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To commit or not to commit? An experimental investigation of pre-commitments in bargaining situations with asymmetric information

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ABSTRACT

In a recent paper Konrad and Thum (2014) present a model that shows that unilateral pre-commitment reduces the likelihood of agreement in bilateral negotiations over the provision of a public good when parties have private information over their contribution costs. We test the model in a laboratory experiment paying particular attention to how behavioral motivations other than payoff-maximization affect the strength of the model's result. We find that the result is no longer statistically significant when we allow for non-payoff-maximizing behavior at each stage of the game. Introducing communication has an interesting effect as it influences different forms of non-payoff-maximizing behavior asymmetrically and leads to the model's result again becoming significant. All in all, we find strong experimental support for Konrad and Thum's model even though we observe considerable amounts of non-payoff-maximizing behavior that is not accounted for in the original model.

1. Introduction

Bargaining over the private provision of public goods may lead to inefficient outcomes if parties have incomplete information or contracts are not enforceable. The literature has largely concentrated on the enforcement problem. Work on international negotiations on environmental regulations, for example, has paid particular attention to the enforcement problem because no common institution exists in this setting and the enforcement of contracts is thus difficult (Carraro and Siniscalco, 1993; Barrett, 1998).

In a recent paper Konrad and Thum (2014) focus instead on the problems that arise in a bargaining environment with asymmetric information. Their model (referred to as KT-model henceforth) assumes the enforcement problem is resolved and examines bargaining over contributions to a public good when parties are privately informed about their cost of provision.

Under asymmetric information bargaining outcomes will generally be inefficient as negotiations can break down with a positive probability even when mutually beneficial agreements are possible (Meyerson and Satterthwaite, 1983). It is well known that in markets for private goods the inefficiency disappears as the number of traders increases and the market becomes large (Gresik and Satterthwaite, 1989). However, Rob (1989) showed that even this asymptotic efficiency does not hold for public goods and thus under asymmetric information negotiations over the private provision of a public good are unlikely to ever achieve an efficient solution.

The question remains, however, how large the inefficiencies will be and under what kind of negotiation rules the likelihood of negotiation breakdown, and thus the inefficiency, can be minimized. In particular, it is unclear if prior commitments by one party have a positive influence on the prospects for achieving more efficient outcomes. The KT-model makes an important contribution to the literature on the private provision of public goods by investigating this issue in a non-cooperative game setting.

The role of prior commitments is highly relevant. The EU, for example, seems to view pre-committing to environmental damage prevention as an act that sets a good example for others and that will motivate others to follow suit. The KT-model, however, states the exact opposite. Comparing the equilibria of two sequential bargaining games – one with commitment and one without – the authors show that the probability for successful cooperation is strictly lower when one party has contributed to the public good before bargaining takes place. This result obviously has strong political implications.

Our paper is an experimental investigation of the findings of the KT-model. In addition to a direct experimental verification of the model our experiment focuses on the potential for the bargaining situation modeled by Konrad and Thum to be influenced by various motives that deviate from payoff-maximization and which could thus affect the results of the model. Inequality aversion, for example, might prevent players from payoff-maximizing if payoff differences are sufficiently large (Fehr and Schmidt, 1999; Bolton and Ockenfels, 2000). Direct and

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indirect reciprocity (Falk and Fischbacher, 2006; Nowak and Siegmund, 2005) may also be a factor in the presence of pre-commitments.

Results from a world-wide survey of people involved in international climate policy indicate that fairness and equity considerations can play a significant role in climate negotiations (Lange et al., 2007, 2010). Since the KT-model's results are particularly relevant for climate negotiations it is thus important to investigate how the model performs in a bargaining environment in which real subjects may harbor such behavioral motivations. A laboratory setting is the ideal venue to explore this extension as the experiment can control for the amount of freedom subjects have to deviate from payoff-maximization.

In order to find out how behavioral motivations other than payoff-maximization affect the results of the KT-model the experiment is designed to be carried out in three settings. Each of the three settings has one treatment with pre-commitment and one without. The first setting is intended to be a direct assessment of the KT-model as it most closely follows the basic assumptions of the original theory, i.e., payoff-maximizing behavior and common knowledge. Technically, one subgame of the KT-model (standard prisoners' dilemma) is replaced by the corresponding Nash payoffs and thus players are forced to behave in a payoff-maximizing way in the final stage of the game. In our experiment we found that in this reference setting cooperation took place twice as often in the treatment without pre-commitment when compared to the treatment with pre-commitment (referred to as cooperation gap henceforth).

In the second setting the entire prisoners' dilemma is introduced to ascertain whether the KT-model is affected by giving subjects additional room to behave in non-payoff-maximizing ways, and if so, whether the cooperation gap persists. We found that the gap did persist in our experiment but became considerably smaller.

In the third setting the KT-model is pushed even further away from its original assumptions through the introduction of pre-play communication between the bargaining parties. There are two motivations for this extension. First, the experimental literature on the provision of public goods has shown that communication between subjects increases the level of cooperation even if communication is cheap talk (Brosig et al., 2003; Valley et al., 1998). It is still unclear, however, what effect communication has in environments with or without pre-commitment. Second, it is an artificial assumption that bargaining over the provision of public goods takes place without communication between the parties involved. It is thus important for the external validity of the KT-model to check whether or not it is communication proof. In fact, in our experiment we observed that with communication there was a strong increase in success rates in both the pre-commitment and no pre-commitment treatments but at the same time the cooperation gap again opened significantly.

The remainder of this paper is structured as follows. The next section outlines the KT-model as it was implemented in our experiment. In section three we specify the experimental procedure. Section four contains our main results, and in the final section five we discuss our findings.

2. The KT-model

The KT-model encompasses two variants of a sequential bargaining game, one with pre-commitment and one without. We start with the more general version without pre-commitment.[1]

Two players $i \in \{A, B\}$ negotiate over the provision of a public good $e = e_A + e_B$, where e_A and e_B denote the contribution of players A and B respectively. Both players can either make a contribution ($e_i = 10$) or not ($e_i = 0$). If player i decides to contribute, his cost of contribution is $10 + c_i$ with $c_i \in \{1, 2, \ldots, 9\}$. The cost parameter c_i is private information of player i and is randomly drawn from a uniform distribution. In the bargaining process, player A can offer a transfer $t \in \{-10, -9, \ldots, 9, 10\}$ to player B. If $t > 0$ the transfer goes from A to B which means that A pays a price to B, if $t < 0$ the transfer is a price B pays to A.

The overall bargaining structure is characterized by a take it or leave it offer similar to the classic ultimatum game: Player A proposes a transfer to B which B can accept or reject. If B accepts then both players become obliged to contribute to the public good ($e_i = 10$). If the offer is rejected no transfer is paid and both players decide over their contributions independently. In this case both players are in a prisoners-dilemma and choosing not to contribute is their dominant strategy. Fig. 1 visualizes the sequential structure of the game without pre-commitment.

This version of the model is contrasted with a version in which A makes a commitment before the game starts. Technically, this pre-commitment is modeled by fixing $e_A = 10$ throughout the whole game, which removes strategy $e_A = 0$ from the prisoners' dilemma in the last stage. Thus, player A no longer decides about his contribution and this is common knowledge.

In both cases the payoffs of the players can be written as

$$\pi_A = e_B - c_A \frac{e_A}{10} - t \quad \text{and} \quad \pi_B = e_A - c_B \frac{e_B}{10} + t. \tag{1}$$

Under the assumption of payoff-maximization the KT-model has the following two results.

Result 1 (Konrad and Thum, 2014). *The probability that A and B agree on a cooperative outcome is higher without pre-commitment for all possible c_A.*

Result 2 (Konrad and Thum, 2014). *The unique perfect Bayesian equilibrium transfer is non-positive in the game without pre-commitment and strictly positive in the game with pre-commitment. Specifically, under the conditions implemented in the experiment the equilibrium transfers are given by $t^*_{nPC} = \min\{-\frac{c_A}{2}, -1\}$ in the game without pre-commitment and $t^*_{PC} = 5$ in the game with pre-commitment.*

The intuition behind these results is as follows. If player A does not pre-commit before bargaining takes place then his gain from reaching an agreement is greater. To keep the chances of getting this gain realized A has to bargain less aggressively which enhances the likelihood of cooperation relative to the game with pre-commitment.

Furthermore, if A does not pre-commit then he can sell his willingness to cooperate to B. Player A thus demands a price for cooperation

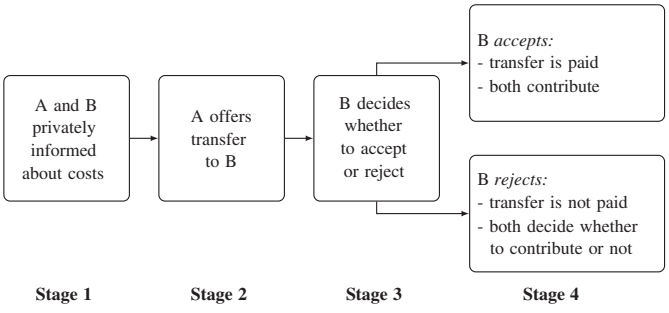

Fig. 1. Sequential structure of the game without pre-commitment.

[1] As the original model is too general to be directly implemented in the laboratory, some basic assumptions of the model had to be slightly adjusted. In particular, the KT-model applies to continuous random variables following arbitrary probability distributions that have a positive inverse hazard rate. In our experiments we use integer variables scaled by factor 10 and a uniform distribution of random variables. Therefore, our presentation of the major results is slightly different compared to the original paper. However, our modification is just a special case of the original theory.