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### Laboratory tests of theories of strategic interaction

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**Introduction**

## 1. INTRODUCTION

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In this thesis, we conduct a series of studies to test theories of strategic interaction in distinct environments. The topics of these studies include human social preferences (on how much people care about others' welfare), people's response to the information on others' preferences and histories in a social dilemma, and peoples' competing behavior in contests. A common theme of all these studies presented in this thesis is the adoption of laboratory experiments in testing theories.

Observational field data on human behavior are strife with a multiplicity of factors that simultaneously drive the observations. In contrast, carefully designed laboratory experiments allow for the collection of observations of human decisions while strictly controlling for many factors that may be deemed noise in view of the research question under investigation. This allows the researcher to isolate those processes and parameters that are at the core of the questions to be addressed. In this way, the data collected from a controlled environment provide a more powerful direct test of a theory, allow for an identification of the influence of specific factors on human decisions, and enable tests of the causal relationships between variables.

This thesis consists of three studies that adopt the experimental method to test economic theories of behavior. Chapter 2 presents a detailed experimental test of one of the most influential social preference theories, the inequity aversion model introduced by Fehr and Schmidt (1999). The studies presented in Chapter 3 and 4 first develop and analyze their own theoretical models and subsequently provide experimental tests of the game-theoretical predictions for these models. What follows is an overview of the content of each chapter.

Chapter 2 (based on Yang, Onderstal, and Schram 2013) presents a test of the Fehr and Schmidt's (1999) model of inequity aversion (IA), which is one of the most influential existing social preference models. (According to Google Scholar, over 6500 works have cited Fehr and Schmidt's (1999) paper.) Economists have conducted various laboratory experiments to test the IA model and, typically, to compare it to other social preferences models. Typically, such studies develop a series of simple games for which various models (including IA) offer distinct predictions. Subjects' choices in these games subsequently provide evidence in favor or against specific models. In contrast to such horse races between models, the approach presented in this chapter facilitates a direct test of the model's premises with respect to preferences and its predictions, independently of other models. The method by Blanco, Engelmann, and Normann (2011) is probably the closest to ours. What distinguishes our method from theirs is that, the presence of direct reciprocity

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is controlled consistently throughout the experiment, which allows us to distinguish the influence of IA on subjects' decisions from that driven by direct reciprocity.

In the experimental study in this chapter, first, a set of menu tests are implemented to estimate the IA parameters in the IA model and a general model which also allows for efficiency concerns in addition to inequity aversion. By comparing the two sets of IA parameters estimated from the two models, we test the robustness of the IA model's estimated parameters to the inclusion of efficiency concerns. Besides, the robustness of the estimates to variations in stakes is also tested. Moreover, this chapter introduces a new game, which is called the 'production game'. This has various desirable properties (as will be discussed in Chapter 2) that will allow us to straightforwardly assess the IA model's predictive power at the individual level. We do so in two environments, one in which subjects can reciprocate others choices and one in which they cannot. The results suggest that the IA parameters are robust to the inclusion of efficiency concerns and the stakes effects. Moreover, in this study we find stronger evidence for the predictive power of the Fehr-Schmidt model than what the existing literature might suggest. This finding seems to be rooted in a bias in previous parameter estimates that occurs if one does not correct for the possibility to reciprocate others' choices. In particular, previous estimates may overestimate the importance of inequity aversion (especially of the disutility of disadvantageous inequity aversion).

In Chapter 3 (based on Yang 2014b), We study the question whether it is sometimes socially beneficial not to reveal certain information. For example, the U.K. and many U.S. states allow juvenile court convictions to be expunged. The idea behind such a policy is to provide a chance of a 'fresh start' to the offenders and encourage them to behave. From a perfectly rational point of view, it is sometimes better not to have certain information. We first use a game-theoretical model to analyse this question. We use a two-round Prisoner's Dilemma game (with rematching between rounds) involving two player types, 'Givers' and 'Takers'. The former have more cooperative intrinsic preferences than the latter (according to the IA model by Fehr and Schmidt 1999). Two information conditions are compared: in one, player types are revealed before actions are chosen; in the other, types remain private information. In both cases, round-1 decisions are revealed to the (new) partners in round 2. We show that, if the proportion of Givers is sufficiently high, a perfect Bayesian equilibrium for this game predicts higher cooperation rates when types are not revealed.

## 1. INTRODUCTION

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We conducted a laboratory experiment to test this theory. The experimental observations do not support the above equilibrium prediction, however. In contrast, more cooperation is observed when type information is revealed. Evidence suggests that such a deviation from the equilibrium prediction may be driven by a combination of indirect reciprocity and bounded rationality. We then show that this is in line with behavioral predictions derived from an evolutionary image-scoring model. In fact 60-70% of the laboratory observations are consistent with such a model.

Chapter 4 (based on Yang 2014a) investigates whether providing credit easing to firms' R&D investments would enhance the total R&D expenditure in an industry. Intuition suggests that firms will invest more if not budget constrained. The matter is not as trivial as it may seem at the first glance, however, because the strategic interactions between firms need to be taken into account. To see why this matters, consider that the R&D investments by firms may be seen as a contest to win (temporary) monopoly power over the market concerned. Then, a firm with low prospects of winning the R&D race may see higher chances of winning the research contest if it expects other firms with better prospects to face financial constraints inhibiting a full realization of their research agenda. In this way, expectations of the winning probability may encourage a firm to invest more under a situation where all firms face potential budget constraints than when government policies relieve such constraints. In fact, Che and Gale (1998b) have used an all-pay auction with complete information to model a lobbying contest to show that, imposing a common (public) cap on each firm's lobbying expenditure may instead increase the total expenditures in equilibrium. But can this conclusion be directly generalized to our research question? Maybe not just yet. In the R&D contests, firms' budget constraints are usually heterogeneous and privately known. Therefore, it seems more reasonable to model the R&D contest as an all-pay auction with private information on both, each contestant's (i.e. firm's) valuation and their budget constraint. In contrast to Che and Gale's (1998b) result, our theory (applied in a private information setting) suggests that removing the constraints will increase the expected aggregate R&D expenditures in the industry.

We further use two specific examples to illustrate differences between different types of industries in the extent of the investment increase following relaxation of budget constraints. Our laboratory experiment supports the general picture predicted by the theory, but individual investment strategies deviate from the equilibrium strategy. In particular, these strategies exhibit a pattern of overbidding at low

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values and underbidding at high values.