

# Topics in Microeconomics

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# Topics in strategy-proof implementation

## Prof. Timos Athanasiou

### 1. Overview

Implementation is the exercise of incorporating incentive issues in the design of policy. It typically marks a departure from first-best solutions and forces the Planner to accommodate informational asymmetries as well as other physical and institutional constraints. Strategy-Proofness constitutes a particular view on implementation. Most notably it requires that the Planner have a minimum amount of information on the characteristics of the population the policy is targeting. A mechanism that complies with Strategy-Proofness induces each participating agent to reveal the information he holds privately voluntarily and truthfully, independently of the actions of the remaining agents in the economy. A strategy-proof mechanism is, thus, "prior-free" in that the implementation exercise does not rely on knowledge of the distribution of types. Characteristic areas where this approach has found fruitful applications are such problems as the provision of public goods, the allotment of indivisible private goods, voting etc.

### 2. Public Goods

The family of Vickrey-Clarke-Groves (Vickrey, 1961 and Groves, 1973) mechanisms constitutes the most notable family of strategy-proof mechanisms. Prominent among which stands the Pivotal mechanism (Moulin, 1986). In economic domains, the family of Vickrey-Clarke-Groves mechanisms is characterized by Strategy-Proofness and Procurement Efficiency (Holmstrom, 1979). Generically, Vickrey-Clarke-Groves mechanisms fail to balance the budget (Green and Laffont, 1979). As a consequence, adhering to Strategy-Proofness and Procurement Efficiency produces a welfare loss. In particular, the waste takes the form of a budget deficit. Today, this result is accepted as an impossibility and has driven the literature to weaker forms of implementation (see d'Aspremont and Gerard-Varet, 1979). However, a path remains largely unexplored: rather than relaxing Strategy-Proofness, one may drop Procurement Efficiency instead. Thus, we would be confronted with the question: what is the set of Strategy-Proof mechanism that are not Pareto dominated by another Strategy-Proof mechanism? In principle, such a set includes both VCG mechanisms that run deficits, as well as other mechanism that may be budget-balanced while procuring the public good inefficiently.

### 3. Private Indivisible Goods

A recent strand of the implementation literature (see Moulin, 2009) has been dealing with the problem of assigning a group of homogeneous indivisible goods among a number of agents. This problem is particularly prominent in the computer science literature (Apt et al., 2008, Guo and Conitzer, 2010). While initially the focus was on designing rebates of the pivotal mechanism's deficit that minimize the welfare loss (Cavallo, 2006), recent work revealed that relaxing the obligation to always assign the entirety of the goods to their claimants produces solutions that are Pareto superior (deClippel et al., 2011). More significantly,

Sprumont (2013) identifies a family of mechanisms, generically outside the VCG family, that enjoy many desirable properties such envy-freeness, while abiding by Strategy-Proofness. Although, members of this parametric family violate Assignment Efficiency, they still lie on a Pareto frontier of sorts, as no other strategy-proof, anonymous, envy-free and individually rational mechanism Pareto dominates them. Thus, Sprumont manages to reveal a class of mechanisms that has been overlooked by the literature. Identifying the Pareto frontier of the class of feasible strategy-proof mechanisms, however, remains an open problem. Sprumont relies on additional properties in order to obtain his neat characterization. Crucially, not all envy-free strategy-proof mechanisms are VCG: while the assignment must be conditionally optimal (the object goes to a maximal valuation agent whenever it is allocated (Svensson, 1983)), no-envy does allow us to leave the object unallocated.

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# **Design of Auctions and Markets**

## **Prof. Sergei Izmalkov**

A student is welcome to undertake his or her research on any topic broadly falling into the category of applied mechanism design. Here are some possible avenues.

### **1. Auctions and markets in Russia**

Goods and services, licenses, advertising slots are allocated via auctions, as they are simple, fast, and efficient mechanisms to find the prices and determine the allocation. Auctions appear essentially everywhere, from selling antiques to privatization of state enterprises. Auction theory, design and analysis of auctions in practice attract lots of attention from the economists. Possible areas of research are abundant and include design of efficient (and optimal) auctions for specific circumstances of sale and analysis of bidding (in particular, collusive) practices. The following are a few examples of possible auctions and markets to consider.

Russian governments of different levels are obliged to purchase most of what they need via electronic marketplaces, data on which is publicly available. Yandex and Google conduct sponsored search auctions every time a user searches for something over the net. These auctions are of particular interests as Yandex and Google serve as market makers, with an opportunity to adjust the rules of the auction as they see fit.

### **2. New paradigms in Mechanism Design**

What economic outcomes can be reached via equilibria of designed mechanisms, via some equilibria or all, in specific environments and with specific equilibrium concepts? — these are classic questions of mechanism design. Some other issues, traditionally overlooked, may be important for practical design. These may be simplicity of mechanisms used, vulnerability to manipulation by participants and the designer herself, protection of private information of participants, robustness to assumptions about knowledge and beliefs of participants, robustness to collusion among the participants, and many other concerns.

### **3. Social networks and Media**

If a question "What is the most visible development in the world in the last 10 years?" is asked, a definite candidate for an answer is the explosion of the online communities and social networks. Think Facebook, netflix, twitter, livejournal, imhonet. This is largely an uncharted territory for economic research, and so both exciting and challenging at the same time. How does the structure of connections among people affects social and economic outcomes? How do these connections form? Can one improve functionality and economic efficiency of such services relying on the knowledge about the underlying network structures?