

RESEARCH PROPOSAL ON IDENTIFICATION OF UNOBSERVABLE
FUNDAMENTALS FROM ECONOMIC EQUILIBRIA

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Consider the situation where a group of households, $\{1, \dots, I\}$, trade L commodities among themselves. Household i initially owns e_l^i units of commodity l , whose price is p_l . To represent the households preferences for consumption of the commodities, introduce *utility functions* $u^i : \mathbb{R}_{++}^L \rightarrow \mathbb{R}$, so that $u^i(x)$ measures how satisfied household i is when their consumption of the bundles is $x = (x_1, \dots, x_L)$. Denote $e^i = (e_1^i, \dots, e_L^i)$, the endowment of household i , and $p = (p_1, \dots, p_L)$, the vector of commodity prices.

If the household chooses the best consumption plan for itself, from all those that are affordable at the given prices, it will pick a bundle x^i that solves the program

$$\max_x u^i(x) : p \cdot (x - e^i) \leq 0.$$

Suppose that for each vector of prices p , this program gives a unique maximizer $x^i(p, e^i)$; function x^i is known as the *demand* of household i . The *aggregate demand* of the group if households is $x(p, e) = \sum_i x^i(p, e^i)$, where $e = (e^1, \dots, e^I)$. Economic equilibrium occurs where the aggregate demand exactly exhausts the resources of the society, in the sense that $x(p, e) = \sum_i e^i$. The *equilibrium manifold* of the group is the set

$$\{(p, e) : x(p, e) = \sum_i e^i\};$$

under well understood conditions, this set is indeed a differentiable manifold.

Notice that the equilibrium manifold depends only on the utility functions representing the preferences of the households. When constructing the manifold, one must find, for a given profile of endowments e , prices p at which aggregate demand equals aggregate resources; aggregate demand is itself a sum of functions; and each of this functions is given by the solution of some optimization problem. So, effectively, given e , the computation of equilibrium prices entails three steps: (i) the solution of optimization problems for each household; (ii) the aggregation of the solutions of these problems; and (iii) the solution of the roots of the equality between aggregate demand and aggregate resources.

It is a deep, and surprising, result that this three-step procedure can be reverted fully. The literature on identification (see references below) has provided conditions under which knowledge of the manifold, even if only local, allows economists to pin down, in a unique manner, the individual preferences that generate it, locally. Intuitively, (i) knowledge of the manifold allows for the recovery of the aggregate demand function; (ii) this function can be decomposed into its summands; and (iii) each of the individual demand functions can be used to pin down the household preferences.

What the literature currently lacks, however, is algorithms that make the implementation of these results possible. The goal of this proposal is to start collaborative work on

the development of such algorithms. The related problem of determining whether there exist preferences that can generate a given set as their equilibrium manifold poses similar questions, and can generate further research.

We propose to have a series of lectures (by us) delivered to interested students, with the participation of interested PhD students from the Economics Department, to present the current understanding in the literature, and to discuss the existing research problems. After this, we will agree on the research plan for the student(s), who will be jointly supervised, through weekly meetings.

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