically ignored these situations by modeling the international arena as one in which states meet and negotiate over the partition of a 'pie'. International interactions are often treated as a series of independent negotiations. These negotiations are an important part—and the most visible one—of the international agenda. For example, states reach bilateral agreements to settle their territorial disputes or agree on investment procedures. They also bargain over tariffs at the World Trade Organization, over military interventions at the United Nations Security Council, and over rights to pollute in Kyoto. Yet, these negotiations are only the last stage of a larger game in which states first invest in, negotiate, or fight over their relative power and only then, on the basis of the level of power they have reached, negotiate over the distribution of benefits. In a sense, the negotiation stage itself merely seals, almost mechanically, a level of power into a distribution of the pie. The real strategic component of the game takes place before the negotiation itself—when states attempt to modify their relative power.

This dissertation is about this preparatory stage. It analyzes some of the measures that states take in anticipation of future negotiations: When, why and how do states negotiate or fight over the determinants of their power? In particular, when do negotiations over instruments of power—capabilities—lead to war? When, on the contrary, do they ease tensions and avoid costly conflicts? And how do states seek to misrepresent their private information to retain the ability to lie at the bargaining stage?

2 Negotiations

To make this more precise, let us define a negotiation as a process by which two or more states try to agree on the partition of some benefits—say, a territory (this could also be money, foreign aid, supportive statements or even power itself). We typically assume some preferences over this set (in this case, more is better),¹ a bargaining procedure which specifies who can do what (e.g., make an offer) and when, and a disagreement point reflecting what would happen if the negotiation failed. Formally, a negotiation is a mapping from these elements of the “game” to an outcome—a partition of the territory.²

Consider, for example, figure 1.1. Two players, A and B , are negotiating over the partition of a territory of size X .³ If, for some reason, the negotiation was to fail, then A would obtain some amount d_A and B would obtain d_B . d_A and d_B could, for example, reflect their respective likelihood of prevailing in a war. Given this information, bargaining theory then strives to explain how the surplus would be divided between them. Depending on the bargaining protocol and the players’ preferences (including their risk aversion and impatience), it tells us what agreement will be reached within the zone of agreement (x in this case).

This bargaining problem (Nash 1950*a*, Nash 1953) has received a tremendous amount of attention in economics.⁴ In international politics, the question that has

¹We also usually assume preferences over time and risk.

²By negotiations, we typically understand a formal setting in which heads of states or delegates meet and exchange offers and counteroffers. This is certainly an important instance of what I refer to in this dissertation. The concept is much broader, however. Negotiations can be both formal and informal and, most importantly, they need not even take place. Clearly defined offers and counteroffers need not be exchanged. In fact, states are in constant negotiations. The US and Canada, for example, are currently negotiating over their territory. It is simply because none of them chooses to challenge the status quo that it looks *as if* negotiations were not taking place. In this sense, I adopt a very broad notion of negotiations to mean any type of strategic situation.

³In this dissertation, I assume that the size of the object of negotiation (e.g., the territory) is fixed. This assumption lets us focus on the problem of allocation itself, and not on mechanisms that attempt to increase the size of the pie. This is not to say that negotiations that aim at expanding the Pareto frontier are not interesting. Yet, they add complexities that will crowd the results presented here. I expect most results to be general enough to apply to different setups, and these should be explored in the future. For now, however, it is important to focus on the essence of the problem—the problem of allocation.

⁴Muthoo (1999) provides an excellent overview of the bargaining literature.

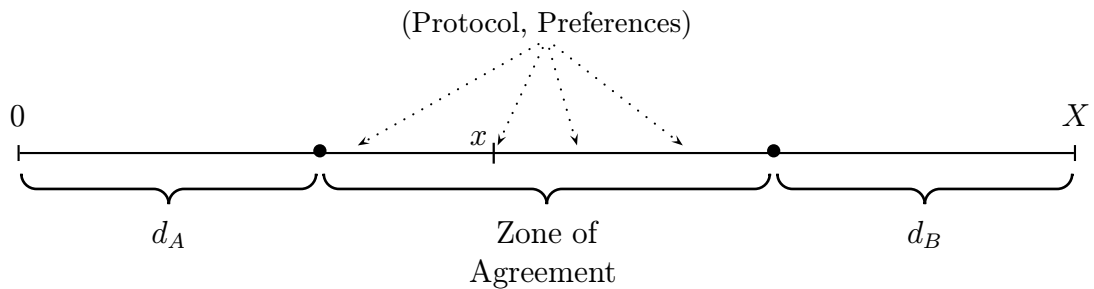


Figure 1.1: The Bargaining Problem

received the most attention is when such negotiations would break down. This is of particular interest because it tells us when we should expect wars, or more generally inefficient outcomes, to occur (Organski 1958, Morrow 1989, Fearon 1995).

This question of where, within the zone of agreement, the parties will settle is interesting *per se*. But often, more important is the question of what determines d_A and d_B . The disagreement points define the boundaries of any possible agreement, and hence often account for a much larger portion of the outcome than the negotiation *per se*, which settles what remains undecided *after* taking into account these disagreement points. This is not to imply that bargaining skill, risk aversion or time preferences do not matter; they are fundamental within the negotiation. Rather, the argument is that the negotiation *per se* only determines the distribution of a small portion of the pie—what is left over after accounting for power relations.

Unfortunately, there has only been little work on d_A and d_B themselves. To some extent, this is because the value of d_A and d_B is simply an empirical question that depends on the issue area and the context of interaction, which can therefore not be easily addressed theoretically. But an important aspect is that d_A and d_B are not immutable. Rather they are, themselves, the consequences of prior strategic moves—of prior negotiations. This is precisely what this dissertation is about: the strategic moves that states take to affect d_A and d_B .

3 Capabilities, Power and Benefits

The disagreement point refers to the utility that the player would derive if the negotiation was to fail. In this dissertation, the type of failure I have in mind is the use of force, or constraint: if the negotiation was to end, what could each player expect to get from the use of force. For example, what is the likelihood that that state would prevail in case of an armed conflict? Or how much territory could it expect to conquer if negotiations broke down? In this sense, I refer to disagreement points— d_A and d_B —as “power.”⁵

This use of the term power is not to deny the existence or importance of other approaches. Yet, despite the importance of power to the study of politics, and even more to international politics, there is little consensus on what it is, or on whether the concept should even be used. While some argue that “power is to us what money is to the economist” (Singer 1963, p. 420), it is far from playing the role of uniform measure that money does (Baldwin 1989). In fact, most studies of power begin by noting the lack of agreement on the meaning of the word. Power used to be defined as a property of states that was susceptible to measurement by certain attributes such as population, territory, GDP and armies (Morgenthau 1948, Singer & Small 1972). This approach was challenged, however, by the ‘relational power’ school, according to which A has power over B if her behavior causes a change in B ’s behavior (Lasswell & Kaplan 1950). So complex is the concept of power that most usually feel the need to derive elaborate distinctions between related terms such as power, influence, control, persuasion, manipulation, or force.

I do not deny the importance of these distinctions. Disagreement points are not meant to encompass or replace existing notions of power; not even to say that they are superior or should replace them. Simply, there is value in their simplicity and quantifiability. Moreover, they reflect the broad agreement in the literature that any conception of power should encompass at least the following: (i) power is not a possession; it is relational and (ii) it varies along issue areas (economic, military).

⁵This follows the use of the term in a large portion of the existing formal literature (Nash 1953, Svejnar 1986, Fearon 1995, Powell 1999)

Power, however, is not to be confused with two closely related concepts: resources and capabilities. Resources refer to anything the player owns or controls. Money, territory, knowledge or population are resources. Resources, in turn, can be used for two purposes: guns (capabilities) and butter (benefits). By capabilities, we mean things that affect the ability to impose costs and offer rewards. Tanks, for example, increase the likelihood of prevailing in a war, and money can be used to bribe others to take certain decisions. They can also be less tangible: reputation and resolve can make threat more credible; technology increases the efficiency of the army; and a large GDP makes it harder to refuse a concession in exchange for market access.

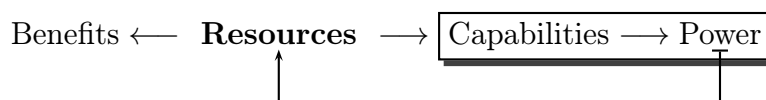


Figure 1.2: Power, Capabilities and Benefits

Power is a *function* of capabilities (and hence indirectly of resources); but it is not equivalent to them. Resources can be used either for guns (capabilities) or butter (benefits) (Powell 1993). In turn, guns grant its owner a better disagreement point (more power), from which more resources can be obtained (Fig. 1.2). Most of the literature has addressed the question of the mapping from power to resources: given a distribution of power, what will the distribution of benefits be? Instead, this dissertation is about the mapping from capabilities to power: given an army, a number of tanks and a certain technology, what is a country’s power. And most importantly, given this mapping, what will be states’ strategy towards their capabilities?

4 Outline

The dissertation proceeds in four main parts. In chapter II, I analyze the problem of large and rapid shifts in relative power. In particular, students of international relations have long argued that rapid shifts in relative power can lead to war. Fighting is rational, it is argued, when the declining state fears that the rising one will exploit

its increased power once the shift has occurred. However, I demonstrate that this explanation is insufficient to explain war. Indeed, the rising state should be willing to alleviate the declining state's concern by reducing its expected future power, such that a commitment problem never emerges. For example, states often limit their ability to launch preemptive attacks by withdrawing weapons (e.g., the Cuban missile crisis) or creating demilitarized zones; they abandon armament programs to avoid preventive wars (e.g., the Washington Naval Treaty); and they disarm to help bring about the trust necessary to end wars. By giving up today the attributes that will increase its power tomorrow, then, the rising state can credibly commit now to a future partition of the pie. Indeed, I show that war never occurs in equilibrium when countries can negotiate over the determinants of their power (their capabilities), no matter how fast relative power shifts. This result is robust to uncertainty about growth rates, and to any bargaining protocol in which war is an option. War occurs only when there are constraints on the players' ability to change their relative power caused by: (i) indivisible or intangible capabilities and (ii) costs in relation to third parties.

In chapter III, I ask the opposite question: when will states be willing to incur the costs and risks of war to acquire those capabilities that increase their future power. In particular, I examine situations in which parties negotiate with the expectation that current gains will affect their future power, and derive the conditions under which such negotiations break down into war. Indeed, states often, if not always, bargain over pies that affect their future bargaining power. A large territory, for example, is not only valuable in itself, but also as an instrument of power. It provides raw material, makes offensive attacks more difficult, and enables a larger population. As a result, states are not only trying to maximize their benefits when they negotiate over the partition of a territory; they also strive to increase their power—their ability to secure a favorable outcome in the future. It is not obvious what outcome we should expect in this type of situation. More specifically, when do negotiations over objects that affect future bargaining power break down into war? In other words, when will states fight wars of investment—wars aimed at accumulating resources that improve

their ability to secure favorable outcomes in future negotiations? I consider a game of complete information in which power is defined endogenously as a function of states' distribution of benefits. Two main results emerge: (i) two states can have a positive expected utility for war when current gains and losses affect future power, and (ii) war occurs in equilibrium *only if* the additional capabilities acquired by fighting lead to increasing power returns.

Chapter IV is about the steps that states take prior to the negotiation to avoid revealing their private information. In particular, states often seek to conceal their private information. Because it can be used against them in future negotiations, information about their power or preferences is valuable, and divulging it implies costs and losses in the ability to secure favorable outcomes in the future. This chapter is about the strategic revelation of information in international politics. Private information is a valuable asset in a negotiation, and I examine the mechanisms that states devise to hide it. How do states conceal or misrepresent their attributes? And how can others extract it? I show in particular how states purposefully devise mechanisms that are costly to lie to—screening mechanisms—and I argue that international agreements are particularly reliable such mechanisms. I also show that states use ambiguity as a way to avoid answering these embarrassing questions.

Finally, chapter V addresses the problem of the allocation power: how do states allocate their scarce coercive capabilities to different fronts, or bargaining tables, and how this allocation translate into a distribution of benefits? States typically pursue multiple foreign policy goals. Yet, resources are scarce, so that priorities must be set and tradeoffs are inevitable. How do states allocate their scarce means of coercion to various fronts and bargaining tables? And how does it affect their ability to extract concessions? When is power a scarce resource that needs to be allocated and when, on the contrary, can it be used and reused freely? These questions touch upon a fundamental problem: What does it mean and imply to have 'more power'? In particular, how do resources and capabilities affect the ability to secure favorable outcomes—i.e., a large share of the pie?

CHAPTER II

Negotiating Over Power: When Do Shifts in Power Lead to War?

1 Introduction

Students of international relations have long argued that rapid shifts in relative power can lead to war. “The growth of Athenian power and the fear which this caused in Sparta” or the rise of Germany, for example, are common explanations for the Peloponnesian war and World War I respectively.¹ More recently, the economic and military rise of China has led many to wonder about the likelihood of a war with its neighbors or the United States.² In each case, the declining state fears that it will negotiate in a position of weakness once the balance of power has shifted and hence, it is argued, prefers fighting now. The problem is not that there are no peaceful solutions that both parties prefer to war; the costs and risks of war ensure that there always exists such an agreement.³ Rather, fighting occurs because any commitment to a specific course of action once the balance of power has shifted is inherently non-credible.

¹The quote is from Thucydides (1984). The rise of Germany as a cause for World War I is discussed in Joll (1992) and, with a twist, in Ferguson (1999, p. 83): “The key to the arms race before 1914 is that one side lost it, or believed that it was losing it. It was this belief which persuaded its leaders to gamble on war before they fell too far behind.” See also Ferguson (2006).

²See, for example, Hoge (2004), Bijian (2005) or Mearsheimer (2006).

³This is assuming, of course, that war *is* costly. This excludes from the analysis situations in which war is desired for its own sake. For example, war can strengthen leaders.

This line of argument, however, is puzzling. If indeed rapid changes in relative power lead to inefficient conflicts, then why do states not negotiate over the causes and speed of that shift. In other words, why would the rising state not offer today concessions of capabilities that reduce his expected power tomorrow? Abandoning a weapons program or withdrawing troops from the border, for example, are simple ways to alter expected incentives in the next period, and hence to credibly commit to a specific course of action.

In other words, a credible commitment mechanism exists in a broad class of bargaining situations. Expectations are based on present attributes (e.g., a battleship program), and hence can be objects of negotiation themselves. By changing these attributes today, the rising state is able to tie his hands in the next period, and hence to alleviate the declining state's concerns. As a result, war never occurs, no matter how fast relative power shifts.

Unfortunately, most existing bargaining models have taken power as exogenous. Bargaining is usually defined in the literature as the process by which a number of actors strive to reach an agreeable partition of a pie on the basis of a set of exogenously defined attributes that determine their bargaining power. One insight in Rubinstein (1982), for example, is that bargaining power depends on the relative magnitude of the players' respective costs of haggling. Taking these attributes as exogenous is realistic if patience is the only determinant of bargaining power, but not in the broad class of situations in which other attributes affect the players' reservation point, because these attributes themselves are often the object of negotiations. Indeed, countries interacting over time are likely to bargain not only over final outcomes, but also over the means to obtain them—in short, over power itself. A cursory look at history shows that states often do bargain over the determinants of their power. For example, they negotiate over their possession of weapons (see the recent crises with Iraq and Iran or the SALT agreements), the positioning thereof (the Cuban missile crisis), or disarm altogether (Japan in 1945); they sometimes create demilitarized zones (the German Rhineland in 1919) or withdraw troops from the border, thereby limiting their ability to launch a successful offensive attack (India

and Pakistan in 2002).

The present paper analyzes a model in which states can bargain not only over a pie, but also over the determinants of their future power themselves. Throughout, the central concern will be efficiency: when do rapid changes in relative power lead bargaining to break down into war? I analyze this class of bargaining situations in the context of a stochastic model of sequential bargaining in which power can shift over time, and actors bargain not only over the division of a pie but also over their power. I first show that war never occurs when players are able to negotiate over their expected future bargaining power. This result is robust to any bargaining protocol with an outside option, and even to uncertainty about growth rates. Furthermore, I show that war reemerges when the commitment mechanism cannot be implemented—that is, when negotiations over power are not feasible. Constraints on the ability to change relative power, then, provide deeper and more specific explanations for the breakdown of bargaining than shifts in power.

2 Related Literature

Rapid changes in relative power are perhaps the most common explanation for war. Taylor (1954, p.166), for example, notes that “every war between Great Powers [between 1848 and 1918] started out as a preventive war.” As a result, a very large literature has analyzed the relationship between rapid shifts in power and war. Organski (1958), for example, argues that rapid economic development driven by industrialization changes the distribution of power more rapidly than the existing international order, and hence leads to tensions.⁴ More recently, Morrow & Kim (1992), Fearon (1995) and Powell (1999, 2004, 2006) have provided more formal and general explanations for why bargaining might fail when relative power changes quickly.⁵ All these works emphasize the idea that rapid shifts in power generate fear in the declining state—fear caused by the inability of the rising state to commit to a

⁴A related argument is found in Gilpin (1981). See also Kim (1992), DiCicco & Levy (1999).

⁵A historical survey of preventive wars can be found in Vagts (1956, pp. 263–350); a good presentation of theories relating power shifts and war is Van Evera (1999).

specific partition of the pie once the shift has occurred. Yet, none of these theories solves the puzzle specified in the introduction: if indeed rapid changes of power lead to inefficient conflicts, then why does the rising state not offer today concessions of capabilities that will reduce his expected power tomorrow?⁶

To solve the puzzle, we need a model in which actors can bargain over power itself. Unfortunately, very few authors have treated power endogenously. Instead, the determinants of the players' reservation point are typically taken as exogenous. In a dynamic game, however, power is a valuable object of negotiation, as it influences a player's share of the pie in the following rounds. A notable exception is Fearon (1996) who, in a related paper, analyzes a model in which actors bargain over objects that affect their future bargaining power. In his model, Fearon finds that war never occurs because one state always makes demands sufficiently small for the other state to prefer granting them than fighting. The problem with domestic growth is different, however, since growth imposes a minimum size of concessions that can lead the mechanism proposed by Fearon (1996) to fail. does not work in this type of situation. In addition, I also analyze the problem of uncertainty about the rate of growth and study how it affects the ability to reach a peaceful outcome.

More applied strands of the literature have indirectly addressed the question of negotiations over power. North & Weingast (1989) and Acemoglu & Robinson (2000) argue that domestic commitment problems can be solved by transfers of political power—whether they take the form of a representative parliament or of an extended franchise. In both cases, risks of bargaining breakdowns today are prevented by concessions that allow the weaker player to have a say in the next period. Similarly, the literature on the time inconsistency problem has typically focused on the need to delegate monetary policy authority to an autonomous institution in order to credibly commit to a specific course of action (Kydland & Prescott 1977). Finally, a more empirical literature on civil war has also emphasized the role of power-sharing as a mechanism of commitment. For example, agreements that include provisions for sharing or dividing military power among former enemies improve the prospects

⁶Fearon (1995) mentions this possibility, but does not elaborate.

for peace (Hoddie & Hartzell 2003). Similarly, institutional arrangements can offer credible guarantees to former enemies as they move toward a situation of centralized state power (Hartzell 1999). These mechanisms are all related. Power transfers, whether to a central bank or rebels, are necessary to ensure the credibility of the commitment. Of interest here is a general analysis of the conditions under which such negotiations over power are possible, and of the assumptions required for such a result to hold.

The paper proceeds in two main steps. A number of models pertaining to the problem are analyzed in section 3, and the main result is presented: war never occurs when states can negotiate over their relative power. In the next section (section 4), I examine the conditions under which war might still occur. Finally, section 5 analyzes historical cases to show how states have negotiated over their power to ease their commitment problems.

3 The Model

3.1 A Commitment Problem

I first review the logic of the commitment problem, namely the idea that when power changes rapidly in the dyad, there is nothing that the rising state can offer now to satisfy the declining one. The intuition for the result is simple, and corresponds to the understanding that fast changes in power lead to war. Imagine, for example, that a country A expects another country B to grow much stronger in the next period. Then A anticipates that B will want a much larger share of the pie tomorrow, and no promise today by B can change this belief. In fact, when the shift is large and rapid, there are no concessions that B can make today that will satisfy A . As a result, A prefers to fight now before B becomes stronger.

To see this more formally, consider the following model. Two players (or ‘states’), A and B , negotiate in two successive periods ($t = 0, 1$) over the occupation of a territory X of size one. The duration of one period is $\Delta > 0$. Let $(x_A^0, 1 - x_A^0)$, where $x_A^0 \in [0, 1]$ denote the distribution of X at the beginning of the game.

In each period ($t = 0, 1$), player A makes an offer $x_A^t \in [0, 1]$ to player B . B observes the offer, and can either accept it or reject it. If B rejects offer x_A^t , then ‘war’ starts. War is a lottery in which A wins the present and future use of the entire territory X with probability p^t . Both states incur a loss of utility (a ‘cost of war’) of size $c_i > 0$, and the game ends after the war and the allocation of payoffs.

If, instead, B accepts the offer, then the players occupy their respective shares of the territory, x_A^t and $1 - x_A^t$ until the end of the period (that is, for some time Δ). Period 1 starts immediately at the end of period 0, and the game ends at the end of period 1.

Payoffs. Let $u_i : X \rightarrow [0, 1]$ be a continuous function that denotes player i ’s payoff for occupying a share of territory $x \in X$. For $i = A, B$, I assume $u_i'(\cdot) \geq 0$, $u_i''(\cdot) \leq 0$, $u(0) = 0$ and $u(1) = 1$. Player i ’s utility for the overall game, then, is defined as

$$\sum_{t=0}^1 \Delta u_i(x_i^t) e^{-d_i \Delta t},$$

where $d_i > 0$ is player i ’s discount rate. For notational convenience, define for each $i = A, B$, $\delta_i \equiv e^{-d_i \Delta}$ to be player i ’s discount factor. In this section, I assume $\Delta = 1$.

Let $G(X, p^t, \Delta = 1)$ denote the game defined in this section. The subgame perfect equilibrium (SPE) will be used to characterize the strategies and outcome of $G(X, p^t, \Delta = 1)$.

Definition 3.1. *A strategy pair is a subgame perfect equilibrium if the strategy pair it induces in every subgame is a Nash equilibrium of that subgame.*

First note that in any subgame, B can always fight and guarantee an expected

payoff (from that period on) of

$$\begin{aligned} & u(0)p^1 + u(1)(1 - p^1) - c_B \\ & = 1 - p^1 - c_B \quad \text{if war occurs in period 1} \end{aligned} \quad (2.1)$$

and

$$\begin{aligned} & (1 + \delta_B)u(0)p^0 + (1 + \delta_B)u(1)(1 - p^0) - c_B \\ & = (1 + \delta_B)(1 - p^0) - c_B \quad \text{if war occurs in period 0} \end{aligned} \quad (2.2)$$

Rationality requires that A offers x_A^1 in period 1 such that B 's utility for accepting x_A^1 is exactly (2.1), and x_A^0 such that B 's utility for accepting x_A^0 in period 0 is exactly (2.2). This means that A offers \bar{x}_A^0 and \bar{x}_A^1 in period 0 and period 1 respectively, where \bar{x}_A^0 and \bar{x}_A^1 are the implicit solutions to the following equalities, (2.3) and (2.4) respectively:

$$u_B(1 - \bar{x}_A^0) + \delta_B(1 - p^1 - c_B) = (1 + \delta_B)(1 - p^0) - c_B \quad (2.3)$$

$$u_B(1 - \bar{x}_A^1) = 1 - p^1 - c_B \quad (2.4)$$

Proposition 3.1. *(i) Let \bar{x}_A^0 and \bar{x}_A^1 be the implicit solutions to equality (2.3) and (2.4) respectively. Then the following pair of strategies is a subgame perfect equilibrium of $G(X, p^t, \Delta = 1)$.*

- *In period 0, A offers $x_A^0 = \bar{x}_A^0$ if $u_A(\bar{x}_A^0) + \delta_A u_A(\bar{x}_A^1) \geq (1 + \delta_A)p^0 - c_A$, and offers $x_A^0 = 1$ otherwise. In period 1, A offers \bar{x}_A^1 .*
- *In period 0, B always accepts an offer x_A^0 if and only if $x_A^0 \leq \bar{x}_A^0$ and fights otherwise. In period 1, B always accepts an offer x_A^1 if and only if $x_A^1 \leq \bar{x}_A^1$ and fights otherwise.*

(ii) In equilibrium, war occurs in period 0 for any

$$p^1 > \frac{(1 + \delta_B)p^0 + (1 - \delta_B)c_B}{\delta_B} \quad (2.5)$$

Example 3.2. Let $\delta_B = 0.9, c_B = 0.2, p_0 = \frac{1}{3}, p^1 = \frac{3}{4}$, and assume $u_i(x) = x, i = A, B$. First note that in period 1, A will offer B a share of X that yields B a utility equal to B's utility for war. That is, B will receive

$$u(0)p^1 + u(1)(1 - p^1) - c_B = 1 - p^1 - c_B = 0.05$$

This means that in period 1, A offers $x_A^1 = 1 - 0.05 = 0.95$, which B accepts. Consider now B's incentives in period 0. If B fights, she obtains an expected utility of

$$(1 - p^0)(1 + \delta_B) - c_B = \frac{2}{3}(1.9) - 0.2 \approx 1.07$$

But note now that the most A can possibly offer B to avoid war is the entire pie, that is, $x_0^A = 0$. However, B's utility from accepting $x_A^0 = 0$ is

$$1 + 0.05\delta_B = 1.045 < 1.07$$

In other words, the utility for fighting is greater than the utility for accepting even the entire pie today, and hence even conceding the entire territory today is insufficient to prevent war. This is the essence of the commitment problem. Because A cannot credibly commit to any large concession in the next period, B prefers fighting now.

Some scholars have argued that reducing the time between negotiations might ease the commitment problem. That is, by renegotiating frequently instead of waiting for long periods of time, the fear caused by large shifts in power would be eased. In this section, I proceed to show that this intuition is incorrect.

To see this, suppose now that the time between negotiations is $\Delta \in [0, 1]$. That is, period 0 corresponds to time 0, whereas period 1 now corresponds to time $\Delta \leq 1$ (and not $\Delta = 1$ as in the previous game $G(X, p^t, \Delta = 1)$). To understand how this affects the equilibrium, we need an understanding of the value of A's likelihood of prevailing for any $\Delta \in [0, 1]$. For simplicity, I assume a linear evolution. That is, $p(\Delta) = \Delta p^1 + (1 - \Delta)p^0$ denotes the probability that A will prevail in a war that starts at time Δ . Finally, it will be convenient to define $\delta_i^\Delta \equiv e^{-d_i \Delta}$ (it will be useful

in the proof to remember that $\delta_i^\Delta > \delta_i$ for any $\Delta \in (0, 1)$.)

Let $G(X, p^t, \Delta < 1)$ be the game thus defined. I now show that for any $0 < \Delta < 1$ and p^1 such that (2.5) in proposition (3.1) holds, war still occurs in equilibrium. In other words, frequent renegotiations over X do not solve the commitment problem.

Proposition 3.2. *For any $0 < \Delta \leq 1$ and for any p^1 such that inequality (2.5) in proposition (3.1) holds, war occurs in equilibrium in $G(X, p^t, \Delta < 1)$ at time 0.*

3.2 Solving the Commitment Problem: Negotiations Over Territory *and* Resources

In this section, I analyze a modified version of the game presented in the previous section. More precisely, I make the determinants of future power themselves objects of negotiation. Indeed, in a bargaining situation, players can negotiate over two types of objects: those that affect their utility directly (benefits), and those that affect it only insofar as they affect bargaining power (capabilities). Most existing models of war have only analyzed the equilibria and efficiency of situations in which the players bargain over final outcomes (benefits). Instead, I make the determinants of future power themselves—what I call “capabilities” an object of negotiation. By capabilities, I mean objects (e.g., military resources) that affect a player’s chance of winning in a conflict. This definition is more general than might appear at first, as it can incorporate any type of capabilities: material ones such as military capabilities, but also intangible ones such as secret strategies or technologies. For example, troops stationed close to the border can easily be modeled as a different capability than troops that are not ready to be mobilized. Thus, withdrawing troops from the border is itself a concession of capabilities.

At the core of the paper is the ability to affect expectations about tomorrow’s power. This is how the rising state is able to reassure the declining one, and hence to avoid war. Note that expectations about the future are based on current features and characteristics of a country. For example, the growth of its military or its GDP. In other words, since expectations are based on factors that exist today, expectations can always be changed today by altering these factors. The issue that I address in

this paper is not whether this is possible, but whether states are willing to engage into such negotiations, and whether they ever fail.

To answer these questions, I analyze a modified bargaining model in which players bargain both over a pie and over the determinants of their power.⁷ More formally, I now consider a different game, in which the object of negotiation is not anymore simply the territory X , but also a set of resources R of size one. That is, the protocol remains the same, except that an offer is now a pair (x_A^t, r_A^t) , where $r_A^t \in [0, 1]$ denotes the share of R that A would control until period $t + 1$.⁸ Assume moreover that the share of resources that each state owns is what determines its likelihood of prevailing in war. More precisely, A wins a war in period t with probability $p^t = p(r_A^{t-1})$, where $p : [0, 1] \rightarrow [0, 1]$ is continuous. The game's payoffs are still defined as

$$\sum_{t=0}^1 \Delta u_i(x_i^t) e^{(-d_i \Delta t)}.$$

Note that payoffs are not a function of r_i^t (intuitively, cannons do not increase utility. This assumption will be relaxed later). As before, $t \in \{0, 1\}$ and in each period, B either accepts an offer (x_A^t, r_A^t) or rejects it, in which case war starts. Let $r_A^0 \in [0, 1]$ denote the initial distribution of R (so $p^0 = p(r_A^0)$). For simplicity, assume $\Delta = 1$.

Let $G(X, R, p(r), \Delta = 1)$ denote this game.

Some additional notation will be useful for the analysis. Let \hat{x}_A^1 be the implicit solution to

$$u_B(1 - \hat{x}_A^1) = 1 - p^1 - c_B, \tag{2.6}$$

⁷A stochastic game is “a repeated game where the state of nature may change from stage to stage, according to a lottery which, just like the current payoff, depends on current state and actions” (Mertens 2002).

⁸and hence $1 - r_A^t$ is B 's share.

and let $(\hat{x}_A^0, \hat{r}_A^0) \in S_A^0$, where S_A^0 is defined as

$$S_A^0 \equiv \left\{ (x, r) \in [0, 1]^2 : (x, r) = \max_{x, r} (u_A(x) + \delta_A(u_A(\hat{x}_A^1))) \right. \\ \left. \text{s.t. } u_B(1 - x) + \delta_B(1 - p(r) - c_B) \geq (1 + \delta_B)(1 - p^0) - c_B \right\}$$

Finally, let condition (2.7) be defined as

$$u_B(1 - x_A^0) + \delta_B(1 - p(r_A^0) - c_B) \geq (1 + \delta_B)(1 - p^0) - c_B \quad (2.7)$$

Proposition 3.3. (i) *The following pair of strategies is a SPE of $G(X, R, p(r), \Delta = 1)$:*

- *State A offers some $(\hat{x}_A^0, \hat{r}_A^0) \in S_A^0$ in period 0, and (\hat{x}_A^1, r_A^1) , $r_A^1 \in [0, 1]$ in period 1.*
- *In period 0, state B accepts any (x_A^0, r_A^0) if and only if (x_A^0, r_A^0) solves (2.7), and fights otherwise. In period 1, state B accepts any (x_A^1, r_A^1) if and only if $x_A^1 \leq \hat{x}_A^1$ and $r_A^1 \in [0, 1]$, and fights otherwise.*

(ii) *War never occurs in equilibrium.*

Example 3.3. *For $i = A, B$, assume $c_i = 0$ (the most difficult case) and $u_i(x) = x$ (no risk-aversion—also the most war-prone). Then in period 1, B accepts any x_A^1 such that*

$$u_B(1 - x_A^1) \geq 1 - p(r_A^0) \Rightarrow x_A^1 \leq p(r_A^0)$$

So A offers $x_A^1 = p(r_A^0)$. In period 0, B accepts any (x_A^0, r_A^0) such that

$$u_B(1 - x_A^0) + \delta_B(1 - p(r_A^0)) \geq (1 + \delta_B)(1 - p(r_A^0)) \\ x_A^0 + \delta_B p(r_A^0) \leq p(r_A^0) + \delta_B p(r_A^0) \quad (2.8)$$

Then an offer (x_A^0, r_A^0) such that $x_A^0 = p(r_A^0)$ and $r_A^0 = r_A^0$ solves (2.8). To see why A

would want to make such an offer, note that the utility derived from such an offer is

$$p(r_A^o) + \delta_{AP}(r_A^o),$$

which is equal to A 's expected utility for war.

This result shows that the inefficiency condition derived in Powell (2004) never holds when transfers of capabilities are added as a dimension in the bargaining space. By giving up capabilities now, B changes his expected maximization problem in the next period, and hence credibly commits to the agreement in the next period. The result holds no matter how rapidly power shifts, and applies to any bargaining protocol with an outside option. As a result, fast changes in relative power associated with commitment problems cannot be a sufficient explanation for war.

3.3 The Issue of Separability

I have so far explicitly assumed that capabilities and benefits can be distinguished. That is, an object can be qualified either as ‘capability’ or as ‘benefit’, but not both. While it is reasonable to assume that states do not derive any direct utility from the possession of cannons, other objects such as territory play a double role. On the one hand, a larger territory increases space for the population, allows additional crops and generates economies of scale. On the other hand, it is also a defensive capability (Levy 1984), or a source of raw materials. Even clearer is the case of money, which is perfectly fungible into either benefits or military power. In fact, it is difficult to find examples of benefits that cannot potentially affect capabilities in the long run.⁹ In short, the problem is that there might be no ‘pure’ capability or benefit, in the sense that benefits and capabilities are sometimes fungible into one another. When this is the case, transfers of present benefits (x) affect future power, and exchanges of capabilities (c) affect current utility. More precisely, “capabilities” and “benefits” are perhaps best understood as a continuum of objects that differ in the degree to

⁹The “Marne Taxis” are an interesting example. They were requisitioned by the French Army to transport troops from Paris to the First Battle of the Marne, during August of 1914.

which they affect utility and power, rather than as two disjoint sets. Thus, at one end of the spectrum are objects with a high impact on power but a low impact on utility (e.g., weapons, forts, reputation). At the other end are pure benefits (e.g., religious or symbolic monuments). In the center of the spectrum are objects that affect both utility and power to various degrees (e.g., money, natural resources).

How is the efficiency result obtained in section ?? affected when benefits overlap with capabilities? Assume, for example, that capabilities and benefits cannot be distinguished at all.¹⁰ Money, for example, is fungible into both benefits and capabilities. When this is the case, I show that bargaining can break down into war if the concessions necessary today to satisfy A imply too large a loss of utility. China, for example, might not be willing to reduce its economic growth simply to reassure its neighbors.

To see this, assume now that A and B negotiate only over a territory X according to the same take-it-or-leave-it protocol. This time, however, A wins a war with probability $p^t = p(x_A^{t-1})$, instead of $p^t = p(r_A^{t-1})$, as was the case in the previous model. Intuitively, this means that objects that affect utility (e.g., territory) also affect the probability of winning a war (a territory can be used for a larger population and hence army, or for a large production base). Let x_A^o denote the initial distribution of X before the game starts. Assume for now that $\Delta = 1$, and let $G(X, p(x), \Delta = 1)$ denote the game thus defined.

Proposition 3.4. *Let x_A^0 be the implicit solution to:*

$$u_B(1 - x_A^0) + \delta_B(1 - p(x_A^0) - c_B) \geq (1 + \delta_B)(1 - p(x_A^o)) - c_B, \quad (2.9)$$

and $x_A^1(x_A^0) \equiv u_B^{-1}(1 - p(x_A^0) - c_B)$. *Then war occurs in all SPE if:*

$$u_A(x_A^0) + \delta u_A(x_A^1(x_A^0)) < (1 + \delta_A)p(x_A^o) - c_A \quad (2.10)$$

¹⁰In this special case, this setup is similar to that of Fearon (1996). Our different results are explained by different assumptions about the discount rate δ_i . Whereas Fearon assumes that both players share a common discount factor, I allow for the possibility that states differ in their preferences about the future. Thus, Fearon's paper is a special case of the present model.

Example 3.4. Assume $\delta_A = 0$ and $\delta_B = 1$. That is, A only cares about today, whereas B cares a lot about tomorrow. Take $c_A = c_B = 0.1$, and assume that for $i = A, B$, $u_i(z) = z$. Moreover, suppose $p^t = \sqrt{x_A^{t-1}}$ and $x_A^0 = 0.25$. That is, A controls 25% of the territory when the game begins. First note that B can always fight in stage t and ensure an expected payoff of

$$\begin{aligned} & (1 + \delta_B)(1 - p(x_A^{t-1})) - c \\ & = (1 + 1)(1 - \sqrt{0.25}) - c = 0.9 \end{aligned}$$

Note also that A 's expected payoff for fighting at time t is

$$(1 + \delta_A)(p(x_A^{t-1})) - c \tag{2.11}$$

$$= (1 + 0)(\sqrt{0.25}) - c = 0.4 \tag{2.12}$$

Since $\delta_A = 0$, the only way A can obtain a utility at least as great as her utility for fighting is by offering an agreement $x_A^t \geq 0.4$. But such an agreement on $x_A^t = 0.4$ yields for B an expected utility of

$$u_B(1 - 0.4) + \delta_B(1 - p(0.4) - 0.1) = 0.6 + 1 - \sqrt{0.4} - c \tag{2.13}$$

$$\approx 0.87 < 0.9 \tag{2.14}$$

This means that A 's best offer—the most A is willing to give—is insufficient to deter B from fighting in the first round.

Let us gain some intuition for this result (Figure 2.1). Assume for simplicity that $c_i = 0$. Problems arise when the x_A^1 implied by the present x_A^0 is too large (red line). In Fearon (1996), the solution was for B to demand $x_A^{0'}$ such that the future distribution of power would not be too large (blue line). This works if both care about the future the same way. But since A cares a lot more about today, A is not willing to offer a low x_A^0 , and hence both can prefer fighting today.

An important remark, however, is that war never occurs as long as the time

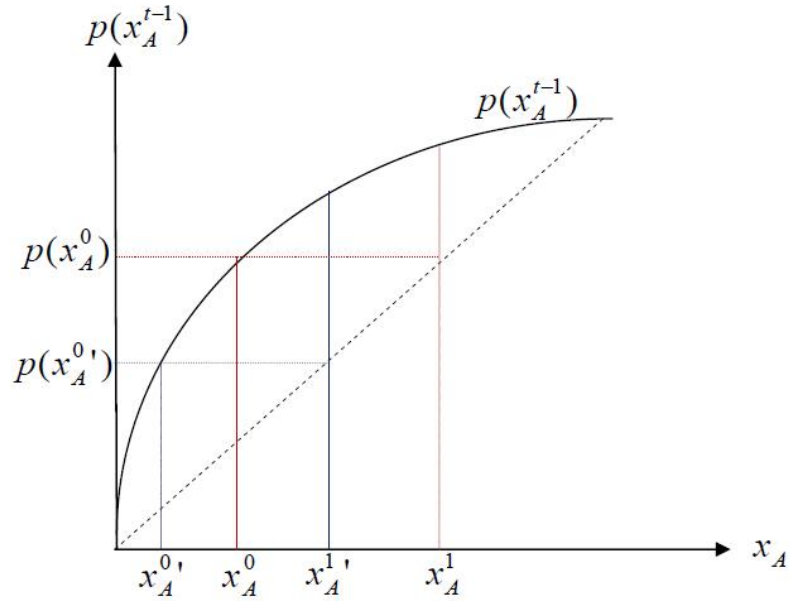


Figure 2.1: Sample Growth Path and the Concessions it Implies

interval between two negotiations is sufficiently short. That is, as $\Delta \rightarrow 0$, war never occurs. To gain some intuition, consider figure 2.2. In an abuse of notation, $p(x_A^{t-\Delta})$ denotes $p(\cdot)$ as a function of x_A in the previous period, when the duration of the period is Δ . Note that, as $\Delta \rightarrow 0$, $p(x_A^{t-1})$ becomes closer and closer to the 45° line. But this means that B only demands low concessions from A today such that the distribution of power in the next period is not too high. Moreover, it can be shown that the total amount of these concessions over a period of time 1 is lower than the concessions that would have been required to ensure that $p(x_A^0)$ is sufficiently low if Δ had been large.

If frequent renegotiations are not possible, war breaks down into war because the rising country needs to make large concessions of benefits now to ensure that his power tomorrow would not be too high in the future. If this large concession is broken down into smaller concessions, however, the loss of utility that B incurs each time is never sufficient to lead B to fight.¹¹ This result is important: even when

¹¹In practice, the kind of frequency that is meant is remains relatively low. In the case of preventive war, where the shift in power takes place over a relatively long period of time, frequent renegotiations should not be an issue. They might pose more of a problem, however, if we are dealing with preemptive war. The risk of preemption—troops marching towards the border, for example—

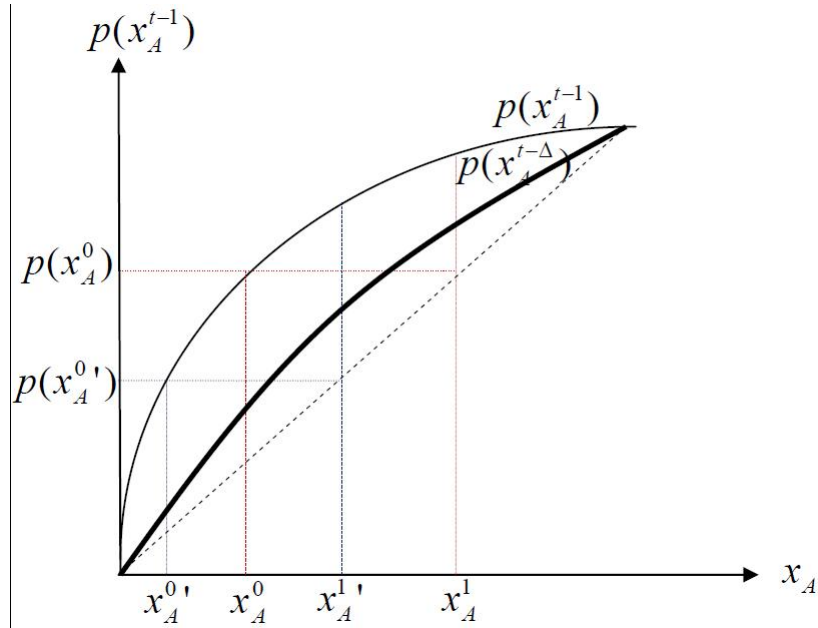


Figure 2.2: Path of Concessions as Δ Becomes Smaller.

concessions of capabilities are costly to the rising state (because they imply a loss of utility), there exists a self-enforcing mechanism that ensures that bargaining never breaks down into war. In other words, commitment problems do not lead to the inefficient use of power.

4 Why War Might Still Occur

Negotiating over capabilities allows the players to define the incentive structure of the game they will play tomorrow, and hence to facilitate commitment. As an important corollary, however, we expect commitment problems to reemerge as a cause of war whenever the players are constrained in their ability to transfer capabilities. I examine now the type of situations in which such constraints are most likely to arise, and their consequences on the occurrence of war.

requires much swifter action, and hence increases the importance of negotiating rapidly.

4.1 Limits on the Ability to Affect Tomorrow's Power

The commitment mechanism detailed earlier does not hold if the parties are unable to trade capabilities. There exist at least two reasons why this could be the case. First, capabilities are not always perfectly divisible or, almost equivalently, the function $p(\cdot)$ might exhibit discontinuities. Unfortunately, the existence of a smallest capability unit or of discontinuities causes proposition 3.3 to fail since the appeaser might not be able to tailor his level of capabilities sufficiently precisely to satisfy the other player. In this case, the rising state faces the choice of making either too large a concession—in which case he becomes the one facing a commitment problem—or an insufficient one, which does not deter the declining state from going to war.¹² However, it is difficult in practice to find such “indivisible” capabilities. Even nuclear heads, for example, can be reduced both in number and in impact. Similarly, situations in which $p(\cdot)$ is discontinuous are difficult to imagine. More likely is that $p(\cdot)$ may exhibit strong increasing returns. These, however, do not lead to bargaining break downs.¹³

Furthermore, capabilities cannot always be transferred. Immaterial capabilities such as resolve, military training, morale, knowledge or experience are typically impossible to give up. As a result, the rising player might be unable to set his capabilities to the level necessary to satisfy the declining power (e.g., setting c_t close to zero could be infeasible), as was the case with indivisible capabilities. In practice, however, this theoretical difficulty is largely inconsequential. Immaterial factors certainly play an important role, but mostly so in combination with material capabilities. For example, power might be conceived of as a function of capabilities of the form $p = M^\alpha I^{1-\alpha}$, where M denotes material capabilities and I immaterial ones. When the function that relates capabilities to the chance of winning (power more generally) takes this form, setting p to any number remains possible simply by changing material capabilities M (assuming, of course, that $\alpha > 0$.) Resolve alone,

¹²A similar argument has been made in the context of imperfectly divisible pies as a cause of war (Fearon 1995, Walter 2000, Toft 2003, Goddard 2006).

¹³Only continuity was needed for the efficiency result.

for example, does not win a war and hence decreasing the size of the army to zero still reduces power to zero as well.

4.2 Beyond Bilateral Bargaining

The assumption that there are only two players, however, proves to be much more problematic and opens an interesting program of research. Capabilities typically affect an actor B 's power vis-à-vis all other actors it interacts with. Thus, B does not only weaken himself vis-à-vis A when he reduces the size of his army, but also versus C . But since capabilities determine B 's reservation point, and hence his share of the pie, giving up capabilities to satisfy A reduces B 's share of the pie with C . It is straightforward to see that, in some contexts, the cost generated by this reduction of capabilities might surpass the relative gains achieved by not fighting with A .

To see this more clearly, consider a game denoted in which there are N players in addition to A (declining) and B , and where $p^{ij} = f(c^i, c^j)$ denotes i 's likelihood of prevailing in case of a fight versus j .¹⁴ Assume moreover that A demands from B a concession of capabilities such that B 's power vis-à-vis A tomorrow will not exceed some value \hat{p}_t^{AB} . But this means that, all else equal, B will now be declining relative to the other N states (i.e., $p_n^{Bj} < \hat{p}_t^{Bj} \forall j \in N$), and hence that these other N states will expect a larger share of their common pie tomorrow. If the expected loss incurred exceeds the risks and costs associated with a war against A , B will prefer fighting A now. In fact, as the number of players increases, smaller amounts of concessions to A become sufficient to lead B to fight.

However, it is important to note that what causes war in this case is actually not the number of players itself, but rather B 's inability to target his reduction. By target, I mean that B should be able to reduce his power vis-à-vis A without affecting his power vis a vis C . For example, Iran does not reduce its power versus its geographically close neighbors when it agrees to limit its stock of long-range weapons. More formally, note that I have implicitly modeled power as a function of a variable c^B . If, instead of a single variable, B 's capabilities are modeled as a

¹⁴I make the usual assumptions about $p(\cdot)$: continuous, monotonic and increasing in c^i .

vector of the form $\mathbf{c}_B = \{c^{BA}, c^{BC}, c^{BD}, \dots, c^{BN}\}$, where each element represents B 's capabilities vis-à-vis some other country $j \in N$, then B will be able to reduce his capabilities vis-à-vis A without affecting his power vis-à-vis all other N states. Thus, it is straightforward to show that all SPE of the bargaining game with transferable power are still efficient with more than two players, provided that power is targetable. Thus, a three-player negotiation is reduced to three two-player negotiations, for which the earlier analysis applies.¹⁵ Hence, understanding the ability to target power and classifying capabilities as targetable or not is an essential part of our understanding of the breakdown of war.

5 Illustrative Cases

The set of cases in which states negotiate over their respective capabilities is very rich and diverse. For present purposes, I distinguish three main types of situations in which states alter their power relations (or the dynamics thereof) for the purpose of solving, or at least easing, tensions arising from commitment problems.

5.1 Avoiding Preemptive Wars

Powell (2006) demonstrates convincingly that offense and first-mover advantages are special cases of commitment problems caused by rapid changes in power.¹⁶ By striking first, a state can significantly increase its chance of prevailing, and hence this is a situation in which rapid changes in power—or at least the anticipation thereof—lead to war. If concerns about a preemptive attack are what prevents efficient bargaining, however, the players should be willing to alleviate the other's fears by voluntarily limiting their ability to launch such an attack. For example,

¹⁵Obviously, the issue is complicated by alliances. My objective, however, is to point to the incentives at play. In turn, these incentives should explain alliances behavior, but these are well beyond the scope of this article.

¹⁶“When a state decides to bargain rather than attack, it is also deciding not to exploit the advantages to striking first. This decision effectively shifts the distribution of power in the adversary's favor by giving it the opportunity to exploit the advantage to striking first, and this shift can lead to war”, p. 184.

the parties can remove their troops from the border, or create demilitarized zones.¹⁷ On July 30 1914, for example, the French Prime Minister René Viviani ordered a 10-kilometer troop withdrawal along the entire French-German border.¹⁸

They can also ease commitment problems through agreements that limit the stocks or range of offensive weapons (e.g., the 1987 Intermediate-Range Nuclear Forces Treaty between the United States and the Soviet Union), as well as by the removal of threatening weapons. Thus, the Cuban missile crisis is a case in which the bargaining power of the Soviet Union would have dramatically increased as soon as the missiles would have become operational. Direct conflict was avoided by negotiations over missiles—that is, explicitly over instruments of power.

5.2 Ending the War

Commitment problems not only lead to the outbreak of war, but can also cause inefficiency by leading wars to last longer than they would otherwise.¹⁹ Indeed, one difficulty in terminating a conflict is for the losing party to promise not to challenge the temporary agreement, and not to fight again in the future.²⁰

This inability to commit can be resolved in two ways. First, by disarming the vanquished by force—that is, by continuing the war and the destruction until the loser is so devastated that there is no hope of rapid reconstruction or revenge. Clearly, this is an inefficient solution. Often, however, war ends short of total destruction

¹⁷Thus, the tensions between India and Pakistan following terrorist attacks on the parliament of India de-escalated following the October 2002 withdrawal of Indian and Pakistani troops from their common border (see for example “India to Withdraw Troops from Pakistani Border.” *The Times of India* 16 Oct. 2002 and “Pakistan to Withdraw Troops from Border with India.” *Kyodo News* 21 Oct. 2002.) Similarly, in December 2005, Ethiopia withdrew some of its forces from the Eritrean border “in the interests of peace” (“Ethiopia ‘to reduce’ border force.” *BBC News* 10 Dec. 2005) and Ecuador and Peru withdrew troops from their disputed border in 1998 (“Ecuador and Peru withdraw troops from disputed border area.” *BBC News* 22 Aug. 1998). Examples of demilitarized zones include: the Rush-Bagot treaty of 1817 between the United States and the United Kingdom; the DMZs between Israel and Syria, Israel and Egypt and Israel and Jordan following Israel’s independence in 1948; the Korean DMZ created in 1953.

¹⁸The order was to be reversed by General Joffre, however. See Tuchman (1994, p. 101) and Stoessinger (2001, p. 18).

¹⁹On the duration of interstate wars, see Bennett & Stam (1996) and Smith & Stam (2004).

²⁰A similar problem exists in the case of civil wars, where the disarming party has no guarantee that the other player will not exploit his weakness once it has disarmed. See, for example, the work of Walter (2000).

of the means to fight. It ends even though both parties are still able to hurt—and potentially to seek revenge in the future. In these cases, ending the war (i.e., reaching an agreement instead of continuing to fight) implies that the victor be able to ensure that the loser will not challenge the terms of the agreement in the near future.²¹ By agreeing to disarm or to reduce its capabilities today, the losing side implicitly agrees to limit its own power in the future, and thereby avoids the costs of war continuation.

Examples of such disarmaments and reduction of power abound in history. Perhaps the most famous is the 1919 treaty of Versailles, which was explicitly designed to alleviate France's fear that Germany might rearm in the near future. By imposing demilitarization and subsequently the occupation of the Ruhr, France obtained a credible guarantee that Germany would not be a threat, despite her initially greater economic and military potential.²² With hindsight, we know of course that the treaty was a failure, and even an underlying cause for the outbreak of World War II. Ultimately, however, what made war possible in 1939 was the rearmament of Germany in the 1930s, the remilitarization of the Rhineland in 1936, and the implicit acquiescence by at least Britain, who seemed more concerned about the French fleet than the German one (Coutau-Bégarie 1995). The problem, then, is that the protagonists failed to negotiate over the distribution of capabilities in a way that would maintain Germany in check. The deeper cause of war is not the difference in rates of growth, but the inability of the parties to negotiate over it.

²¹The fact that such settlements are often perceived as imposed in such cases should not obscure the fact that the defeated party typically retains the choice to keep fighting.

²²It was important for France to reduce the sources of German economic power—and hence indirectly to ensure that reconstruction of a significant army be difficult. This was accomplished by a broad range of measures, including: the placement of the Saar region's coal fields under French control for 15 years; the prohibition of the annexation of Austria, Czechoslovakia, Poland or Dantzig; the cessation of Silesia to Poland, and the dismemberment of German colonial possessions. Other measures were also agreed upon to limit the country's military more directly: the Rhineland was to be demilitarized in order to create a buffer zone; troops could not exceed one hundred thousand and conscription was banned; the manufacture of weapons, artillery, tanks and military aircraft was prohibited; naval forces were strictly limited.

5.3 Avoiding Preventive Wars

Preventive wars are perhaps the purest case of conflicts caused by commitment problems. They are caused by deeper and slower changes in relative power. Their goal is “to avoid a war waged later under worse conditions, or to avoid being later compelled to bargain from weakness” (Van Evera 1999).

States have often negotiated to avoid rapid shifts in power. Limitations on naval armaments, for example, address concerns about shifts in power over longer periods than the simple withdrawal of troops or offensive weapons mentioned above. A fleet takes time and is costly to build, and personnel need intensive training that cannot be improvised over a short period of time.²³ With such agreements, states avoid deeper shifts in power by limiting growth in naval armaments. In the eighteenth century, for example, Choiseul—then France’s minister for foreign affairs—chose to limit the reconstruction of the French Navy in order to avoid fear, and a possible preventive reaction from Britain. France did not seek superiority, or even parity, but rather purposefully maintained a fleet equal to two-thirds of the British one (Masson 1981).

The Washington Naval Treaty of 1922 is a more recent example of states bargaining over power to ease tensions created by differentials in relative growth. After World War I, the British Empire had the world’s largest and most powerful navy, although the United States and, to a lesser extent, Japan were following closely. More concerning for Britain, the United States had announced its goal to create a navy “second to none”, while Japan was actively increasing the size of its fleet. Furthermore, the United States’ economic power surpassed that of the United Kingdom, and it would therefore not be long until the Royal Navy would fall behind. Contrary to common beliefs, naval rivalry led to strong tensions between the two countries. Buell (1922), a contemporary of the conference, writes for example:

The naval program of the United States, along with its refusal to join the League of Nations, naturally aroused the suspicion of England as to the impurity of American motives. It is certain that eventually the British Empire would have answered the challenge of the “big navy” men in the

²³See Coutau-Bégarie (1995) for a history of naval disarmament.

United States. [...]. But such a struggle could be forestalled only by checking naval competition. (p. 147)

In hindsight, it is tempting to underplay the rivalry of two countries that ended up not going to war. Yet, strong tensions were palpable not only with Japan, but also with Britain—so much so that some even stated that “the relations between the two countries are beginning to assume the same character as that between England and Germany before the war.”²⁴

It is in this context that the United States called for a disarmament conference. The treaty reached in Washington in 1922 limits the naval armaments of its five signatories—the United States, Britain, Japan, France and Italy. It was widely viewed as an attempt to ease the climate of tensions by limiting the arms race, and particularly the fast growing Navy of the US.²⁵ Doing this even involved the destruction of fifteen existing ships and eleven uncompleted ones. In the words of Secretary of State Stimson,

The United States [...] was engaged in building a fleet of battleships larger and more powerful than those of any other nation in the world. [...]. In order to stop naval competition and to put an end to the consequent rivalry, suspicion, and fear between the nations which would grow out of such competition, America destroyed all of those new ships, together with thirteen older battleships in her possession.²⁶

Perhaps an even clearer and more explicit case of negotiations over relative power is the principle of compensation used since the eighteenth century. Compensations (typically territorial ones) were relied upon to maintain a balance of power that

²⁴House to Wilson, 30 July 1919, in Seymour (1926, Vol. IV, p. 510). Quoted in McKercher (1990). Also: “a war with America would indeed be the most futile and damnable of all, but it is not ‘unthinkable’, and we shall the more surely avoid it by cutting that word from our vocabulary. If it is childish—and it is—to suppose that two nations must forever be enemies, it is also childish to stake one’s whole existence on the gamble that two must be forever friends (especially when they never have been really).” (Vansittart (Head, Foreign Office American Department) minute, 15 Sept. 1927, Austen Chamberlain MSS (Foreign Office Archives, Public Record Office, London) FO 800/261. Quoted in McKercher (1990)).

²⁵See Roskill (1968, 1976) for a detailed history of naval policy in the interwar period.

²⁶Radio address by Henry L. Stimson from London, January 28, 1930, in “London Naval Conference: Speeches and Press Statements by Members of the American Delegation, Conference Series 3 (Washington, D.C.: United States Government Printing Office, 1930), p.6. Quoted in Lamb (1988).

would have been upset by the gains of one nation. By splitting the gains equally among the strong actors, this system avoided rapid shifts in relative power. The first partition of Poland in the late eighteenth century is one such example. Catherine II's campaign of 1769 against Turkey was a large success, so much so that leaders of Prussia and Austria started to fear the rapid change in power that a victory would afford Russia. Moldavia and Wallachia were taken by the end of 1769, and these victories represented a menace to Austria's eastern border.²⁷ Kaunitz, then minister of foreign affairs, declared for example that it would be impossible to sit by and see the balance of power destroyed by these rapid successes (Kaplan 1962).²⁸ Russia, in order to appease Austria, considered different options to compensate Austria's loss of relative power, and the tumultuous internal affairs in Poland provided an opportunity for exploitation. Thus, the first partition of Poland between Russia, Prussia and Austria is an example of concessions of capabilities made to avoid too large a discrepancy in the anticipated rate of power change.

The numerous examples touched upon in this section show that states often negotiate over their relative power. To be sure, negotiations of this nature do not always aim at solving commitment problems. Sometimes, agreement over capabilities are reached for purely financial reasons. In other cases, however, the parties do clearly express their intention to reduce the fear and suspicion that might arise from potential military growth in the future.

6 Conclusion

A prevalent argument in the literature on international relations is that rapid shifts in relative power create tensions that can lead to war. When relative power changes over time, the declining state worries that the rising one will exploit its increased strength in the future. If the shift is sufficiently rapid, the declining state

²⁷See Kaplan (1962) for an analysis of the first partition of Poland (see pp. 121–130 in particular).

²⁸Kaplan also shows direct evidence that “if Russia continued to be obstinate and push her advantage, war with Austria was inevitable. The penetration of Russian troops deep into the Danube basin or the determination of Russia to make Poland a province of her empire would be sufficient cause for Austria's intervention” (p. 127).

prefers fighting now to avoid bargaining tomorrow in a weaker position. Even though the present analysis has focused on interstate wars, this inefficiency is not specific to international politics. In civil wars, rebels fear that the government will exploit their weakness once they have dropped their weapons. In domestic politics, the outgoing leader prefers engraving his policies into inefficiently rigid institutions to protect them from his successor's changes. In each case, there exist agreements that both would prefer to fighting, but the inability of the rising state to commit to any behavior once it is stronger prevents them from being reached.

To avoid inefficiency, the challenge is for the rising party to find a way to credibly commit to not exploiting the declining state in the future. This paper is a first attempt at understanding the conditions under which this is possible. I found that concessions of capabilities—and hence indirectly of future power—are almost always possible in practice, which implies that rapid changes in relative power in the dyad cannot be a sufficient explanation for war.

Yet, it is worth emphasizing that the paper's main contribution is not simply an efficiency result, but also an analysis of the conditions under which bargaining can fail. War occurs because countries cannot transfer their capabilities, or most plausibly because such transfers imply too high a cost vis-à-vis third parties. These findings, in turn, open new lines for research. In particular, extending the analysis beyond bilateral negotiations leads to interesting insights into strategic considerations that are too often ignored in existing models. When can power be targeted? When can capabilities be distinguished from benefits? Answering these questions—theoretically as well as empirically—will further our understanding of the causes of conflict.

Overall, the demonstration that rapid changes in power in the dyad are insufficient to explain the breakdown of bargaining is not only an interesting theoretical construct, but also leads us to practical and testable question: why are states sometimes unable, or unwilling, to negotiate over their relative power? What explains the variance in their ability to do so? Incomplete information or the inability to observe disarmament could be important explanations, but further theoretical and

empirical work is needed to further our analysis of bargaining failures in this broad class of bargaining situations.

Appendix: Proofs

Proof of proposition 3.1. (i) In period 1, B can always fight and guarantee a payoff of $1 - p^1 - c_B$. This means that, in period 1, B cannot credibly threaten to reject an offer x_A^1 such that

$$u_B(1 - x_A^1) \geq 1 - p^1 - c_B \quad (2.15)$$

I now show that A will want to make an offer x_A^1 such that (2.15) holds with equality. To see this, fix B 's strategy and consider an offer $x_A^{1'} > x_A^1$. B will reject this offer, and war occurs. Wars yields for A an expected utility of:

$$u(1)p^1 + u(0)(1 - p^1) - c_A = p^1 - c_A.$$

But note that $x_A^1 \geq p^1 + c_B$ since $u_B(\cdot)$ is weakly concave, and so $u_A(x_A^1) \geq p^1 + c_B$ by concavity of $u_A(\cdot)$. Since $c_i > 0$, $u_A(x_A^1) > p^1 - c_A$, and hence offering $x_A^{1'}$ cannot be a best response to B 's strategy.

Clearly, an offer $x_A^{1''} < x_A^1$ cannot be a best response either, since B would accept x_A^1 , and $u_A(x_A^{1''}) < u_A(x_A^1)$ since $u_A(\cdot)$ is increasing in x .

Consider now the subgame starting in period 0. First note that B 's utility for fighting in period 0 is

$$(1 + \delta_B)(1 - p^0) - c_B,$$

whereas B 's expected overall utility for accepting an offer x_A^0 is

$$u_B(1 - x_A^0) + \delta_B(1 - p^1 - c_B)$$

This implies that B cannot credibly threaten to reject an offer x_A^0 such that

$$u_B(1 - x_A^0) + \delta_B(1 - p^1 - c_B) \geq (1 + \delta_B)(1 - p^0) - c_B. \quad (2.16)$$

So if war is to be avoided, A must offer $x_A^0 \leq \bar{x}_A^0$, where \bar{x}_A^0 solves (2.16). This means that the largest share of the pie A can obtain in any peaceful equilibrium is \bar{x}_A^0 . It remains to be seen under which conditions A would want to make such an offer. We want to show that A will make such an offer \bar{x}_A^0 if and only if the payoff of doing so is greater than the payoff for war, that is if

$$u_A(\bar{x}_A^0) + \delta_A u_A(\bar{x}_A^1) \geq (1 + \delta_A)p^0 - c_A. \quad (2.17)$$

(a) To prove the ‘if’ part (i.e., if (2.17) holds, then offer \bar{x}_A^0), assume that (2.17) holds, and consider an offer $x_A^0 > \bar{x}_A^0$. But such an offer is rejected by B , and A obtains her expected payoff for fighting, which is lower than or equal to the utility for x_A^0 .²⁹ Note also now an offer $x_A^0 < \bar{x}_A^0$ is strictly dominated, since there exists $x_A^{0'} > x_A^0$ such that A ’s payoff is greater. (b) I now show that offering x_A^0 is a best response only if (2.17) holds. To see this, assume that (2.17) does not hold. But then A can always offer $x_A^0 > \bar{x}_A^0$, which B will reject, yielding for A an expected total payoff of $(1 + \delta_A)p^0 - c_A$. So offering $x_A^0 = \bar{x}_A^0$ if (2.17) does not hold cannot be a best response. Moreover, since any $x_A^0 > \bar{x}_A^0$ would be rejected and lead to war, A is indifferent between any $x_A^0 > \bar{x}_A^0$, and hence offering $x_A^0 = 1$ is a best response. This completes part (i) of the proof.

To see why (ii) must be true, note that the most A can possibly offer B in period 0 is $x_A^0 = 0$, which yields for B an overall utility of

$$u_B(1) + \delta_B(1 - p^1 - c_B) \quad (2.18)$$

Since $u_B(\cdot)$ is decreasing in x_A^0 , this means that (2.18) is the highest payoff B can possibly receive from accepting an offer. Hence, if (2.18) is strictly smaller than B ’s utility for fighting, then there is no offer from A that B will prefer to fighting, and

²⁹By the usual convention in this type of model, a player accepts an offer with probability one if he is exactly indifferent between accepting and rejecting the offer.

hence war occurs in equilibrium. So war occurs in equilibrium in period 0 if

$$(1 + \delta_B)(1 - p^0) - c_B > 1 + \delta_B(1 - p^1 - c_B)$$

$$p^1 > \frac{(1 + \delta_B)p^0 + (1 - \delta_B)c_B}{\delta_B} \quad (2.19)$$

□

Proof of Proposition 3.2. By the same argument as in the proof of proposition 3.1 (replacing p^1 with $p(\Delta)$), war occurs in equilibrium in period 0 if

$$p(\Delta) > \frac{(1 + \delta_B^\Delta)p^0 + (1 - \delta_B^\Delta)c_B}{\delta_B^\Delta} \quad (2.20)$$

It remains to be seen whether (2.20) holds whenever (2.5) holds. The rest of this proof shows that this is the case. To see this, recall that $p(\Delta) = (1 - \Delta)p^0 + \Delta p^1$. Then (2.20) can be rewritten as

$$p^1 > \frac{(1 + \delta_B^\Delta \Delta)p^0 + \delta_B(1 - \delta_B^\Delta)c_B}{\delta_B^\Delta}$$

Assume now that (2.5) holds. Then if we can show that

$$\frac{(1 + \delta_B)p^0 + (1 - \delta_B)c_B}{\delta_B} > \frac{(1 + \delta_B^\Delta \Delta)p^0 + \delta_B(1 - \delta_B^\Delta)c_B}{\delta_B^\Delta}, \quad (2.21)$$

then we will have shown that (2.20) holds whenever (2.5) holds. Simple algebraic manipulation of (2.21) yields:

$$(\delta_B^\Delta - \delta_B)c_B \geq (\delta_B - \delta_B^\Delta - \delta_B \delta_B^\Delta (1 - \Delta))(p^0)$$

But note that $\delta_B^\Delta \geq \delta_B$ for any $\Delta \in [0, 1]$, so that the left hand side must be positive. Note also that $\Delta < 1$, so that the right hand side must be negative. This proves that (2.21) holds, and hence that (2.20) holds whenever (2.5) holds. This implies that if (2.5) holds, then war occurs in equilibrium for any $\Delta > 0$. □

Proof of proposition 3.3 . Consider first the subgame that starts in period 1. Since this is the last period, and hence r_A^1 has no influence on payoffs, the analysis in the previous section essentially carries over. That is, A offers $(\hat{x}_A^1, \hat{r}_A^1)$ such that $u_B(1 - \hat{x}_A^1) = 1 - p^1 - c_B$ and is indifferent between any $r_A^1 \in [0, 1]$. Similarly, B accepts any (x_A^1, r_A^1) such that $x_A^1 \leq \hat{x}_A^1$ and any $r_A^1 \in [0, 1]$ and fights otherwise.

Consider now incentives in period 0. As before, B 's utility for fighting in period 0 is

$$(1 + \delta_B)(1 - p^0) - c_B,$$

whereas B 's total expected payoff for accepting an offer (x_A^0, r_A^0) is:

$$u_B(1 - x_A^0) + \delta_B(1 - p(r_A^0 - c_B))$$

So if A is to avoid war in the first period, A must offer (x_A^0, r_A^0) such that

$$u_B(1 - x_A^0) + \delta_B(1 - p(r_A^0) - c_B) \geq (1 + \delta_B)(1 - p^0) - c_B \quad (2.22)$$

Rationality implies that A offers (x_A^0, r_A^0) such that (2.22) holds with equality. It remains to be seen that such an offer (x_A^0, r_A^0) is (i) feasible and (ii) a best response for A . To see that it is feasible, let $x_A^{0*} = 1 - u_B^{-1}(1 - p^0 + c_B(\delta_B - 1))$, where $u_B^{-1}(\cdot)$ denotes the inverse of $u_B(\cdot)$ and let $r_A^{0*} = r_A^0$.³⁰ Then B 's payoff for accepting (x_A^{0*}, r_A^{0*}) is

$$\begin{aligned} & u_B(1 - x_A^{0*}) + \delta_B(1 - p(r_A^{0*}) - c_B) \\ &= 1 - p^0 + c_B(\delta_B - 1) + \delta_B(1 - p^0 - c_B) \\ &= (1 + \delta_B)(1 - p^0) - c_B. \end{aligned}$$

This proves that an offer (x_A^0, r_A^0) such that (2.22) holds with equality is feasible. It remains to be seen that A would want to make such an offer. To see this, note that

³⁰Note that $x_A^{0*} \in [0, 1]$ exists, since $0 \geq u_B^{-1}(z) \leq 1$.

A 's total expected payoff for (x_A^{0*}, r_A^{0*}) is

$$\begin{aligned}
& u_A(x_A^{0*}) + \delta_A (u_A(x_A^{1*})) \\
& \geq u_A(x_A^{0*}) + \delta_A (p(r_A^{0*}) + c_B) \\
& \geq u_A(1 - (1 - p^0 + c_B(\delta_B - 1))) + \delta_A(p^0 + c_B) && \text{by concavity of } u_B \\
& \geq (1 + \delta_A)p^0 + c_B && \text{by concavity of } u_A \\
& > (1 + \delta_A)p^0 - c_A && \text{since } c_i > 0
\end{aligned}$$

But note that $(1 + \delta_A)(p^0 - c_A)$ is A 's expected payoff if B rejects A 's offer, which proves that A prefers making an offer (x_A^{0*}, r_A^{0*}) than making any offer that would be rejected by B (i.e., any offer such that (2.22) does not hold). This proves that war never occurs in equilibrium, but not that (x_A^{0*}, r_A^{0*}) is a best response, as there could be another peaceful agreement that yields a higher utility for A . An offer that is a best response for A is one that maximizes her payoff under the constraint that condition (2.7) is satisfied. So A will offer $(\hat{x}_A^0, \hat{r}_A^0) \in S_A^0$, where S_A^0 is defined in the text. □

Proof of proposition 3.4 (Sketch) . First note that A offers x_A^{1*} in period 1 such that

$$u_B(1 - x_A^{1*}) = 1 - p(x_A^0) - c_B,$$

which B accepts. Consider now incentives in the subgame starting in period 0. First note that B can always fight and ensure an expected payoff of

$$(1 + \delta_B)(1 - p(x_A^o)) - c_B \tag{2.23}$$

So if war is to be avoided, A needs to offer x_A^0 such that

$$u_B(1 - x_A^0) + \delta_B(1 - p(x_A^0) - c_B) \geq (1 + \delta_B)(1 - p(x_A^o)) - c_B \tag{2.24}$$

and, by an argument several times above, the best A can do is to offer x_A^0 such that (2.24) holds with equality. However, note that if A 's expected payoff for offering x_A^0 is lower than her payoff for offering $x_A^{0'}$ such that $x_A^{0'}$ is rejected by B (and hence war ensues), then offering x_A^0 cannot be a best response. This is the case when

$$u_A(x_A^0) + \delta_A u_A(x_A^1(x_A^0)) < (1 + \delta_A)p(x_A^0) - c_A, \quad (2.25)$$

where $x_A^1(x_A^0) \equiv u_B^{-1}(1 - p(x_A^0) - c_B)$. When (2.25) holds, A offers any $x_A^{0''} > x_A^0$, which B rejects.

□

CHAPTER III

Fighting Over Power: War as an Investment

1 Introduction

Wars are inefficient mechanisms of allocation of resources and, as such, present a puzzle: Why do negotiations break down and strategic players allocate resources to such costly contests? To address the puzzle, scholars have typically modeled international interactions as negotiations over a ‘pie’, and attempted to derive the conditions under which they might fail. Thus, given certain attributes of the players (‘power’) and a bargaining protocol, we can make strong theoretical predictions about how states will divide the pie, and when they might fail to reach an agreement and fight.¹

These negotiations over the distribution of benefits are certainly an important aspect of international interactions. Yet negotiations themselves merely seal, more or less mechanically, a level of relative power previously reached into a share of the pie. The actual amount obtained by each party may vary depending on the negotiators’ skills or unpredictable idiosyncracies but, overall, the strong obtain a large share, while the weak must contend themselves with a small one. In a system in which there is no supranational authority to enforce rules, power—the ability to hurt and to offer benefits—is the real determinant of the outcome.

¹See, in particular, Nash (1950*b*), Rubinstein (1982), Fearon (1995), and Powell (1999).

Trying to understand international interactions by modeling negotiations, then, misses a central aspect of states' concerns and strategies. If power determines their share of the pie at the negotiation table, players will want to reach the negotiation stage with the highest possible level of power. In other words, they will prepare for the bargaining stage itself by negotiating and potentially fighting to increase their power—that is, their likelihood of securing a favorable outcome at the negotiation. Indeed, states often—if not always—negotiate over objects that affect their future bargaining power. For example, countries are not only trying to maximize their benefits when they negotiate over the partition of a territory; they also strive to increase their raw material and population, both important sources of power—the ability to secure a favorable outcome in the future. In short, states not only concern themselves with the share of the pie they obtain, but also with what this share implies for their future power.

To account for these concerns, I argue that international interactions are better conceived as a two-stage process. In the first stage, players prepare for the negotiation itself by accumulating, through negotiation or war, the resources that will increase their future power. In the second stage—the negotiation per se—they bargain over the partition of a pie, on the basis of the level of power they have reached in the first stage. Unfortunately, this preparatory stage in which the instruments of power themselves are the object of strategic behavior has received very limited attention in the bargaining literature. As a result, even though we have gained a fair understanding of when war is more likely to occur given a certain distribution of power, we know little about the efficiency of negotiations when power is endogenous.²

What is needed, then, is an analysis of the first stage of the game. When do negotiations over objects that affect future bargaining power break down into war? In other words, when do states fight wars of investment—wars aimed at accumulating resources that improve their ability to secure favorable outcomes in future negotiations? I derive formally the conditions under which states are willing

²Note, however, that models involving price wars or entry deterrence, for example, fall in this category.

to incur the costs and risks of war in order to acquire capabilities, and show the surprising result that war occurs if, and only if, additional resources increase utility more than proportionally.³ This result contrasts with two main bodies of literature. It first demonstrates that two states can plausibly have a positive expected utility for war, even under complete information and without risk-acceptance—in contrast to Fearon (1995); second, it challenges the classical balance of power and realist theories by showing that cumulativeness, even when it is large, is not sufficient to make war profitable (Morgenthau 1948, Mearsheimer 2001).

This chapter proceeds in three steps. First comes a discussion of existing approaches to the causes of war to understand more precisely the gap I strive to fill. Second, the two-stage model is specified and the conditions under which wars are most likely to break out are derived. Finally, I identify factors that limit the incentive to fight wars of investment.

2 Rationality of War

Over the past twenty years, scholars have attempted to explain the causes of war rigorously by analyzing a wide variety of bargaining models and deriving the conditions under which rational actors may fight (Morrow 1989, Fearon 1995, Powell 1999, 2004, 2006).⁴ Three central mechanisms have been the focus of attention. First, private information creates incentives to misrepresent, such that both parties in a dyad can have a positive expected utility for fighting (Jervis 1976, Fearon 1995); second, war can occur when large shifts in relative power are so rapid that the declining state prefers fighting now than waiting until tomorrow, when he will be weaker (Powell 2006, Kugler & Organski 1989, Morrow & Kim 1992). Finally, indivisibilities can make it impossible for the parties to locate a self-enforcing agreement (Walter 2000, Toft 2003, Goddard 2006).⁵

Unfortunately, these models provide at best an incomplete explanation for wars of

³More precisely, if the mapping from resources to utility is nonconvex.

⁴For a review of bargaining theory and international conflict, see Powell (2002).

⁵Powell (2006) shows that indivisibilities are a special case of commitment problems, broadly construed.

investment—wars in which states fight over stakes whose intrinsic worth might seem small when compared to the costs of fighting, but that states value as instruments of future power.

2.1 Wars of Investment

Consider for example the Eighty Years' War (a.k.a. 'Dutch revolt'), in which Spain fought the Seventeen Provinces of the Netherlands (1568–1648). At the origin of the conflict lay tensions accumulated during Philip II's reign over heavy taxation, the repression of Protestantism and centralization efforts, which ultimately led to rioting and armed revolt in the Netherlands. The war lasted longer than any other uprising in modern European history and was ruinous.⁶

From the point of view of existing rationalist explanations for war, this is puzzling. First, misperceptions or asymmetric information can only provide an odd reading of the conflict, especially given its intensity and duration. Indeed, as early as 1574, it was clear to Philip II that "it is a terrible situation and it is getting worse every day" and that "[to speak of] conquering [the Netherlands] by force is to speak of a war without end."⁷ Rapid changes in relative power were never a source of concern either, and there was nothing indivisible about the rebels demands.⁸ Why, then, did Spain undertake this war and, even more puzzling, continued it even though "no treasury in the world would be equal to the cost of this war," and that "there would not be time or money enough in the world to reduce by force the 24 towns which have rebelled in Holland, if we are to spend as long in reducing each one of them as we have taken over similar ones so far"?⁹

⁶For an estimation of the war's cost, see Parker (1975).

⁷Instituto de Valencia de Don Juan, envío 51 fo 31, Mateo Vazquez to the king with holograph royal reply, 31 May 1574, quoted in Parker (1976). Council of State, *Ibid.*

⁸Even the possibility that Philip II was not "rational"—and hence that existing rationalist explanations do not apply—is doubtful, for even a critic admitted that "His Majesty's brain must be the largest in the world".

⁹Archivo General de Simancas, Estado 560 fo 33, Don Luis de Requesens (Spanish commander-in-chief) to the king, 7 November 1574, quoted in Parker (1975). *Nueva Colección de Documentos Inéditos para la historia de España*, v (Madrid, 1894), p. 368, Requesens to the king, 6 October 1574, quoted in Parker (1975).

The answer lies in the Spanish court's perception of the broader value and meaning of the Netherlands. The essential reason for Spain's insistence on fighting such a costly war was not the value of the Low Countries themselves, but rather strategic considerations vis-à-vis third parties—in particular France and England, as well as other parts of the Empire. Had only the Netherlands been at stake, Philip would most likely have given up the fight rapidly. Yet, he understood that maintaining order in the Netherlands also had implications for Spain's future bargaining power.¹⁰ No peaceful agreement was reached because the pie at stake was broader than the Netherlands alone, so that Spain was not willing to make any concession—they would have had too dire consequences for the Empire.

First, the Spanish leaders believed that the outcome of the war in the Low Countries would have an impact on other parts of the Empire. Ministers argued, for example, that “if the rebellion in the Low Countries is allowed to continue, Lombardy and Naples will follow,” and that

“the first and greatest dangers are those that threaten Lombardy, the Netherlands and Germany. A defeat in any of these three is fatal for this monarchy, so much so that if the defeat in those parts is a great one, the rest of the monarchy will collapse; for Germany will be followed by Italy and the Netherlands, and the Netherlands will be followed by America; and Lombardy will be followed by Naples and Sicily, without the possibility of being able to defend either.”¹¹

Others contended that even more could be lost: “if we lose Flanders, we will also lose the Indies and other Kingdoms;” “Spain will enjoy neither peace nor security, so that the true and perhaps the only way to secure Spain and also the other states [of his Majesty] is to make the supreme and ultimate effort to cure the Netherlands [problem] now;” and, even more dramatically, “keeping Flanders is so essential that I very much fear that the Spanish Monarchy will not last long if we lose it.”¹²

¹⁰For an overview of how the Netherlands fit into Philip II's grand strategy, see Gonzáles de León & Parker (2001).

¹¹Report of d'Assonleville, Dec. 1558, quoted in Parker (1998, p. 90). These beliefs were not entirely unfounded, as rebels in Naples cited the Dutch example as an inspiration (Parker 1972). The quote is from an advisor to the Spanish Emperor (Kennedy 1987, p. 51).

¹²Advisor to the Council of State, 19 Oct. 1629; Marquis of Aytona to Olivares, 29 Dec. 1633;

A second concern was reputation. Failing to fight would “strain Your Majesty’s conscience and hazard your honor and prestige” and was incompatible “with the honour and reputation of Your Majesty, which is your greatest asset.”¹³ Philip’s concern was also that any sign of weakness in the Netherlands would reduce Spain’s prestige and international stature as a world power. “We should consider the issue of religion not only as a matter of piety and spiritual obligation, but also as a temporal one involving reputation.”¹⁴

Third, the war was believed to act as a “punching ball” that focalized other enemies’ resources, and hence alleviated the costs and pressures on Spain (Parker 1972):

“Although the war which we have fought in the Netherlands has exhausted our treasury and forced us into the debts that we have incurred, it has also diverted our enemies in those parts so that, had we not done so, it is certain that we would have had war in Spain or somewhere nearer.”¹⁵

Finally, the conflict in the Low Countries was part of a larger power struggle for hegemony in Europe between the Spanish Empire and France: “the surest means we have of keeping the French in check is to maintain strong forces in Flanders.”¹⁶ Abandoning Flanders would mean that France was likely to control it—a dangerous concession to one of Spain’s most serious enemies:

“[The Low Countries] are the bridle which restrains and curbs the French, the English and the rebels, whose forces, should that shield fail, would fall on Your Majesty and his Kingdoms in several parts, giving rise to greater expenses and dangers.”¹⁷

In short, fighting was justified as an investment—one that would avoid further costs and loss of prestige, and hence of bargaining power.

Cardinal Alexandrino to Nuncio Castagna; Aviso of Juan Andrea Doria, 1605. See Parker (1972, p. 111) and Parker (1998, p. 90) for these and further quotes.

¹³Philip II to Alba, 1573, quoted in Parker (1998, p. 89).

¹⁴Olivares to the King in 1628, quoted in Parker (1972).

¹⁵Quoted in Kennedy (1987, p.51).

¹⁶Cardinal Granvelle, 1582, quoted in Parker (1972).

¹⁷Consulta of the Council of State, 21 March 1600, Real Academia de la Historia (1929–34, III, p. 7).

The reasoning of the Spanish king is not an isolated case in history. George the Third, for example, speaking on the necessity of subduing the American colonies in 1779, thought that “it is necessary [...] to weigh whether expences [of war] though very great are not sometimes necessary to prevent what might be more ruinous to a country than the loss of money.”¹⁸

“Should America succeed in that, the West Indies must follow them [...]. Ireland would soon follow the same plan and be a separate state; then this island would be reduced to itself, and soon would be a poor island indeed.”¹⁹

The United States’ containment doctrine is another example of the incentive to engage in wars of investment. Korea and Vietnam were not defended for their economic or military value, but rather because losing them would “promote recklessness by great powers who have not abandoned goals of world conquest” and “result in a collapse of confidence in American leadership, not only in Asia but throughout the world.”²⁰ Vietnam in particular was a war of investment—a war waged to increase, or at least to avoid losing bargaining power vis-à-vis other nations.²¹

“Without accepting the pat simplicities of domino theory, none of us can doubt that preservation of the independence of Thailand, of Malaysia, of Singapore and Burma—and behind them, in the long run, Indonesia, India, the Philippines and Australia—will become infinitely more difficult if this [communist] venture succeeds in South Vietnam.”²²

Similarly, French politicians and officials in the post-WWII period feared that nationalism would spread rapidly throughout the French Union if they did not curb

¹⁸George III’s letter to Lord North, June 11, 1779, quoted in Fortescue (1927, Vol. IV, pp. 350–1).

¹⁹Quoted in Robinson (1906).

²⁰Statement by President Nixon on Nov. 3, 1969. Along the same lines, “Around the globe, from Berlin to Thailand, are people whose well-being rest, in part, on the belief that they can count on us if they are attacked. To leave Vietnam to its fate would shake the confidence of all these people in the value of American commitment, the value of America’s world. The result would be increased unrest and instability, and even wider war.” Speech by Lyndon Johnson at John Hopkins University, April 7, 1965.

²¹For a discussion of domino theory in the context of the cold war, see Jervis & Snyder (1991).

²²William Bundy, Assistant Secretary of State for Far Eastern Affairs, May 22, 1966, quoted in Girling (1970).

nationalism in Indochina, and that this would lead to the destruction of the Empire.

2.2 Endogenizing Power

Unfortunately, two central modeling choices in existing rationalist models for war make it difficult to explain the class of wars that the Dutch revolt illustrates. First, power is usually taken as exogenous. Fearon (1995), for example, takes probabilities of prevailing in a conflict as a primitive, from which he derives various results about the rationality of war.

$$Power \longrightarrow Benefits \longrightarrow Utility$$

Such mappings are insufficient, however, as they ignore changes in power driven by the players' strategies themselves, and hence rule out by assumption the possibility to fight over capabilities. Yet, if certain attributes enable players to affect others' utility and hence determine their share of the pie, then these players should value these attributes and behave strategically to acquire them. States, for example, often go to war not only to gain direct benefits, but also to accumulate resources that will increase their future power. Rather than ignoring this stage, the present paper endogenizes power and analyzes states' incentives to acquire it by mapping capabilities into power.

$$Resources \longrightarrow Capabilities \longrightarrow Power \longrightarrow Benefits \longrightarrow Utility \quad (3.1)$$

A notable exception is Fearon (1996), who analyzes the similar case of two nations bargaining over the division of a pie when present gains affect future bargaining power. However, Fearon limits his analysis to the dyadic case, which is the second restrictive modeling choice that has been prevalent in the literature. Doing so ignores the possibility that bargaining might be only a stepping stone toward further goals. Obtaining concessions from B matters not only for the utility derived from a larger

share of the pie, but also as a potential source of future power vis-à-vis C .²³

Some empirical studies have examined the first part of the game by analyzing the ability to extract resources from conquered states (Lieberman 1996). However, they study rates of extraction, or “cumulativity”—in other words, they analyze how conquests affect capabilities (*Resources* \rightarrow *Capabilities*). They do not ask whether conquest is worth pursuing, but rather how much can be extracted and how “cumulative” these resources are (Van Evera, 1999). Instead, this paper deals with the value of these additional capabilities (*Capabilities* \rightarrow *Power*)—that is, how they affect the conqueror’s chance of prevailing in future conflicts—rather than how many capabilities states can extract from conquered territories.

To be sure, the idea that states might be willing to fight over resources that affect their future power is not new, and is perhaps best expressed in the work of realists such as Morgenthau (1948). Yet, realists have typically assumed the profitability of investments in additional sources of power, without necessarily questioning the conditions under which this is the case. Thus, even though it is probably accurate that “the more powerful [states] are relative to their rivals, the better their chances of survival” (Mearsheimer 2001), why states would fail to reach an agreement and fight as a result is not as obvious. A more fruitful approach would be to examine how much capabilities afford the players. Does doubling capabilities double power? Can capabilities be reused at different bargaining tables simultaneously? Answers to these questions will tell us when fighting to acquire resources that increase future bargaining power is rational, and when expansionist states should be feared. They will give us clearer predictions about when we should expect wars to occur, as opposed to realist explanations which, although they can always justify war ex post as the result of states’ pursuit of power, cannot tell us ex ante when war should or should

²³In Fearon (1996), fighting against B is not rational because war ends the game and there is no C to use the accumulated gains against. Moreover, a large part of Fearon’s results are critically dependent upon the size of the cost of war and the value of the discount factor. Thus in his simplest example, the dissatisfied ends up controlling the entire territory of the satisfied state because the latter is sufficiently impatient. In the present analysis, however, the result that war can be rational holds independently of the values of the discount factors and the cost of war. It also extends to a large class of bargaining protocols. The result obtains because players have an incentive to “invest” in war in order to acquire further resources that can be used against third parties.

break out.

Finally, the idea that present outcomes have an impact on future interactions has been analyzed in a number of contexts in biology and economics under the label of “self-reinforcing mechanisms,” “positive feedback,” or increasing returns (Buchanan & Yoon 1994). In international relations, increasing returns to scale are perhaps received the most attention in so-called “domino” effects.²⁴ The argument is generally that losing a small amount of the pie today leads to even larger losses tomorrow. This is a clear case in which a small decline (increase) in resources (e.g. loss of a small ally during the cold war) can lead to a more than proportional decrease (increase) in power, and hence in benefits (i.e., a case of nonconvexity).

Unfortunately, the incentive structure that results from such effects has largely been ignored. Yet, given that small events or small decisions can lead to lock-in effects or reinforcing mechanisms, we should expect rational actors to behave strategically and to try to manipulate these small events. Thus, if a small initial concession leads, through a multiplier mechanisms, to concessions several time the size of the initial concession, then a state might prefer to fight than to make this concession.

3 When Do States Invest in War?

When are states willing to incur the costs and risks of war to acquire the capabilities that increase their power? To answer this question, I endogenize power by letting states fight or bargain over objects that affect their future bargaining power—in other words, over their capabilities. In contrast to typical bargaining models, war or an agreement do not end the game. Rather, the players agree on a partition of the pie or fight not only in view of immediate gains, but also strategically by anticipating how these gains will affect their future power.

²⁴“Finally, you have broader considerations that might follow what you would call the ‘falling domino’ principle. You have a row of dominoes set up, you knock over the first one, and what will happen to the last one is the certainty that it will go over very quickly. So you could have a beginning of a disintegration that would have the most profound influences.” Dwight D. Eisenhower at a News Conference on April 7, 1954. See *Public Papers of the Presidents: Dwight Eisenhower, 1954*, Washington, DC: U.S. Government Printing Office, 1960, pp. 382–83.

Incorporating this strategic behavior into bargaining models is particularly important, as it leads to situations in which there are no self-enforcing agreements that Pareto dominate war—and hence in which war occurs in equilibrium. Letting power be the outcome of the players’ strategic competition for capabilities rather than an exogenous variable, then, leads us to another central rationalist explanation for war: two states can fail to reach an agreement when the objects they bargain over affect their future bargaining power.

3.1 Model

There are three states indexed by $i \in \{A, B, C\}$, each endowed with an initial level of capabilities r_i^0 . Each pair of states (i, j) shares a pie denoted by π_{ij} .²⁵ All players have perfect and complete information throughout the game. The game proceeds in two stages, denoted by $t \in \{0, 1\}$.

Stage 0: In the first stage, A and B bargain over π_{AB} , of size normalized to one. Negotiations follow a typical Rubinstein (1982) bargaining model of alternating offers with a potentially infinite horizon and an outside option (‘war’). That is, the players alternate offers until one is accepted or a player exerts his outside option (‘fights’). If a partition of the pie, denoted by $\pi_{ij} = (\pi_{ij}^i, \pi_{ij}^j)$, is agreed upon, then each receives the specified share, and the second stage begins.²⁶ The outside option can be used at any time (regardless of whose turn it is to make an offer), in which case A wins the entire pie π_{AB} with probability $p_{AB} = p_{AB}(r_A^0, r_B^0)$, both incur the costs of war—a one-time loss of utility $k_{ij}^i > 0$, and the second stage begins.²⁷

²⁵In other words, there are three pies in the world. These might be territories (e.g., France and Britain negotiating over the partition of Africa), but other interpretations are equally valid (e.g., π_{AB} as the tariff rate between A and B or any other policy).

²⁶Technically, it is possible that negotiations never end and hence that the second stage never takes place. However, because information is complete, either an agreement is reached immediately or war occurs, as the model will demonstrate.

²⁷Hence, B wins with probability $1 - p_{AB}$. I assume that $p(\cdot)$ can take values in the interval $[0, 1]$, is twice differentiable. Moreover, I assume that $\partial p(r_i, r_j) / \partial r_i^t \geq 0$, and that $\partial p(r_i, r_j) / \partial r_j^t \leq 0$ (i.e., an increase in i ’s resources do not decrease i ’s likelihood of prevailing at the dyadic level, while an increase in j ’s resources do not increase i ’s likelihood of prevailing). In the literature, the cost of war has been modeled alternatively as a one-time loss in utility (Fearon 1996) or as a cost that the players incur forever, even after the conflict has ended (Powell 1999). It is difficult to justify substantively why the players would incur the cost of fighting beyond the duration of the war, and

Stage 1: In the second stage, A and C bargain or fight following the same protocol (i.e., agree on a partition or fight). However, A 's capabilities are adjusted to incorporate her gains or losses in the first stage.²⁸ Intuitively, A can extract resources from the share of π_{AB} she obtained and transform them into capabilities (e.g., use the occupied territory's manufactures to build military material).²⁹ More formally, let $e^i(\pi_{ij}^i)$ denote player i 's ability to extract resources from her share of π_{ij} . Then player A 's resources in the second stage are given by $r_A^1 = r_A^0 + e^i(\pi_{ij}^i)$.³⁰ Thus, A 's chance of winning is affected by her potential gains in the first stage. That is, if A and C fight, then A wins with probability $p_{AC}(r_A^0 + e^i(\pi_{ij}^i), r_C)$.³¹ Finally, the players derive utility $u_i = u_i(\pi_{ij}^i)$ from their share of each pie.³² Note that the possibility that other pairs of country than A and B may want to fight is explored in the next sections.

3.2 When Does War Occur?

Does war occur in equilibrium and, if it does, under what conditions? The subgame perfect equilibrium (SPE) concept will be employed to characterize the outcome of this game. First, note that war never occurs in the last stage of the game (stage 1 here), since it is strategically equivalent to Fearon's setup (1995).

hence I choose the former option.

²⁸Note that the concept of "capabilities" is not restricted to tangible ones. Reputation, for example, can very well be incorporated into r_i^t .

²⁹See Liberman (1996) for a discussion of the ability to extract resources in various regimes.

³⁰I simply assume that $\partial e^i / \partial \pi_{ij}^i \geq 0$ (i.e., an increase in the share of the pie implies that no less resources will be extracted from it), and $\partial^2 e^i / \partial (\pi_{ij}^i)^2 \leq 0$ —i.e., the marginal ability to extract resources is not increasing in π_{ij} .

³¹This initial setup simplifies reality in two main ways. First, there is no "last negotiation" that states prepare for in the real world. Rather, states always bargain over a pie both for its current value and as a source of power. Yet, the model captures in a simplified way the idea that objects have a value not only for their direct utility, but also because they increase future power. The second restricting assumption is that C is passive in the first round. For now, this lets us focus on A 's incentive in the abstract, which will be useful to understand C 's decisions later on. Overall, it corresponds to situations in which A anticipates future threats that have not emerged yet, but that are likely to in the future. States know that the balance of power changes, that new states will emerge or grow stronger, while others might form offensive alliances. ("Given the difficulty of determining how much power is enough for today and tomorrow, great powers recognize that the best way to ensure their security is to achieve hegemony now, thus eliminating any possibility of a challenge by another great power" (Mearsheimer 2001).

³²As is standard in bargaining models, assume $\partial u_i / \partial \pi_{ij}^i > 0$ and $\partial^2 u_i / \partial (\pi_{ij}^i)^2 \leq 0$. In other words, a larger share of the pie is desirable and the players are not risk-acceptant.

Lemma 3.1. *War never occurs in the last stage.*

War, then, can only occur in the first stage—the “investment stage”. Consider A ’s incentives when facing B in the first stage. A knows that the outcome of this negotiation matters not only for what she obtains now (her share of π_{AB}), but also for her ability to bargain with C in the next stage (her share of π_{AC}). Hence, A might be willing to incur significant costs to acquire additional capabilities if these capabilities increase her bargaining power versus C . This implies that even the largest concession that B is willing to make might be insufficient to satisfy A . Thus, I show in proposition 3.1 that, when present gains affect future power, two states can have a positive expected utility for war in the dyad, even without risk-acceptance or asymmetric information.

To make this clearer, let p_{AC}^H denote the probability that A will prevail in a fight against C after defeating B , and p_{AC}^ω denote that same probability after reaching the best possible agreement with B .

Proposition 3.1. *War occurs in equilibrium in stage 1 if*

$$p_{AB}(p_{AC}^H - p_{AC}^L) > p_{AC}^\omega + \frac{\hat{k}}{\pi_{AC}}, \quad (3.2)$$

where \hat{k} refers to the costs and risks of war, broadly defined (see proof in the appendix). Thus, the left hand side of the equation denotes the expected utility derived from fighting B . The right hand side denotes the utility derived from reaching an agreement with B , plus the avoided costs and risks of war, broadly defined. In short then, condition 3.1 shows that war occurs if the added capabilities gained by defeating B , weighted by the probability that A actually wins, increases A ’s chance of winning against C more than any agreement that B is willing to sign. When this is the case, the most B is willing to concede remains insufficient to satisfy A .

Beyond the details of the proposition, it is important to understand why war can occur in equilibrium in this model, in contrast with existing models of negotiation under complete information (Fearon 1995, Powell 1999). Fearon (1995), for example,

challenges explanations for war according to which conflict may occur if states estimate that the expected utility of fighting outweighs the expected costs. Because war is costly and hence reduces the size of the pie to be divided, there must exist a peaceful agreement that both parties prefer to fighting. If both player know each other's reservation point, they can agree to a division of the pie that avoids the cost of war. As a result, he argues, only incomplete information can lead both countries to have a positive expected utility for war.³³

However, Fearon's argument holds only under the assumption that all the mappings are concave. When power is taken as exogenous as in Fearon (1995), the only mappings considered are the ones from power to benefits and from benefits to utility—that is, how a distribution of power translates into an agreement on a share of the pie, and how this agreement, in turn, affects the players' utility. In this case, assuming concavity simply means that the players are not risk-acceptant (i.e., $u(x)$ is concave)—a very plausible assumption.³⁴ However, this assumption becomes problematic once we extend the analysis by endogenizing the determinants of power. If current gains affect future bargaining power, then the amount of B 's concessions matters not only for its inherent value, but also for how much it increases A 's chance of winning against C . Spain's goal in the Eighty Years War, for example, was not only to control the Netherlands; it was to avoid negotiating in a position of weakness in the future. Similarly, one important goal behind Hitler's conquest of Poland was its transformation into "an assembly area for future German operations" (Dippel 1992).

More generally, the result that war does not occur with complete information fails when there exist "nonconvexities"—situations in which half the pie is not half as good as the entire pie (see Fig. 3.1). This is well recognized by Fearon in the case of risk-acceptance, for example. In the present model, however, such nonconvexities

³³Commitment problems can also lead to war, he argues. However, only one player has a positive expected utility for war in this case. The other player would rather avoid war, but cannot commit to a future division of the pie.

³⁴Indeed, increasing returns are unlikely to emerge in the mapping from power to outcomes, since bargaining power (more precisely, the likelihood of winning a contest) maps linearly into an outcome (see for example Powell, 1999).

emerge because present gains affect future power. Controlling the entire AB pie can be more than twice better than only half of it, because controlling the entire AB pie increases the likelihood of prevailing against C more than proportionally. As a result, countries may undertake what appears as risk-acceptant actions at the dyadic level in order to reap larger benefits at the global level.³⁵ This becomes evident only as we move from a one-stage setup to a nested game in which the pie is not simply a final goal, but rather a means towards an end.

An important corollary of proposition 3.1 is that war occurs *only if* the returns to additional capabilities are increasing. That is, A has an incentive to fight only if an additional resource increases her likelihood of winning against C more than proportionally. Practically, it means that war occurs only in situations in which obtaining half the initial pie is not half as useful as obtaining it all.

Proposition 3.2. *War occurs in equilibrium in stage 1 only if $p_{AC}(\cdot)$ is convex in r_A on the interval $[r_A^0, r_A^0 + e(\pi_{AB})]$.*

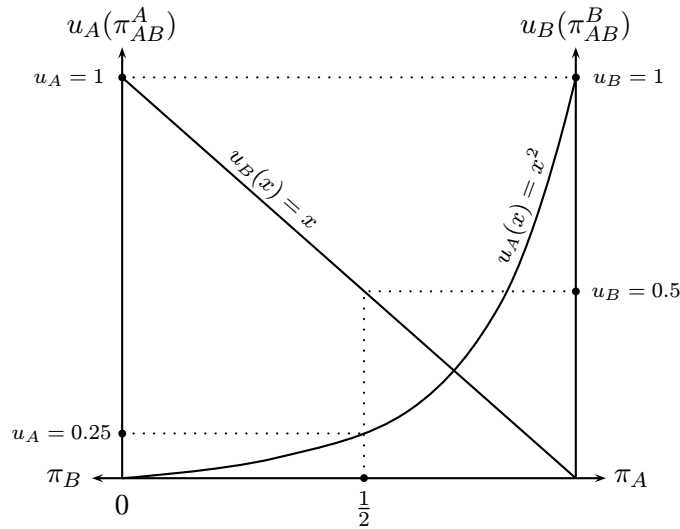


Figure 3.1: Nonconvexities

This is counterintuitive. It implies that, no matter how much an additional unit of capabilities increases A 's likelihood of prevailing against C , A has no incentive

³⁵More precisely, it is the perception of increasing returns by A that matters. Since information is complete here, the nuance is irrelevant.

to fight B to acquire this extra unit as long as p_{AC} is linear or concave—that is, as long as the marginal returns to an additional unit of capability are non-increasing. Thus, the result holds for example for *any* β in $p_{ij} = \frac{\beta r_i}{\beta r_i + r_j}$, a typical contest success function that is not convex but that can be very steep for high values of β (Hirshleifer 2001).

The logic is the following. If doubling capabilities does not more than double power, then half the amount of capabilities is at least half as good as all the capabilities (Fig. 3.1). An agreement at $\frac{1}{2}\pi_{AB}$ ($\pi_{AB}^A = 0.5$), then, is at least as good as a .5 probability chance of winning $1\pi_{AB}$ by fighting. If, on the other hand, doubling capabilities increases future power by a factor greater than two, then fighting can be preferable. If, for example, obtaining $1\pi_{AB}$ leads to gains against C more than twice higher than those that would have been obtained with an agreement at $\frac{1}{2}\pi_{AB}$, then fighting now can be a best response for both parties, since A will not be satisfied with any concessions that B is willing to make.

Example 3.1. *To see this more clearly, consider a simple example in which, for simplicity, we ignore the costs of war, we assume p_{AC} to be linear (obviously, the result holds for a concave function, as demonstrated in the proof), and we assume that all players are risk-neutral. A starts the game with some resources r_A and wins a war against B with probability p_{AB} . Consider now her expected utility at the end of the game if she reaches an agreement with B . First note that A and B will agree on a partition of the pie such that A receives $\pi_{AB}p_{AB}$. Anything less and A prefers fighting; anything more and B prefers fighting. Normalize π_{AB} to 1. Then A 's expected utility at the end of the game from an agreement with B is given by $u_A(\text{Peace}) = p_{AB} + p_{AC}(r_A + p_{AB}, r_C)\pi_{AC}$. The first term is the share of the AB pie that A receives, as discussed above. The second term is her expected share of the AC pie, given her initial gains against B . Consider now her expected utility from fighting. If she fights, then she wins the entire AB pie with probability p_{AB} and then goes on to fighting against C with probability of winning $p_{AC}(1 + r_A)$. But with probability $1 - p_{AB}$ she might also lose against B , in which case she will face C with probability $p_{AC}(0 + r_A)$. Her utility for fighting, then, is given by: $u_A(\text{War}) =$*

$\left[p_{AB} \times (1 + p_{AC}(1 + r_A)\pi_{AC}) \right] + \left[(1 - p_{AB}) \times (0 + p_{AC}(0 + r_A)\pi_{AC}) \right]$. Since p_{AC} is assumed to be linear, we have $p_{AC}(a + b) = p_{AC}(a) + p_{AC}(b)$. Hence $u_A(\text{War})$ simplifies to $p_{AB} + p_{AB}p_{AC}(1)\pi_{AC} + p_{AC}(0 + r_A)\pi_{AC} = p_{AB} + p_{AC}(r_A + p_{AB})\pi_{AC} = u_A(\text{Peace})$. In other words, the utility of fighting equals the utility of an agreement. Clearly, fighting is then never rational when we add the costs ($k_{AB} > 0$) and risks ($u_i''(\cdot) < 0$) of war to the model. The reader might want to convince herself of the result by choosing specific functions p_{AB} and p_{AC} and verifying that war never yields a higher utility as long as p_{AC} is linear or concave (and continuous).

At a more general level, the problem with increasing returns is that they generate situations that are strategically equivalent to ones of indivisibilities or of risk-acceptance, in the sense that a partition of the pie provides a lower total utility than the whole pie, so that there exists no self-enforcing equilibrium that both parties in a dyad prefer to war.³⁶ Thus, A rejects B 's offer to split the AB pie in, say, half, because securing the whole pie more than doubles A 's final utility. The reason war occurs is not A valuation of the AB pie itself, but rather because of what its control implies for her ability to extract benefits from C .

Proposition 3.2 has important implications for the realist paradigm. It demonstrates that war arises in the preparatory stage only when the returns to additional capabilities are increasing. States will fight to acquire power only if the expected increase in capabilities from fighting B increases their likelihood of prevailing in future encounters more than proportionally—that is, if the marginal gain in power derived from an additional unit of capability is increasing. States can be expansionist, but only when the mapping from capabilities to power exhibits nonconvexities. This gives us practical predictions about the occurrence of war. Under complete information, war only occurs in the presence of increasing returns—more precisely, when the players *perceive* returns to be increasing.³⁷ The drive to fight to acquire

³⁶For a discussion of indivisibilities as a cause of war, see Fearon (1995), Toft (2003) and Goddard (2006).

³⁷The problem is not limited to the case with more than two states. Nonconvex functions pose a similar problem at the bilateral problem. Empirically, however, it is unclear what type of situation would generate such nonconvexities. Risk-acceptance is certainly one, but it seems implausible

power is not as universal through space and time as we might have expected.

3.3 Do Alliances Prevent War?

In the previous sections, third parties were modeled as passive— C did not participate until the second round. This was useful to isolate A 's incentives but, in the real world, third parties need not stay inactive. In particular, how does the possibility to form alliances affect the results obtained so far? While limited space prevents us from examining a complete model of alliances, I sketch the logic of a model to show when alliances form and prevent war—and when they do not.

Consider first the case of defensive alliances—by far the most prevalent form (Walt 1987, Leeds 2003). They are agreements by which C (e.g., the U.S.) offers B (e.g., Kuwait) support in case of an aggression by A (e.g., Iraq). Defensive alliances will avoid war only if at least two conditions are met. First, C needs to have an incentive to ally with B . Defending an ally is risky and costly, and so C might prefer abandoning B . In other words, defending B must be in C 's interest if the alliance is to be credible. Second, an alliance needs to be sufficiently powerful to deter A from attacking B regardless.

To model defensive alliances, suppose that C has the choice of offering B some support—a “subsidy” of size s , which is paid if A attacks B , and which has a cost (in utility) of $f(s)$. Let p_{AB}^s and p_{AB}^* denote A 's likelihood of winning against a B who receives C 's support, and one who does not, respectively.³⁸

Lemma 3.2. *C forms a defensive alliance with B only if*

$$f(s) < (p_{AB}^* - p_{AB}^s) (p_{AC}^H + p_{AC}^L).$$

Three main factors affect C 's choice to support B or not. First, for sufficiently large values of f , C will prefer not supporting B . A large f could be due, for example,

that a large number of wars can be explained by such preferences. With three or more states, however, nonconvexity is much more plausible. In this case, fighting B is rational despite risk-aversion because the gains thereby obtained increase A 's chance of winning against C more than proportionally.

³⁸That is, $p_{AB}^s = p_{AB}(r_A^0, r_B + s)$ and $p_{AB}^* = p_{AB}(r_A^0, r_B)$.

to the difficulty or financial cost of moving troops, the geographical distance or the audience costs incurred (Morrow 1993). Second, the efficiency of C 's support—how it affects A 's likelihood of prevailing against B —is also determinant. In particular, the larger the effect of the subsidy (the larger $(p_{AB}^S - p_{AB}^L)$), the higher a price C is willing to pay to support B . Finally, the extent of the difference between facing a strong A (one that has defeated B) and a weak one (one that lost against B) also affects C 's calculus. As the difference between facing a victorious A and a defeated A decreases (i.e., as $(p_{AC}^H - p_{AC}^L)$ decreases), so does C 's willingness to support B . Beyond these particular results, what matters is that the possibility to form defensive alliances is not always sufficient to prevent war, even without asymmetric information or miscalculation. If the cost for C of allying with B is too high, or if the returns to its support are low, then letting A attack B is a best response.

Consider now offensive alliances—situations in which A allies with B against C to extract a potentially larger share of π_{AC} , without incurring the costs of an initial war of investment against B . While a complete model of offensive alliances is well beyond the scope of this paper, I elaborate on a number of reasons why such alliances might fail to form, and why war might still occur. First, note that alliances can be inefficient mechanisms of capability aggregation, such that the likelihood of winning of an alliance can be lower than if the resources had been pooled and used under a single country's banner (Morrow 2000). Second, an alliance presents significant risks for A . B might promise to fight alongside A in case of a war with C , but end up being less committed than initially agreed upon, or even defecting to C . Finally, supporting A is dangerous for B . Indeed, once A has extracted more resources from C thanks to her alliance with B , there is no guarantee for B that A will not use this additional power to exploit him. “To ally with the dominant power means placing one's trust in its continued benevolence” (Walt 1985).

4 When Are Investments Profitable?

Fighting is a way to acquire resources that increase future power—and hence the probability to survive and/or expand. War, however, only occurs in situations in which doubling capabilities more than doubles power. Give the importance of these ‘nonconvexities’ to the mechanism presented above—and hence to our understanding of the causes of war—I present in this section a typology of the classes of situations in which they are likely to emerge. I then examine factors that reduce the returns to additional capabilities—in other words, reasons why incentives to acquire additional capabilities can be limited.

4.1 Sources of Increasing Returns

What factors affect returns on investment? More specifically, when is the marginal effect of additional capabilities on power increasing? In this section, I explore a number of conditions under which additional capabilities significantly increase the likelihood of securing a favorable outcome at the negotiation table, and hence in which wars of investment are most likely to occur.

First, an additional capability can increase the likelihood of winning in a military conflict more than proportionally (Hirshleifer 2001). Thus, Lanchester’s Square Law, widely used in official combat models used by the Defense Department, states that the power of an army in modern combat is proportional not to its number of units, but to the square of this number, and hence is nonconvex (Lanchester 1956). To be sure, empirical evidence for the theory is mixed (Biddle 2004). However, the claim here is not that a large N study of battles need verify the empirical validity of the laws. Rather, it is that there exist situations in which the laws apply, and these situations are the ones in which incentives to fight exist.

Economies of scale are another mechanism leading to nonconvexities, since they lead to situations in which multiplying inputs by two (say, territory) increases output (say, GDP) by more than two. Sources of economies of scale are multiple, and I mention only a few examples here. A large market, for example, generates clear

economies of scale. In per capita terms, it is cheaper to “buy” defense in a larger country. Similarly, the ratio of government spending over GDP should be larger in smaller countries (Alesina & Spolaore 2003).

Finally, conquering 100% of an opponent’s territory is qualitatively different from conquering only 99% of it. Garfinkel and Skaperdas, for example, show that war can rationally occur because of the savings in defense spending such conquest implies. Eliminating an opponent now saves spending on military defense in the future. This is a case where controlling 99% of the pie is fundamentally different from controlling 100%, and hence in which nonconvexities are the underlying cause of war.

4.2 Limits to Increasing Returns

I explore in this section a number of mechanisms that limit the incentive to fight to acquire capabilities. In essence, these mechanisms “concavify” the mapping from resources to utility, and hence compensate potential increasing returns in the mapping from capabilities to power.

Frictions

One thing that affects the magnitude of returns are what can be called “frictions” in one of the mappings from resources to utility. First, any incentive to challenge the status quo is always limited by the size of the initiator’s cost of war. If war is expected to be costly, any threat to change the status quo by force to reflect a slight change in relative power is not credible. In other words, returns to capabilities need to be very high if the cost of war is high, as is clear from proposition 1.

Another source of friction is the level of cumulativity. Although this paper mostly addressed the mapping from capabilities to power, the mapping from resources to capabilities also matters. It is explored, for example, in Van Evera (1999) and Liberman (1996). Resource cumulativity refers to the ability to transform additional resources into actual capabilities. The level of extraction, for example, might be low (i.e., $\partial^2 e^i(\pi_{ij}^i)/\partial(\pi_{ij}^i)^2$ might be low), such that an additional piece of territory or a greater population do not change the level of capabilities much.

Finally, risk aversion—more precisely, the concavity of $u_i(\cdot)$ can also limit incentives to fight. If the convexity of $p(\cdot)$ is more than compensated by the concavity of $u(\cdot)$, then the overall mapping from resources to utility does not exhibit increasing returns, and hence war is not rational.³⁹ The concavity of $u(\cdot)$ means that a player is risk-averse. In this case, the value of any gamble is discounted compared to the value of the certain outcome. As a result, even if the mapping from capabilities to power exhibits increasing returns, concavity in $u(\cdot)$ can make the overall mapping from resources to utility concave.

Immediate Costs, Long-term Rewards

The incentive to invest is further limited in a more subtle fashion by the risk that the aggressor incurs vis-à-vis third parties. To attack B , A must expand scarce resources and capabilities on one front. Fighting involves short-term costs that change the shape of the mapping from investments to power (figure 3.2). Although the long-term gains of a victory might easily offset this cost, the loss puts the state at risk vis-à-vis third parties, who might take advantage of this temporary weakness and demand more of him while he is weak.⁴⁰ In other words, A 's war with B temporarily decreases her ability to fight C , and this creates a window of opportunity during which C can demand more from A . But then, C has an incentive to exploit this window of opportunity by demanding more from A .

In other words, the expanse of resources toward B cannot always be analyzed in an atemporal fashion. Resources are used over time, and such an expansion can put a state at risk in the short run. Fighting involves short-term costs that change the shape of the returns to an initial investment. It generates a temporary weakness from which the conqueror might never recover, and hence the inefficiencies caused by nonconvexities are offset by a sufficiently large initial loss.

³⁹More precisely, this is the case if $\frac{\partial^2 p(\cdot)}{\partial r^2} < -\frac{\partial^2 u(\cdot)}{\partial x^2}$.

⁴⁰Blainey (1988) makes a related point.

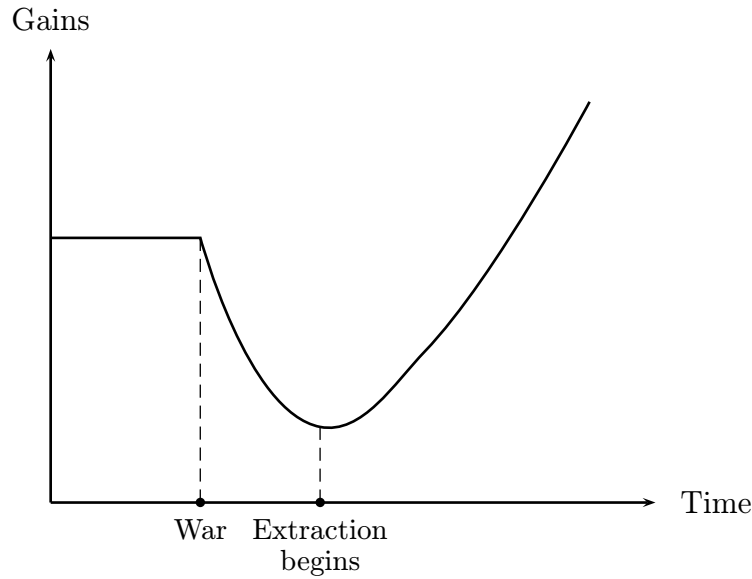


Figure 3.2: Short term losses, long term gains

5 Concluding Remarks

The lack of dialog between formal modelers and realists has contributed to a gap in our understanding of war. Although the more classical literature has long recognized that war can be an investment for longer-term purposes, it has not derived the specific conditions under which we should expect this to be the case. As a result, both the occurrence of war and its absence can be justified under the banner of the pursuit of power. Understanding the conditions under which such an investment is rational requires that we analyze how accumulated capabilities transform into actual power—the ability to secure a favorable agreement. On the other hand, formal modelers have almost exclusively analyzed bargaining as a process by which players negotiate over the partition of a pie that is valued for its own sake. Bargaining theory has elaborated a complex web of theories to understand outcomes in the final stage of the game—in which players negotiate over the partition of a final outcome on the basis of previously defined levels of power. However, few have analyzed the incentive structure that emerges when players can prepare this negotiation stage. As a result, they have largely ignored the possibility that war can be only a part of a broader strategy, and as a result often offer an odd reading of a number of wars.

Overall, the present paper brings together the more classical literature on the causes of war and more recent formal work. It provides micro-foundations for offensive realism, while at the same time extending existing formal work by endogenizing power—something that has largely been missing in the formal literature. Differences in results between realist approaches and bargaining theories can be explained by different assumptions about the mapping from capabilities to power. I have shown that nonconvexities are necessary for the realist theories, and also that they lead us to reconsider the results obtained in the bargaining literature that both parties in a dyad cannot have a positive expected utility for war when information is complete. The two strands of the literature examine different parts of a larger game. Bargaining models have limited their attention to the mapping from power to final outcomes and hence have not given players the ability to adopt strategic moves to improve the physical foundation of their long-term power; more general theories are too lax and vague, and do not tell us much about the sufficient or necessary conditions for war. This paper is a first attempt at reconciling the two approaches.

Appendix: Proofs

Proof of lemma 3.1. In the second stage, the setup is the same as Fearon (1995). In short, because information is complete and war is costly, an agreement is reached immediately and war never occurs (see also Rubinstein 1982). \square

Proof of Proposition 3.1. Normalize the size of π_{AB} to one, and normalize $u_i(0) = 0$ and $u_i(\pi_{AB}) = 1$.

Note that B will reject any agreement π_{AB}^B that yields a utility lower than fighting—that is, any agreement such that:

$$u(\pi_{AB}^B) < (0)p_{AB} + (1 - p_{AB})\pi_{AB} - k_{AB}^B \quad (3.3)$$

$$< 1 - p_{AB} - k_{AB}^B \quad (3.4)$$

This means that the most A can obtain in an agreement is

$$\bar{\pi}_{AB}^A = 1 - u_B^{-1}(1 - p_{AB} - k_{AB}^B) \quad (3.5)$$

In any subgame, A prefers fighting if the utility of fighting is greater than 3.5 plus the benefits (in the form of additional power) that A derives from 3.5 in the second round. That is, A will fight if:

$$(1 + \pi_{AC}p_{AC}^H)p_{AB} + (0 + \pi_{AC}p_{AC}^L)(1 - p_{AB}) - k_{AB}^A > \bar{\pi}_{AB}^A + \pi_{AC}p_{AC}^\omega \quad (3.6)$$

Let $v = [1 - u_B^{-1}(1 - p_{AB} - k_{AB}^B)] - p_{AB}$,⁴¹ and let $\hat{k} = k_{AB}^A + v$. Then A will fight whenever it's her turn if

$$(p_{AC}^H - p_{AC}^L)p_{AB} > p_{AC}^\omega + \frac{\hat{k}}{\pi_{AC}} \quad (3.7)$$

\square

⁴¹Intuitively, v denotes the extent of B 's risk aversion and costs for war. Thus, note that $v = 0$ when $u_B'' = 0$ and $k_{AB}^B = 0$.

Proof of Proposition 3.2. As before, normalize $\pi_{AB} = 1$, $u(0) = 0$ and $u(1) = 1$. As in proposition 3.5, let $\bar{\pi}_{AB}^A$ denote the largest concession that A can obtain without B fighting. First note that A 's utility for fighting is given by:

$$\left[1 + p_{AC}(r_A^0 + e(1), r_C)\right] p_{AB} + \left[0 + p_{AC}(r_A^0 + e(0), r_C)\right] (1 - p_{AB}) - k_{AB}^A \quad (3.8)$$

and her utility for the most B is willing to concede is:

$$\begin{aligned} & u_A(1 - u_B^{-1}(1 - p_{AB} - k_{AB}^B)) + p_{AC}(r_A^0 + e(1 - u_B^{-1}(1 - p_{AB} - k_{AB}^B)), r_C) \\ & \geq u_A(p_{AB} + k_{AB}^B) + p_{AC}(r_A^0 + e(p_{AB})) \quad \text{by concavity of } u_B(\cdot) \text{ and } e(\cdot) \end{aligned} \quad (3.9)$$

$$\geq p_{AB} + k_{AB}^B + p_{AC}(r_A^0 + e(p_{AB})) \quad \text{by concavity of } u_A(\cdot), \quad (3.10)$$

by concavity of $u_i(\cdot)$.

So war will occur only if 3.8 > 3.10, that is if (after rearranging and simplifying):

$$(1 - p_{AB})p_{AC}(r_A^0 + e(0), r_C) + p_{AC}(r_A^0 + e(1), r_C)p_{AB} > p_{AC}(r_A^0 + e(p_{AB})) \quad (3.11)$$

But note the following about the RHS of 3.11:

$$p_{AC}(r_A^0 + e(p_{AB})) \geq p_{AC}((1 - p_{AB})(r_A^0 + e(0)) + (r_A^0 + e(1))p_{AB})$$

by concavity of $e(\cdot)$.

Recall now that a function f is convex on an interval I if and only if

$$(1 - t)f(a) + tf(b) \geq f((1 - t)a + tb)$$

for all $a, b \in I$ and all $t \in [0, 1]$. This is precisely the relationship that 3.11 exhibits, which means that 3.11 holds only if $p_{AC}(\cdot)$ is convex. \square

Proof of Lemma 3.2. C will support B only if the net benefit of her support in case of an attack by A against B are greater than those of not supporting B . That is, C

will support B only if:

$$\begin{aligned} p_{AB}^s p_{AC}^L + (1 - p_{AB}^s) p_{AC} - f(s) &> p_{AB}^s p_{AC}^L + (1 - p_{AB}^s) p_{AC}^H \\ (p_{AB}^s - p_{AB}^s)(p_{AC}^L + p_{AC}^H) &> f(s) \end{aligned} \tag{3.12}$$

□

CHAPTER IV

Misrepresenting Power: The Right to Remain Silent?

1 Introduction

States are under constant scrutiny. Their choices are observed and judged by other states' leaders, as well as by their own constituents, domestic groups and lobbies. This is because their actions, statements and performance are important sources of information. Russia's defeat to Japan in 1905 revealed its military weakness; France's refusal to criticize China for its human rights records in 2004 conveyed its preference for trade deals; and the US' rejection of the Kyoto protocol led the world to believe the US did not value the environment.

In fact, in a strategic situation, any action or inaction, statement or absence thereof conveys information about a player's reservation point. For example, international agreements, as the result of bargaining processes, reflect power and preferences. Even refusing to sign them reveals something about a player's motivation, preferences or power on an issue. In short, states have the right to remain silent, but even this may be used against them.

This is problematic, because private information is an asset for strategic actors. By publicly revealing information, a state deprives itself of the ability to misrepresent its position in future negotiations, and therefore from reaching advantageous deals. Private information is an asset in the bargaining process that is relinquished in the

revelation of a state's reservation point. We would therefore expect actors to behave strategically with respect to how much of it they reveal.

The challenge states often face, then, is how to conceal their information—how to reveal as little as possible, given that any action or inaction whatsoever will convey something about their preferences and power. In this paper, I explore the mechanisms that states can—and do—use to reduce the amount of information they reveal. While the literature has focused on how states can convey information, there is relatively little work on how they can *hide* it. That is, when lying is costly and remaining silent is not an option, how do states avoid revealing information they would rather keep private?

The converse aspect of the problem is equally important. While states often attempt to restrict the amount of information they reveal, others have incentives to extract this hidden information. I explore a number of mechanisms that states use to achieve this goal.

In short, then, this article asks two main questions: (i) how do states restrict the amount of information they give out, and (ii) how do others extract it? I address these questions in four steps. I first review the existing literature on the role of information in strategic encounters (section 2). I then explain why revealing information is costly (section 3), and how other states can exploit this cost to extract information (section 4). Finally, section 5 analyzes how states can monitor the amount of information communicated.

2 Dynamic Information Structures

Most political and economic situations involve some elements of both strategic behavior and asymmetric information. Who knows what has important distributional implications and, as a result, rational actors will behave strategically with respect to information itself. When faced with different possible actions, a country will choose the one that suits its choice of information revelation. Modeling the information structure as a dynamic object of strategic behavior is therefore essential to our

understanding of strategic interactions.

The problem has received significant attention both in the political science and the economics literature. In particular, a large number of models have focused on states' incentives to send signals to change others' beliefs about their type (Crawford & Sobel 1982, Spence 1973, Fearon 1994, Sartori 2002).¹ Yet, while they do model the information structure as dynamic and as an object of strategic behavior, they do not analyze the incentives to hide information. To be sure, they analyze situations in which an actor pretends to be something it is not, but the present paper examines a state's options when lying is costly, but information needs to be hidden.

This question is more closely addressed in principal-agent models (Holmström 1979, Grossman & Hart 1983), in which an agent seeks to conceal private information (his ability or his effort) to a principal. The principal cannot observe the agent's actions, but knows his preferences and cost of effort. Unfortunately, these models are not well suited for the present problem for two main reasons. First, the principal usually knows too much. As we will see in section 5.1, this make lying impossible for the agent, but only under strong assumptions. Second, the models do not include the subtleties of ambiguity. In other words, the agent cannot affect the ability of the principal to draw inferences.

The related question of information revelation as a strategic instrument has received a growing attention in economics. In particular, the question of how much information a seller will reveal to a buyer in a sequential equilibrium has been studied by Farrell (1986), Farrell and Sobel (1983), Grossman (1981), Mathews and Postlewaite (1985), Milgrom (1981), and Milgrom and Roberts (1986). However, these models cited ask *when* an actor will want to misrepresent—not *how*.

The question of ambiguity has received some attention in the literature on law and economics. In particular, much debate (both positive and normative) has surrounded the issue of the optimal level of precision in legal matters.² The literature on

¹See Nalebuff (1991), Powell (1990), Morrow (1989), and Alt, Calvert & Humes (1988) for works on reputations for resolve. See also Huth (1997) and Leng (1993). For a good review of the literature in economics, see Wilson (1985) and Rasmusen (2006).

²See Fon & Parisi (2003), cited in Koremenos (2007).

incomplete contracting has focused on three main costs to explain why contracts almost never fully address all possible contingencies: (i) unforeseen contingencies;³ (ii) the cost of writing contracts; and (iii) the cost of enforcing (Tirole 1999).⁴ Instead, I focus here on another incentive for incomplete (public) contracts: the incentive to avoid revealing private information.

The question of ambiguity has also been addressed in American Politics, particularly in the context of electoral competition. In Glazer (1990), for example, candidates are uncertain of the location of the median voter. As a result, they choose to be ambiguous to avoid specifying an incorrect and hence beatable policy. In Aragonés & Neeman (2000), ambiguity can be chosen by candidates in equilibrium because their objective function includes not only votes, but also the flexibility they will enjoy after winning the election.⁵

Unfortunately, studies on ambiguities have focused on *when* ambiguity is preferred over clarity, but not on the mechanisms by which it is generated. On the contrary, I *assume* the desire to misrepresent (for reasons explored in section 3), and focus instead on the mechanisms limiting how much can be inferred.

3 Costly Truth

State leaders are constantly pressured to respond to international events—human rights violations somewhere in the world, military attacks, changes in leaderships, or international conferences. When China violates human rights in Tibet, for example, other countries must choose whether to react or not, and with what intensity. In turn, these choices convey how much risks and costs the reacting state is willing to incur to attempt to change China’s behavior. Similarly, victory in a military conflict or a negotiation, G8 statements, domestic speeches and choices of diplomatic trips by heads of states are more or less subtle cues about a state’s preferences, as well as

³See Ehrlich & Posner (1974). For an interesting application to international relations, see Koremenos (2007), who develops conjectures about the relationship between precision, and the delegation of international dispute resolution.

⁴See also Hart & Moore (1988). Tirole (1999) provides a good review.

⁵See also Campbell (1983), Shepsle (1972) or Alesina & Cukierman (1990).

its ability and willingness to obtain what it wants. Remaining silent is often not a solution either, since the absence of statement or measures is just as revealing, if not more, as a formal statement or action. Refusing to sign a human rights agreement or the Nuclear Non-Proliferation Treaty, for example, reveals preferences and intentions.

How do audiences infer preferences and power from actions or agreements? As in economics, where only bundle choices can be observed, only outcomes (agreements or actions) are observed in international relations—not the preferences of individual actors, and much less a utility function. From these observations, however, we can construct preference relations, which in turn can be rationalized by a utility function. To simplify, if a bundle of goods x_1 could have been bought by an individual when in fact she was observed to buy another bundle x_2 , it is presumed that she has “revealed” her (weak) preference for x_2 over x_1 .⁶ Choices are observed, and preferences are inferred from these observations.

A similar mechanism applies in international relations. There, power defines a budget line (how much of the pie this state can obtain) and the counterpart of the bundle is, for example, an agreement over the division of benefits on a number of issues.⁷ The agreements a state chooses to sign, how much it obtains out of the deal, and the compensation it offers the other state all reveal information about preferences and their intensity. They convey how much the state can, and is willing to “exchange” of one issue against another. And because more powerful actors tend to obtain more benefits than less powerful ones, agreements also inform about relative power. In short, public international agreements act as the equivalents of prices and quantities in economics. They reveal what and how much was exchanged, and at what price. This is not limited to agreements. For example, Japan’s decisive victory over Russia in 1905 demonstrated its rise as a military power; the inability of the US

⁶If choice data satisfies the General Axiom of Revealed Preferences (GARP), for example, we would ideally be able to extract a rationalizing utility function through which to recover preferences and forecast choices on out of sample allocations. Varian (1982) uses GARP and assumptions of convexity and monotonicity to generate an algorithm that serves as a partial solution to this so-called recoverability problem. For a more general discussion of preference revelation in economics, see Mas-Colell, Whinston & Green (1995).

⁷For an illustration of the problem of recovering preferences from strategic data, see Signorino (1999) and its extension to incomplete information, Lewis & Schultz (2003).

to twist the hand of Iran or Pakistan is often interpreted—at home and abroad—as a sign of the US’ weakness; and the frequent incapacity of the European Union’s to take strong foreign policy stances conveys its inability to tackle larger international problems.

Information is revealed to two main audiences. First, public actions such as agreements or statements reveal the leader’s true preferences to its domestic audiences—constituents, lobby groups, or campaign supporters. These revealed preferences might be different from the platform on which s/he was elected. The recent discovery of C.I.A. prisons in Europe, for example, revealed secret agreements which, if made public at the time they were concluded, would have led European leaders to incur domestic audience costs and to be unable to misrepresent their position to their domestic population. Similarly, foreign leaders’ stance on the Israeli-Palestinian conflict, say, reveals, at least in part, their preferences to their domestic groups, and have electoral implications.

Second, publicly observable actions or statements reveal information at the international level. Other states constantly seek to learn the preferences and power of their future negotiation partners. Even if the goal is not learning per se, public actions can be used as evidence to discredit another country. The decision not to ratify the statute of the International Criminal Court or the Kyoto protocol, for example, altered other countries’ beliefs about the United States’ preferences. Similarly, France’s decision to sell jet fighters to China in 1994 revealed, at least to some extent, its preferences for trade opportunities over human rights.

Revealing private information implies two main sources of costs for leaders. First, it makes it more difficult to misrepresent their position in future negotiations.⁸ If preferences or ability can be inferred from actions, then the ability to misrepresent them in the future will be compromised, such that the ability to secure favorable outcomes at the bargaining table will be reduced. A car seller who makes it public that he previously sold a car for \$10,000 will face difficulties obtaining \$11,000 for the

⁸To be sure, states can also take deliberate actions (lie) to make it *easier* to misrepresent in the future. I study these in the next section.

same car in any subsequent negotiation. Second, revealing private information can make it impossible to satisfy multiple audiences. This is perhaps best illustrated by the US' "strategic ambiguity" towards Taiwan. Throughout the years, the US has carefully balanced its military support of Taiwan and its refusal to do so unconditionally. The idea here is to deter Taiwan from provoking mainland China—which would drag the US into a costly intervention—and the PRC from engaging in any military action against Taiwan.⁹

4 Asking Questions

Information is costly to reveal, but the converse is also true: the ability to infer other countries' preferences and power is a source of benefits. Extracting information does not only mean learning about preferences. It can also be for the purpose of demonstrating the other's bad faith or to justify the failure of the negotiation to domestic audiences.

An important way of doing this is to make it costly for others to lie. Questions, for example, can be used as strategic tools to constrain third parties to reveal their true preferences. Indeed, given that information can be inferred simply by observing the answer—or absence thereof—to a question, other states will strategically use this inability to remain silent in order to learn about other's private information. A casual look at international relations suggests that states do ask questions with the purpose of separating types. They ask, for example, "do you want to sign this treaty?"; "Will you defend me if I am under attack?" and "How will you react if I threaten my neighbor?" In part, these questions often aim at obtaining something from the receiver—a concession or a promise. But another part of them aims at probing the other's resolve and preferences. Hitler's crisis over the Sudentenland, for example, largely intended to test France and Britain's resolve. The Korean war is often understood in a similar way, with Stalin playing the role of the prober.

However, all sources of information are not equally valid, and not all questions are

⁹See, for example, Niou & Benson (2002).

efficient tools to extract information. What is needed are questions that are costly to lie to. International agreements are an important way by which states can ask such questions. That is, states will use international agreements proposals to force other states to reveal their preferences. Proposals allow states to confront others about their preferences. Thus, while a country might publicly state its interest in human rights, its refusal to sign a human rights treaty reveals information about its true preferences. The US, for example, has suffered from the discrepancy between its publicized concern over global warming but lack of willingness to engage in multilateral efforts at curbing CO₂ emissions. Similarly, while the efficacy of human rights agreements in terms of compliance is often low, they can at least contribute to separating types. In this sense law is not only a constraining mechanism, but also a strategic tool for states to force others to reveal their preferences.

Three factors contribute to making agreements certifications of truthfulness. First, publicly misrepresenting the country's reservation point can imply domestic audience costs. If the agreement does not reflect the state's true type, opposition parties in democracies will point to the discrepancy, thereby revealing the true reservation point. This mechanism is presented in detail in arguments about democracies' relatively superior ability to signal intentions and resolve (Fearon 1994, Schultz 2002).

Equally important is the other party's monitoring of compliance with the terms of the agreement. This monitoring indirectly verifies that the true preferences were revealed in the first place. The other party will condemn the agreement in case of defection, which signals to third parties that the agreement did not reflect the actor's true preferences. By the same token, the absence of condemnation confirms the truthfulness of the initial revelation. This external monitoring power thus adds credibility to the signaling. To be sure, the hider could lie, and actually abide by an agreement that it does not like only for the sake of misrepresenting its type and building a favorable reputation. This, however, is costly, as it necessitates the adoption and implementation of policies that deviate from that state's ideal point (see section 5.1 below).

Finally, because reputation costs make renegeing costly, states will tend to sign

only agreements with which they intend to comply. Similarly, abiding by the terms of an agreement that does not reflect the actor’s true preferences is costly, and will therefore be avoided. Once more, agreements act as credible revealers of the actors’ true preferences.

5 Hiding Information

How do states make it difficult to infer their true type?¹⁰ That is, how can they devise their actions or reaction to questions or events, so that the true cause of their behavior remains ambiguous?¹¹ Ambiguity can be defined either in terms of message attributes (e.g., abstract language, limited details) or in terms of receiver interpretation—how equivocal the receiver perceives the message to be (Putnam & Sorenson 1982). In this paper, I use the second meaning. A message is ‘ambiguous’ when the sender takes into account the way his message will be interpreted, and attempts to widen the possible interpretations—to pool with other types.¹²

Suppose that a state, call it A , seeks to conceal its private information. More precisely, assume that A ’s true type is $\eta < 0$, and that other states’ prior beliefs about η , which I denote by b_0^η , have mean zero and standard deviation σ (note that $b_0^\eta > \eta$ by assumption). At times $t = (1, 2, \dots)$, A is confronted to a question (e.g., war crimes in Sudan or a human rights convention) and must respond with a

¹⁰Of course, revealing information need not be costly. When others’ beliefs about my preferences or power are unfavorably distorted—when, for example, they underestimate my actual resolve, I have an incentive to make it as clear—and credible—as possible that my type actually is my type. Since this problem is more specifically studied in more typical signaling models, however, I focus here on the problem of information concealing, and simply assume that the state is attempting to hide or misrepresent private information.

¹¹The concept of ambiguity itself is slippery. In linguistics, ambiguity has been analyzed as indirectness (Branham 1980, Nofsinger 1976), vagueness (Pascale & Athos 1982), disqualification Bavelas (1983) and vagueness (Wender 1967). The formal literature in economics and political science (american politics in particular), on the other hand, has tended to define ambiguity as a probability over states of the world. In Shepsle (1972), for example, ambiguity in a candidate’s strategy is defined as a nondegenerate probability distribution over positions.

¹²Ambiguity here is not a measure of the precision of the signal itself, but rather of the intended interpretation by the receiver. Thus, ambiguity may very well be generated by detailed language. Incomplete phrases or vague references in the context of friends sharing a common history (a code), for example, may be better at generating high levels of clarity than “precise” messages (Eisenberg 1984).

message m_t . Intuitively, m_t could be, for example, a statement to be issued, or an international agreement to sign. Let b_t^η denote the states' posterior beliefs about η after a signal m_t has been received. Assume moreover that A 's goal is to appear as being a high type. That is, $U_A = u(b_t^\eta)$, where $u' > 0$. A strategy for A , then, is a sequence $\{m_t\}_{t=1}^\infty$ that maximizes her utility.

This section is a typology of the ways by which states can avoid revealing their private information. In particular, I examine four main ways by which A can make this sequence more ambiguous. First, he can plainly and simply lie—that is, take actions that purposefully misrepresent its type as another's. Second, A can act or react privately. Instead of signing public agreements, for example, A can keep them private to reduce the audience costs associated with the revelation of its private information. Third, he can take actions or make statements that are imprecise. Here, I use a model in which states can choose the variance of their statement endogenously. Finally, A can cloud his answers by adding dimensions that make it difficult to draw specific inferences.

5.1 Lie

To misrepresent their type, states often take actions—potentially costly ones—to pool with another type. In the case of a car dealer, for example, one way to deal with the problem is for the seller to pay someone to buy the car at a high price, thereby artificially signaling the value of the car, and potentially generating further profits in the long term.¹³ Similarly, if only tough players fight wars, then going to war—and incurring its cost—can pay off if the goal is to appear tough. Japan's 1905 war against Russia was, at least in part, an effort towards obtaining recognition as an equal of the European powers;¹⁴ the US-Vietnam war has often been presented as an

¹³A related problem has been the object of research in economics. Incumbent firms, for example, often lower their price below monopoly price—which they could charge—in an effort to artificially signal the non-profitability of the market. This practice of 'signal-jamming' aims at deterring competing firms from entering the market by misrepresenting downward the margins that potential entrants would obtain (Fudenberg & Tirole 1986).

¹⁴To be sure, the benefits reaped went beyond the simple gain of a reputation. See, for example, Kowner (2007).

endeavor to advertise resolve; and states often sign human rights or environmental agreements even though they have not intention of abiding by them.

The costs incurred can be high, however, as the US discovered with Vietnam. They can be justified if the number of states to “impress” is high or, more generally, if the shadow of the future is large. If, following the sponsored deal, the car seller expects to sell 100 cars at \$15,000 instead of \$10,000 then clearly the initial subsidy was well worth it. Often, however, this is not the case. Maintaining a reputation implies repeatedly engaging in many such actions, so that the total cost is often high. Moreover, the number of states to impress might not be sufficient to justify the initial sacrifice.

To see this a little more formally, let $a_t \in \mathbb{R}$ denotes A ’s choice of actions—that is, A ’s intentional distortion of the signal. η represents A ’s ideal point, while a_t represents its deviation from that point. The problem for A at time t is to choose an action a_t to affect the message—that is, to choose m_t such that:

$$m_t = \eta + a_t \tag{4.1}$$

Actions a_t are assumed to be costly, because they deviate from h ’s ideal point. More specifically, let this cost be represented by $g(|a_t|)$, where $g' \geq 0$. That is, the further the message departs from the ideal point, the more costly it is. A large a_t would be incurred, for example, by fighting a war when the ideal point is peace. On the contrary, a simple statement could imply a low a_t .

For simplicity, assume A is risk neutral, with preferences given by the following utility function:

$$U(a_t, b_t) = \sum_{t=1}^{\infty} \beta^{t-1} [b_t - g(|a_t|)], \tag{4.2}$$

where $b_t \equiv b(m_t, k)$ refers to the benefits gained from sending signal m_t —for example, the prestige gained from appearing strong—to k audiences.

There are two cases to consider. One in which A ’s utility function is publicly

known, and another in which it remains A 's private information. (i) Assume first that $U(\cdot, \cdot)$ is common knowledge. Then other states can infer A 's action a_t by solving 4.2, and hence can infer his type from 4.1.¹⁵ As a result, A is trapped in the equivalent of a rat race. Because others know his incentive to lie, they will adapt their expectations according to this incentive, and discount his action. This implies

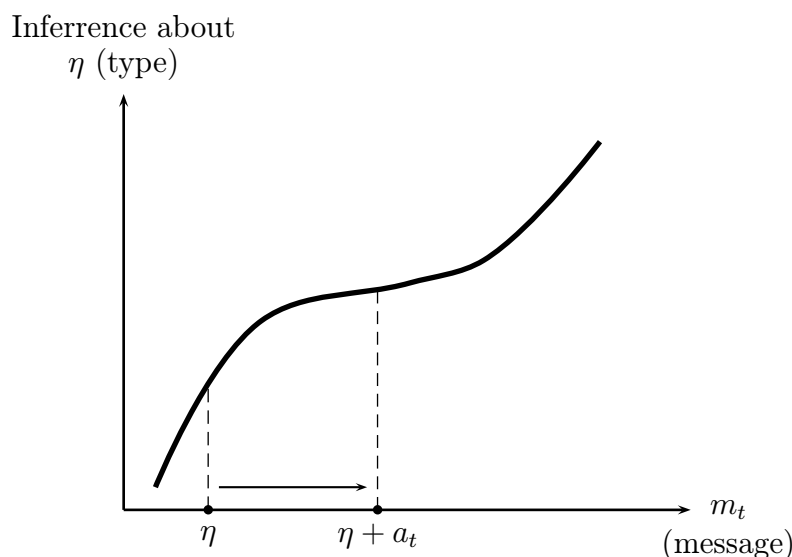


Figure 4.1: Lying

that A 's actions are useless in changing others' perception of his type. However, not taking them would be even worse because A 's actions are discounted given the expectations about the lie. Statements about human rights, for example, are often issued, even though everyone in the international community knows that their content is a lie. Not making the statement would be even worse, as others would infer that preferences for human rights are even lower.

(ii) More commonly, however, $U(\cdot, \cdot)$ is not publicly known. In other words, the extent to which A values a good reputation is private information. When this is the case, any inference about A 's true type is not possible. Even statistical inference, as in Signorino (1999) or Lewis & Schultz (2003) is of limited use, since the game that is actually played is unknown. Inferring preferences from observed actions without

¹⁵The same logic applies in Holmström (1999).

inferring something outside of choice is not possible (Sen 1993). I come back to this point later.

For now, what matters is that *A can*, under some circumstances, successfully lie, but that it is costly. Pretending to be someone else means deviating from one's ideal point, which involves costs sometimes as high as wars. However, there are other, cheaper actions that states can take to reduce the extent to which third parties or domestic audiences can infer private information.

5.2 Secrecy

Information can also be concealed simply by avoiding public actions. Secrecy—sending an empty message—has many advantages. For example, a private alliance or secret manoeuvres can provide a valuable element of surprise; secret payments for the release of hostages let states retain some credibility in future negotiations with abductors; keeping weapons deals with Iran secret avoids the wrath of the US; and covert interventions let democracies use the methods usually attributed to authoritarian states without incurring their bad reputation.

Yet, private agreements are not always desirable or feasible ways to hide information. First, while information is not revealed, the signatories also lose some of the benefits of publicity. Enforceability, in particular, becomes difficult when the reneger knows he will not incur any reputation cost for defecting. More problematic is that keeping agreements, actions or reactions private is not always an option. Public action is often required. In a multilateral negotiation, for example, a private agreement is not possible; and when an international event occurs, remaining silent does not avoid conveying information.

It is not only the publicity of the outcome itself that conveys information, however. The choice between public and private negotiations also affects the amount of information that is revealed (Stasavage 2004, Koremenos 2007). This is illustrated by two types of behavior that negotiators exhibit under public negotiations. First, representatives often posture—adopt uncompromising positions during negotiations in order to demonstrate to their constituents that they are effective or committed

bargainers. Second, they tend to pamper their constituents—choose policies based on voters’ opinion, even if representatives themselves believe that voters are incorrectly informed about their true interests (Stasavage 2004).

At the international level, open-door negotiations also entail revelation costs. And whereas agreements, as the end-result of negotiations, define a single outcome (equilibrium), the negotiation process—a dynamic process in which offers and counter-offers are exchanged— can reveal the entire demand and indifference curves. This cost explains the choice of secrecy in military negotiations. Even in economic affairs, the Green Room—or “mini-ministerial”— practice at the WTO, whereby a small group of rich countries bargain without other countries illustrates the need to not reveal certain information. Secrecy is essential for rich countries to assemble pre-packaged deals, which are then presented to developing nations on a take-it-or-leave-it basis.¹⁶ Similarly, actors learn about each other’s resolve, power and preferences in situations of crisis bargaining (Slantchev 2003).

Finally, compliance monitoring and information gathering systems also play a major role in making information public or private. Those mechanisms typically gather information on compliance with the terms of the agreement. As such, they certify whether the actors are abiding by the terms of the agreement, and therefore whether they revealed their true preferences in the first place. In particular, two main criteria affect the level of information revealed. First, whether the reporting of information is made by the actor himself or by a third party allowed to collect independently affects the credibility of the information. Second, whether the information collected is shared with other parties to the agreement, or made public, affects the cost of revelation. As a result, countries who want to avoid revealing information will not implement such mechanisms.¹⁷

¹⁶Some might argue that the purpose of the Green Room, instead, is the efficiency provided by the small number of negotiator. If this was the case, however, any group of countries could be randomly assigned a position in this group. Yet, developed countries have systematically denied access to the room to other participants.

¹⁷To be sure, not all monitoring mechanisms provide adequate information, however. For example, the parties to the 1966 International Covenant on Civil and Political Rights “undertake to submit reports on the measures they have adopted which give effect to the rights recognized herein and on the progress made in the enjoyment of those rights” (Art. 40). The Human Rights Committee,

5.3 Imprecision

Perhaps the most common way states avoid revealing their private information is by being vague or imprecise. At one extreme, as seen above, they can keep their actions private (e.g., military agreements). Even when their actions are public, they can range from very vague (e.g., G8 promises on global warming) to very precise (International Coffee Agreement).¹⁸ International agreements, for example, vary from detailed written documents to joint communiqués, oral speeches or tacit bargains (Koremenos, Lipson & Snidal 2003). “The most sensitive and embarrassing implications of an agreement can remain nebulous or unstated for both domestic and international audiences, or even hidden from them” (Lipson 1991).

More generally, I use the word precision in a way similar to Koremenos (1997).¹⁹ I use it to refer to the amount of doubt that exists about the way the behavior, preferences or attributes are described in the statement or agreement. This is a purposefully abstract definition, that I implement in the model simply by letting the state choose the size of his message’s variance. The Basel convention on the control of transboundary movements of hazardous waste, for example, was vague and did not define key terms. It simply called for the disposal of waste in “an environmentally sound manner.”

Perhaps the most visible example of purposeful vagueness is that of the US’ position in relation to Taiwan. Consider, for example, the following exchange between McCurry and members of the press at a White House briefing:

composed of eighteen independent experts, has the task of reviewing these reports. Yet, the Committee does not evaluate or comment on the compliance or lack thereof. And the reports are often evasive at best. Guinea, for example, simply claimed that its national legislation was at a “more advanced stage” than required by the Covenant; and Mongolia stated that there had never been a complaint about its respect of human rights in the country (Donnelly 1986).

¹⁸See, for example, Koremenos (2002).

¹⁹Although her study focuses on agreements, the definition is easily accommodated to include other types of actions such as statements. “Precision or vagueness refers to the exactness or ambiguity of an agreement’s prescribed, proscribed, and authorized behaviors. Precision is often reflected in the amount of detail accorded to each behavior as well as in clearly stated ‘shall/shall not.’ Ambiguity refers to how much doubt exists about the way in which the behaviors are to be executed. Easily quantifiable behaviors are usually very precise. Those that broaden the range of behavior, like forbidding actions of a military nature, are usually only somewhat precise. Behaviors stated in very general terms, like those in many human rights treaties, are vague.”

“Q: *Has China been given an ambiguous answer on what we would do if it did attack Taiwan?*

A: Oh, I doubt very much, given the PRC’s understanding of the Taiwan Relations Act, that they have much doubt.

Q: *I thought you said earlier that we were being deliberately ambiguous.*

A: Well, we’ve not—we’ve never specified the exact response consistent with the exact wording of the Taiwan Relations Act. But if you look at that act, if you look at the requirement for peaceful resolution of issues related to the Straits, it’s quite clear what the view of the international community would be of any unnecessary provocation.

Q: *What would that be?*

A: It’s very clearly specified in the Taiwan Relations Act.

Q: *Which is?*

A: Which I don’t have in front of me.”²⁰

Later on, McCurry made this even clearer:

Q: *Do you think the United States would be bound by the 1979 Act to defend Taiwan against Chinese aggression?*

A: The 1979 Taiwan Relations Act does not answer that question specifically and, indeed, there is merit we believe in keeping somewhat ambiguous about the matter.²¹

Another example is Israel, who maintains that it “will not be the first country to introduce nuclear weapons into the Middle East.” The word ‘introduce’ here can be interpreted either as ‘create’ or as ‘use’ (Baliga & Sjostrom 2008). As a result, it is unclear whether Israel currently possesses these weapons.²² Israel even acknowledges her strategy by arguing that “deliberate ambiguity maximizes our deterrence”.²³ Doing so avoids arms races in the Middle East (Woods, Lacey & Murray 2006, p. 6), but also maintains sufficient deterrence—deterrence by doubt (Gordon 2006, p.65).

²⁰Press Briefing by Mike McCurry, 13 February 1996 WL60961 (White House, February 13, 1996), quoted in D’Amato (1997, p. 261).

²¹Press Briefing by Mike McCurry, 1996 WL107147 (White House, March 12, 1996) quoted in D’Amato (1997, p.261–262).

²²Of course, by now the existence of Israeli nuclear weapons is a “public secret” due to the declassification of US government documents.

²³Thomas Friedman. “Israel and the Bomb: Megatons of Ambiguity.” *The New York Times*. November 9, 1986, p.23. Of course, it should be noted that the ambiguity has long been lifted, especially given its leaders slips. See, for example, Greg Myre. “In a Slip, Israel’s Leader Seems to Confirm Its Nuclear Arsenal.” *The New York Times*, Dec. 12, 2006.

Saddam Hussein’s strategy has been very similar. He possessed weapons of mass destruction in the early 1990s, but not anymore at the end of the decade. In both cases, however, he chose to remain ambiguous. Had he admitted to having weapons, he would have incurred sanctions and potentially preemptive strikes; had he clearly demonstrated he did not have them (assuming this is possible), he would have lost his ability to deter neighboring countries, in particular Iran.

Consider a variant of the model presented in section 5.1, to which I now add the ability for A to choose a level of precision h_ε . That is, A now chooses a message m_t such that

$$m_t = \eta + \varepsilon_t, \tag{4.3}$$

where ε_t are distributed normally and independently with mean zero and precision h_ε . By choosing h_ε , then, A can determine how rapidly others will learn about its type. More precisely, given normality, the rules for updating beliefs about η are given by:²⁴

$$m_{t+1} = \frac{h_t \mu_t + h_\varepsilon m_t}{h_t + h_\varepsilon} = \frac{h_1 \mu_1 + h_\varepsilon \sum_{s=1}^t m_s}{h_t + h_\varepsilon}, \tag{4.4}$$

$$h_{t+1} = h_t + h_\varepsilon = h_1 + t h_\varepsilon. \tag{4.5}$$

From 4.4, note that $\{m_t\}$ is a random walk with variance that, in the limit, goes to zero. In the long run, then, η_t becomes fully known. But the long run might be of little interest to the hider.

This is not to mean that imprecision is always preferable. For one, precision can help with the enforcement of agreements. A precise agreement reveals credible information about preferences and therefore can help solve cooperation problems when uncertainty about behavior hinders cooperation. Moreover, the enforcement process—the adjudication of disputes, for example—is easier when the contract is

²⁴Bolstad (2004, p. 178). See also or DeGroot (2005).

complete. Finally, a very low precision might not be desirable, since only those who want to hide something will use it. As a result, a low level of precision could be just as revealing as a high one.

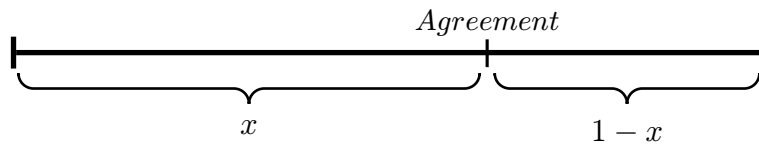
This last point, however, begs an important question: if all players who have something to hide use imprecision as a way to avoid revealing their true preferences, then others can infer their type from this imprecision. In other words, the question is whether there is a one-to-one function between the level of precision and the type. If there is, then imprecision itself—the variance—reveals information about my preferences and motivations. A casual look at international relations, however, suggests that a low level of precision does not necessarily mean that states have something to hide. The fact that the US, for example, does not make its commitment to Taiwan as clear as possible does not automatically imply that it would not defend Taiwan, but rather that ambiguity gives it more leverage in relation to both Taiwan and China. Consider also the U.N. Convention on the Rights of the Child, which calls for the respect of children’s basic human rights.²⁵ Only two countries have not ratified it: Somalia and the U.S.²⁶ Clearly, the persistent refusal of the U.S. to ratify the Convention does not imply its intent on not applying the letter of the treaty. Simply, critics in the United States have rejected it on the basis that “the right of the child to freedom of thought, conscience and religion” intrudes on the family and could lead to interference of the government into family life. In other words, the fact that states do not ratify or push for vague and empty agreements does not allow us to infer their preferences. Lack of precision can have many different reasons, only one of them being the intention to hide preferences. In other words, the level of precision itself is usually insufficient to separate types.

²⁵Among other rights, it calls for: the right to survival and full development (Art. 6); to protection from harmful influences, abuse and exploitation (Art. 32); and to participate fully in family, cultural and social life (Art. 31) (UNESCO 1989).

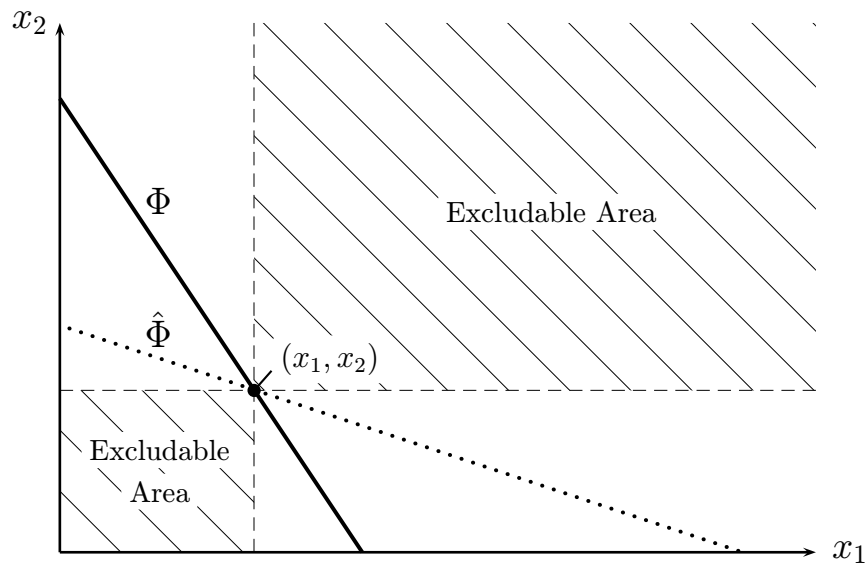
²⁶Former President Clinton signed it in 1995 but the convention was never ratified.

5.4 Clouding the Issue

Finally, the number of issues included in the negotiations and the agreement also affects the clarity of the information received by third parties. Simply put, the more issues are added, the more difficult it is to infer what preferences or the balance of power on each issue are. To see this, consider first a distribution issue over a single dimension (Fig. 4.2(a)). Arguably, the distribution of benefits should be a function of the distribution of power and of resolve. A distribution $x \in [0, 1]$ for A and $1 - x$ for B can thus be interpreted roughly as: A has, on this issue, a relative level of power $p_A = f(x) \approx \frac{x}{1-x}$ (assuming a simple contest success function).



(a) Inferences from a One-Dimensional Agreement



(b) Inferences from a Multi-Dimensional Agreement

Figure 4.2: The Problem of Dimensionality

As the number of dimensions increases, however, accurate inferences become more

and more difficult. Adding dimensions blurs the information revealed about power and preferences and therefore reduces revelation costs. For example, France could suspend foreign aid to another country by arguing that this country violates human rights, whereas the truth is that aid has become too costly. Including two issues prevents inference about France's true motives. Further agreements, for example the sell of jet fighters to China, will be necessary to reveal France's true preferences.

In figure 4.2(b), for example, actors have reached an agreement on (x_1, x_2) , defining the distribution over two flows of benefits. What can observers infer from this? Rational actors maximizing their utility should reach an agreement located on the budget line.²⁷ Unfortunately, the number of budget lines—i.e., of power ratios Φ —that rationalize A is infinite. Even assuming that relative levels of power are known (i.e., the budget line is known to third parties), an infinite number of utility functions could also be fitted on this single point. The observation of the agreement does impose restrictions on the set of distributions of power and preferences that could have generated it (the hatched area can be excluded under only mild assumptions), but these restrictions lead to less and less precise predictions as the number of issues incorporated into the agreement (its dimensions) increases.

6 Conclusion

“There is much to be gained from venturing nothing,” writes Goffman (1955, p. 43). Strategic actors, however, do not have the right to remain silent, and so need to venture something—but something that seems like nothing. This paper makes two main observations. First, states often have incentives to hide their true preferences or power, and will behave strategically with regard to the information they reveal. Lying can be costly, but there are other ways that can help misrepresenting private information—imprecision or the addition of dimensions to agreement were proposed here, but there are certainly more. This explains why diplomats' statements are often vague; why most states sign human rights agreements, even though they have little

²⁷Many qualifications would be in order here, since the rationality of the players need not simply efficient outcomes. However, these are beyond the scope of this paper.

interest in them; and why some treaties are much less precise than others. Second, given that misrepresenting is often difficult or costly, other states have incentives to devise costly questions to force others to reveal their type.

One important question remains, however: Can we test this empirically? Can we show systematically that states misrepresent their information? I argue that we cannot. The problem is not that we cannot make precise inferences because we lack sufficient data points, or because we have not observed the game play a sufficient number of times. It is that unbiased inferences from *public* actions are to a large extent impossible because, if they were possible, then states would change their behavior accordingly.²⁸ In other words, states often strive to minimize the ability of others' to infer their true type, so that inference itself becomes an indirect part of their utility function.

It is as if strategic actors were playing a game with us, the scholars. To be sure, they try to misrepresent their private information because they fear that their competitors, enemies or partners will infer this information, and that these inferences will lead to detrimental outcomes from themselves. But the matter is that often, if not always, strategic actors do what they do in front of an audience, and they care about what these audiences think. As a result, nothing we observe is genuine; everything that is made public—everything that we scholars and them, the audiences, can observe—is, at least in part, an effort to mislead us. Just as in physics, where observing by flashing beams of light can alter a particule's trajectory and behavior, our very observation (or, more precisely, the audience's observation) alters the initial behavior of strategic players in way that makes it impossible to recover the initial motivation for their actions.²⁹ Even worse, even if there existed some algorithm to recover preferences, then the audience could also use it and, as a result, the actor would change its behavior accordingly. Moreover, there is no central planner to devise a mechanism to recover private information. As we saw, international agreements can play a screening role, but in general the findings from the theory of mechanism

²⁸This is not to say that acquiring information is impossible. Intelligence or archives can provide access to such information.

²⁹In particular, see the Uncertainty Principle (Heisenberg 1927).

design are of limited use here.³⁰

In other words, the nature of strategic interactions imposes limits on what we can know and infer about states' preferences—and hence on our ability to anticipate and predict the future is fundamentally limited. This is because states have incentives to behave strategically with respect to the information they reveal and, hence, the information that we have access to is necessarily biased by states' efforts at misrepresenting it.

³⁰On mechanism design, see for example Myerson (1979).

CHAPTER V

Allocating Power: The Value of Capabilities

1 Introduction

States typically pursue multiple foreign policy goals. The US, for example, was threatening Saddam Hussein while keeping North Korea under check, maintaining order in Africa, and pledging the defense of Taiwan. Yet resources are scarce. The number of soldiers a country can deploy and the number of wars it can fight simultaneously, for example, are limited. Similarly, the budget imposes constraints on the amount of money that can be devoted to bribing other countries. To address challenges and exert power on several ‘fronts’ simultaneously, countries need to allocate their bargaining power at multiple tables. As a result, they “must set priorities and consider inescapable tradeoffs and opportunity costs” (Gates 2009).

How do states allocate their scarce power to achieve their various strategic objectives? And how many concessions can they obtain given their resources? There does not seem to be an obvious answer to that question. Britain was able to control all of India with only a few thousand soldiers, but Germany had major difficulties dealing with two simultaneous fronts in the first World War. Unfortunately, the question of allocation has not received much attention in political science, in stark contrast to economics. In particular, formal theory has neglected the issue by focusing on bilateral negotiations, or on negotiations in which multiple players strive to agree

on a single partition. With a uni-dimensional negotiation, the question of allocation is simple: all coercive resources (“guns”) should be allocated to this opponent or issue. With multiple bargaining tables, however, the question of how states allocate their power to achieve their foreign policy goals arises. For example, how do threats against one state affect the ability to threaten another? And how much total benefits can states extract from these different fronts?

This chapter addresses these questions from a theoretical point of view. I analyze a bargaining model in which a country is negotiating at several tables. The central question is whether, or rather when, power can be used at different tables simultaneously. In other words, when does the use of coercion at one table prevent its use at another? When, on the contrary, can a state extract large amounts of benefits at each table? And do states ever overstretch their power? The chapter proceeds in three steps. After briefly reviewing the literature (section 2), I analyze a game in which a state must allocate its troops at several fronts. How are resources allocated and does war ever occur in equilibrium (section 3)? I then address the more general question of scarcity (section 4): when do capabilities need to be allocated and when, on the contrary, can they be used at several tables simultaneously?

2 Related Literature

The question of allocation has obviously received a tremendous amount of attention in economics. There is, however, a central difference between the allocation of money and the allocation of coercive resources. In the market, benefits are obtained when one actor exchanges one good or service against another one. Some scarce resource must be expended and given up—usually time or money. In matters of power, however, threats can be used to obtain concessions. And when threats succeed, the coercer has obtained something for nothing. In other words, power need not be expended to translate into concessions.

On the other hand, power itself has received a tremendous amount of attention in political science (see chapter I). How much power people or states have and how they

use it are central questions in the study of most, if not all, political processes. Yet, what is missing is an understanding of what it means to have power when more than one opponent is faced at the same time. How are scarce means of coercion allocated, and what are the implications in terms of benefits? If power, for example in the form of a threat, is expanded at one table, does it reduce its use at another? What we need to answer such questions is an analysis at the crossroad of economics and politics; one that deals with allocation, but the allocation of power.

This question of allocation is directly related to the balance of power, and more generally to alliances.¹ The point of this paper is not to replace an analysis in terms of alliances. Alliances involve promises, consultation and common exercises that are not reflected in the simple problem of allocation. Rather, the model presented here has the advantage of illustrating the void that alliances fill. Alliances are mechanisms that emerge when uncoordinated strategies fail. They are institutions that solve problems such as asymmetry of information or free-rider incentives. But a large portion of what alliances do, such as balancing power—preventing the overexpansion of one or several members of the system—is achieved by states simply pursuing their self-interest. Alliances only emerge when these independent strategies lead to suboptimal outcomes for the countries concerned. In other words, a large portion of what is typically attributed to alliances would also take place in their absence. In this sense, this chapter elaborates on the micro-foundations of alliances. By analyzing a game in which states independently and strategically choose how to allocate their resources, we can obtain a better understanding of how the outcome of these strategies can be suboptimal for them, and hence of what the incentives are to join alliances. In other words, we gain an understanding of the added value of alliances over simple uncoordinated strategies.

¹On alliances in international politics, see Niou, Ordeshook & Rose (1989) and Morrow (2000).

3 Allocating Troops

In 1914, German Emperor Wilhelm II was concerned about fighting a war on two fronts. At the last minute on August 1, he attempted to stop the mobilization and the imminent aggression against Luxembourg. The idea was to offer France autonomy for Alsace in exchange for a pledge of neutrality. Then, Germany could “go to war against Russia only. [It would] simply march the whole of [its] army to the East” (Tuchman 1994, p. 93). Unfortunately, the mobilization was too advanced and the process could not easily be undone. However, the insistence and urgency with which the Kaiser attempted to avoid a war on two fronts illustrates the costs associated with allocating troops at different bargaining tables.

Two-front wars abound in history. Napoleon fought the British at the same time as the Russian Empire; the British were at war with both France and the United States in 1812; the US had to split its forces between the European front and the Pacific theater; Hitler was also fighting on two fronts; and, in 1948, 1967 and 1973, Israel fought two-front wars. Although the problem is best illustrated in the context of a war at multiple fronts, the problem is much more general. Even when troops are not “allocated” per se, threats must be credible. The US’ multiple international commitments make threats against Iran less credible, and foreign aid given to Chad limit France’s ability to promise aid to Mali. How do states allocate their scarce sources of coercion? And how does the number of fronts affect the ability to secure a large share of the pie? Finally, does war ever occur in equilibrium?

3.1 Setup

I consider a game of complete information between a country h (home) and $N = \{1, 2, \dots, N\}$ other countries indexed by n . Each country $i \in \{h, N\}$ is endowed with a fixed number of soldiers $s_i > 0$. For simplicity of exposition, assume that, at the beginning of the game, each country $n \in N$ owns a territory of size π_n , and that h owns nothing.²

²This simplifies the notation, and is without loss of generality.

The game proceeds in an infinity of periods, each divided into sequential steps. In the first step of period $t \in T$, h negotiates with country 1 over the partition of π_1 . The outcome of this negotiation is observed by all players and, once it is over, h negotiates with 2 over the partition of π_2 , and so on. After the negotiation with state N , period $t + 1$ starts (and h starts negotiating with 1 again, in an infinite loop).

Each negotiation between h and $n \in N$ follows a simple take-it-or-leave-it protocol (figure 5.1). First, h makes an offer π_n^h , which denotes the share of π_n it demands (and hence n would receive $\pi_n - \pi_n^h$). Then, n chooses either to accept the offer, in which case h and n each receive the specified share of π_n , or to reject it. If the offer is rejected, then war starts, each party incurs a cost $k_i > 0$, and h chooses an allocation s_h^n , denoting the number of soldiers h sends to front n .

The outcome of the war—total victory from one side or the other—is determined by a simple lottery with expected value $p(s_h^n, s_n)$.³ In other words, the outcome is determined both by h 's allocation of troops at this front and by his opponent n 's number of soldiers. If one side wins, then the other player is eliminated from the game and the winner controls that pie forever. I assume that the soldiers sent to this front cannot be reused in the future (i.e., they die, or fighting takes time). This represents the problem of scarcity—and hence of allocation: soldiers cannot be allocated to two fronts simultaneously. The game then proceeds to the next negotiation between h and $n + 1$ until $n = N$, at which point the game ends. A strategy a_h for h is defined as

$$a_h = (a_n \times (\pi_n^h) \times (s_h^n))_{n \in N} \in \mathbb{R}^{3N};$$

A strategy for $n \in N$ is simply $a_n = [0, \pi_n] \times \{Accept, Reject\}$. Payoff r_i for $i \in \{h, N\}$ is given by

$$r_i = \sum_{t=0}^T \sum_{n=1}^N u_i(\pi_n^t),$$

where u_i is non-decreasing and $u'' = 0$ for simplicity (risk neutrality).⁴ For simplicity,

³I assume $\frac{\partial p}{\partial s_h^n} \geq 0$, $\frac{\partial p}{\partial s_n} \leq 0$ and that $p(\cdot)$ is continuous and differentiable.

⁴So for $i \in N$, we have $r_i = u_i(\pi_n - \pi_n^h)$.

I normalize $u_i(0) = 0$ and $u_i(\pi_n) = 1$. In other words, all pies have equal values for everyone. This has little importance for the result, but simplifies the presentation.

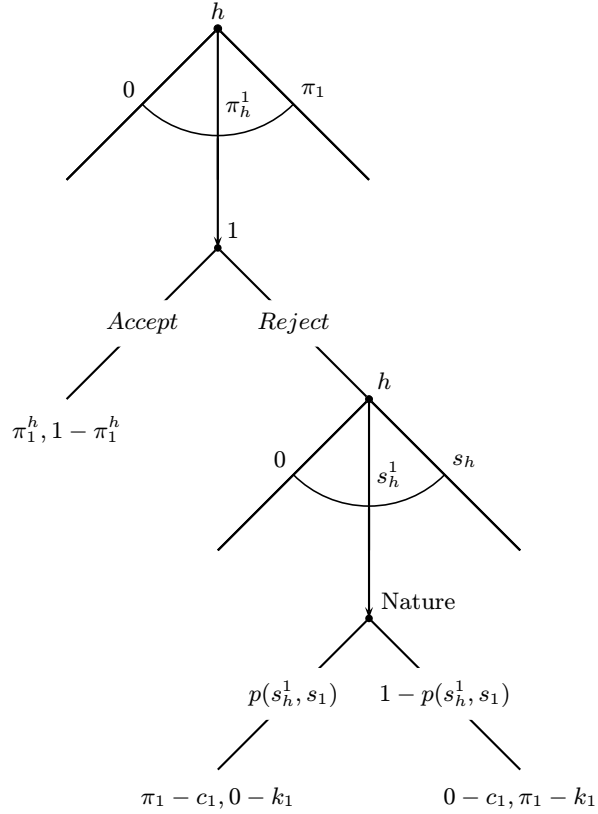


Figure 5.1: First Round of the First Period of the Allocation Game: h vs. State 1

3.2 Equilibrium

Even though h can rely on threats and hence need not actually allocate any soldier to extract concessions, the surprising equilibrium is that h cannot extract a larger total of concessions than it would by physically assigning troops to fronts. This is because any threat beyond this level is inherently non credible and will be rejected by the other state.

To gain some intuition for the result, consider a simple example in which there are only three states (h , 1 and 2) and no cost of war. First h negotiates with 1, then with 2. Assume now that h demands $\pi_1^h = p(s_h, s_1)$ from 1. That is, assume

that h threatens to allocate all of its troops to this front. This would be a credible demand if the game was to stop there, and A would accept it since her expected utility for war is $1 - p(s_h, s_1) = \pi_1^h$. However, in this game h also needs to save troops to allocate to front 2, so that her threat to employ all her troops against 1 are not credible. Proposition 3.1 generalizes this result.

Proposition 3.1. *Let*

$$((s_h^1)^*, \dots, (s_h^N)^*) \equiv \operatorname{argmax}_{(s_h^n)_{n \in N}} \sum_{n \in N} p(s_h^n, s_n) \quad (5.1)$$

Then, for each $n \in N$, and in each period t , h offers $\tilde{\pi}_n^h = p((s_h^n)^, s_n) + k_n$, which n accepts.*

So the problem for h is simply the following maximization under constraint:

$$\begin{aligned} \operatorname{argmax}_{(s_h^n)_{n \in N}} \sum_{n=1}^N p(s_h^n, s_n) \\ \text{s.t.} \quad \sum_{n=1}^N s_h^n \leq s_h \end{aligned} \quad (5.2)$$

In other words, the best h can do is allocate troops according to their marginal returns in terms of the likelihood of prevailing at one front. What is remarkable about this outcome is that h 's total benefits are equal to its total power. That is, even though troops are never used, they must still be "allocated" as if they were used. In other words, h cannot "reuse" its power at multiple tables. Even though the benefits h obtains at each table only rely on threats, these threats are credible only if h does not overextend, which is the case only if h allocates troops *as if* they were actually going to be allocated.

With complete information, then, the balance of power is the equivalent of a general equilibrium in which each state allocates its power (its money) to the front (the good) that provides the largest marginal utility. This is a definition of the balance of power that matches casual empirical observation: the system is not

balanced when all states are equal, but rather when none of them is gaining a share of benefits disproportionate relative to its ability to hurt. Note, however, that this result—which extends the one by Powell (1999) to the N-Player case—holds only under complete information, as the next subsection explores.

3.3 Incomplete information

Scholars generally agree that, under complete information in the dyad, war should not occur (barring any commitment problem). Here, I show instead that war can occur despite complete information in the dyad. It is not sufficient that h 's number of troops, or any of its attributes, be common knowledge. Rather, war can occur even if there is uncertainty *only* over the number of troops of third parties ($n \in N$ here).

To illustrate the idea, assume for example that player $N - 1$ has complete information about h 's total number of soldiers and their allocation at each table, but is uncertain about how many soldiers country N owns. More specifically, let b_{N-1}^N denote the beliefs of country $N - 1$ about N 's number of soldiers and assume, for example, that $b_{N-1}^N > s_N$. That is, $N - 1$ overestimates country N 's power. These beliefs are not common knowledge. It is easy then to see that this can lead bargaining between $N - 1$ and h to break down, since, in essence, $N - 1$ miscalculates h 's optimal program. In step $N - 1$, h will claim that she needs few troops to deal with N , and hence will demand a large share of π_{N-1} .⁵ Given $N - 1$'s beliefs, however, h 's claim appears as a bluff. As a result, both parties can prefer fighting.⁶

The converse is also true. If beliefs are mistaken in the opposite direction (and assuming beliefs are common knowledge), then war never occurs and h can obtain a disproportionate share of the pie. Assume, for example, the extreme case in which none of the N states is aware of its fellow states. That is, $b_n^m = 0$ for all $n, m \in N$. Then h 's threat to allocate all its troops ($s_h^n = s_h \forall n \in N$) to this front is credible,

⁵Note that this does not contradict proposition 3.1, since I now assume incomplete information.

⁶Note that h 's choice of offer does not necessarily constitute a separating equilibrium, since h has an incentive to bluff.

and hence h can extract a total of

$$\sum_{n \in N} \left(p(s_h, s_n) + k_n \right). \quad (5.3)$$

This simple example illustrates the difficulty of extending bilateral power to multilateral power. The fact that h would be weak in a bilateral fight against each of the other N states separately does not necessarily imply that its *total* share of the pie will be low. In fact, it might be higher than any of the other states', provided it has more information.

3.4 The Algebra of Fronts

In this section, I consider a more dynamic model in which the number of fronts is not fixed as in section 1, but rather is a result of h 's strategic choices. In particular, there are benefits to suppressing fronts in order to focus all energy on another one. I show in this section that war can occur in equilibrium despite complete information. The logic is related to the one explored in chapter III in the sense that a state can “invest” in war: fight is not only for its expected direct benefits, but also for what fighting the war itself means in terms of future power. The logic is different, however. Fighting is profitable here not because it generates capabilities that can be used in future combat, but rather because it frees existing capabilities for other fronts.

To see this, assume now that the game takes place in two rounds. The first round is the same as in the previous section. That is, h negotiates in turn with $(1, 2, \dots, N)$, each time either reaching a partition of the pie or fighting. But assume now that this round does not end the game. During the second round, those pies that have been won during the first round remain under the control of the winner, and the loser disappears. This means that no more troops need be allocated to this front, and these capabilities are freed for other fronts. Consider for example the Schlieffen plan. The idea was to avoid a two-front war by first rapidly defeating France in the West before the “Russian steamroller” could attack East Prussia. The plan was to

take advantage of differences in the countries' speed of mobilization—Russia being the slowest.

How war could occur in this case despite complete information is obvious. Assume, for example, that h fights against N in the last stage of the first round. Then with probability $p = p((s_h^N)^*)$ it wins, and with probability $1 - p$ it loses. Whether it wins or loses, $(s_h^N)^*$ troops will be freed for the next round, and used to put additional pressure at other fronts. If the benefits from the additional pressure are greater than the cost of war against N , then fighting N is rational, despite complete information.⁷

4 Bargaining Chips?

In the previous section, I studied the question of allocation of scarce coercive means. In this section, I argue that not all instruments of coercion are scarce. Rather, I draw a distinction between what I call *depletable* and *non-depletable* capabilities. Depletable forms of power can only be allocated to a specific opponent or issue. For example, troops sent to Iraq cannot fight in Afghanistan at the same time. Similarly, a financial reward given in exchange for a favorable vote at the UN cannot be given to both A and B . This specific amount of money has been spent: capabilities are depletable in this case.

On the contrary, non-depletable capabilities are not scarce. They can be reused to affect the behavior of multiple opponents. That is, they can be promised, given, threatened or withdrawn without affecting the ability to influence other opponents. For example, I can share information with B in exchange for concessions, and simultaneously do the same thing with C ;⁸ I can scold both China and Russia for their human rights record; I can offer access to my market (or to lower trade barriers) as a commodity in exchange for concessions.

⁷A similar idea is explored in Garfinkel & Skaperdas (2000), where war can be rational to save on defense costs in the future.

⁸Note in this case that C might then get the information from B instead, but this is beyond this paper's scope.

The difference between the two types of capabilities is one of opportunity costs. In the first case, using capabilities reduces their future or concurrent use, and will therefore be used with more care. More specifically, actors will need to *allocate* their capabilities to the most profitable front. For example, troops need to be kept for the most pressing situations not only because their use is costly in absolute terms (monetary and humanitarian costs), but also because committing troops to one place prevents using them for another purpose: troops “allocated” in Afghanistan cannot be committed to Iraq at the same time, as we saw in the previous section.

Note that depletable capabilities need not be tangible. The ability to vote, for example, is an example of a pure depletable capability. Whether used in elections, Congress, or coalition formation, votes or policies express one specific combination of preferences—a bundle—and not another one. Thus, pleasing one member of a potential coalition prevents pleasing another member sitting at the opposite of the spectrum; voting for Bush prevents voting for Kerry. And while China might be able to exchange its respect for human rights against foreign aid assistance from Japan, this specific change in policy cannot be reused.

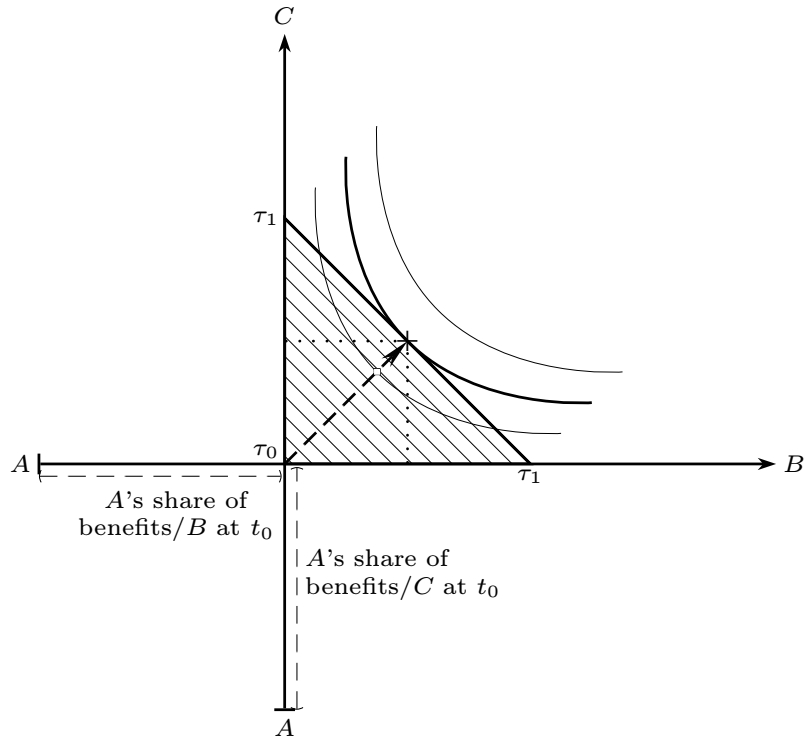
Depletable	Mixed	Non-depletable
Military Power	Military Protection	Access to market
Economic aid	Statements	Sharing technologies
Vote		Praise
Policies		Information, intelligence

Table 5.1: Depletable, Non-Depletable and Mixed Forms of Power

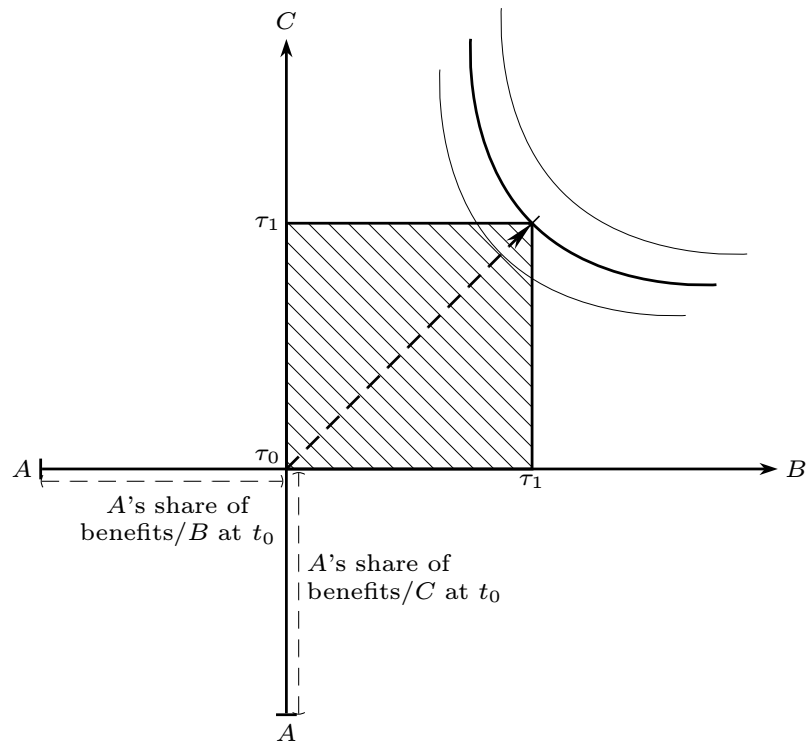
To be sure, the distinction between depletable and non-depletable capabilities is not a binary one. Rather, there exists a continuum of types of capabilities that range from low opportunity costs (non-depletable capabilities) to high ones (depletable capabilities). In particular, we can define mixed forms of capabilities as capabilities that are not purely rival, but that are subject to what can be understood as crowding effects. For example, statements can be issued freely and it would seem that their use does not reduce their concurrent use. Yet there is such a thing as overusing statements. Criticisms, for example, derive their influence from their

scarcity: countries dislike being singled out and criticized. But if all are criticized, the effect is lost. Thus, while the use of criticism—a way to affect the opponent’s utility, and hence to exert power—is not scarce per se, its overuse reduces its value.⁹ As a result, there are opportunity costs to using criticisms. Similarly, military protection can only be promised to a limited number of states or it will lose its credibility and hence other actors will be willing to concede less and less to obtain it. To clarify ideas, Table 5.1 gives examples of depletable and non-depletable forms of capabilities. The distinction is not only typological. It has important implications for the amount of concessions that states can obtain. For example, troops need to be committed to a specific area (A) rather than another (B). This allocation provides benefits, but also implies opportunity costs, since these troops cannot be made available elsewhere. With non-depletable capabilities, however, concessions can be extracted from both A and B . Since access to the domestic market can be promised to both A and B , both will be willing to pay for it. Formally, $\frac{\partial f}{\partial D} = 1$ for depletable capabilities, while $\frac{\partial f}{\partial ND} = n \geq 1$ for non-depletable capabilities, where $n \in \mathbb{R}+$ denotes the number of players A is interacting with. Figure 5.2 illustrates these ideas graphically. Figure 5.2(a) displays a typical budget set such as the one used in microeconomic analysis. Each axis denotes an amount of “consumption” of each bundle—her share of each territory. Imagine for example that A allocates all of her foreign aid to B . In that case, A is able to obtain an amount τ_1 of this “pie”. However, that also means that no foreign aid will be allocated to C , so that A ’s share of the C pie will remain at the status quo. This is an example of a depletable capability: the use of power against one of the actors reduces the benefits against the other. Figure 5.2(b), on the contrary, shows the case of non-depletable forms of power. Here, A obtains a share τ_1 from B in exchange for access to its market, and *also* a share τ_1 from C in exchange for this access. As a result, A is able to reach a higher indifference curve than with private capabilities. In fact, the more opponents A is interacting with, the more non-depletable capabilities yields benefits, as A can extract an amount τ_1 of concession from each opponent (the result obviously extends to further dimensions).

⁹Sartori (2002) makes a related point.



(a) Depletable power



(b) Nondepletable power

Figure 5.2: Sets of achievable distributions of benefits after a gain of power

As a result, A should obtain a total of $n\tau_1$.¹⁰

Non-depletable forms of power can be compared to club goods: the actor sells a “service” or more generally sells access to a flow of benefits in exchange for concessions (the price). Offering one more unit of the good is free or very cheap. Depletable forms of power, on the contrary, can be compared to ‘wealth’ or ‘endowment’ in economics: once spent, they cannot be reused for a different purpose. Scarcity then enters the analysis of power and allocation problems are relevant: countries will allocate their power to the most rewarding situation, and withdraw it when the opportunity cost is too high.

5 Conclusion

This paper asked four main questions. First, how do states allocate their power, and what consequences does it have for the distribution of benefits in the system? Unsurprisingly, I found that they should allocate it according to its marginal returns. More interesting is the finding that, even though power need not actually be exercised—troops need not be allocated—the distribution of benefit actually reflects the distribution of capabilities. Threats have no bite unless they rely on tangible means of coercion. With incomplete information, however, the country with more information can potentially extract more concessions than any actual allocation of power would allow.

Second, this paper asked whether issues of allocation can lead to inefficiencies. I showed two reasons why war might occur despite complete information in the dyad: first, incomplete information about third parties can lead to miscalculations in the dyad itself. Second, allocating resources such as troops to different fronts is costly. Instead, states can prefer fighting to free their troops and apply more pressure—thereby obtaining more benefits—at other fronts.

Finally, the paper asked *when* power needs to be allocated. In particular, I drew a distinction between depletable capabilities—those that can only be used once—

¹⁰This is assuming, for simplicity, that all opponents are identical. The result obviously holds if this is not the case, but must be adjusted by the strength of each opponent.

and non-depletable ones, which can be reused at different fronts simultaneously. This dichotomy has not been explored in the literature on power, and I showed its implications in terms of states' ability to obtain concessions.

This paper is a first attempt at modeling the allocation of power explicitly. More work is needed. In particular, when do states "overstretch" their capabilities? And do powerful states tend to receive a disproportionate share of benefits in the system? These questions will be the object of future research.

Appendix: Proofs

Proof of Proposition 3.1. The proof proceeds in two steps. I first show (i) that in any stage n , any offer $\pi_h^n \neq \tilde{\pi}_h^n$ cannot be part of an equilibrium. I then demonstrate (ii) that n always accepts π_h^n .

(i) That any offer $\pi_h^n < \tilde{\pi}_h^n$ cannot be made in equilibrium is obvious, since it would violate the optimality of the schedule $((s_h^1)^*, \dots, (s_h^N)^*)$. The other case, however, requires a little more work. Assume that h makes an offer $\pi_h^n > \tilde{\pi}_h^n$. Then n has an incentive to reject it since, after rejection, it is optimal for h to allocate only $(s_h^n)^*$. Any other allocation would violate the optimality of the schedule. In other words, h 's threat is not credible, and n will reject it. Since war is costly, h 's initial offer was therefore not a best response and cannot be part of an equilibrium.

(ii) This follows directly from Powell (1999, Ch. 3): since $u(\tilde{\pi}_h^n) = u(\text{war})$, n weakly prefers accepting the offer. \square

CHAPTER VI

Conclusion

This dissertation analyzed how states strategically manipulate their power to suit their long-term interests. In particular, why and how do they negotiate or fight over their relative power? When do these negotiations avoid costly conflicts and when, on the contrary, do they break down into war? I showed that the range of states' strategies toward power cannot be reduced to a simple rule.

First, they sometimes negotiate over their power to reduce the tensions caused by large and rapid shifts in relative power (chapter II). Because the rising state expects that the shift in power will lead to preventive action (war) by the declining state, he prefers making concessions today such that his power tomorrow will be reduced. Under a broad set of conditions, such concessions are feasible and avoid war. In other words, most of the time the rising state is able to commit to a specific future partition of the pie by reducing today the determinants of tomorrow's power. Using a large number of historical examples, I showed how states have solved all three main kinds of commitment problems identified in the literature by designing mechanisms to credibly reduce their expected power tomorrow. Preemptive wars, for example, are avoided by withdrawing troops from the border or reaching agreements on offensive weapons; the commitment problems that make ending war so difficult can be solved by reaching disarmament agreements; and preventive wars, caused by long and deep shifts in the distribution of power, are avoided by sharing territories, negotiating over navies, or pooling capabilities as was the case for the European Coal and Steel

Community.

Chapter III then examined the opposite question: Do states ever fight wars of investments—wars in which the goal is not conquest itself, but rather what this conquest implies in terms of future power. This type of war had been addressed in the informal literature on international relations, but without a clear understanding of *when* states would want to initiate. Their existence and rationality was simply assumed. Instead, I showed the counterintuitive result that fighting *B* to acquire capabilities that increase the likelihood of prevailing against *C* is rational *only if* these additional capabilities increase *A*'s likelihood of prevailing against *C* more than proportionally. This result challenges two main bodies of literature: it first demonstrates the existence of a third rationalist explanation for war beyond incomplete information and commitment problems; it also shows that the pursuit of power by costly means such as wars are not as common or justifiable as realists like to argue. Moreover, this explanation for war accounts for behavior that seem to defy rationality, or at least to be at odds with existing rationalist explanations for war. Wars of investment such as the American war in Vietnam or the Eighty Years War are difficult to explain by relying solely on incomplete information or commitment problems caused by rapid changes in power—lest we assume irrationality or at least risk-acceptance. The argument that war does not end the game—wars can be fought for purposes other than simply conquering a territory—rationalizes this behavior.¹

Chapter IV analyzed another strategy that is best explained by reference to long-term goals: states often attempt to misrepresent or conceal their true power and preferences, because revealing the truth would deprive them of leverage in future negotiations. I explored a number of mechanisms by which they can avoid revealing their true preferences. First, they can lie. But lying is costly since it implies adopting a behavior that does not match one's preferences.² This is not to exclude lying as a

¹Schelling (1980) makes a similar argument when he writes about reputation as a cause of war. In chapter III, reputation can be conceived as a special case of a capability that states might want to invest into. Thus, Schelling's argument can very well be conceived as an example of wars of investment.

²This is not to mean that states would necessarily not be willing to incur these costs, for example to improve their reputation. However, the focus of this chapter was on situations in which lying is

possible choice, but the focus was on situations in which lying today, even for gains tomorrow, is too costly, and hence in which the player would want to *conceal* its private information rather than misrepresent it. Second, they can keep their actions private. By avoiding publicity, they also avoid revealing embarrassing facts about themselves. However, remaining silent can reveal more than speaking. A major way in which states can get around this is by being vague—by choosing statements or actions that can be interpreted in multiple ways (e.g, the US’s attitude toward the defense of Taiwan). Finally, states can attempt to cloud the issue by including many variables in their agreements or statements, such that any inference about which variable is causing the choice is made more complicated.

Finally, I explored in chapter V the problem of the allocation of power. States typically pursue multiple foreign policy goals, but their means of coercion are scarce. The troops a state can deploy and the number of wars it can fight simultaneously, for example, are limited. As a result, states must choose strategically where and how much of their troops and threats they allocate at each front. This chapter showed three main results. First, the system is in equilibrium only when the distribution of benefits reflects the distribution of power. With complete information, threats have no bite unless they rely on existing means of coercion. With incomplete information, however, the country with more information can potentially extract more concessions than any actual allocation of power would allow. Finally, inefficiencies can emerge even under complete information in the dyad: first, incomplete information about third parties can lead to miscalculations in the dyad itself; second, allocating resources such as troops to different fronts is costly. Instead, states can prefer fighting to free their troops and apply more pressure—thereby obtaining more benefits—at other fronts.

Perhaps the main contribution of this dissertation is a better understanding of the rationality of war. It uncovered a number of mechanisms by which war can occur between rational actors, beyond the main ones the formal literature has identified. It

too costly, and on the mechanisms that states can use to avoid revealing their private information without lying.

also challenged the logic of perhaps the most important cause of bargaining failure—fear caused by rapid shifts in power. More generally, an understanding of war requires an understanding of power and of states’ strategic behavior towards it. When we observe that large and rapid shifts in power lead to fear and conflict, we should ask why the states were unable to reach an agreement that would slow down the speed or tame the extent of the shift. States often reach such agreements; why do they sometimes fail? And when we observe wars that seem irrational, or at least risk-acceptant, we should ask whether they are not justified by broader, longer-term power considerations.

This dissertation was largely an exercise in logic. Its purpose was to establish logical connections and propositions about the way rational actors behave. Some of them can be empirically tested. For example, we can examine when and how states have negotiated over their relative power in history. When do these negotiations succeed in alleviating fears, and when they do not. Chapter II started to do so, but a more systematic and extensive analysis is clearly needed. Similarly, leaders’ perception of rates of return to conquest can be used to better understand empirically whether states do invest in war.

But what if more systematic empirical evidence was to show that, for example, the rising state never sincerely attempts to alleviate the fears of the declining state? Or if we cannot convincingly prove that states fight wars of investment? Would this invalidate the point of this exercise? No, because the goal is not simply to describe what states do or do not, but rather to exclude illogical or incomplete statements about the rationality of war. This matters first because excluding illogical or incomplete explanation lets us look in the right direction. It forces us to change statements such as “war occurred because of a growth differential” to “it did because the rising state failed to alleviate the fears of the declining state;” or “wars occur because state pursue power” to “they occur because leaders perceive increasing returns to fighting.” Perhaps most important, however, the findings have normative implications. We ultimately hope to use this better understanding of wars to derive recommendations to avoid them—design institutions, or bargaining procedures and

warning mechanisms to avoid inefficiencies. But first, we need to understand exactly what problem these mechanisms should solve. This work was intended as a step towards such an understanding.

BIBLIOGRAPHY

- Acemoglu, Daron & James Robinson. 2000. "Why Did the West Extend the Franchise? Democracy, Inequality and Growth in Historical Perspective." *Quarterly Journal of Economics* 115(4):1167–1199.
- Alesina, Alberto & Alex Cukierman. 1990. "The Politics of Ambiguity." *Quarterly Journal of Economics* 105(4):829–850.
- Alesina, Alberto & Enrico Spolaore. 2003. *The Size of Nations*. Cambridge, MA: The MIT Press.
- Alt, James E., Randall L. Calvert & Brian D. Humes. 1988. "Reputation and Hegemonic Stability: A Game-Theoretic Analysis." *American Political Science Review* 82(2):445–466.
- Aragones, Enriqueta & Zvika Neeman. 2000. "Strategic Ambiguity in Electoral Competition." *Journal of Theoretical Politics* 12(2):183–204.
- Axelrod, Robert. 1981. "The Emergence of Cooperation Among Egoists." *American Political Science Review* 75(2):306–318.
- Axelrod, Robert. 1984. *The Evolution of Cooperation*. New York, NY: Basic Books.
- Axelrod, Robert. 1997. *The Complexity of Cooperation: Agent-Based Models of Competition and Collaboration*. Princeton, NJ: Princeton University Press.
- Baldwin, David A. 1989. *Paradoxes of Power*. New York, NY: Basil Blackwell.
- Baliga, Sandeep & Tomas Sjöström. 2008. "Strategic Ambiguity and Arms Proliferation." *Journal of Political Economy* 116(6):1023–1057.
- Bavelas, Janet. 1983. "Situations that Lead to Disqualification." *Human Communication Research* 9(2):130–145.
- Bennett, Scott & Allan C. Stam. 1996. "The Duration of Interstate Wars, 1816–1985." *American Political Science Review* 90(2):239–257.
- Biddle, Stephen. 2004. *Military Power: Explaining Victory and Defeat in Modern Battle*. Princeton, NJ: Princeton University Press.
- Bijian, Zheng. 2005. "China's 'Peaceful Rise' to Great-Power Status." *Foreign Affairs* 84(5):18–24.
- Blainey, Geoffrey. 1988. *The Causes of War*. Sydney: Macmillan Co.

- Bolstad, William M. 2004. *Introduction to Bayesian Statistics*. New York, NY: Wiley-Interscience.
- Branham, Robert J. 1980. "Ineffability, Creativity, and Communication Competence." *Communication Quarterly* 28(3):11–21.
- Buchanan, James M. & Yong J. Yoon. 1994. *The Return to Increasing Returns*. Ann Arbor, MI: University of Michigan Press.
- Buell, Raymond. 1922. *The Washington Conference*. New York, NY: Appleton and company.
- Campbell, John. 1983. "Ambiguity in the Issue Positions of Presidential Candidates: A Causal Analysis." *American Journal of Political Science* 27(2):284–293.
- Coutau-Bégarie, Hervé. 1995. *Le Désarmement Naval*. Paris: Economica.
- Crawford, Vincent P. & John Sobel. 1982. "Strategic Information Transmission." *Econometrica* 50(6):1431–1451.
- D'Amato, Anthony. 1997. *International Law Studies: Collected Papers*. Amsterdam: Martinus Nijhoff Publishers.
- DeGroot, Morris H. 2005. *Optimal Statistical Decisions*. New York, NY: Wiley-Interscience.
- DiCicco, Jonathan M. & Jack S. Levy. 1999. "Power Shifts and Problem Shifts: The Evolution of the Power Transition research program." *Journal of Conflict Resolution* 43(6):675–704.
- Dippel, John V.H. 1992. *Two Against Hitler: Stealing the Nazis' Best-kept Secrets*. Westport, CT: Praeger/Greenwood.
- Donnelly, Jack. 1986. "International Human Rights: a Regime Analysis." *International Organization* 40(3):599–642.
- Ehrlich, Isaac & Richard A. Posner. 1974. "An Economic Analysis of Legal Rulemaking." *Journal of Legal Studies* 3(1):257–286.
- Eisenberg, Eric M. 1984. "Ambiguity as Strategy in Organizational Communication." *Communication Monographs* 51(3):227–242.
- Fearon, James. 1994. "Domestic Political Audiences and the Escalation of International Disputes." *American Political Science Review* 88(3):577–592.
- Fearon, James. 1995. "Rationalist Explanations for War." *International Organization* 49(3):379–414.
- Fearon, James. 1996. "Bargaining over Objects that Influence Future Bargaining Power." Annual Meeting of the APSA.

- Ferguson, Niall. 1999. *The Pity of War: Explaining World War I*. London: Penguin Books.
- Ferguson, Niall. 2006. *The War of the World: Twentieth-Century Conflict and the Descent of the West*. London: Penguin Books.
- Fon, Vincy & Francesco Parisi. 2003. "Litigation and the Evolution of Legal Remedies: a Dynamic Model." *Public Choice* 116(3):419–433.
- Fortescue, Sir John. 1927. *The Correspondence of King George the Third from 1760 to December 1783*. London: Macmillan and Co.
- Fudenberg, Drew & Jean Tirole. 1986. "A "Signal-Jamming" Theory of Predation." *Rand Journal of Economics* 17(3):366–376.
- Garfinkel, Michelle & Stergios Skaperdas. 2000. "Conflict without Misperceptions or Incomplete Information." *Journal of Conflict Resolution* 44(6):793–807.
- Gates, Robert M. 2009. "A Balanced Strategy: Reprogramming The Pentagon For A New Age." *Foreign Affairs* 88(1).
- Gilpin, Robert. 1981. *War and Change in World Politics*. Cambridge, MA: Cambridge University Press.
- Girling, John L.S. 1970. "Laos: Falling Domino?" *Pacific Affairs* 43(3):370–383.
- Glazer, Amihai. 1990. "The Strategy of Candidate Ambiguity." *American Political Science Review* 84(1):237–241.
- Goddard, Stacie E. 2006. "Uncommon Ground: Indivisible Territory and the Politics of Legitimacy." *International Organization* 60(1):35–68.
- Goffman, Erving. 1955. "On Face-Work: An Analysis of Ritual Elements in Social Interaction." *Psychiatry* 18(3):213–231.
- González de León, Fernando & Geoffrey Parker. 2001. The Grand Strategy of Philip II and the Revolt of the Netherlands. In *The Origins and Development of the Dutch Revolt*, ed. Graham Darby. New York, NY: Routledge.
- Gordon, et al. 2006. *Cobra II: The Inside Story of the Invasion and Occupation of Iraq*. New York, NY: Pantheon Books.
- Grossman, Sanford J. & Oliver D. Hart. 1983. "An Analysis of the Principal-Agent Problem." *Econometrica* 51(1):7–45.
- Hart, Oliver D. & John H. Moore. 1988. "Incomplete Contracts and Renegotiation." *Econometrica* 56(4):755–785.
- Hartzell, Caroline A. 1999. "Explaining the Stability of Negotiated Settlements to Intrastate Wars." *Journal of Conflict Resolution* 43(1):3–22.

- Heisenberg, W. 1927. "Über Den Anschaulichen Inhalt der Quantentheoretischen Kinematik und Mechanik." *Zeitschrift für Physik A Hadrons und Nuclei* 43(3):172–198.
- Hirshleifer, Jack. 2001. *The Dark Side of the Force: Economic Foundations of Conflict Theory*. Cambridge, MA: Cambridge University Press.
- Hobbes, Thomas. 1650. *The Leviathan*. New York, NY: Penguin.
- Hoddie, Matthew & Caroline Hartzell. 2003. "Civil War Settlements and the Implementation of Military Power-Sharing Arrangements." *Journal of Peace Research* 40(3):303–320.
- Hoge, James F. 2004. "A Global Power Shift in the Making." *Foreign Affairs* 83(4):2–7.
- Holmström, Bengt. 1979. "Moral Hazard and Observability." *Bell Journal of Economics* 10(1):74–91.
- Holmström, Bengt. 1999. "Managerial Incentive Problems: A Dynamic Perspective." *Review of Economic Studies* 66(1):169–182.
- Huth, Paul K. 1997. "Reputations and Deterrence: A Theoretical and Empirical Assessment." *Security Studies* 7(1):72–99.
- Jervis, Robert. 1976. *Perception and Misperception in International Politics*. Princeton, NJ: Princeton University Press.
- Jervis, Robert & Jack Snyder. 1991. *Dominoes and Bandwagons: Strategic Beliefs and Great Power Competition in the Eurasian Rimland*. Oxford: Oxford University Press, USA.
- Joll, James. 1992. *The Origins of the First World War*. London: Longman.
- Kaplan, Herbert. 1962. *The First Partition of Poland*. New York, NY: Columbia University Press.
- Kennedy, Paul. 1987. *The Rise and Fall of the Great Powers: Economic Change and Military Conflict from 1500 to 2000*. New York, NY: Random House.
- Kim, Woosang. 1992. "Power Transitions and Great Power War from Westphalia to Waterloo." *World Politics* 45(1):153–172.
- Koremenos, Barbara. 2002. "Can Cooperation Survive Changes in Bargaining Power? The Case of Coffee." *Journal of Legal Studies* 31(1):259–283.
- Koremenos, Barbara. 2007. "An Economic Analysis of International Rulemaking." *Revise and Resubmit, International Organization* .
- Koremenos, Barbara, Charles Lipson & Duncan Snidal. 2003. "The Rational Design of International Institutions." *International Organization* 55(4):761–799.

- Kowner, Rotem. 2007. *The Impact of the Russo-Japanese War*. New York, NY: Routledge.
- Kugler, Jacek & A.F.K. Organski. 1989. *The Power Transition: A Retrospective and Prospective Evaluation*. Boston, MA: Unwin Hyman.
- Kydland, Finn E. & Edward C. Prescott. 1977. "Rules Rather than Discretion: The Inconsistency of Optimal Plans." *Journal of Political Economy* 85(3):473–492.
- Lamb, Christopher. 1988. *How to Think About Arms Control, Disarmament, and Defense*. Englewood Cliffs, NJ: Prentice Hall.
- Lanchester, Frederick W. 1956. Mathematics in Warfare. In *The World of Mathematics*, ed. Newman JR. Vol. 4 New York, NY: Simon and Schuster pp. 2138–2157.
- Lasswell, Harold D. & Abraham Kaplan. 1950. *Power and Society*. Yale Univ. Press.
- Leeds, Brett A. 2003. "Do alliances deter aggression? The influence of military alliances on the initiation of militarized interstate disputes." *American Journal of Political Science* pp. 427–439.
- Leng, Russell J. 1993. *Interstate Crisis Behavior, 1816-1980: Realism vs. Reciprocity*. Cambridge, MA: Cambridge University Press.
- Levy, Jack S. 1984. "The Offensive/Defensive Balance of Military Technology: A Theoretical and Historical Analysis." *International Studies Quarterly* 28(2):219–238.
- Lewis, Jeffrey B. & Kenneth A. Schultz. 2003. "Revealing Preferences: Empirical Estimation of a Crisis Bargaining Game with Incomplete Information." *Political Analysis* 11(4):345–367.
- Liberman, Peter. 1996. *Does Conquest Pay? The Exploitation of Occupied Industrial Societies*. Princeton, NJ: Princeton University Press.
- Lipson, Charles. 1991. "Why Are Some International Agreements Informal?" *International Organization* 45(4):495–538.
- Mas-Colell, Andreu, Michael D. Whinston & Jerry R. Green. 1995. *Microeconomic Theory*. New York, NY: Oxford University Press.
- Masson, Philippe. 1981. *Histoire de la Marine - Tome I: L'ère de la voile*. Paris: Charles Lavauzelle.
- McKercher, B.J.C. 1990. *Anglo-American Relations in the 1920's: The Struggle for Supremacy*. Edmonton, AB: University of Alberta Press.
- Mearsheimer, John J. 2001. *The Tragedy of Great Power Politics*. New York, NY: Norton & Company.

- Mearsheimer, John J. 2006. "China's Unpeaceful Rise." *Current History* 105(690):160.
- Mertens, Jean-François. 2002. *Stochastic Games*. in Handbook of Game Theory with Economic Applications, Vol. 3. St. Louis, MO: Elsevier Science chapter 47, pp. 1811–1829.
- Morgenthau, Hans. 1948. *Politics Among Nations: The Struggle for Power and Peace*. New York, NY: Alfred A. Knopf.
- Morrow, James D. 1989. "Capabilities, Uncertainty, and Resolve: A Limited Information Model of Crisis Bargaining." *American Journal of Political Science* 33(4):941–972.
- Morrow, James D. 1993. "Arms Versus Allies: Trade-Offs in the Search for Security." *International Organization* 47(2):207–233.
- Morrow, James D. 2000. "Alliances: Why Write Them Down?" *Annual Reviews in Political Science* 3(1):63–83.
- Morrow, James D. & Woosang Kim. 1992. "When Do Power Shifts Lead to War?" *American Journal of Political Science* 36(4):896–922.
- Muthoo, Abinay. 1999. *Bargaining Theory with Applications*. Cambridge, MA: Cambridge University Press.
- Myerson, Roger B. 1979. "Incentive Compatibility and the Bargaining Problem." *Econometrica* pp. 61–73.
- Nalebuff, Barry. 1991. "Rational Deterrence in an Imperfect World." *World Politics* 43(3):313–335.
- Nash, John. 1950a. "The Bargaining Problem." *Econometrica* 18(2):155–162.
- Nash, John. 1950b. "Equilibrium Points in N-Person Games." *Proceedings of the National Academy of Sciences of the United States of America* 36(1):48–49.
- Nash, John. 1953. "Two-Person Cooperative Games." *Econometrica* 21(1):128–140.
- Niou, Emerson M. & Brett V. Benson. 2002. Comprehending Strategic Ambiguity: US Security Commitment to Taiwan. In *Annual Meeting of the American Political Science Association*.
- Niou, Emerson M., Peter C. Ordeshook & Gregory F. Rose. 1989. *The Balance of Power: Stability in International Systems*. Cambridge, MA: Cambridge University Press.
- Nofsinger, Robert E. 1976. "On Answering Questions Indirectly: Some Rules in the Grammar of Doing Conversation." *Human Communication Research* 2(2):172–181.

- North, Douglass C. & Barry R. Weingast. 1989. "Constitutions and Commitment: The Evolution of Institutions Governing Public Choice in Seventeenth-Century England." *Journal of Economic History* 49(4):803–832.
- Organski, Abramo F.K. 1958. *World Politics*. New York, NY: Alfred A. Knopf.
- Parker, Geoffrey. 1972. *The Army of Flanders and the Spanish Road*. Cambridge, MA: Cambridge University Press.
- Parker, Geoffrey. 1975. War and Economic Change: the Economic Costs of the Dutch Revolt. In *War and Economic Development*, ed. J.M. Winter. Cambridge, MA: Cambridge University Press pp. 49–71.
- Parker, Geoffrey. 1976. "Why Did the Dutch Revolt Last Eighty Years?" *Transactions of the Royal Historical Society* 26(2):53–72.
- Parker, Geoffrey. 1998. *The Grand Strategy of Philip II*. New Haven, CT: Yale University Press.
- Pascale, Richard T. & Anthony G. Athos. 1982. *The Art of Japanese Management*. Middlesex, England: Penguin Harmondsworth.
- Powell, Robert. 1990. *Nuclear Deterrence Theory: The Search for Credibility*. Cambridge, MA: Cambridge University Press.
- Powell, Robert. 1993. "Guns, Butter, and Anarchy." *American Political Science Review* 87(1):115–132.
- Powell, Robert. 1999. *In the Shadow of Power*. Princeton, NJ: Princeton University Press.
- Powell, Robert. 2002. "Bargaining Theory and International Conflict." *Annual Review of Political Science* 5(1):1–30.
- Powell, Robert. 2004. "The Inefficient Use of Power." *American Political Science Review* 98(2):231–241.
- Powell, Robert. 2006. "War as a Commitment Problem." *International Organization* 60(1):169–203.
- Putnam, Linda L. & Ritch L. Sorenson. 1982. "Equivocal Messages in Organizations." *Human Communication Research* 8(2):114–132.
- Rasmusen, Eric. 2006. *Games and Information: An Introduction to Game Theory*. New York, NY: Wiley-Blackwell.
- Real Academia de la Historia. 1929–34. *Colección de documentos ineditos para la historia de España y de sus Indias*. Madrid: Archivo Historico Espanol.
- Robinson, James H. 1906. *Readings in European history*. Vol. 2 Boston, MA: Ginn and Company.

- Romer, Paul M. 1990. "Are Nonconvexities Important for Understanding Growth?" *American Economic Review* 80(2):97–109.
- Roskill, Stephen. 1968. *Naval Policy Between the Wars: Volume I – The Period of Anglo-American Antagonism, 1919 – 1929*. London: Collins.
- Roskill, Stephen. 1976. *Naval Policy Between the Wars: Volume II - The Period of Reluctant Rearmament, 1930 – 1939*. London: Collins.
- Rubinstein, Ariel. 1982. "Perfect Equilibrium in a Bargaining Model." *Econometrica* 50(1):97–109.
- Sartori, Anne E. 2002. "The Might of the Pen: A Reputational Theory of Communication in International Disputes." *International Organization* 56(1):121–149.
- Schelling, Thomas. 1980. *The Strategy of Conflict*. Cambridge, MA: Harvard University Press.
- Schultz, Kenneth. 2002. *Democracy and Coercive Diplomacy*. Cambridge, MA: Cambridge University Press.
- Sen, Amartya. 1993. "Internal Consistency of Choice." *Econometrica* 61(3):495–495.
- Seymour, Charles. 1926. *The Intimate Papers of Colonel House*. Boston, MA: Houghton Mifflin.
- Shepsle, Kenneth. 1972. "The Strategy of Ambiguity: Uncertainty and Electoral Competition." *American Political Science Review* 66(2):555–568.
- Signorino, Curtis S. 1999. "Strategic Interaction and the Statistical Analysis of International Conflict." *American Political Science Review* 93(2):279–297.
- Singer, David J. 1963. "Inter-Nation Influence: a Formal Model." *American Political Science Review* 57(2):420–430.
- Singer, David J. & Melvin Small. 1972. *The Wages of War, 1816–1965: A Statistical Handbook*. New York, NY: Wiley.
- Slantchev, Branislav L. 2003. "The Power to Hurt: Costly Conflict with Completely Informed States." *American Political Science Review* 97(1):123–133.
- Smith, Alastair & Allan C. Stam. 2004. "Bargaining and the Nature of War." *Journal of Conflict Resolution* 48(6):783.
- Spence, Michael. 1973. "Job Market Signaling." *Quarterly Journal of Economics* 87(3):355–374.
- Stasavage, David. 2004. "Open-Door or Closed-Door? Transparency in Domestic and International Bargaining." *International organization* 58(4):667–703.

- Stoessinger, John G. 2001. *Why Nations Go to War*. Eighth ed. New York, NY: St. Martin's Press.
- Svejnár, Jan. 1986. "Bargaining Power, Fear of Disagreement, and Wage Settlements: Theory and Evidence from U.S. Industry." *Econometrica* 54(5):1055–1078.
- Taylor, Allan J.P. 1954. *The Struggle for Mastery in Europe, 1848–1918*. New York, NY: Oxford University Press.
- Thucydides. 1984. *The Peloponnesian War*. New York, NY: Penguin.
- Tirole, Jean. 1999. "Incomplete Contracts: Where Do We Stand?" *Econometrica* 67(4):741–781.
- Toft, Monica. 2003. "Indivisible Territory, Geographic Concentration, and Ethnic War." *Security Studies* 12(2):82–119.
- Tuchman, Barbara. 1994. *The Guns of August*. New York, NY: Ballantine books.
- UNESCO. 1989. *Convention on the Rights of the Child*. United Nations Treaty Collection.
- Vagts, Alfred. 1956. *Defense and Diplomacy: The Soldier and the Conduct of Foreign Relations*. New York, NY: Kings Crown.
- Van Evera, Stephen. 1999. *Causes of War*. Ithaca, NY: Cornell University Press.
- Varian, Hall R. 1982. "The Nonparametric Approach to Demand Analysis." *Econometrica* 50(4):945–973.
- Walt, Stephen M. 1985. "Alliance Formation and the Balance of World Power." *International Security* 9(4):3–43.
- Walt, Stephen M. 1987. *The Origins of Alliances*. Ithaca, NY: Cornell University Press.
- Walter, Barbara. 2000. Explaining the Apparent Indivisibility of Territory. In *American Political Science Association Annual Conference*.
- Wender, Paul H. 1967. "Communicative Unclarity: Some Comments on the Rhetoric of Confusion." *Psychiatry* 30(4):332.
- Wilson, Robert. 1985. Reputations in Games and Markets. In *Game-Theoretic Models of Bargaining*. Cambridge, MA: Cambridge University Press pp. 27–62.
- Woods, Kevin, James Lacey & Williamson Murray. 2006. "Saddam's Delusions: The View From the Inside." *Foreign Affairs* 85(3):2–26.