Pre-study plan: The Effect of Commitment Types in Repeated Games with Long-lived and Short-lived Players

Tom-Reiel Heggedal and Magnus V. Knutsen

April 2025

Introduction

Repeated games with a long-lived player facing a sequence of short-lived players has, sins these games were first studied in Fudenberg and Levine (1989), been the focus of much theoretical work.In more recent years these models have received much attention due to their application to trade on online platforms such as Ebay and Amazon (which is becoming increasingly important). Like the more studied case of two long-lived players, the case with one long-lived player also suffers from multiplicity. Thus, while it is clear from a theoretical perspective that repeated interactions can help long-lived and short-lived players coordinate on mutually beneficial outcomes, it is unclear how this will come about.

We set out to experimentally study strategy choices in repeated games with long-lived and short lived players by running a series of lab experiments. Our perspective is on the role of commitment types in this framework. That is, to what extent the presence of commitment types help coordination towards beneficial outcomes. From a theoretical perspective, commitment types will help long-lived and short-lived players to coordinate on beneficial outcomes by excluding equilibria in which cooperation never takes pace.

We implement the model of reputational concerns introduced by Fudenberg and Levine (1989, 1992), which has become a workhorse model in the theoretical work on situations with reputational concerns. In the model, a long-lived player interacts with an infinite sequence of short-lived players. The long-lived player has a commitment types and short-lived players observe the complete history of play. Despite the vast theoretical literature, the experimental evidence on infinitely repeated games building on the paradigm of Fudenberg and Levine (1989, 1992) is scarce. The environments with a long-lived player facing a sequence of short lived players has been studied in experiments before, but only a setting with finite horizons. Thus, to our knowledge we are the first to take the model of Fudenberg and Levine (1989) to the lab.[1]

[1] The effect of commitment types are very different in the finite setting. In a finite setting introducing commitment

Experimental design and outcome measures

The aim of the experiment is to empirically investigate the effect of commitment types in an indefinitely repeated game where the long-lived player faces a trade-off between short-run and long run gains, and where the efficient outcome is an equilibrium. However, as it is only one of many, reaching it requires that players coordinate. We hypothesis that the presence of a commitment type will facilitate this coordination.

Experimental design

In the beginning of the experiment, each participant is assigned a role as either Player 1 or Player 2. These roles remains fixed throughout the experiment. The table below depicts the stage-game along with payoffs in experimental currency units (ECU).

Table 1: The stage-game (payoffs in ECU)

		Player 2	
		h	l
Player 1	H	$90, 100$	$0, 60$
	L	$130, 0$	$30, 60$

Each session is divided into five supergames. Discounting is induced by random termination of a supergames.[2] That is, after each period there is a probability of 0.9 that the supergame continues for another period. When a supergame ends, all histories are reset. This implies that Player 1 starts the first game after a reset without any history and that the history of Player 1 within a supergame will include only actions taken in that supergame. The choice of having participants play multiple supergames is made to facilitate learning.[3] The termination period of the supergames are pre-drawn, and are the same for all treatments.

To empirically investigate the effect of commitment types, we compare behavior in two different treatments where we vary the prior beliefs on a commitment type: One treatment were we we do not induce a commitment type (Treatment $\mu0$) and one where the probability that long lived seller is committed is 0.25 (Treatment $\mu25$). Commitment types are induced by way of computerized

types usually leads to different equilibria. In the infinite setting, however, commitment types will tend to reduce the set of equilibria and thus facilitate coordination

[2]This is a common way to implement indefinite horizon in lab experiments, see Fréchette and Yuksel (2017) for a discussion.

[3]Dal Bó and Fréchette (2011) emphasize the role of experience in helping participants coordinate on cooperative equilibria.

long-lived players who always chooses action H.

Prior to making their decisions in a period, each Player 2 will observe the history of actions taken by the Player 1 he/she is matched with in that period. Each player 1 will also observe his/her history when making their decisions.

Payoffs are determined by payoffs from all games in the experiment. This method is chosen because drawing games at random and having them determine payoffs would imply drawing supergames which would be difficult to explain to subjects.

Finally, in the experiment the game is framed as a quality choice game where Player 1 is referred to as a seller who makes a choice between high (H) and low (L) quality. Player 2 is referred to as a buyer who decides whether to buy the product offered by the seller (h) or not (l).

Outcome measures and hypotheses

Our focus is on four main outcome measures: Player 1 payoffs, the frequency at which Player 1 chooses H, the frequency at which Player 2 chooses h, and the frequency at which Player 1 and 2 are able to coordinate on the efficient outcome. Our hypotheses is that these four measures are higher in the presence of the commitment type.

The unit of observation will be matching block averages. As no matching is done across these block, these will be independent. In treatment $\mu 0$ one matching block contains eight participants. In treatment $\mu 25$ one participant is replaced by a computer player. Thus, in treatment $\mu 25$ one matching block contains only seven participants.

Homegrown commitment types and elicitation of beliefs

There may be participants that always choose H regardless of the incentives in the game. We call such participants homegrown commitment types. We set up an add-on game to be able to shed light on the share of homegrown long-lived players and elicit the short lived players beliefs about homegrowns in the population. The add-on game is a one-period version of the game played in the main experiment. This game is played after the main experiment.

There is no history in the add-on game and there are no computer induced commitment types. The participants simply play the static stage-game depicted in Table 1, in which the unique equilibrium is (L, l) The add-on game is played in three stages in which all subjects participate in all of the stages. In stage 1 they play the role of the seller, in stage 2 we ask participants about their belies about how many subjects did choose H in the first stage, and in stage 3 all subjects are randomly matched in pairs and they play the role of the buyer without observing stage 1 choices. For (a strategic) subject choosing L is a strictly dominant strategy in stage 1, while the best response in stage 2 is to choose h whenever beliefs about her counterpart being a commitment type exceeds 0.6 (i.e, γ).

Power

A pilot study with two matching blocks for $\mu 0$ and two matching blocks for $\mu 25$ was carried out. We use seller payoff as the bases of our power computations. The average Player 1 payoff was 53 ECU in $\mu 0$ and 76 ECU in $\mu 0$ whereas the variances (between blocks) was 71 and 13, respectively.

Based on the average posted prices and the variance, we calculate the sample size needed to reach a power of 99 percent or better, given a 5 percent significance level and a Wilcoxon rank sum test. This estimate was obtained using the method described in Bellemare et al. (2016). The power-threshold required is reached with 6 independent matching blocks per treatment.

References

Bellemare, C., L. Bissonnette, and S. Kröger (2016): "Simulating power of economic experiments: the powerBBK package," *Journal of the Economic Science Association*, 2, 157–168.

Dal Bó, P. and G. R. Fréchette (2011): "The evolution of cooperation in infinitely repeated games: Experimental evidence," *American Economic Review*, 101, 411–429.

Fréchette, G. R. and S. Yuksel (2017): "Infinitely repeated games in the laboratory: Four perspectives on discounting and random termination," *Experimental Economics*, 20, 279–308.

Fudenberg, D. and D. K. Levine (1989): "Reputation and Equilibrium Selection in Games with a Patient Player," *Econometrica*, 57, 759–778.

——— (1992): "Maintaining a Reputation when Strategies are Imperfectly Observed," *The Review of Economic Studies*, 59, 561–579.