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Note

Optimal value commitment in bilateral bargaining

Volker Britz *

Center for Operations Research and Econometrics, Université Catholique de Louvain, Voie du Roman Pays 34, B-1348 Louvain-la-Neuve, Belgium

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ABSTRACT

We study the role of commitment as a source of strategic power in a non-cooperative bargaining game. Two impatient players bargain about the division of a shrinking surplus under a standard bargaining protocol in discrete time with constant recognition probabilities. Before bargaining, a player can commit to some part of the surplus. This commitment remains binding until the surplus has shrunk below the amount that the player is committed to. Intuitively, one cannot remain committed to something which has become impossible. The model offers insight on the relative importance of proposal power and commitment for the bargaining outcome. In a version of the game where both players may simultaneously choose their commitments, the equal split emerges from within a range of equilibrium divisions as a focal point which is robust to changes in the model parameters.

1. Introduction

We consider a standard surplus-division problem among two impatient players who play a non-cooperative bargaining game with complete information. In this context, we are interested in the ability to commit as a source of bargaining power. More in particular, our interest is in commitments which expire endogenously during the bargaining process.

Endogenous expiration of commitments is of interest because of its influence on the players' incentives to reach an agreement. In particular, as players anticipate that commitments are about to expire endogenously, they may want to come to an agreement as long as their own commitment is still binding, or may want to delay agreement until their opponent's commitment has expired. In the paper at hand, our focus is on one particular kind of endogenously expiring commitment which leads to such incentives. The commitment device which we propose is based on two simple restrictions on the commitment's credibility. We assume that any commitments are chosen by the players before the bargaining process starts. The first restriction on the commitment is that it must be expressed in present value terms. Since the players are impatient by assumption, this is different from a commitment to a share of the surplus. Loosely speaking, a player can credibly commit only to something that he cares about as by his utility function. This idea of *value commitment* has been introduced to the bargaining literature by Li (2007) who argues that

"After all, what negotiating parties care about is the discounted value rather than the size of their share of the pie."

We impose a second restriction which says that a player cannot remain committed to something which has become impossible. To see what this means, suppose that a player is committed to a certain present value but disagreement persists long enough so that even the receipt of the entire surplus would no longer suffice to generate that present value. We assume that as of this *moment of truth* the commitment loses its credibility and thus its binding power.

* Fax: +32 10 478306.
E-mail address: volker.britz@uclouvain.be.

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One crucial feature of such a commitment is that after each disagreement it becomes more demanding until it eventually collapses. It is a well-documented phenomenon in the management and psychology literatures that decision-makers tend to continue or even reinforce losing courses of action. This is often explained by appealing to a need for justification or to prospect theory[1]. One frequently cited example of such behavior is a gambler who has lost money in one round of roulette and now wants to bet even higher in the next round so as to recover the previous losses. He avoids writing off his losses and admitting that the first bet was a mistake. If the gambler continues to make losses, the bets will keep increasing until they eventually collapse when the gambler's budget constraint is reached. One interpretation of the commitment device introduced in this paper is that it reflects an analogous behavior in the context of non-cooperative bargaining with commitments.

To be more precise, suppose that in some round of bargaining no agreement is reached. If a player is share-committed he automatically "writes off" the cost of delay since he now demands the same share of a smaller surplus. In contrast, a value-committed player refuses to realize the loss incurred due to the delay. As a result, his posture towards the opponent becomes ever more demanding. The opponent is now also supposed to bear the cost of delay alone. However, the refusal to account gradually for the cost of delay ultimately amplifies this cost. Just as the gambler experiences a rude awakening when he reaches the budget constraint, the value-committed player's rude awakening is the moment of truth when the surplus has shrunk below the commitment.

Our paper is most closely related to two strands of the bargaining literature. First, there are a number of papers in which commitments act as reference points in the utility function and typically evolve over time. In Fershtman and Seidmann (1993) and in Li (2007), a player's commitment is given by the best offer which he has so far rejected. Fershtman and Seidmann evaluate the best rejected offer according to the share of the surplus whereas Li considers the present value. The main objective of these two papers is to explain equilibrium paths with gradual concessions. Since rejecting an offer creates a commitment, a proposer does not want to offer too much too early so as not to give the opponent the opportunity to be strongly committed. While the two aforementioned papers treat commitment as a function of previous decisions to accept or reject proposals, we consider commitment as an independent strategic choice which is made once and for all at the start of the bargaining process. In our analysis, there is no delay on the equilibrium path. Second, our paper relates to a number of studies on less-than-perfect commitments. In these studies, some extra features are added to the bargaining model which limit the binding power of the commitment. Two examples are a non-prohibitive cost of violating one's commitment and the introduction of some noise in the commitment technology.[2] In contrast to this literature, we stick to a simpler bargaining model in which the ability to commit is only limited by the two aforementioned restrictions, that is, commitments are in present value terms, and they expire. To be more precise, let us briefly introduce the model.

We consider a game with two stages. In the initial commitment stage, either one or both players can choose a commitment of the type described above. Section 4 focuses on the case where only one player can commit at this stage, and Section 5 deals with the case where both players can commit. Once the commitment(s) have been determined, a bargaining stage with a potentially infinite number of rounds follows. In each such round, one of the two players is recognized as the proposer by a draw from a time-invariant probability distribution. The proposing player makes an offer and the game ends if this offer is accepted by the opponent. In case of a rejection the next round starts. However, any consumption in the next round will be discounted by a constant factor $\delta \in (0, 1)$. In line with our earlier discussion, the commitment device punishes the committed player if he accepts less than his commitment level while the pie's value is still higher than that level. But once the *"moment of truth"* where the pie's value shrinks below the commitment level has passed, no punishment is given. The bargaining stage is analyzed in Section 3.

Throughout the paper, we compare our results to those which one would expect if a share commitment was made before bargaining and were to remain effective forever. We refer to this kind of commitment as *perfect commitment*. When the discount factor is small, our results approximate those under perfect commitment. When the discount factor is large, however, we find quite different predictions. The key finding is that commitments tend to be moderate rather than extreme. For instance, even in the case where only one player can commit, the (unique) equilibrium payoff for that player may almost be as low as one half of the surplus, depending on the recognition probabilities. When both players are able to commit simultaneously, we find a range of equilibrium divisions which narrows down substantially as the discount factor approaches one. The equal split emerges as a uniquely robust focal point within the range of equilibrium divisions.

2. Game description

Two players have a perfectly divisible pie of unit size at their disposal. They consume the pie once they have agreed on its division. Each player's instantaneous utility is equal to his consumption of pie, but future consumption is discounted by

[1] The classic paper by Staw (1976) as well as the later review papers by Staw (1981) and Brockner (1992) provide a good overview on this issue. Whyte (1986) emphasizes the link with prospect theory.

[2] Commitments which can be revoked at a non-prohibitive cost have been studied by Muthoo (1992) and Muthoo (1996). Another approach proposed by Crawford (1982) and Ellingsen and Miettinen (2008) is to assume that a player's attempt to commit only succeeds with some probability. A related approach frequently encountered in the literature is to introduce incomplete information; a player believes that with some probability his opponent is of a type which is exogenously committed. In such a model, an uncommitted type of player may have an incentive to mimic the committed type (Abreu and Gul, 2000; Kambe, 1999).