Surplus Extraction with Behavioral Types

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Motivation

- In a mechanism design setting where information is independent private information leads agents to retain informational rents
- Myerson (1981) and others have shown that if instead information is correlated then extracting all the rents is possible
- This is usually called *full surplus extraction*
- Crémer and McLean (1988) have identified the key condition under which full extraction is possible
- Here we consider a *reduced form environment* where some types are *behavioral* and do not react optimally to incentives. We study the surplus extraction problem in this environment.

Model

Reduced form environment of McAfee and Reny (1992)

- Single agent with type $t \in T = B \cup S$
  - B is the set of *behavioral* types (finite)
  - S the set of *strategic* types (finite)
- Informational rents of type t: $v_t \in \mathbb{R}_+$
- A finite set of exogenous states Ω
- Beliefs of type t: $p_t \in \Delta(\Omega)$
- A *contract* c is a map from states to transfers: $c : \Omega \to \mathbb{R}$
- A *contract menu* $\mathbf{c}$ is a collection of contracts for each type,

$$\mathbf{c} = \{c_t : \Omega \to \mathbb{R}\}_{t \in T}$$

- The payoff for type t under contract $c_{t'}$ is

$$v_t - \langle p_t, c_{t'} \rangle$$

where $\langle p_t, c_{t'} \rangle = \sum_{\omega \in \Omega} p_t(\omega) c_{t'}(\omega)$

Behavioral assumption

Incentive compatibility is **only** required for strategic types, behavioral types always choose their own contract.

Definitions

- ***Incentive compatibility*** requires that each *strategic* type chooses his cost minimizing contract, i.e., for each $s \in S$

$$c_s \in \arg\min_{t \in T} \langle p_s, c_t \rangle$$

- A contract menu $\mathbf{c}$ achieves ***full extraction*** if for all $t \in T$,

$$\langle p_t, c_t \rangle = v_t$$

- We say that a set of beliefs P satisfies the ***CM condition*** if for any $p \in P$, $p \notin co(P \backslash \{p\})$.

Theorem

Let $P^S = \{p_s \in \Delta(\Omega) : s \in S\}$ be the set of beliefs of strategic types. There exists an incentive compatible contract menu $\mathbf{c}$ which achieves full extraction if

(1) P^S satisfies the CM condition
(2) For all behavioral types $b \in B$, $p_b \notin co(P^S)$

Description of the results

Under conditions (1) and (2) it is possible to find separating hyperplanes that allow to punish deviators to induce incentive compatibility. The main result follows from such punishments not being required for behavioral types since they don't "try" to deviate.

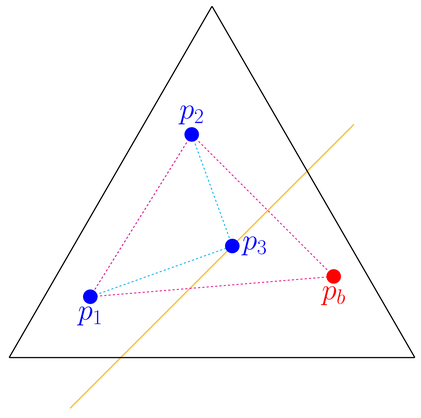
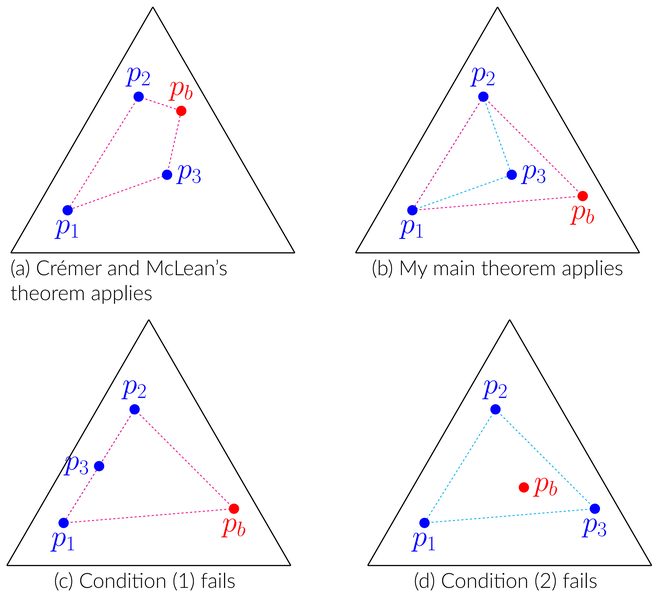


Figure 1. An example where full extraction works: 3 states, 3 strategic types (1,2, and 3) and a behavioral type b. Note that the original McAfee and Reny's result doesn't work here.



(a) Crémer and McLean's theorem applies
(b) My main theorem applies
(c) Condition (1) fails
(d) Condition (2) fails

Figure 2. The conditions of the theorem illustrated

Further results

- Condition (1) is a necessary condition for full extraction
- Condition (2) is not necessary as long as we introduce restrictions to the informational rents of behavioral types

Proposition: Suppose P^S satisfies the CM condition. Let $\hat{B} = \{b \in B : p_b \in co(P^S)\}$. Then, full extraction with behavioral types is feasible if for each $b \in \hat{B}$

$$v_b \geq \sum_{s \in S} \lambda^b(s) v_s,$$

where $\lambda^b \in \Delta(S) : p_b = \sum_{s \in S} \lambda^b(s) p_s$.

Future directions

- Extend the model to richer behavioral assumptions.
- Identify necessary conditions for full extraction if behavioral types are present.
- Complete characterization in a structural model (e.g., auction environment).