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Optimal contracts with team production and hidden information: An experiment☆

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ABSTRACT

We devise an experiment to explore optimal contracts in a hidden-information context. A principal offers one of three possible contract menus to a team of two agents of unknown skill levels, with both agents' participation needed for production. We observe numerous rejections of the more lopsided menus, and principals respond by offering more favorable menus. Apart from rejections, we see almost complete separation in agent choices according to the agent types. Behavior converges towards a consensus in which one of the more equitable menus is proposed and agents accept a contract. The consensus menu differs across two treatments in which we vary the payoffs resulting from a rejection. We find strong evidence of social learning by low-skill agents (but only for low-skilled agents), in that a low-skill agent is more likely to reject a contract menu if her teammate rejected a contract menu in the previous period. In addition, low-skilled agents have a particularly adverse reaction to reduced wage offers.

1. Introduction

The classic 'lemons' paper (Akerlof, 1970) illustrated the point that asymmetric information led to economic inefficiency, and could even destroy an efficient market. Since the seminal works of Vickrey (1961) and Mirrlees (1971), research on mechanism design has sought ways to minimize or eliminate this problem.[1] In an environment with *hidden information* (sometimes characterized as adverse selection), each agent knows more about her[2] 'type' than the principal does at the time

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[1] Mas-Colell et al. (1995) provide a good introduction to this topic, as well as its numerous applications.

[2] Throughout this paper we assume that the principal is male and the agents are female.

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of contracting. In the standard scenario, a firm hires a worker but knows less than the worker does about her innate work disutility.[3]

Private information leads to inefficiency because it is effectively a form of monopoly power (of information). Sometimes it is possible to introduce competition (such as auctions) as a method of reducing informational rents. If competition is not a possibility, mechanism design can still effectively minimize the rents of the privately informed, provided that there are more dimensions in preferences than in the informational problem. If a principal knows workers care both about wages and the number of hours worked, he can devise a contract menu of hours and wages that induces more truthful revelation and reduced inefficiency.[4]

However, while agency theory has traditionally sought incentive-compatible mechanisms on the assumption that people care only about their own material wealth, economic interactions frequently are associated with social approval or disapproval. In dozens of experiments (e.g., Güth et al., 1982; Charness and Rabin, 2002), many people appear to be motivated by some form of social preferences, such as altruism, difference aversion, or reciprocity. Recently, contract theorists such as Casadesus-Masanell (2004) and Rob and Zemsky (2002) have expressed the view that contract theory could be made more descriptive and effective by incorporating some form of behavioral considerations into the analysis. von Siemens (2004) considers optimal contracts in relation to hidden information and social preferences, finding that inequity aversion (Fehr and Schmidt, 1999) "increases the distortions originating from asymmetric information in a monopsony."

We are only aware of two experimental studies of the static principal-agent problem with hidden information. Güth et al. (2001) conduct an experiment in which a principal faces two agents with unequal productivity functions. The principal finding is that making work contracts observable leads to a greater degree of pay compression. Effort choices differ systematically from the "rational" choices in relation to concerns of horizontal fairness. Charness and Dufwenberg (2009) consider the hidden-information problem in an experiment, and find that cheap-talk statements are very useful in achieving desirable outcomes when less-able agents can participate in a Pareto-improvement over the principal's outside option, but not when this Pareto-improvement is not feasible.

Another consideration is that of social learning. Ellison and Fudenberg (1993, p. 612) use the term social learning to describe contexts where agents' decisions reflect the experience of others. We are particularly concerned with whether social norms are susceptible to learning, or whether one's social preferences are immune to information about the actions of others. Previous experimental work in this area has primarily involved social learning in intergenerational games with explicit advice,[5] while some recent work (e.g., Charness et al., 2007; Eckel and Wilson, 2007; Zafar, 2009) has found evidence that people change their social behavior upon mere observation of the behavior of others, as in Ellison (2002).

In the light of these considerations, we conduct an experimental test of contracts with hidden information. In our design, there are two types of agents (high-skill and low-skill, with effort less costly for the high-skill agent) and it is common information that these types are equally prevalent. A principal selects one of three menus, each having two possible contracts, to a pair of agents of unknown types. Each individual agent, who knows her own type and the menus available to the principal, then independently selects one of the two contracts offered on the menu or rejects both. Incentive-compatibility based on standard preferences should separate the types' optimal choices for every menu and no rejections should ever be observed. The menus are ranked with respect to how much they favor the principal.

If both agents accept a contract, the contracts are implemented; if either agent rejects, both the agents and the principal receive symmetric payoffs that differ across treatments. By introducing contracts that must be accepted by both workers, we contemplate the common situation where contracts must be negotiated with a union and then approved by the workers.[6] Besides this feature, our environment, with 3-person groups and interactive preferences, leads to a realistic structure (without otherwise altering the theoretical contractual benchmark) for the way in which subjects receive feedback; this is important since one of our purposes is to understand the way in which agents learn about social norms.

Since people frequently do not act as pure money-maximizers in experiments, there is the immediate conjecture that the usual theoretical predictions will be rejected; nevertheless, we observe that principals usually initially propose the theoretically predicted contract, with this being significantly more likely in the treatment with higher reservation payoffs (those in the case of rejection). When these early-period contracts are rejected sufficiently often (how often depends very much on the individuals and on the reservation payoffs), the principals who were offering them instead choose progressively less self-favorable alternatives, until rejections cease and an 'equilibrium' menu is reached; this menu differs across the two treatments. One might expect principals to recognize that rejections are more costly for agents when the rejection payoff is reduced, so that they offer the most selfish contract menu with some impunity. However, instead the contract menus initially offered are less selfish when the rejection payoff is lower and the contract menu is more stable over time.

We also find a nearly complete separation across types of agent when the agent does not reject the menu that is offered, with the high-type skill choosing low effort less than 6% of the time and the low-skill agent choosing high effort less than

[3] Other typical applications include a monopolist who is trying to price discriminate between buyers with different (privately known) willingness to pay, or a regulator who wants to obtain the highest efficient output from a utility company with private information about its cost.

[4] This is with respect to a situation where the agent cares about only one variable (as in Akerlof, 1970).

[5] See for example, Schotter and Sopher (2003, 2007), Ballinger et al. (2003), Chaudhuri et al. (2006) and Çelen et al. (2010).

[6] In essentially all of Europe, collective bargaining involving trade unions covers more than 75% of all workers (Layard et al., 1994). Our design assumes that a contract structure that affects all workers needs to be approved by a supermajority rule.