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Continuity in mechanism design without transfers

David Martimort [a,b,*], Aggey Semenov [c,1]

[a] University of Toulouse, (IDEI, GREMAQ), France
[b] Institut Universitaire de France, France
[c] University of Toulouse (GREMAQ) and CORE, France

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Abstract

We adopt a mechanism design approach to model communication between a principal and a privately informed agent in the context where monetary incentives are not available. We provide a simple condition on the distribution of the agent's type which ensures that the optimal mechanism is continuous. With strict log-concavity of the distribution, there exists a unique optimal mechanism that is characterized.

Keywords: Communication; Mechanism design without transfers

JEL classification: D72; D82

1. Introduction

Mechanism design problems between a principal and an agent whose preferences over a state-contingent policy conflict in contexts where monetary transfers are not available have recently received a lot of attention. Such models have been developed in view of applications to delegation within the firm (Holmström, 1984), political science (Baron, 2000; Martimort and Semenov, 2006), or regulation

* Corresponding author. IDEI, Manufacture des Tabacs, Bt F., 21, Allée de Brienne, 31000 Toulouse, France. Tel.: +33 5 61 12 86 14; fax: +33 5 61 12 86 37.
E-mail address: martimor@cict.fr (D. Martimort).
[1] *Present address:* National University at Singapore and CORE.

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(Armstrong, 1994) among others. Those models have provided insights on the pattern of communication which takes place within these organizations. With a mechanism design perspective, the principal commits to a policy rule before the agent reports his private information on the state of the world.[2] As such, this approach can be viewed as complementary of the huge literature which, following Crawford and Sobel (1982), deals instead with the reverse signaling timing.

The motivation for the commitment assumption is twofold. From a practical viewpoint first, this assumption might seem sometimes at least as reasonable as the assumption made in the signaling literature that the informed agent moves first. In the context of the organization of legislative committees, for instance, the legislature (principal) can structure the work of committees by moving first. The timing of the mechanism design approach seems also a relatively good short-cut for modeling the repeated relationship between this legislature and a particular committee. More importantly maybe, the commitment assumption is also attractive because it solves the equilibrium indeterminacy that arises in the signaling environment where the agent moves first. The mechanism design approach allows also a full characterization of communication patterns achievable at any equilibrium of a communication game among the agents and allows a meaningful optimization. This is important from a normative viewpoint.

It turns out that in the simple environments with quadratic single-peaked preferences inherited from Crawford and Sobel (1982), the structure of deterministic incentive mechanisms is relatively straightforward as demonstrated by Melumad and Shibano (1991). Those mechanisms may nevertheless exhibit discontinuities much in lines with the kind of discontinuities which arise with the partition equilibria of signaling models à la Crawford and Sobel (1982). Those discontinuities stand however in sharp contrast with the findings of Moulin (1980). This author indeed characterized dominant strategy incentive mechanisms when no parametric restriction on the domain of single-peaked preferences is imposed and found that they are continuous. Without restriction on preferences, the differentiable approach used below[3] is no longer available and Moulin's characterization in fact eliminates discontinuous mechanisms of interest.

In practice however, much attention has been given to continuous mechanisms.[4] For instance, Baron (2000, p. 501) directly postulated the continuity of the optimal communication mechanism in comparing the performances of a legislature using transfers and those of a legislature constrained in this respect. Martimort and Semenov (2006) used continuous communication schemes to compare the performance of different organizations of the legislature with several committees. The benefit of focusing on continuous mechanisms is of course a gain in tractability; an important step to proceed to a normative analysis comparing communication patterns and payoffs across organizational modes. A key issue is thus to determine how much is lost, if anything, by making such restriction. In case continuity of the mechanism is not a significant restriction, the signaling model with its partition equilibria and the screening model significantly differ, leaving as a puzzle which approach is actually the best.

This note provides a sufficient condition that can be directly checked on the distribution of the agent's type which ensures that the optimal mechanisms is indeed continuous.[5] Adding then strict log-concavity

[2] In some of the above applications, the direct mechanism can equivalently be implemented through delegation of the decision to the agent under some constraints.

[3] As well as in Melumad and Shibano (1991).

[4] Or to their interpretation as connected delegation sets.

[5] Our result on continuity appeared in an earlier working paper "*Communication by Multiple Interest Groups*" (2005). Independently, Alonso and Matouschek (2005) have generalized those conditions taking into account that the principal's utility function may not be quadratic. Our proof is more elementary and direct than theirs.