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A THEORY OF MONEY AND FINANCIAL INSTITUTIONS:

PART II.

ON THE PARADOX OF THE EFFICIENT PRICE SYSTEM IN A COMPLETELY CENTRALIZED ECONOMY AND IN A CAPITALIST INDIVIDUAL OWNERSHIP ECONOMY

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Introduction

Although it may be immediately evident that the role of numbers is of considerable importance to both the functioning of a monetary economy and a price system in a nonmonetary economy, formal mathematical general equilibrium models have paid scant attention to the role of either numbers or money. At the level of model building the questions: How many individuals must there be in an economic system before we may expect that there will be a functioning generally accepted paper money system? and How many competitors are required for a price system to emerge? have not been answered. They are extremely difficult to phrase meaningfully in a way that they can be investigated by mathematical methods.

It is my contention that an adequate microeconomic theory of money calls for the correct formulation of both of these questions and their answers. The first undoubtedly requires more modeling of socio-economic behavior than has been done to date. It also requires the application of

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limiting processes to study system behavior as numbers increase. The second requires the use of the latter. Game theoretic methods are suited to both. In this and subsequent papers they are stressed and employed in an attempt to introduce money and financial institutions into a closed economic system.

A Paradox

Why is it that two groups who happen to have the same goals--one a completely centralized socialist economy and the other the citizenry of an individual enterprise economy--should use the same price system in order to achieve their purposes? In the first case, an enormous amount of centralized data gathering and planning is called for. The price-announcing board must essentially solve the general equilibrium problem. It must then announce the appropriate prices to its economy. In contrast, the individual enterprise economy using the markets should evolve the same prices.

Immediately we are confronted with a technical difficulty. There could easily be more than one price system. Is there any reason to expect that the enterprise system and the centralized system should produce the same set of efficient prices? A priori it would seem that the centralized system has "more control." It has the choice over which set of efficient prices will prevail in that economy. We set aside this additional problem, not because it is unimportant but because we wish to address ourselves to an even more basic problem concerning the comparison of enterprise and centralized price systems.

The Disappearance of the Role of Number in General Equilibrium Analysis

In virtually all of the important writings prior to the mathematization of the general equilibrium system, the role of numbers of competitors in the economy has figured in a central way in the descriptions of the economic process. Bohmbawerk's horsetrading market, Cournot's market, Marshall's description of the firm in partial equilibrium, Edgeworth's discussion of the roles of numbers in bargaining, and many, many other writings serve as examples. However, once an adequate mathematization of the general equilibrium system was given, "the baby was thrown away with the bath water." The role of numbers as being particularly relevant to the functioning of a free enterprise price system disappeared from the theory.

One can describe equally well the functioning of a price system for a market consisting of two traders trading in two commodities as well as one can describe its functioning for a market of 200 million traders trading in millions of commodities.

The general equilibrium system, as it is presently mathematized, enables us to establish the existence of a price system that satisfies certain criteria of efficiency (but very weak criteria of distribution). It is the correct abstraction for the way to run an efficient centralized economy via a price system, but it is the incorrect description for the functioning of a free enterprise economy.

Consistent with the needs of a totally centralized economy, the general equilibrium system tells us of the existence of a set of efficient prices but tells us nothing about the emergence of this set of prices.

The actors in a centralized price-announcing general equilibrium system are nonstrategic automata. The very nature of the mathematics constrains each of the individuals to maximize a utility function that is essentially defined for one control variable. The centralized issuers of the price system are able to supply the appropriate information to each little isolated cell in that society so that each individual in that cell is confronted with a one-person maximization problem and, furthermore, is constrained to maximize. His strategic freedom is removed from him by fiat.

The critical confusion between this model of behavior and one in which strategic freedom is maintained rests on a basic misunderstanding of the difference between restricting an individual's freedom to maneuver and having the value of an individual's freedom to maneuver attenuate. An example helps to illustrate this point. When a wheat farmer finds himself in the position of being "one in a million," he has very little influence over the whole of the market. Nevertheless, he is his own master and if he wishes, he may adopt a strategy at which he names a price for his hundred tons of wheat that is a dollar over or under the market price; he is at liberty to have his overpriced wheat rot in his silos or to suffer losses owing to the ridiculously low price he has obtained for his crop. He is a player with strategic freedom in an extremely large game in which the power associated with his strategic freedom is not very much. If there were only two wheat farmers, the power associated with the same strategic freedom would be considerable. This is very different from someone whose "hands are tied," who is instructed that "you have no strategic freedom whatsoever; you are not even permitted to commit errors."

The basic concept of a free enterprise system is one in which even though there may not be outside uncertainty present, there is always competitive uncertainty present. The essence of the system is such that the myriads of competitors are striving in a constructive manner to better their position. Because there are many of them, they may not observe each other individually but may have to be satisfied with aggregates. Furthermore, because there are many of them, the power of the individual to manipulate the entire market attenuates. This does not mean that his strategic freedom has been removed; very specifically, we would expect that one of the virtues of the system is that if someone is not skillful in the game, after committing a series of blunders he is not bailed out by being "forced to do the right thing" but instead goes under.

The Necessity to Study Limiting Behavior in Large Markets

The paradox of the similarity between how to run a centralized economy and how to run a free enterprise economy using a price system disappears if one approaches the modeling of the closed general equilibrium economy from a different viewpoint than that generally used. The approach calls for the specific introduction of the special role of numbers of competitors into the general equilibrium system. This can be done in one of two types of ways. The complete economy may be regarded as a cooperative game or it may be regarded as a noncooperative game.

We may start with an economy that contains a specific number of different types of traders, consumers, and producers. There are a certain number of butchers, bakers, candlestick makers, and so forth. We use some

form of "solution concept" to decide upon distribution policy for this economy. The concept may be something like a generalization of the contract curve of F.Y. Edgeworth (the core), a generalization of the Cournot equilibrium point, or the type of equilibrium suggested by E.H. Chamberlin (the Nash noncooperative equilibrium), or a concept of fair division, or more or less any procedure one might wish to suggest for the division of economic goods among the members of a small society.

We may then take the same model and add more traders, consumers, and manufacturers of the different types to the economy. So that we consider markets in which there are many individuals of every type. A natural economic and a natural mathematical question to ask of this economy is: "Do the various solutions we have proposed start to show regularities or limiting properties as the numbers of individuals in the society grow?" The answer to this question for several strikingly different types of theorizing about the behavior of the few individuals in a market is yes. We do get a striking set of limiting behaviors.

In many instances an efficient price system emerges as the number of individuals grow.

It must be stressed that the deduction of the emergence of an efficient price system from the role of large numbers of traders in a market is extremely different from the assumption of the existence of an efficient price system with no reference whatsoever to the role of the numbers of traders in a market.

On Oligopolistic Elements in an Enterprise Economy

The emergence of the price system that is efficient in an enterprise economy appears to depend specifically upon the adequacy of the numbers of competitors in the market. If some markets have only few competitors, then there will be an oligopolistic distortion to the system as a whole. It may be approximately competitive and efficient in many markets, but it will not be so in all markets.

We are now in a position to summarize the important distinctions between "a numbers approach" to the functioning of an enterprise economy via a price system and the general equilibrium approach. The general equilibrium approach makes no use whatsoever in the formal system of the role of numbers of competitors. It therefore cannot distinguish the behavior or the reasons for changes in behavior of economic units in economies involving many or few individuals that have a centralized political system running the economy, from economic behavior in economies that have individual entrepreneurs "trying their luck."

Not only can a game theoretic approach that depends explicitly upon the role of numbers make the above distinctions, but in doing so several features clear and consistent with common sense and the verbal description of the functioning of an enterprise economy surface immediately in the mathematical formulation.

If there are few traders, there is no particular system property that calls for them to operate via a price system. If a centralized authority for administrative or political purposes decides that they should do so, general equilibrium theory can then be used as a technical programming

instrument to tell the central planning agency what efficient prices are in that particular economy.

If, instead of the above case, there is an economy with individual entrepreneurs and customers in plentiful supply in all occupations, then under a host of very different assumptions an efficient price system will emerge. This requires no central planning board; furthermore, it permits each individual to do as he pleases. If in such a system there are oligopolistic agents, the price of the existence of these agents is reflected in a distortion of the overall price system. The level of the distortion is a function of numbers and other economic data.

On the Role of Numbers in a Monetary Economy

The use of fiat money is a mass market phenomenon. There may be some anthropological examples of instances where paper money was used by a few hundred individuals (although I have been unable to find such examples); but the use of paper money in a market system appears to be predominantly associated with societies who have a well-defined formalized political system and thousands to millions of individuals. If paper money is introduced into the economic system and a government and the agencies that comprise the financial infrastructure are permitted (in various ways) to manipulate the supply of that paper, a new element is then introduced into the control of any emerging price system. Once more we must examine the implications of numbers. In a modern economy, the price system and the market structures form an externality to all individuals. The control over the supply of money in "the game" is as real

a factor as is the control over the supply of wheat. The numbers problem is here with us again.

An economy that coagulates into large units, such as important oligopolistic industries, large trade unions, large municipal and state buying or selling enterprises, large federal activities, and a financial infrastructure consisting of few large units, will form an overall game that is basically oligopolistic. It is extremely unlikely that an efficient decentralized price system can emerge "by itself." An attempt at price control or the breaking up of the large economic units may appear to be the two ways in which one might try to restore or obtain an efficient price system. There are enormous administrative and political problems associated with either approach.

It is not necessarily true that in all economic systems the summum bonum be an efficient price system. That is not the main claim of this article. The major point is that numbers play a critical role in the free evolvement of a price system, and that general equilibrium microeconomic theorizing ignores this role, with the result that it is unable to cast light on a central problem in political economy. That problem is the fundamental difference between a centralized economy and the emergence of a price system in a highly decentralized individual enterprise economy.