

INTRODUCTION TO THE THEORY OF MARKETS

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The functioning of markets attracts a lot of attention. Of particular interest is how markets operate and whether markets function at all in allocating scarce commodities and resources. There is an overwhelming amount of questions that are important both from a theoretical and a practical point of view. For instance, does an equilibrium exist in a decentralized operating market system, how is an equilibrium reached, what happens if price formation is subject to rigidities, what are the consequences of missing markets, for example for future commodities, why is it that so many markets are missing, is it possible to give explanations for the prevailing market structure, which market structures will evolve in case of bounded rationality, incomplete information and externalities, how to regulate markets in case full competition is undesirable or maybe even impossible, what is the impact of monetary policy on the functioning of markets?

That all those questions are not merely theoretical is shown by the continuing debate about the success and the failure of the market mechanism in many countries. For instance, in the Netherlands there exists a governmental program called “market competition, deregulation and privatization,” which aims to strengthen market competition in lots of economic sectors. The program also concerns sectors in which increasing returns to scale have led to natural monopolies run by the government in the past. Recent societal debates are about the question how these sectors should be moved towards the market. Many interesting issues emerge concerning the optimal regulation and organization of markets. The colloquium held in the summer of 1998, on which the contributions in this book report, aims to look at the functioning of markets from a theoretical perspective, however without passing by the possible empirical consequences.

One of the most central issues in economic sciences concerns the existence of a general equilibrium. In most economic models equilibrium means a set of wages, interest rates and prices at which demand equals supply for all commodities. Existence has been proved rigorously in the so-called Arrow-Debreu model, being the basic model in general equilibrium theory. The next logical question is how the economy can reach such an equilibrium. This problem has led mostly to negative results. In the early sixties Scarf gave an instructive example, in which the classical Walrasian price mechanism never reaches an equilibrium. The results of Sonnenschein, Mantel and Debreu in the seventies show that this feature is not an artifact. More recently it has been proved that for a universally convergent price adjustment process to exist, it needs more information than just the values of past supplies and demands. These theoretical results have been supported by simulation studies. By basing economic adjustment processes on simplicial algorithms, however, it has

been shown that incorporation of a small piece of information about prices realized in the past, as opposed to only values of supplies and demands, makes it feasible to design such a universally convergent process.

A necessary condition for market clearance through prices is enough flexibility of prices. In reality many kinds of price rigidities do exist, with downwards rigid wages being a prominent example. Because of these institutional rigidities the price mechanism may not be able to clear the markets. In 1975 Drèze published a pathbreaking article, in which in a general equilibrium framework price rigidities are modeled and market clearance may take place by means of quantity adjustments. This work gave an important push to the macroeconomic literature to amalgamate Keynesian and neo-classical analyses and was in later years also of importance for describing economic systems as present in Eastern Europe and the former Soviet Union. The theory of general equilibrium with price rigidities is also of great help when studying the transition of centrally planned economies to market economies. The theories mentioned above were made operational by means of applied general equilibrium theory.

The basic model of neo-classical economic theory takes it for granted that it is possible to trade today in all possible commodities, including goods that are available or can be delivered only in the future, at any moment in time, contingent on the realization of any possible event. The presence of asymmetric information and transactions costs make such an institutional set-up most unlikely. In the incomplete markets literature such an unrealistic assumption is not being made. This enables us to analyze the vulnerability to risks of fluctuating income that may be due to a variety of exogenous shocks against which full insurance is not possible. These models also make a sound analysis of the financial sector possible. A shortcoming of traditional general equilibrium analysis is that it offers no explanation for all the different financial instruments that are available and has difficulties to account for the role played by money. For example, under certain assumptions incomplete market models yield the in practice often used CAPM approach to price financial securities. Models with incomplete markets have led to new insights in economic theory, such as the constrained suboptimality of the market system, non-neutrality of money and the informational role of prices. Consequently, these models have attracted a lot of attention during the last few years.

The results of the market theories mentioned above are only valid under certain conditions, such as the price taking behavior of the agents and the absence of externalities. Price taking behavior of agents is more realistic in case there are many sellers and buyers on every market. This will not be the case for example if there is increasing returns to scale. To determine the behavior of agents under such circumstances a game theoretic or, more recently, an evolutionary approach is often taken. The evolutionary set-up makes it possible to incorporate a social mechanism in which economic agents adapt their behavior by learning and imita-

tion. As a result the actions of successful agents will appear more frequently in the population, ending up in an equilibrium situation in which all agents play an optimal action given the actions of the others. It has been shown that under this approach boundedly rational behavior of the agents is sufficient to attain stable equilibria satisfying some optimality conditions.

In these proceedings all research topics mentioned above will be addressed. The first six contributions of this book concern adjustment or evolutionary processes and the type of equilibrium that will be reached or may evolve. The opening paper of Drèze analyzes how coordination failures may emerge in a decentralized market economy. Commodities are distinguished in two groups, one with flexible prices and the other with nominally downwards rigid prices. For the latter group of commodities, excess demand results in nominal price increases and excess supply results in quantity rationing of supply at prices that do not change. Under the assumptions of non-inferiority and substitutability the process converges to a supply-constrained equilibrium, at which some markets clear through quantity constraints on supply, with no constraints on demand. The process studied is one in continuous time that mimics several aspects of the functioning of decentralized markets.

A similar model with production is analyzed by Herings, van der Laan and Talman, who dispense with the non-inferiority and substitutability assumptions and prove convergence to a supply constrained equilibrium for a price and quantity adjustment rule which uses some small piece of information of realized prices and quantities in the past. In the short run input prices are fixed and only quantity adjustments take place. In the mid run input prices are adjusted upwards in case of positive excess demand until a supply-constrained equilibrium is reached. In the long run the factor prices in markets with supply constraints are decreased, until eventually a Walrasian equilibrium is reached. In all phases, production adjusts instantaneously to meet the demand of outputs and to keep the output markets in equilibrium.

The paper of Vasil'ev concerns the analysis of economies with central planning and government interference in the allocation of resources, incorporated by a system with two markets for each commodity. The first market is characterized by fixed prices that are set by the state, governmental orders and quantity constraints. Trade on the second market is unrationed and equilibrated by completely flexible market prices. Surplus of goods, purchased at the first market at fixed prices, may be sold at the second market. Due to nonlinear income functions as a result of multiple regulation mechanisms, the type of cooperative stability depends on the order structure of equilibrium prices. Conditions are presented under which the core in the model with two types of markets coincides with the mixed equilibrium allocations. In case of economies with an infinite number of commodities a fuzzy-core approach is proposed.

Saari discusses the question whether we are modeling the correct market information. He argues that basic economic assumptions dismiss important aspects of desired information. The comparison of what happens in experiments with the theoretical results that describe chaotic behavior, learns that people do not behave as predicted. Missing information is for example how to model a rational agent. By averaging excess demand over all initial endowments and prices within a neighborhood of the actual initial endowment and prices, the variation of the averaged excess demand is bounded, whereas it may be unbounded in case of non-averaging. In this way extreme behavior is dropped and better convergence results for adjustment processes are obtained.

Brock and Hommes study in their paper how animal spirits play a significant role in the pricing of risky assets, in order to incorporate market psychology to the behavior of rational agents. In their model the financial market consists of many heterogeneous agents with competing trading strategies based upon possible different beliefs about future prices. Traders update their beliefs according to the evolutionary fitness measure of accumulated past realized profits. A bifurcation route to complicated, chaotic equilibrium price fluctuations occurs when the memory of the fitness measure increases. Also an example is presented of a large type limit, a deterministic approximation of a market with many different types of traders, where initial beliefs are drawn from some random distribution.

The paper of Alós-Ferrer, Ania and Vega-Redondo studies a market in which firms adjust their production on the basis of imitation, learning from own experience, and by local experimentation. Whereas for a fixed number of firms a symmetric marginal cost pricing equilibrium will evolve in the long run, the rate of returns to scale determines the long-run market structure in case entry and exit on the market are allowed. Under decreasing returns to scale and some fixed cost, the Walrasian equilibrium with full capacity will emerge. However, if there is increasing returns to scale, the unique outcome involves a profit maximizing monopolist. This contrasts, for example, with the theory of contestable markets.

The next four papers are about incomplete markets. Although most of the incomplete markets literature has focused on existence, efficiency and indeterminacy issues, little attention has been paid to the question under which circumstances equilibria are unique, a property necessary for comparative statics exercises. The paper of Hens, Schmedders and Voss fills in this gap. Uniqueness can be shown in representative agent economies, or when utility functions are quasi-linear, quasi-homothetic or quadratic. It is also shown that the celebrated Mitjushin-Polterovich Theorem can be extended to an incomplete market setting. Results that do not make use of collinearity of endowments are obtained when coefficients of risk aversion are less than or equal to one. Uniqueness of equilibria might fail when all households have Cobb-Douglas utility functions in a framework with incomplete markets. A new computational method that can be used to generate examples

with multiple equilibria is outlined.

Judd, Kubler and Schmedders address the economic impacts of constraints on short sales and portfolio penalties on the equilibrium behavior of a dynamic stochastic exchange economy with two financial securities. An algorithm is developed that allows agents to trade in the entire portfolio space instead of discretizing the state space as done by others, so that agents can trade as small a quantity of an asset as they want. As a result it appears that in contrast with results for a discrete state space, short-sales constraints will typically be binding. They also show that the type of numerical procedure used may introduce additional constraints to the economic model.

In the paper of Levine and Zame the effect of market incompleteness on risk sharing is studied. They consider a one-good, infinite horizon exchange economy that is populated by a finite number of infinitely lived consumers, who maximize discounted expected utility relative to a stationary period utility function that displays decreasing absolute risk aversion. It is shown that when the investors are sufficiently patient, individual endowments follow an iid process, there is no aggregate risk, and bond markets exist, the equilibrium utilities obtained in an incomplete markets framework are close to the utilities that result from perfect risk sharing. Since the equilibrium interest rate might be quite negative, it is crucial to show that consumers are able to self-insure by borrowing alone, without ever saving, in order to obtain this result.

Bisin, Gottardi and Guaitoli study the interaction between private information and the observability of agents' trade. This observability may range from exclusivity, captured by allowing for price schemes to be arbitrary nonlinear functions of agents' trade, to complete anonymity with linear price schedules. Conditions are examined under which competitive equilibria can be obtained as the limit, as the number of traders goes to infinity, of the Nash equilibria of a game. With symmetric information or in presence of asymmetric information with complete observability of trades, the Nash equilibria converge to competitive equilibria. When information over agents' trade is more limited, convergence is not always guaranteed. Convergence to competitive equilibria with bid-ask spreads obtains if each financial intermediary cannot prevent the agents from buying multiples of the contracts he issues.

The last four contributions are policy oriented. Polemarchakis and Vidal study a macroeconomic model of a monetary economy with cash-in-advance constraints in order to illustrate the macroeconomic effects of monetary policy at equilibrium. Monetary policy has real effects when asset markets are incomplete or when individuals are asymmetrically informed. In particular, when intertemporal substitution of outputs is possible, the rate of inflation increases with the rate of interest set by the monetary authority to accommodate demand for money. Moreover, due to the cash-in-advance constraint, an increase in the interest rate causes a decrease

in both the consumption and the capital stock required to produce the good in all periods.

In the paper of Ruys and van den Brink an institutional market economy is considered in which the firms have an internal organization determined by the environment in which they operate. The value added of a firm is distributed over the distinct positions within the firm according to a game theoretical based remuneration system. The reward for each position consists of a competitive market wage plus a positional rent, while the unique position at the top is the profit-maximizing owner who chooses the optimal firm size. It is shown that internal cooperation might be a cause for wage rigidity, but may as well serve as a tool to increase labor productivity, depending on the production technology.

The models of Keyzer and Ermoliev on producer decisions in a spatial continuum are related to issues of environmental and social sustainability of land-utilization. For each of the models a stochastic quasi-gradient procedure is described that computes with probability one a global optimum for the producers. Two of the models concern a number of industrial plants and a continuum of land users, where the firms pollute the neighborhood, or land users supply inputs to the plants. The third model concerns the question of an optimal parcel structure in case transportation costs are involved and farmers decide which distribution center to use. The optimal solution may only be implemented when accompanied by huge side payments. If not feasible, one may agree on a second-best solution taking the initial parcel structure as given.

The final paper of Rutherford, Böhringer and Pahlke addresses the economic impacts of introducing a carbon tax in order to meet certain emission standards such as those agreed upon in the world-wide Kyoto meeting. It is argued that the overlapping generations model is the only appropriate framework for the analysis. The results obtained differ considerably from those that would have come out of an analysis with an infinitely-lived representative agent. Insight is provided into the distributional consequences of environmental tax reform as well as a more consistent assessment of the social cost of abatement. For illustration a multi-sectoral general equilibrium model calibrated to data for the German economy is used.