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Essays on bargaining and strategic communication

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Chapter 1 Introduction

1.1 Overview

Communication and bargaining are social activities that permeate many aspects of life. We negotiate with strangers, friends and foes alike: We strike political and business deals, try to cajole our friends into the restaurant we like and haggle in the family about the small (who changes the diapers) and big (who gets the children after divorce). The two activities are intimately linked: Bargaining is done through communication and many instances of communication involve a certain degree of strategic behavior and bargaining.

This thesis is a collection of four essays on bargaining and strategic communication from the perspective of behavioral economics. These two topics have a rich tradition in standard economics, in particular in game theory. In recent years, behavioral economists have been able to improve on the predictions of standard economics by relaxing its assumptions and supplementing theory with experimental data. A common thread running through this thesis is its focus on strategic situations (games) where strict adherence to traditional assumptions of rationality and equilibrium fail to yield helpful predictions. As such, it falls within the domain of behavioral game theory. In particular, it belongs to the branch that focuses on predicting aggregate behavior of boundedly rational individuals in dynamic settings. The first and last study we present are applications of behavioral methods to economic and political questions (in Chapters 2 and 5). Chapter 3 and 4 provide a methodological contribution by introducing and testing a behavioral stability measure for cheap talk equilibria. In the remainder of this introduction, we first provide an overview showing the common threads running through the chapters. Subsequently, we discuss each study and its contribution to the literature in more detail.

In Chapter 2 we study how bargaining power influences the clarity of communication. In other fields the relation between power and communication is widely recognized, but in economics this relation is a largely untouched research

area. By modeling communication as a cheap talk game, we get a remarkable theoretical result: The informed party cannot transmit much information if she has little power, as the uninformed party can use that information to exploit her. Increasing the informed party's power reduces the extent to which she can be exploited. This, in turn, increases the maximum amount of information transmission possible in equilibrium. The analysis leaves one issue open: increasing the informed party's power does not eliminate equilibria with little information transmission. Hence, to make a prediction we need an equilibrium refinement. However, cheap talk equilibria are hard to refine and existing refinements have little predictive force in this model.

This leads us to the open problem that no equilibrium refinement exists that is generally predictive in cheap talk games. We take up this challenge in Chapter 3, which introduces the Average Credible Deviation Criterion (ACDC), a stability measure for cheap talk equilibria. ACDC builds on previous rational theories of credible deviations. It manages to be generally predictive by relaxing the common rationalistic assumptions that stability is binary and that an equilibrium is completely upset by any (credible) deviation. We show that the predictions of ACDC are sensible across a wide range of games and that it can organize data well from earlier experiments. One application is that ACDC selects a most informative equilibrium in the class of games studied in Chapter 2. This allows us to substantiate the prediction that an increase in the Sender's relative power leads to an increase in *actual* information transmission.

In Chapter 4, we put ACDC to the test in a new set of experiments. This experiment is the first to systematically test whether and to which extent credible deviations matter. We use the class of cheap talk games introduced in Chapter 2, as this allows for large equilibrium sets and hence provides a good testing ground for refinements. We find clear support for the predictions of ACDC. In addition, we designed the experiment in such a manner that we can also directly test the hypothesis of Chapter 2. The data shows that increasing power indeed increases information transmission.

Finally, in Chapter 5 we study how the formality of (legislative) bargaining affects its outcome. Whereas Chapters 2, 3 and 4 focus on information transmission during bargaining, Chapter 5 assumes complete information and zooms in

on the bargaining process itself. The bargaining problem studied here shares important characteristics with that of Chapter 2 (and 4): both have a non-convex outcome set that consists of the real line on which preferences are single peaked and a disagreement point outside of the line. Chapter 5 starts with the observation that political agreement is typically forged in a mix of formal bargaining in parliamentary session and informal bargaining outside of it. A major challenge in studying informal bargaining is the strategic richness of such situations. We show that standard game theory is silent about the influence of formality in the setting we study. Using an experiment, we are able to show that formality matters: informal bargaining is better for the party in the superior bargaining position.

Below we describe our contributions in more detail.

1.2 Chapter 2: Power and the Privilege of Clarity

Chapter 2 addresses an issue that has largely gone unnoticed in economics: the relation between power and communication. In other fields, in contrast, it has been widely recognized that power has an important impact on communication. One particular idea is that clarity is a privilege of the powerful: People belonging to a more powerful social, economic or political group seem to be able to communicate their preferences more clearly than those with less power. Social psychologists have found, for instance, that workers are more assertive in communicating their desires towards lower ranked co-workers than towards higher ranked co-workers (Kipnis, Schmidt & Wilkinson (1980), Yukl & Falbe (1990)). Similarly, gender studies have found that women in patriarchal societies are more hesitant in stating their wishes and interests than men (Baer (1976), Butler (1976), Maltz & Borker (1982), Henley & Kramarae (2001)).

It could be that the relation between power and clarity is entirely historical and cultural. In Chapter 2, however, we explore the possibility that there is a strategic foundation to this relation as well. We model the interaction in an asymmetric information continuous cheap talk (veto threats) bargaining game. It consists of one round of communication between an informed Sender and an

uninformed Receiver, followed by an ultimatum game where the Receiver makes a proposal to the Sender. Using game theory has the virtue that we can operationalize our concepts precisely: We define power as the attractiveness of the outside option and clarity as the degree of information transmission in equilibrium. Our main result is that the maximum amount of information transmission in equilibrium is increasing in the power of the Sender and decreasing in that of the Receiver. The intuition is that having power allows the Sender to be more open: Information transmission is limited because the Receiver can exploit the Sender with information the latter provides and increasing the Sender's power reduces the extent to which she can be exploited. In Chapter 4, we provide experimental evidence that the Sender's relative power increases information transmission.

In addition to casting game theoretic light on the relation between power and communication, this chapter also contributes to the existing cheap talk literature. Our model differs from previous ones in that the private information of the Sender does not determine her bargaining power. This allows us to capture the power individuals have due to the social, political or economic position of the group they belong to. This is what sets it apart from Matthew's model of veto threats (1989) and buyer-seller models (e.g. Matthews & Postlewaite (1989) and Farrell & Gibbons (1989)). The modeling choice also has profound implications for information transmission. Whereas in Matthews' model, information transmission is limited, a full range of partition equilibria exists in our set-up. In particular, the role of power in our model mirrors the role of interest-alignment in the model of Crawford and Sobel (1982).

Finally, we provide testable implications of our model for labor contracts and for remedy negotiations between firms and competition authorities.

1.3 Chapter 3: ACDC Rocks When Other Criteria Remain Silent

Chapter 3 proposes a solution to the important equilibrium selection problem in cheap talk games. Crawford & Sobel (1982) introduced asymmetric infor-

mation games with cheap talk communication. The main question in such games is how much information can be transmitted in pre-play costless communication between an informed Sender and an uninformed Receiver when interests are partially aligned. This class of games proved to have many real world applications in economics and politics, ranging from stock recommendations (Morgan & Stocken, 2003) to the presidential veto (Matthews, 1989). A major problem in applying such models is that they have multiple equilibria, which differ drastically in their predictions about how much information will be transmitted. Furthermore, the set of equilibria has proven to be very hard to refine, since – in contrast to signaling games – messages are costless. Currently, no refinement exists that successfully selects equilibria across a wider range of cheap talk games. Our model in Chapter 2 is one example where existing refinements are not predictive. We believe that existing refinements lose predictive power because they impose a binary distinction between stable and unstable equilibria, whereas the success of equilibria to organize behavior is typically a matter of degree.

This study proposes a generalization of refinements based on credible deviations, such as neologism proofness (Farrell, 1993) and announcement proofness (Matthews, Okuno-Fujiwara & Postlewaite, 1991). These refinements are grounded on the observation that messages can have a literal meaning. In particular, such messages can urge the Receiver to play an out-of-equilibrium action in a manner that is credible to rational players. Neologism proofness and announcement proofness select equilibria that do not admit credible deviations. Unfortunately, these refinements tend to eliminate all equilibria. According to our Average Credible Deviation Criterion (ACDC), the stability of a cheap talk equilibrium is a continuous quantity determined by the frequency and the size of credible deviations. An equilibrium is an ‘ACDC equilibrium’ if it minimizes the amount of credible deviations. This provides a way to rank equilibria that are unstable in a strict sense and to guarantee the existence of a most plausible equilibrium.

ACDC provides a contribution relative to existing concepts as neologism proofness, announcement proofness, Partial Common Interest (Blume, Kim & Sobel, 1993) and No Incentive to Separate (Chen, Kartik & Sobel, 2008). We

show that ACDC organizes behavioral data equally well as the other criteria in the settings for which these criteria were designed, improves upon them in other settings and makes sensible predictions where all previous criteria are silent.

1.4 Chapter 4: An Experimental Study of ACDC

Chapter 4 puts ACDC to the test in a new experiment. The experiment tests the predictions of ACDC that credible deviations matter and matter gradually. In addition, it tests directly whether the ACDC equilibrium predicts best. In the experiment, we study five games that belong to the model of Chapter 2. These games are a suitable testing ground for selection criteria, as they allow for a clean manipulation of the size and frequency of credible deviations and can have a large equilibrium set. Our key results are that credible deviations matter gradually and that the ACDC equilibrium predicts best in each game. More generally, the data provides evidence that ACDC can predict the stability of equilibria within and across games, even if all equilibria admit credible deviations and if all existing criteria are silent. We introduce a neologism dynamic that supports the conclusions of ACDC and explains important dynamic aspects of our data. In addition, our design is such that the experiment allows us to test the main hypothesis from Chapter 2 about power and clarity. We find that increasing the relative power of the Sender indeed increases information transmission.

Our experiment adds to the recent experimental literature on equilibrium selection in cheap talk games. Blume, DeJong & Sprinkle (2001) study equilibrium selection in discrete games, whereas Dickhaut, McCabe & Mukherji (1995)¹ look at the Crawford-Sobel uniform quadratic game. Both studies support the conclusions of ACDC, although the results of the former are also consistent with the PCI criterion (Blume, Kim & Sobel, 1993) and those of the latter with the NITS criterion (Chen, Kartik & Sobel, 2008). In the current experiment we employ a setting where both other concepts are silent.

¹ Cai & Wang (2006) and Wang, Spezio & Camerer (2010) perform comparable experiments to Dickhaut, McCabe & Mukherji (1995) and reach similar conclusions.

1.5 Chapter 5: Formal versus Informal Legislative Bargaining

Whereas the previous chapters focused on information transmission, Chapter 5 examines the bargaining process itself. It deals with the question of how the formality of the legislative bargaining process can affect the outcome. When parliament is in session, parliamentary procedures strictly govern what members can do at what time; hence, bargaining is highly formalized. After official sessions have been adjourned, however, bargaining often continues informally in offices, corridors and backrooms, where formal rules barely exist. As a consequence, the outcome of the legislative process is usually a result of both formal and informal bargaining. How the degree of formality affects the bargaining outcome is an open question.

That the bargaining procedure can drastically affect the outcome and favor specific negotiators through the order of voting, agenda-setting power, or proposal and voting rights has been recognized since the research boom on spatial voting in the late 1970s (e.g., McKelvey (1976; 1979), Schofield (1978), McCarty (2000)). The difference between a formal and an informal procedure, however, cannot be captured by a difference in voting or proposal rights. In addition, if both procedures provide equal rights to each player, then no procedure *prima facie* favors a specific player. Rather, the difference is that informal bargaining provides much more flexibility to all the bargaining parties. Players can use this flexibility both to make more offers and to communicate more, since any proposal also conveys credible information about what a player is willing to accept.

To answer our research question, this study compares a formal alternating offers game to an informal continuous-time bargaining game. Both non-cooperative games correspond to the same cooperative game: a three-player median voter setting with an external disagreement point. The divergence of interests (polarization) determines whether the core is empty (if so, we consider the uncovered set). In the formal game, the (refined) subgame perfect equilibrium converges to the core if this exists. The informal game is strategically so rich that a large range of outcomes can be supported in equilibrium, including the

equilibrium outcomes of the formal game. As a consequence, theory is silent about the influence of formality on the outcome and an experiment can shed light on this issue. Our main experimental finding is that formality matters. In particular, the median player is significantly better off under an informal bargaining procedure. Our interpretation is that the informal game provides the median player more room to exploit her superior bargaining position by allowing her to play off the other players against each other. Another interesting result we get is that the median player is harmed by polarization, even if her ideal is the unique core, probably due to inter-coalitional fairness concerns.

The study in Chapter 5 is the first to provide evidence that the formality of bargaining matters to the outcome. In particular, it suggests that parties in a superior bargaining position are better off under an informal structure. Our finding is relevant for the study of institutional choice, because it suggests that political agents (should) have strategic preferences over the weight they wish to put on formal versus informal bargaining. To put this far-reaching conclusion on a stronger footing, more research is needed as we compare two representative but still specific procedures. Recently, this conclusion has received support from Drouvelis, Montero & Sefton (2010).