Conflict, Cooperation and Coordination

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Essays in Game Theory and Experimental Economics

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To the mice

Preface

This report is a result of a research project carried out at the Department of Economics at the Stockholm School of Economics (SSE). This volume is submitted as a doctors thesis at SSE. The author has been entirely free to conduct and present his research in his own ways as an expression of his own ideas. SSE is grateful for the financial support which has made it possible to fulfill the project.

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Introduction

This thesis consists of four independent papers from two categories. The first two papers I wrote are theoretical whereas the other two report results from laboratory experiments. The structure of this thesis is such that the experimental work comes first. Within each category the ordering of papers is chronological. In the remainder of this section I briefly summarize each of the papers.

1. Dismissal and Replacement in Relational Contracting

The recent economic crisis in Europe has led to renewed attacks on the continent's rigid labor laws. Beyond the complaints about the unfairness of protecting "insiders", the main criticism of such laws is that they destroy workers' incentives to exert effort, which beyond its direct effect on efficiency reduces firms' incentives to hire in the first place. The laws' defenders argue that such statements are unproven, and promoted mainly by employers who seek the freedom to fire as a way to unfairly extract more of the economic gains from production. The benefits of firing appear almost as controversial on the other side of the Atlantic. During the 2012 Republican Primary candidate Mitt Romney attracted a storm of negative publicity for saying "I like being able to fire people", while discussing incentives for health care providers. His argument was that the threat of firing would encourage better service.

However, what is notable about all these claims is that they are not exclusively concerned with firing. Consider for instance how Mitt Romney continued: "If someone does not give me a good service that I need, I want to say, 'I'm going to go get someone else to provide that service to me.'" This is not so much about firing, the option not to buy services, as about the ability to go elsewhere, and replace those who provide bad services with a better alternative. Similarly, the assertion that firms seek the threat to fire primarily as a bargaining tool would seem to hinge on the existence of a replacement option rather than the ability to fire per se. Yet the ability to fire and the ability to replace are conceptually different mechanisms which do not always coincide. For instance, in thin labor markets where qualified workers

are scarce, or in situations where workers acquire extensive firm-specific human capital, replacement can be very difficult even when firing is easily possible.

Motivated by this debate, our paper sets out to test how both firing and replacement determine market outcomes using data from a controlled experiment. Our work is primarily concerned with labor markets, which differ from many other markets in that there is typically a large degree of contractual incompleteness (Williamson, Wachter, and Harris [1975] is a classic reference). When performance is not third-party enforceable the threat of future unemployment can play an important role in incentivizing worker effort; hence the ability to fire and replace can have significant effects.

Our workhorse is a gift exchange game (Fehr, Kirchsteiger, and Riedl [1993]), in which a firm makes a (binding) wage offer and (non-binding) effort request, to which a worker responds. This captures the incompleteness of most employment contracts. The game is repeated (indefinitely), allowing for the prospect of a future relationship to motivate worker effort. To this setup we added simple treatment variations. We implemented a Standard Labor Market (SLM) with both firing and replacement by giving firms full flexibility to revise offers between rounds, and a permanent pool of unemployed workers to make offers to. A second treatment allowing Firing but No Replacement (FNR) had full contract flexibility but limited a firm to making offers only to the first worker it hired. Finally, in a third treatment, we applied Employment Protection Legislation (EPL) preventing firing and replacement, by requiring that once hired, a worker be offered a contract with a wage at least as high as that given in the previous round. The underlying market framework is borrowed from Brown, Falk, and Fehr [2004] and Falk, Huffmann, and MacLeod [2008].

We find that markets with replacement are more efficient than those where firms can fire but not replace, while employment protection, preventing firing, lowers efficiency further. However, surprisingly, we find that the ability to replace workers has little if any effect on the terms of trade, with workers obtaining an equal share of surplus created in both settings.

Our data shows that firms did use the threat of punishment to create time-consistent dynamic incentives for worker effort in treatments allowing firing (and replacement), and we argue this is the primary explanation for higher efficiency in those settings. However, our prediction of zero effort and employment under EPL is not borne out, indeed employment was on average profitable for firms.

While standard theory can readily explain the comparatively low efficiency of EPL, it cannot explain the efficiency gap between our replacement treatment (SLM) and the treatment

with firing but no replacement (FNR). Firing alone can incentivize workers to exert high effort through the threat of unemployment which is available in both settings. We nonetheless provide evidence for many intuitive forces at work behind this result. Firstly, even given a credible threat, firing lowers efficiency when it *does* have to be carried out, while replacement does not. Secondly, we claim the ability to replace is crucial for sorting into jobs those workers who are most responsive to incentives. Finally, and as a consequence of the aforesaid, the threat to fire appears to be less credible when firms cannot replace workers, and workers were more likely to shirk at least somewhat, hurting efficiency and firms' profits.

Our finding for EPL certainly suggests the existence of some workers who are motivated by non-material incentives. However we also claim that complementary to this, the use of promotion contracts by firms is an important factor behind the result. In all treatments, we find evidence that many firms raised wages and desired effort over time, contingent on good worker behavior. In addition to providing short term incentives, a rising wage profile allowed firms to screen for uncooperative workers early in a relationship when the stakes were low. This suggests promotion should be particularly important in countries with strong labor laws. It ties into the recent theoretical literature on the optimality of "starting small" (Watson [1999, 2002]) and recent experiments (Andreoni and Samuelson [2006], Andreoni, Kuhn, and Samuelson [2011]), although previous labor market experiments have not identified such behavior.

The finding that regardless of replacement options, workers obtain an equal share of the surplus is surprising but does not contradict standard economic theory. While the world of complete contracts suggests that competition allows the short side of the market to obtain all the gains of trade, incomplete contracts can interfere with such a mechanism. The reason is that unemployed workers have no way to commit to providing a better service at a lower price. Indeed as shown in the classic relational contract paper of MacLeod and Malcolmson [1989], there are typically a wide variety of surplus sharing rules compatible with equilibrium, even with a surplus of workers. Supporting the claim that outcomes represent equilibrium behavior, we provide evidence that generous wage offers were optimal for firms given worker responses. Nonetheless, we believe our results suggest a strong role for fairness norms in acting as a focal point for equilibrium selection in markets characterized by incomplete contracts, an argument in the spirit of Schelling [1960].

2. Coordination in Heterogeneous Populations and the Focality of Normative Rules

The need for coordination among people or entities with heterogeneous characteristics is an undeniable fact of social and economic life. When a single point has to be selected from a potentially large equilibrium set, differing opinions and expectations resulting from heterogeneity can cause substantial frictions. What is more, coordination problems often have a threshold characteristic in the sense that an endeavor is only fruitful if a critical amount of resources can be bundled, and not otherwise. The recent disagreement among Member States about the size, scope and particularly financing of the European Financial Stability Facility, devised to discourage speculation against Eurozone sovereign debt, presents a case in point. Heterogeneity on relevant and observable characteristics can hinder, or hold up, success in such endeavors by triggering disagreement about how to properly take this heterogeneity into account. In the EFSF example relevant observables could be GDP, population size and debt-to-GDP ratio. Crucially, some or all of the resources put into the project, or at least the effort sunk in trying to succeed, may be wasted in case of failure. Hence all parties involved are at risk not only of jettisoning efficiency but also of wasting private resources in case of mis-coordination.

It has been suggested that social norms, more specifically fairness norms, can act as focal points in equilibrium selection (Schelling [1960]; Lindahl and Johannesson [2009]). As laid out in Binmore [1994, 1998], evolution may have favored the emergence of social norms as a means to select among multiple equilibria on the Pareto frontier. The problem in heterogeneous groups, at least in the short run, is that there may be multiple plausible fairness norms, which differ between subjects in their primary salience (a situation we call "ex-ante normative disagreement"), and this may lead to coordination failure. For instance, when it comes to cost sharing among agents or entities with differing wealth levels, those who apply a principle of equal sacrifice may disagree with those who first think of equal outcomes. And even if (without knowing it) subjects interacting in a group happen to agree ex-ante, they may expect others to disagree and adjust their behavior pre-emptively. Thus, heterogeneity in normative expectations alone may be sufficient to upset coordination.

We conducted an experiment to study coordination frictions, and the importance of fairness norms as focal points, in step-level public good games with large equilibrium sets and heterogeneous agents. Heterogeneity was with respect to initial endowments in one treatment, and with respect to benefits from the public good in the other. We show that heterogeneity creates frictions on aggregate. An elicitation task along the lines of Bardsley, Mehta, Starmer, and Sugden [2010] reveals that individuals held, and expected others to hold, well-defined yet

conflicting views of fair contribution rules related to efficiency, equality, and equity. While three equilibrium allocations (equal-contributions, proportionality and equal-earnings) out of several thousand stand out as focal in our normative data, in the heterogeneous treatments this was sufficient to create considerable normative disagreement between subjects, even within types, and caused strategic uncertainty. As a consequence, mis-coordination was frequent and success rates were lower than in homogeneous groups. Even conditional on success, more resources were wasted. Yet conditional on reaching one of the three normatively focal allocations heterogeneous groups were as stable as their homogeneous counterparts, who uniquely selected equal-contributions. In particular, normatively focal allocations were more stable than other equilibrium allocations. Moreover, normative viewpoints and expectations (as elicited ex-ante) predict initial choices at the individual level, and equilibrium selection at the group level. However, we cannot confirm the hypothesis of a link between ex-ante normative disagreement and the probability of success in the interaction, a fact that we argue speaks in favor of the focal-point interpretation and against an alternative explanation of strong intrinsic allocative preferences.

3. Level-k reasoning in contests

Contest theory has mostly used Nash equilibrium to solve models and derive predictions. Konrad [2009] provides an overview of the field. The standard Tullock [1980] contest is dominance-solvable and hence common knowledge of rationality pins down unique equilibrium beliefs and choices. However, assuming common knowledge of rationality in the population is a very strong assumption and likely to be wrong, especially in one-shot interactions in large populations or when players have not had sufficient time to learn. The current paper instead introduces level-k reasoning to contest theory. Variants of the level-k framework have been studied and used by Stahl and Wilson [1994, 1995], Nagel [1995], Costa-Gomes, Crawford, and Broseta [2001], Costa-Gomes and Crawford [2006], and Camerer, Ho, and Chong [2004]. Players are taken to be rational, but do not necessarily hold consistent beliefs about other players. They are assumed to think that they are "a little smarter" than their opponents. We investigate (a) if and how level-k predictions differ from those of Nash equilibrium in standard Tullock contests, and (b) how well the level-k approach explains experimental evidence from contests. As for (a), we find that relative to Nash equilibrium, level-k thinkers exert less effort for any finite level k, but there is monotone convergence. This immediately affects our answer to (b) since most of the experimental literature finds spending to be higher than predicted. However, we cannot definitively refute the level-k approach on these grounds

as most studies implicitly assume subjects to maximize expected material payoffs, which is questionable. We discuss this briefly.

4. A folk theorem for endogenous reference points

This note establishes a Folk Theorem à la Fudenberg and Maskin [1986] for infinitely repeated game protocols with players whose preferences exhibit reference dependence: a player evaluates her utility in any given period by holding her material payoff from that period against her payoff history which maps into a reference point. Individual reference points are therefore endogenous, starting out from some initial condition and then evolving as time goes by. The class of preferences we study includes widely used specifications with and without loss aversion.

We draw on work by Friedman [1990], who develops a Folk Theorem for time-dependent supergames. Our contribution is to (a) extend the scope of his main result to more general state and strategy spaces and (b) show how game protocols with reference dependent preferences can be analyzed easily as time-dependent supergames. The strategy is to map the supergame into an auxiliary supergame that can be analyzed using an extension of Friedman's theorem.

Reference dependence in static decision problems has been studied extensively, both theoretically and experimentally (Kahneman and Tversky [1979, 1991, 1992]; Munro and Sugden [2003]; and Bateman, Munro, Rhodes, Starmer, and Sugden [1997]). In dynamic decision problems it is mostly known as habit formation, (see e.g. Pollak [1970]). The study of games using reference dependence and loss aversion was pioneered by Shalev [2000]. More recently, Köszegi and Rabin [2006] extended the analysis to forward-looking reference points.

The concept of a game *protocol* as opposed to a game, motivated by controversy over how to interpret experimental evidence, was coined in Weibull [1980] and the distinction is crucial to our analysis. (A precursor is the so-called *game form*, see Gibbard [1973].) An infinitely repeated *game* is not compatible with our notion of reference dependence under the standard discounting criterion since the stage game, and hence the set of attainable Bernoulli utility vectors, is fixed at each stage irrespective of the game's history. Conceptually separating the (fixed) stage game protocol from the supergame with preferences over current and past payoffs yields a flexible tool for the analysis of behavior in theory and experiment.

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