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Oskar Morgenstern, Thirteen Critical Points in Contemporary Economic Theory, JEL 10 1972 1163 - 1189.

63 David Hilbert at second international congress of Mathematicians in Paris listed 23 unsolved problems in mathematics from whose solutions much progress could be expected.

O M disclaimed being a Hilbert, noted however that average textbooks refer to applied economic problems, that for them theoretical problems just do not seem to exist.

Surprising that anyone should go into a science in which there seem to be no basic problems -- physics and biology attract brilliant men because their problems are well known and readily acknowledged -- need of good men in economics since problems abound and the very survival of the race may depend on their solution

64 & 65 introductory criteria

1. Control of Economic Variables

65 Present economic theory allegedly deals // 66 // with maxima
66 e.g. of profit, utility... (or minima, e.g. of cost, disutility)

The fundamental objection is that these extrema exist and are attainable only if the firm (or whatever other entity) controls all variables on which the maximum depends.

Economic theory simply is not, in general, confronted with pure maximum problems, certainly not when the theory deals with the interaction of the individual agents not under centralized control. However, this is how economic theory is set up at present and how it is still viewed, e.g. by Samuelson in his Nobel lecture (28a).

What is stated above summarizes a precise and more elaborate exposition of the fundamental issue spelled out in the first chapter of Theory of Games and Economic Behavior (35).

... This is certainly no maximum problem but a peculiar and disconcerting mixture of several conflicting maximum problems.

... This kind of problem is nowhere dealt with in classical mathematics. We emphasize at the risk of being pedantic that this is no conditional maximum problem, no problem of the calculus of variations, of functional analysis, etc. It arises in full clarity, even in the most "elementary" situations, e.g., when all variables can assume a finite number of values.

only/

67 A guiding principle cannot be formulated by the requirement of maximizing two (or more) functions at once.

It is sometimes believed that linear programming, or some /s. of its variants, provides a method for avoiding the above difficulties.

To put linear programming into the right perspective, I quote:

Linear programming is a conceptually very limited matter: it replaces assumptions of continuous relationships by discontinuous ones and allows for inequalities. This makes linear programming more realistic in application, provided the basic condition is met, which is that there must be a central authority (person, firm, government) on whose acts alone the ~~the~~ outcome depends. This must be due to the overriding fact that this authority (person, firm, government) has complete and unchallenged control over all variables. Where there is not complete, central control, i.e., where the outcome depends on several decision makers, as in game theory, linear programming does not give the complete answer. It can however provide caeteris paribus answers (22 p. 446).

To summarize: There is no complete substitution by game theory, but it is evident that maximization, programming whether linear non-linear, dynamic, etc., become ~~is~~ subordinate in the theory of general decision processes. This ~~is~~ is similar to the restriction of the role of Newtonian planetary mechanics by the wider space--time ⁿ concept of relativity theory. However, the absorption of a new paradigm awaits, ~~as~~ a rule, a new generation as Planck has so clearly stated in his scientific autobiography.

2. Revealed Preference Theory

68 .. it is possible, by observing the choice of goods of an ~~an~~ individual under ~~his~~ budget constraints in a market, to determine the order (ranking) of his preferences. Thus, when confronted with the goods, x, y, z... he first ~~he~~ chooses y then ~~he~~ x then z, this reveals his presumably complete ordering y x z.

... the choice is made, given prices for the commodities. The theory asserts that it is possible to infer his preferences from the individual's behavior when confronted with successively changing prices.

... his preference structure can only be "revealed" by an analysis that reaches much further than the observation of his behavior in the above circumstances. The "farther" reach means

either that he has to be questioned directly -- or indirectly by carefully designed experiments -- and that certain minimal time intervals have to be considered over which the attempted preference extends. The time intervals are partly a function of the expected life span of the durable ~~x~~ goods and partly of the nature of the income stream. The time factor of course adds a great complication to what appears to be an innocuous arrangement.

Only if $x, y, z \dots$ are instantly perishable goods or services with effects which often disappear instantly can one imagine that preferences are revealed by the chronological sequence of choices. The theory of revealed preference however is supposed to apply to any kind of goods, to any mixture of durable and non-durable goods. This is by implication, by virtue of the claim of its general validity.

... So we conclude that the theory of revealed preferences in spite of its sometimes mathematical presentation whether in "weak" or "strong" form is found wanting in some of its basic assumptions and is at best restricted to an exceedingly narrow empirical basis.

3. Pareto Optimum

69 The central idea is often formulated in the following manner: an optimum of a group or a society is reached when, by improving the position of one individual (by adding to his possessions) no one else's position is deteriorated....

How does one find out whether there is improvement or diminution? There are only two ways: either the individuals have to be questioned or the outside observer has to make the decision on the basis of the facts.-- But ~~xxxxxx~~ what facts are known to him? How are they established?...

NB Pareto optimum is sometimes used in broader sense: when all further trading stops because no one any longer can improve his position. The difference however is not always ~~xxxxxx~~ sharp.

4. Tâtonnement

71 Since it is conceivable that a state of \bar{x} equilibrium may never be reached in any finite time, the existence of equilibrium has to be proved independently of the use of tâtonnement and it is doubtful whether this superficially intriguing notion is at all required. What possibilities there are would require the use of methods of convergence of non-linear programming.

"Perfect foresight" must of course not be confused with perfect and complete information since these concepts are used in game theory and without contradiction. In game theory the different states of information and their development during the course of play are thoroughly taken into account, especially in the extensive form of a game tree.

5. The Walras-Pareto Fixation

71 It is hard to explain the persistence of this fixation; perhaps it is the silent recognition that facing the real world, the empirically given problem, means the overthrow of much of established, cherished doctrine, and its wake the abandonment of certain mathematical tools which have \bar{x} become so dear to so many... .. "a spectre has arisen" -- game theory -- which, as in their heart they know, rightly challenges the classical outlook, a theory which is so uncomfortable to embrace. However there will be no escape. The // 1172 // Walras-Pareto fixation will have to give way, first slowly, then with increasing momentum. "Free competition" now the \bar{x} center and starting point of economic theorizing will be recognized for what it is: a pathological limiting case of possible economic organization, millions of miles from any reality ever known through the ages. Curiously, Pareto himself has stated the matter concisely: "Free competition produces the maximum of ophémelité; free competition is the rule in our societies; these are two different propositions. The first is most likely \bar{x} true; the second is certainly false." I would say the first is also false or at least unproven or unprovable.

72 .. one cannot treat one's adversary in chess or poker statistically if one wishes to prevail. Instead one must determine one's optimum strategy; and that is not a problem of finding maxima.

A game of infinitely many non-cooperating players is an interesting mathematical construct; a Walrasian system of ~~price~~ perfect competition is an economic aberration.

.. just as utility theory.. is completely deterministic, so is general equilibrium theory... Let no one think that matters could be improved.. merely by introducing stochastic considerations.. Clearly there is uncertainty about prices, quantities produced, demand, stocks... Randomness of the above kind does not resolve the basic -- game theoretic -- problem of how the interlocking economic agents ~~is~~ should be described and explored.

73 If we look at any economy we see bargaining on all levels whether it be wages, price ~~contracts~~, private or government, etc. ... But a look at some leading textbooks...

.. we find that there simply "exists" a price line. Indifference curves do not ~~is~~ contribute anything to answering the question where these prices come from. Not one word about the extensive game-theoretic literature on bargaining, about the many subsequent sophisticated experiments, but merely the statement that it is a complex phenomenon..

.. only mention two (objections to the current general equilibrium theory): first there is the fact that the formation of prices is not explained, as mentioned above... In current theory prices simply exist -- some are equilibrium prices, others are not. If not the adjustments are supposed to occur which will certainly lead to equilibrium either by tâtonnement or in time. Tâtonnement has been discussed above. So a few words about the treatment of ~~time~~ time, the second ~~comment~~ comment on general equilibrium theory is appropriate.

.. But time is a factor in utility, in value, in savings, in expectations, in storage, in the very ~~is~~ notion of a durable good.

There is still no deliberate explicit and comprehensive incorporation of time intervals into the body of contemporary theory exception of course where interest appears.

What is not satisfactory is to have a mixture of phenomena for which time is considered explicitly and with varying assumptions and of phenomena where time is neglected though clearly and ~~powerfully~~ powerfully present.

Finally these systems are supposed to be in stable equilibrium ... Is it not interesting to recall that we cannot yet prove that the orbit of the moon around the earth is stable -- a much simpler system than the American economy?

6. Allocation of Resources

It is the tenet of current theory that the market, and the market alone, allocates resources optimally, presumably under "free competition." If this is to be a description of reality it overlooks the existence of monopoly, duopoly, and oligopoly; I fail to see proofs of the existence of general equilibrium incorporating these market forms in various arbitrary mixtures.

Further more there exist what Italian economists have called *prezzi politici*, i. e., prices formed by political processes. Consider these briefly regarding allocation. Economic theory assumes that allocation of resources only is through markets and that this assumption holds (implicitly) even if there were the above mentioned mixture of market forms. This view completely overlooks the existence of governments, national and local, where allocations are made not through the medium of markets but by means of voting (cf Shubik 32, 1970). Congress, parliaments, governments vote how much is to be invested, when and where the investment should take place. They vote the income of millions of persons (government employees, the military personnel, welfare recipients, etc.). Clearly the movement of these funds -- a respectable percentage of national income -- sets forth flows of money, determines demand, influences prices, and thus affects the free economy sector of the whole economy with its prices, incomes, allocations.

Now it is obviously necessary to expand and deepen the theory of voting just as we try to form a theory of pricing and income formation in the classical sense. Hence attention should be paid to voting procedures which also are of importance for explaining the operation of boards of directors of companies -- not only government.

We thus need studies starting with Condorcet and leading to the theory of a multitude of majority games where votes may even be bought, etc. It is clear that the goals and methods of these

games differ substantially from those describing competitive pricing. It will be very difficult to // 1175 // combine these two worlds into one. The science of public finance continues to ~~live~~ lead a kind of solitary life of its own. Many sound ideas, developed over the last few decades, ought to be incorporated into the general economic theory.

75 There are also allocations -- again affecting income formation -- by chance (eg stock market, inheritance, gifts, etc.) or by technological scientific progress (when certain processes become obsolete and entirely new ones become possible). Some of these are compatible with static theory theory, others have a dynamic element.

Optimal allocation is a conceptually simple matter for ~~h~~ the consumer or the firm when they think that they have completely fixed conditions, both present and future. All they have to do then is to equate marginal costs and marginal benefits because these concepts are applicable then and only then. This may be ~~if~~ computationally of phenomenal difficulty, but logically there is no problem of any complication. However this is not the world we live in. Rather allocations are made in the face of "others" who are also trying to allocate optimally, all interacting with each ~~o~~ other in various ways. Once this fact is realized, a different structure emerges and optimal allocation poses new intriguing problems. It may suffice here to indicate that they exist (23, 1973).

In brief, there is good reason to return to the older notion of political economy as a more adequate discipline for our world than mere economics.