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Identification of Pareto-improving policies: Information as the real invisible hand

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Abstract

Finite sets of market data may not suffice to determine Pareto-improving policies.

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1. Introduction

When competitive markets fail to exhaust gains from trade, the question arises whether it is possible to design policies that induce a Pareto improvement. The transfer paradox, introduced by Leontieff (1936),[2] illustrates the difficulties implicit in policy design: without information about fundamentals that are unobservable, such as individual preferences, the prediction of the welfare effects of economic policy is far from obvious.

The theory of general equilibrium with incomplete markets argues that the problem of policy identification is, indeed, of interest: Geanakoplos and Polemarchakis (1986) showed that, when individuals face uninsurable risks, there exist, typically, policies of asset reallocation (which subjects the design of the policy to the same financial constraints that bind the individuals in the competitive market) that make every individual in the economy ex-ante better off.[3]

Early literature on the empirical structure imposed by the competitive equilibrium hypothesis at the aggregate level was understood to imply that the difficulties associated with the identification of Pareto-improving policies were insurmountable: the Sonnenschein–Mantel–Debreu theorem[4] was understood to imply that no information about individual (unobservable) preferences could be elicited from aggregate data.

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[2] Donsimoni and Polemarchakis (1994) stated the paradox in a general setting; Turner (2004) finds bounds on the amount of trade that is required, at equilibrium, for the transfer paradox to arise.
[3] This result, which had been suggested by Stiglitz (1982), was later refined by Citanna et al. (1998) and it was extended to other types of policy by Citanna et al. (2006).
[4] Sonnenschein (1974), Mantel (1974), Debreu (1974); see also Mas-Colell (1977).

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Very perceptively, however, Brown and Matzkin (1990, 1996) introduced an element that was missing in the discussion of the empirical implications of the competitive equilibrium model: the effects of perturbations to individual endowments yield testable restrictions on the graph of the equilibrium correspondence of a standard exchange economy. This idea was exploited by Chiappori et al. (2004), Matzkin (2005) and Carvajal and Riascos (2005), to show that, in economies without uncertainty, the graph of the equilibrium correspondence can be used to identify individual preferences.

The argument for identification extends to economies with uncertainty and an incomplete asset market, as was shown by Kübler et al. (2002) and Carvajal and Riascos (2006); but the extension requires the observation of relatively open subsets of the graph of the correspondence.

Here, we show that finite data sets of equilibrium information may be insufficient for the identification of Pareto-improving policies, let alone of preferences. We restrict our attention to the types of policies considered by the original argument of Geanakoplos and Polemarchakis (1986), and show that finite data sets need not suffice for the identification of individual marginal utilities of income in different states of the world.

The intuition for this failure of identification of Pareto-improving asset reallocations is straightforward: Pareto-improving policies exist when market incompleteness allows the vectors of marginal utilities of revenue across states of the world of different individuals to diverge from co-linearity even at equilibrium. But, with vectors of marginal utilities of revenue that are neither identified nor collinear, Pareto-improving policies are unclear: on the basis of observed data, a profile of preferences in which the policy leaves at least one individual worse off cannot be ruled out.

2. Not everything will do

Consider a finite, two-period economy with uncertainty. Suppose that there are I individuals, S states of nature and L commodities, with commodity 1 acting as numèraire, and that there are $A < S$ linearly independent numèraire assets. Denote asset payoffs in state s by $r_s \in \mathbb{R}^A$.

Let $\mathcal{U}$ be the class of all strongly concave and strictly monotone $\mathbf{C}^2$ functions $v : \mathbb{R}^L_{++} \to \mathbb{R}$.

For individual i, contingent on state s, endowments are $e^i_s \gg 0$ and preferences are $u^i_s \in \mathcal{U}$. There is no date-zero consumption, so a consumption plan is $x = (x_s)_{s=1}^S$. Ex-ante preferences are $U^i(x) = \sum_{s=1}^S u^i_s(x_s)$.

Let $p_s \in \mathcal{P} = \{p \in \mathbb{R}^L_{++} : p_1 = 1\}$ be commodity prices contingent on state s, and let $p = (p_s)_{s=1}^S$. Denote asset prices by q, and let z^i be individual i's portfolio of assets.

If $(q, p, (z^i, x^i)_{i=1}^I)$ is a financial markets equilibrium of this economy, then, generically in the space of economies, there exists a redistribution of individual asset holdings that makes every individual in the economy ex-ante better off (Geanakoplos and Polemarchakis, 1986). That is, for some $(\mathrm{d}z^i)_{i=1}^I$, with $\sum_i \mathrm{d}z^i = 0$, it is true that, for all i, $\mathrm{d}U^i = \sum_s \mathrm{d}u^i_s > 0$, where $\mathrm{d}u^i_s$ is the (spot) general equilibrium welfare effect resulting from revenue transfers $(r_s\,\mathrm{d}z^j)_{j=1}^I$ at spot equilibrium $(p_s, (x^j_s)_{j=1}^I)$ in exchange economy $(u^j_s, e^j_s + r_s z^j (1, 0, \ldots, 0))_{j=1}^I$.

Suppose that, after asset markets have closed, a planner who knows the asset market and who has observed asset prices, q, and individual portfolios, $(z^i)_{i=1}^I$, but who does not know the fundamentals of the economy, namely state-contingent endowments and preferences, attempts to design one such asset redistribution. From an application of the transfer paradox, it follows, with minor qualifications, that this task is impossible: the appropriate policy is not identified from observation of data from the asset markets alone.

Proposition 1. *Information from asset markets does not identify Pareto-improving policies. Let* $(\mathrm{d}z^i)_{i=1}^I$ *be an asset redistribution*: $\sum_i \mathrm{d}z^i = 0$; *if for each state there is at least one individual whose income and utility are perturbed* (*namely*, $r_s\,\mathrm{d}z^i \neq 0$ *and* $\mathrm{d}u^i_s \neq 0$), *then there exists an alternative ex-ante economy*, $((\tilde{u}^i_s, \tilde{e}^i_s)_{s=1}^S)_{i=1}^I$, *that*

1. *cannot be ruled out on the basis of observed data: this economy has a financial markets equilibrium*, $(\tilde{q}, \tilde{p}, (\tilde{z}^i, \tilde{x}^i)_{i=1}^I)$, *that is consistent with the observed data in the sense that* $\tilde{q} = q$ *and, for every individual*, $\tilde{z}^i = z^i$; *and*