

KEYNES LECTURE IN ECONOMICS

# Incomplete Market Economies

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MARKET ECONOMIES are now widely praised, sometimes in quite unlikely quarters. There are of course important ‘Hayekian’ reasons which account for this as well as the lack of success of alternative economic arrangements. I shall not be concerned with these arguments. Indeed I have no intention of arriving at some final judgment of what may be the ‘best’ economic arrangement. My aim is much more modest: it is to re-examine the fundamental notion of ‘market’, to consider whether and in what sense there may be ‘too few’ of these and to study the modifications of economic analysis of market economies which such an examination suggests as needed.

It will probably be useful to begin with an outline of where I am going and why I consider the subject matter of this lecture to be important.

Adam Smith taught us to regard markets as the central device for co-ordinating the actions of a large number of self-interested agents. They provided the ‘invisible hand’. Not only would markets prevent chaos, they would also be beneficial in other ways, for instance in permitting the division of labour. In late twentieth-century economics one of the beneficent consequences of a market economy is summed up by the first Welfare Theorem. It tells us that if every item which enters either into agents’ preferences or into their production activities can be traded at a given price, then the resulting equilibrium is Pareto-efficient.

Pigou was one of the first to provide an analysis of cases where

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important items of preference or technology are not tradable. These are the items connected with external economies and diseconomies. Thus there is no market in pollination services of bees nor in nectar, nor are there markets for air. One can continue. Coase later taught us to regard the market insufficiency as due to deficiencies in property rights, but did not go on to ask why they might be deficient. For instance, it is not clear how property rights could be established for unborn generations which will suffer from our polluting propensities. But in any case 'the problem of externalities' is not only a problem of market economy inefficiency but also of incomplete markets. Economists have had no difficulty in proposing non-market intervention in those cases where I include taxes and subsidies and marketable licences under that category. The point is that all these instruments are employed by a collective and not by the self-seeking agent.

But externalities of the kind familiar from textbooks are only one example of incomplete markets. There are others. In particular there may not be a sufficiently rich array of intertemporal markets and of insurance markets. I shall later give some reasons why this may be so. It is with this kind of incompleteness that I shall be concerned this afternoon.

Take a familiar example. Keynes maintained that 'savings were not a demand for future goods'. But they are undertaken with a view of one's own or one's heirs' eventual consumption. If the saver at the time of saving could also signal his future demand at various dates which these savings represent, many central planks of Keynesian theory would be lost—and he knew it. This is even more true if we allow for uncertainty. Agents care about it and on completeness arguments should be able to trade in it—that is, there would have to be adequate insurance markets. Thus savings in a complete market economy would give rise to trade in goods for conditional forward delivery. For instance one would buy a water bottle or doctor's services with part of one's savings, to be delivered if one is sick next year while nothing is delivered if one is well. In such an economy savings would not be diverted to 'precautionary money balances' and once again little would remain true, or even relevant, of Keynesian theory.

The example suggests that the study of incomplete market economies and the recognition that they need studying may be important. I shall later remind you of an important further problem which incomplete markets present. Students are taught that firms maximise profit. Except for certain extreme cases, this cannot mean that firms are only interested in today's receipts and costs. So it is explained that it is the present value of profit that is maximised. But if goods cannot be traded forward today, then this maximand depends on price expectations. Those may be different for

different shareholders. Once we are in the realm of expectations we must also consider risk aversion. But that may differ amongst shareholders. In short, we have no justification for what we tell students unless markets are complete. Should students not be told? Should advisors to Chancellors not be alerted?

But there is another important consequence of incompleteness on which I shall dwell more fully later. Incomplete inter-temporal markets give rise to an economy with trading at every date—a ‘sequence economy’. The stage is set for monetary theory. It cannot be studied in a complete market economy. But even more significant is the impossibility for the economist of neglecting price expectations. Yet another stage is set on which Keynes can play a star role. For one must now consider equilibria as equilibria of beliefs and this, as we know from the ‘sunspot literature’, is a departure from orthodoxy for which equilibria are reflections of ‘fundamentals’.

So there are a lot of rather important questions to be answered. But so far I have taken markets to mean what the textbooks call ‘perfect markets’. Not only that, these markets are conjured up but not analysed. Most transactions are mediated transactions. For instance by shops and wholesalers. Of course one might think of a market for some good as just an opportunity to trade it. But that gives too little structure although no doubt there are goods which are traded directly. I think sufficient generality is ensured if we say that a good has a market when it is traded through mediators. The latter to some extent perform the role of the fictional auctioneers of theory, although they are ‘real’ auctioneers. But that analogy must not be taken too far and the mediator, just because he is not fictional, may well bargain with either his supplier or demander. All of these matters are taken up in the second part of this lecture, but you must be warned that I do not get as far in the analysis as one would like.

I shall now start off in the more traditional way which does not concern itself with the mechanism of exchange, but simply assumes what the textbook calls ‘a perfect market’. I do so because I want to report on some of the new results in the analysis of such economies for which the market is incomplete. They certainly are of intellectual interest on their own account. But they also have what I consider at least two important messages. The first is that incomplete market equilibria are not only Pareto-inefficient, which is obvious, but *constrained* Pareto-inefficient. The second is that equilibrium analysis may not buy us much because it may be that there are not only many, but a continuum of equilibria. If these propositions are true for the idealised economy here studied, then one would be surprised to find that more realistically based models perform better. Of course they might. But that is not all. The idealised

model has been much used by empirically minded economists—not least by ‘classical macro-economists’. For them these new results should be of peculiar interest.

## I. The Tradition

It is useful to start with what we know. In received theory (as I have already noted), to assert that a good has a market is equivalent to the claim that agents can trade in that good to any extent at known and given terms. The market structure of an economy is then given by the array of prices that agents face. It does not seem that classical and neo-classical economists differ much here.

From my point of view the first important step is to consider the classification of goods. We want to distinguish one object from another if it is distinguished either in preferences or in technology. In general this means that goods need to be distinguished by location, date of delivery and state of nature as well as by physical characteristics. Perhaps to some the only unfamiliar item here is ‘state of nature’. Savage thought of a state of nature as a particular history of the environment which is independent of the actions of agents. If this history brings rain today then an umbrella will be valued differently than it would have been had it been fine. In principle a good at any location and date must be distinguished by all states of nature between which agents can distinguish and for whom the distinction is economically relevant. It now follows that if all goods so distinguished have markets in the traditional sense it is equivalent to all goods having a price. If one picks a particular date, location and state, as the ‘present’ then all these goods must be priced in the present. In that case markets are said to be ‘complete’ although I shall argue shortly that this may be a misnomer.

Since this way of thinking of goods and markets may not be familiar to everyone, I give an implication of complete markets, by way of example. Consider a firm. We think of it now of making a contingent production plan. That is, it decides on its inputs and outputs for each date and state of nature. It buys and sells claims to these goods in the present. For instance it makes a contract in the present for labour to be delivered next year if it does not snow, and pays for it in the present. It also sells the output of this labour in the present, that is what that labour will produce next year if it does not snow. If it does snow no labour or output will be delivered. It is clear that the firm will be fully insured against unpredictable states of nature and that the future is collapsed into the present. If such a firm

maximises profit, that is the revenue from all goods sold minus the revenue from all inputs bought, then it is easy to show that this is exactly what each shareholder of this firm regards to be in his or her best interest. In textbooks this rather weird scenario is rarely spelled out but it underlies the rationale of profit maximisation.

Now let us note that there is an obvious moral hazard problem with contingent forward contracts. The moral hazard problem and its consequences are perhaps less well known and certainly not yet fully understood. Strictly speaking, forward contracts are promises, and promises can be broken. They may be broken deliberately or because of miscalculation. Until quite recently the matter has not received proper theoretical attention. As we shall see this difficulty may account for incompleteness of markets. But it also reminds us of the necessity of thinking of a market theory as firmly embedded in a legal system. For instance bankruptcy and default laws are clearly relevant. To give an example, privatisation of the Czechoslovak economy is at the moment retarded by a lack of adequate bankruptcy laws which, for instance, are required to attract foreign investors.

Suppose we now, as in the textbook, ignore all these caveats (including externalities), and return to what is misnamed a complete market economy. An equilibrium of such an economy is by its nature an equilibrium through time. Once transactions have been completed, the actual economy unfolds as time and states of nature unfold. Deliveries are made at each date and in each state as agreed beforehand. Of course this long run equilibrium is not necessarily a steady state, nor even a stochastic steady state. For instance it could manifest itself cyclically. But under suitable assumptions we know that such an equilibrium exists and what is more, that it is Pareto-efficient. To this last result, even in the purest cases, we need to add a caveat—we are speaking of finite economies, that is, economies over a finite future. If the indefinite future is included then some further conditions are needed to ensure Pareto-efficiency. We also, of course, have the subtler second Welfare Theorem which tells us that in suitable circumstances every Pareto-efficient allocation can be decentralised into a competitive equilibrium.

It is unlikely that many people will regard this abstract theory as yielding an adequate base from which to mount arguments in favour of market economies. As stated it is plainly false: for instance such an economy could have no use for money as a medium of exchange, because all transactions are carried out once and for all in the present. But there are other counter-factuals to which I return.

However it is possible to make the story somewhat less unrealistic, although, as I shall argue, not much less so. This modification is due

to Arrow (1953). Suppose we consider a date  $t$ . Now if it rains at  $t$  we will call this an event: it is all the states of nature—histories of the environment—which have rain at  $t$ . We then call  $t$  and rain a ‘date-event pair’. So far we have assumed that all goods, whatever their appropriate ‘date-event’ pair, have markets in the present. Arrow suggested that we can do with far fewer markets. In particular if we had in the present as many securities with independent payoffs in the date-event pairs, as there are date-event pairs, then that economy would have the same equilibria as the one with many more markets. Once certain assumptions are made the argument is straightforward.

Suppose there are only two dates, the present (when the state of nature is known) and tomorrow. Suppose it is not possible to have any conditional forward transactions in the present. Suppose further, and that is crucial, that everyone knows with certainty what prices tomorrow will clear all markets for every possible event. Note that there are now only spot prices for goods and that agents will no longer be able to complete all their transactions in the present. However, knowing tomorrow’s market clearing prices, say if it rains, there is a certain amount agents would wish to have available. If there is a security which pays a certain amount of numeraire if it rains tomorrow they can make sure of their wealth for this date-event pair by buying an appropriate amount of it in the present. If it does not rain, perhaps that security pays nothing, but there is another which pays if it rains. In that way all the insurance open to agents in the complete markets is also open to them in the Arrow-security economy. Moreover there are no new opportunities and so the same choices will be made in both economies.

Arrow has thus shown us a way in which the economy with all transactions in the present can equally well be thought of as a sequence economy with transactions in every date-event pair. Completeness now means that the security pay-offs ‘span’ the set of all date-event pairs so that any combination of wealth across these can be attained by a suitable present portfolio. However this equivalence of the equilibria may, and indeed has, obscured certain important differences between the two economies.

In economies in which goods markets are complete any given economy is adequately describable by preferences, endowments and technology together with the commodity space and consumption sets. This is not a sufficient description of the Arrow-sequence economy. For the latter we have also to specify spot price expectations—that is the prices expected for any date-event pair other than the present pair. At this stage Arrow introduces an assumption which has since become very popular—he assumes that there is perfect foresight of market clearing prices for each

date-event pair. This is not only a strong assumption and one which I shall argue is not unambiguous, but it is an assumption which is not needed in the complete goods market economy.

A second difference arises between these two types of economies if we take account of transaction costs. Since there are fewer markets in one than there are in the other, one would expect equilibrium transaction costs to differ between them. Taking account of such costs in both economies will generally yield different equilibria which one would expect to differ with respect to Pareto-efficiency.

The ambiguity in the expectation hypothesis arises from the likelihood of multiple equilibria. Consider a two-period economy. Second period spot prices which clear markets given an event will generally not be unique simply because the conditions necessary for uniqueness are pretty restrictive. If that is so, then, in specifying price expectations held in the present we must arbitrarily pick one possible equilibrium from amongst what may be a large set of equilibria. There is thus an important *ad hoc* element. It should however be noted that a full Arrow-Debreu economy may have a unique equilibrium even when the associated sequence economy with complete securities has multiple second period equilibria.

Before I discuss this further I want to take a short detour to rational expectations models as used particularly by macro-economists. In that literature, expectations are said to be rational if the price (of the single 'representative good') is equal to the mathematical expectation of this price, conditioned on the agents' information plus an error term of zero mean and fixed variance. Note that all price differences over states of nature are captured by the error term. Note also that since these authors seem to postulate risk neutrality as a matter of course, there is no desire to trade across states of nature. Finally note that, like Arrow, agents are assumed to know which of a number of possible equilibria will occur. It is not easy to see why any of these assumptions are justified. Moreover there is the unfortunate fact that a theory designed to rescue us from the '*ad hoc*ness' of Keynesian practitioners is thoroughly *ad hoc* itself.

Returning to the main theme one notices that in the Arrow-sequence economy such spot price uncertainty as there is in the present is entirely based on state uncertainty. The state is a random variable but the spot prices are single-valued functions of the state. As I have said, this is a possible assumption but it is not descriptively persuasive. It is, for instance, not fanciful that in the present the agent is uncertain of the market clearing price of wheat next period, if it rains. This uncertainty may be based on the understanding the agent has that there are a number of market clearing prices of wheat if it rains and that the one which will prevail will depend

on the beliefs of other agents which will determine the wealth which they transfer to the state 'rain' next period.

I have now come to a point in the argument where I pause to admire an important Keynesian insight. For neo-classical theory of the sort that I have been dealing with, the market economy is a non-distorting reflection of the reality encapsulated in preferences, endowments and technology. Accordingly, a market equilibrium reflects this reality faithfully if markets are complete. For Keynes a market equilibrium is an equilibrium of beliefs which may or may not reflect reality. This insight has only recently resurfaced in sunspot theory and in game theory. If my foregoing arguments are correct and the economy has multiple spot equilibria, then the Arrow security equilibrium is what it is because everyone believes that that is the equilibrium and not because the underlying reality demands it. It is somewhat surprising that many politicians seem to understand the basic idea here—think of the arguments for joining E.R.M.—while economic theory until recently has taken no notice of it.

But this line of argument leads to certain, not exclusively technical, difficulties with the notion of complete markets and indeed with that of equilibrium.

Suppose for the sake of simplicity that second period market clearing prices are formed by auctioneers of the usual tatonnement story. But each one of these auctioneers guides the economy to one of the possible second period equilibria. Then agents can be thought to have expectations of which auctioneer will be in charge. In the usual way let us think of these beliefs as probability distributions. There is now uncertainty concerning the state of nature and concerning the auctioneer in charge. One is now tempted to say that we shall need securities to span not just the states of nature but the joint 'state' of states of nature and auctioneer. One thus would need more securities. I shall now distinguish between 'Savage States of Nature' which are the states I have discussed so far and the 'Augmented States' which include the auctioneers.

However completion with respect to augmented states leads to a serious problem. It is easy to show as before that the completion of securities in this sense would once again lead to an equivalence between the complete goods market economy and the sequence economy. That is, there would be implicit prices such that it is possible to think of this economy as completing all of its transactions at a single date. But households' utilities depend on the amount of each good they have in each state of nature and not at all on which auctioneer performs in the second period. If these households are risk-averse expected utility maximisers, then their present choice of goods for any state of nature in the second period cannot be different when auctioneers are different. That is so because if it were so dependent



the expected quantity of these goods over auctioneers would dominate the supposed choice.<sup>1</sup> This is a simple consequence of risk-aversion. Hence markets completed for price uncertainty leads to the conclusion that there can be no price uncertainty.

The arguments here are closely related to the sunspot literature.<sup>2</sup> The different auctioneers are like sunspots in the sense that agents' endowments and preferences do not depend on them. The uncertainty arising from multiple second period equilibria is extrinsic, i.e. not deriving from 'fundamentals'. We know that if we include extrinsic uncertainty with states of nature and have complete markets, then there cannot be an equilibrium with extrinsic uncertainty. Sunspot equilibria are not possible in an Arrow-Debreu economy which is derivable from a complete securities sequence economy.

We have come to an interesting conclusion. Assuming that second period spot equilibria are not unique, completing the security market rules out multiplicity. But then the extra securities which the spanning of the augmented state space seemed to require, will be redundant. From this I conclude that equilibrium with complete securities spanning the augmented state space implies that there is only one second period equilibrium for each Savage state. But that means that there cannot be multiple second period price equilibria, which is what I started with.

All of this sounds like airy-fairy theory topped with technical froth. But even though it sounds like that, it is of considerable practical relevance. Market economies may expose agents to uninsurable uncertainties which cannot be insured by creating insurance possibilities. Even quite casual acquaintance with the citizens of countries making the transition to market economies will convince one that they are vividly aware and sometimes resentful of the extra uncertainties they impose. My claim is that these may be intrinsic and not just traceable to Savage states of nature which of course also impinge on a command economy. If it is indeed true that typically people are risk-averse, then we know that they would be willing to trade mean income for a reduction in risk. It is thus an important policy question whether completely free market institutions are what one wants. To answer that one would have to undertake a careful analysis of possible uncertainty-reducing public policies which could be pursued in a basically market-oriented economy.

I now conclude this line of thought by reporting briefly on traditional incomplete market theories in which it is assumed that all agents know

<sup>1</sup> Utility depends on consumption  $c(s)$  in various states  $s = 1 \dots S$ . Risk aversion implies that if it is possible for the agent he will want to consume the same amount  $c(s)$  whatever the price vector  $p(s)$  which clears markets.

<sup>2</sup> I owe the direction of my thoughts here to a conversation with Andreu Mas-Collel.

with certainty what second period equilibrium is for each Savage-state of nature. The economists who have recently made most progress here are Radner (1972), Geanakoplos and Mas-Colell (1989), Geanakoplos and Polemarchakis (1986), but there are other contributors, in particular an early one, namely Cass (1984).

Radner was the first to provide an explanation for incomplete markets. This turned on asymmetric information. A contract where payment was conditional on a state which one party could verify while the other could not would be exposed to moral hazard and so, Radner argued, could not be made. Nowadays we would put this differently: asymmetric information requires contracts whose terms ensure incentive compatibility. That is, they make it in the interest of the better informed party to be truthful in the report of the realised state. If this is possible the contract will not be of the sort which we find in Arrow-Debreu theory. Radner thus was right in saying that Arrow-Debreu contracts may be impossible to make under asymmetric information, but he was not right in thinking that no contracts could be entered into by differentially informed parties.

A second reason for incomplete markets is the existence of transaction costs. Brokers and insurance companies do not come free. I argued this a good time ago (1965). But transaction costs pose problems for traditional theory, and it is best to postpone their discussion.

The line taken by research is to take the degree of incompleteness as exogenous. This is clearly unsatisfactory and the closing of this intellectual gap must be high on the agenda. So far it has not been possible to do so satisfactorily.

If we stick to a world where all insurance is by means of securities, we must distinguish between at least three pure kinds: securities whose pay-off is denominated in unit of account, those that are denominated in numeraire, and those that are denominated in goods. There are conclusions peculiar to each of these. If pay-off is in unit of account and securities are incomplete in  $S$  Savage states, then (generically) there is an  $(S-1)$  dimensional set of equilibria.<sup>3</sup> This is indeterminacy indeed and gives much scope to Keynesian bootstraps. For the numeraire case there is only the possibility of isolated equilibria. On the other hand all of these are generically constrained Pareto-inefficient. By that one means that they are inefficient even taking account of the constraints that all insurance must be by means of securities. The inefficiency is best understood by remembering that with incompleteness, the marginal rates of substitution of wealth over states will generally differ between agents. A small, initial

<sup>3</sup> I.E. The set of equilibrium allocations is generated by a differentiable function from  $(S-1)$  dimensional Euclidean space.

wealth preserving redistribution of securities between agents will then generally affect equilibrium prices. That is, a social planner would have to take this externality into account in allocating securities.

In the final kind of security there are difficulties with existence proofs first noted by Hart but since resolved in a surprisingly highbrow way.

It is seen that incompleteness is not just a theoretical toy. It has for instance important policy relevance. A good example is provided by Newbery and Stiglitz (1981) in their analysis of agricultural price stabilisation schemes and many more in a survey paper by Newbery (1989). The 'indeterminacy' results of course throw doubt on the usual rational expectations macro-models and so on forecasts and policies based on them. In particular the assumption that 'agents know the structure of the true model' even if accepted is now a quite inadequate foundation for these models. Indeed indeterminacy suggests that the formulation of learning hypotheses and adjustment processes may be essential to the usefulness of macro-economic models. But I leave this analysis carried out in the framework of traditional value theory in order to consider some more radical difficulties.

## II. Some Steps Towards Realism

The traditional, let me call it 'textbook' treatment of markets has the virtue of simplicity, but the drawback that it is incomplete and also in various ways unrealistic. To say that some good has a market is to claim no more than that it may in some circumstances be exchanged for something else. This is not very precise nor informative. For instance is there a cost involved in the exchange act? Is there only a limited number of goods against which it can be exchanged? Do agents know that an exchange is possible on certain terms or do they have beliefs on this? And so on. Evidence for the incompleteness of the textbook account is its inability to provide an exchange role for money and its neglect of a large and important group of agents which consists of middlemen.

One could attempt an abstract formulation of the market structure of an economy of which the textbook case would, I believe, be a very special instance. This way of proceeding accords best with my inclinations but, on reflection, seems inappropriate to this occasion. I shall accordingly concentrate on certain elements of a whole collection which may eventually add up to a satisfactory account. My particular aim is to give a more plausible and also perhaps more interesting account of incompleteness.

I shall concentrate on mediation. There have been a number of fine technical accounts of economies where agents are confined to bilateral

exchange and where exchange partners' meetings are random. Particular notice here is owed to the very fine work of Douglas Gale (1986). But his intention was quite different from my present one. He was concerned to establish that in certain cases the stationary outcome of exchange encounters would be the textbook one. My concern at the moment is to make theory descriptively more adequate and bilateral exchange does not provide that. To this I am bound to add that Gale paid little attention in this work, although he had done so elsewhere (1982), to problems of trust which arise in inter-temporal exchange.

The reason why exchange à la Gale is comparatively rare is that it leaves open a profitable, but unfilled, niche. This is especially so for a monetary economy. The best and simplest example is an estate agent. He collects offers to sell or offers to sell conditionally on an agreed price. This is plainly to the advantage of buyers and sellers. Both would be willing to pay for the informational services provided. Notice further that the estate agent's existence does not exclude eventual bargaining between buyer and seller once they have found each other. In other words the institution of middlemen provides information for which other agents are willing to pay. There is naturally also a cost to mediation and whether particular exchanges are mediated by a middleman will then, of course, depend on an obvious cost and willingness to pay condition.

By increasing the chances that a willing buyer will meet a willing seller, middlemen of course reduce transaction uncertainty. In many cases middlemen can reduce the buyer's transaction uncertainty significantly by holding inventories and so becoming the proximate sellers. This is particularly true for standardised goods. They may also enable futures contracts to be entered into which would not be possible in bilateral exchange. The reason is that large numbers can make risks of default acceptable. All of these roles, to be fully understood, require formal modelling and here they should not be treated as more than suggestive.

But it may be helpful to show the possible importance of some of these suggestions in the context of familiar search theory. To fix ideas consider labour search. The worker knows the distribution of offers but not any particular one. He searches for an offer at a wage which is no less than a critical one. The latter depends on the distribution of offers and on search costs. Now imagine a mediator in the form of an employment exchange. Since these theories assume homogeneous labour it is pretty clear that the distribution would collapse. On the other hand, workers would save search costs. It is not difficult to see that the employment exchange may be able to charge workers as long as there is no private transmission of the information which it has. In fact the employment exchange would make this market very close to that described in the textbook.

Or consider Diamond's (1982) very interesting approach. It will be recalled that this is a model of search for bilateral exchange partners. He noted that increasing the number of searchers, by raising the probability of partners finding each other, would be Pareto-improving. He thus identified what appears as an important externality and a potential source of co-ordination failure. Yet here also there are unexploited profits to mediation. In his particular example all a middleman need do is to provide a list of all those willing to exchange, while crossing out names as exchange proceeds. This would involve some costs both for him and the agents who must give their names and tell him when to cross them off. But it would be surprising if not everyone involved were not better off than in the Diamond world. There is co-ordination failure because there is no co-ordinator even though a co-ordinator could cover his costs.

It is seen that allowing for mediators can affect the conclusions we reach. But while a glance at statistics will quickly convince one that mediation is a surprisingly large fraction of G.N.P., there are also obstacles to mediation.

An important obstacle is that it is almost surely subject to increasing returns. This fact alone would reinstate Diamond's externality although it would now be of slightly different origin. But significantly increasing returns may make mediation altogether unprofitable for specialised goods with few traders. This would seem to apply to goods conditional on idiosyncratic states of nature where 'idiosyncratic' here means that these states are pay-off relevant to only small groups of agents. Moreover, if asymmetric information requires that exchange be carried out by means of incentive compatible contracts, then mediation may be inhibited by the cost of devising such contracts for heterogeneous traders.

I should now like to propose that by incomplete markets we mean incomplete mediation. This proposal is motivated by the notion that by a market we really understand the possibility for exchanges. But it is not easy to think of goods for which exchange is strictly impossible, except where there are legal constraints. It may be costly in search time and thus finally not profitable, but that is something different. The advantage of my proposal is that it will in an obvious, but by no means simple, way make incompleteness endogenous. It will also bring it closer to what is ordinarily meant by the claim that such and such a good has no market. The reason why an exact implementation of the proposal will not be simple is this. One will need to decide whether the existence of what I have called a profitable niche is sufficient for it to be filled. But profitability itself will not be straightforward: one particular niche may only be profitable if some other niche has been filled. We are familiar with this kind of problem in

attempts to make the variety of goods endogenous. In the present case increasing returns add further complications.

There is also the very difficult question of competition between mediators. Increasing returns alert us to well known problems here. There is the additional fact (recently emphasised by Stahle [1988] and Yanello [1989]) that mediators deal with both sides of the market and that there will thus be competition in both sides, and that competition will be by price-setting. Particular cases may yield to analysis relatively easily, but it will not be easy even to define, leave alone prove, the existence of an economy-wide equilibrium.

But there is a further caveat. The proposal, as indeed the whole story of mediation, only makes sense in a monetary economy. One can imagine mediation of barter, but it is likely to be very costly. We now have a very satisfactory literature which has made the very old arguments showing the efficiency gains of monetary exchange precise. (e.g. Ostroy and Starr, [1990], Darrell Duffie [1990]). But I believe that these efficiency gains are themselves closely related to mediation. This seems particularly clear in Duffie's contribution which, incidentally, also seems to identify 'market' with mediation.

Suppose now that mediation is complete. It will not ensure the Pareto-efficiency of an equilibrium. That is so for two reasons. Mediators make their return from a spread between selling and buying price. This spread will put a wedge between the marginal rates of substitution of buyers and sellers. The second reason arises from increasing returns to mediation. For instance there may be a Pareto-improvement possible from making a 'thin' market 'thick'. But as long as it is thin and costs are high, agents are deterred from using it and there is no obvious decentralised mechanism to remedy the situation. There is here an externality for which there does not appear to be a Coasian remedy by means of property rights.

Of course care must be taken with the appropriate notion of Pareto-efficiency. Reallocations themselves will incur mediation costs. Nonetheless, taking account of this, there are generally Pareto-improving reallocations from equilibrium. That would be true even without increasing returns to mediation. The reason is, just as in the incomplete securities case, that the social planner would need to include in any decentralisation rule, changes in relative equilibrium prices resulting from a reallocation; private agents do not take account of these.

I believe that we are now on the way to a richer analysis of incompleteness. When I gave an account of what I have called the 'textbook view' it was clear that it was taken for granted that spot markets were costlessly mediated or behaved as if that were so. But that assumption removes a number of problems of considerable economic importance. If

goods are durable then generally their date of birth matters. If goods are purpose-specific, they may have a narrow market or no mediation at all. That means the purchasers of new durables or of specific goods run considerable transaction risks if there is no mediation for them in subsequent periods. Considerable costs may be required for their exchange. This is a familiar problem of illiquidity and inflexibility. The risk is two-fold: there being no mediation it is not plausible to suppose that there is a known price. But there is also the cost of finding an exchange partner at all. These risks of incomplete mediation have been ignored in the incomplete market literature. They may have serious consequences.

To sum up. I have argued that the textbook notion of 'market' is unsatisfactory, not only because of its lack of realism but also because it leaves an extremely important range of activities unexplained. I have proposed to distinguish between mediated and non-mediated exchange. Completeness now refers to mediated exchange. Because of increasing returns to most mediation, we would not expect a counterpart to the first Welfare Theorem to hold. One also expects that this is a further source of multiplicity. Lack of mediation exposes agents to uncertainty which is different from state of the world uncertainty, and which may be more important. A theory of the economy from the standpoint here taken concerns a monetary economy since one can take it that, because of the high cost of doing so, mediation in a barter economy would be much restricted.

### III Remarks on Production and Imperfect Competition

So far I have been largely concerned with pure exchange economies. Production raises new problems which I can touch on but not resolve.

I have already noted that when markets are incomplete we cannot rely on shareholders' unanimity to justify the assumption of profit maximisation. Except for some special cases (e.g. Dreze [1987], Grossman-Hart [1979]), the principal-agent problem becomes peculiarly opaque. Many of the difficulties point towards a managerial theory of the firm. That is to a theory in which the organisation and perhaps ethos of a firm, as well as its information flows, become central. There are such theories, but much remains to be done. One part of this will have to deal with the constraints in which managerial decisions operate. Here incompleteness will again be important. We believe that management must pay some attention to share prices (because of take-overs), but except for the case of risk-neutral investors, we cannot rely on the 'efficient market' hypothesis. Share prices will reflect not only estimates of profits but also attitudes to risk. It is for

instance not at all clear how managers should evaluate the effect on the price of their shares of increased expenditure on R and D.

It may now be argued that while these observations are largely correct it is nonetheless unlikely that the hypothesis of profit maximisation will be seriously misleading when, for instance, used as a basis for comparative statics. Thus, it may be said, there is no reason to suppose that managers will not wish to produce efficiently, so that for instance well known substitution effects of changes in relative input prices will continue to be validly predictable. I have some sympathy for this view but there are reservations. These are that this kind of 'as if' methodology will leave many important phenomena unexplained and indeed unpredicted. For instance risk-aversion, together with incompleteness, seems important for an understanding of investment which is postponed until some uncertainty is resolved. Hence at the very least I would take 'as if' far enough to endow the firm with a utility function. This sloppy way out is perhaps the best we can do now—but it is very much a second best.

But in many ways a more serious problem is raised by the perfect competition postulate. There is a limit to 'as ifery', and here we have probably reached it. Certainly the assumption stops us asking important questions or explaining important phenomena. For instance it rules out any meaning to a claim that effective demand is too high or low and of course it makes a theory of price adjustment by economic agents impossible. At the very least it must be worthwhile attempting theories not so much at variance with the world. Of course I cannot do so here and I confine myself to only a few remarks on non-perfect competition and incomplete markets.

Once one takes the courageous step to do without the perfect competition assumption one also begins to feel that 'state of the world incompleteness' may not be the only, or even most important, form of incompleteness. That is because non-perfect competition thinking quickly leads one to recognise externalities which have nothing directly to do with property rights and do not seem to lend themselves to market-like cures. It is here simplest to think of game theory. There the externality—that is, the effect of the actions of other players on the pay-off of a given player—is of course of the essence. Not surprisingly it has been found that very often games have multiple Nash equilibria which can be Pareto-ranked. One may ask whether this could be avoided by redesigning the game without making it a co-operative one. The intrinsic externalities one here encounters and the 'co-ordination failures' which they lead to have been the subject of useful papers for example by Heller (1986).

As far as I know, no one has yet succeeded in formulating an economy-wide market game in which firms, workers and consumers are players. It certainly will be a formidable task. But one conclusion seems



to me pretty certain to be reached. Arrow-securities, even if complete, will not yield the required co-ordination. That is so because firms need to know not only next period's price (for each state) but also next period's demand at that price and state. Not just that they need to know demand functions. The Arrow-securities markets will not convey that information. So if we were designing a market game for this world we would, I believe, need all the Arrow-Debreu goods markets plus something else. That something else would require knowledge of the consequences of deviating from the given price. Prices are not now 'called' but set. Negishi (1960) took the first step here and I followed him with the idea of a 'conjectural equilibrium' (1978).

But the difficulties with these notions are still very severe. For even if in some sense conjectures are 'correct', there seem to be very many equilibria with correct conjectures. Once again only more insistently, we need to think of an equilibrium of beliefs. The so-called 'fundamentals' of the economy will be seen only through a glass darkly.

But that markets do not provide a sufficiently rich language by which agents can communicate is a conclusion which I consider to be of some importance. To return to the Keynesian theme of my opening, not only is savings not a demand for future goods, neither is the supply of labour. That is, an individual firm hiring more labour will not know whether the extra output can be sold at the going price. Some forward markets for labour in the form of labour contracts exist, but these have only been studied under the perfect competition hypothesis. One should, it would seem, combine these with proper forward markets for goods. While these would still leave us exposed to the indeterminacy arising from beliefs, it may just be possible to show that, for instance, a central Keynesian problem could be avoided—at least if that is interpreted as the efficient use of labour.

This is as far as I can go. I hope I may have convinced you that the problems raised by incomplete markets are real and not just purely theoretical problems. I believe that many of these, perhaps not in the form which I have given them, exercised Keynes. He has been declared out of date and wrong by the very simple device of ignoring and assuming away all of the difficulties which he thought to be important. But they will not go away. When, as now appears to be the case, they are again recognised, economists will again become more circumspect in their judgment of market economies. It is unlikely that we shall find that *The General Theory* provides all that we need. But it will again be seen as pointing to the right questions.

It may well be that Keynes' insights, from liquidity preference to the role of effective demand, are now best understood as the 'economics of missing markets'.

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## References

- Arrow, K. J. (1953): 'Le rôle des valeurs boursières pour la repartition la meilleure des risques', *Econométrie, Colloques Internationaux du Centre National de la Recherche Scientifique* 11, 41–7. English translation, *Review of Economic Studies* 31 (1964), 91–6.
- Cass, D. (1984): 'Competitive Equilibrium with Incomplete Financial Markets', CARESS Working Paper 85–16, University of Pennsylvania.
- Diamond, P. (1982): *A Search-Equilibrium Approach to the Micro-Foundations of Macroeconomics* (The Wicksell Lectures 1982), Massachusetts Institute of Technology.
- Dreze, J. (1987): 'Pseudo Equilibria of the Firm' in Jacques Dreze; *Essays on Economic Decisions under Uncertainty*, pp. 271–3, Cambridge University Press.
- Duffie, D. (1990): 'Money in General Equilibrium Theory' in B. Friedman and F. Hahn (eds.), *Handbook of Monetary Economics*, pp. 82–100.
- Gale, D. (1982): *Money: In Equilibrium*, Cambridge Economic Handbook, Cambridge University Press.
- Gale, D. (1986): 'Bargaining and Competition Part I: Characterisation', *Econometrica* 54, 785–806.
- Gale, D. (1986): 'Bargaining and Competition Part II: Existence', *Econometrica* 54, pp. 807–18.
- Geanakoplos, J. and Polemarchakis, H. (1986): 'Existence, Regularity and Constrained Suboptimality of Competitive Allocations when Markets are Incomplete', in Heller, Starr and Starrett (eds.), *Essays in Honor of Kenneth Arrow*, Vol. 3, Cambridge University Press.
- Geanakoplos, J. and Mas-Colell, A. (1989): 'Real Indeterminacy with Financial Assets', *Journal of Economic Theory* 47 (1), 22–38
- Grossman, S. and Hart, O. (1979): 'A Theory of Competitive Equilibrium in Stock Market Economies', *Econometrica* 47, 293–330
- Hahn, F. H. (1965): 'Equilibrium with Transaction Costs', *Econometrica* 39, 417–39.
- Hahn, F. (1978): 'On Non-Walrasian Equilibria', *Review of Economic Studies* 45, 1–17.
- Heller, W. (1986): 'Co-ordination Failure under Complete Markets with Applications to Effective Demand', in Heller, Starr, Starrett (eds.), *Equilibrium Analysis, Essays in Honor of K. J. Arrow*, Vol. 2, pp. 155–76.
- Negishi, T. (1960): 'Monopolistic Competition and General Equilibrium', *Review of Economic Studies* 28, 196–201.
- Newbery, D. and Stiglitz, J. (1981): *The Theory of Commodity Price Stabilization (A Study in The Economics of Risk)*, Clarendon Press, Oxford.
- Newbery, D. (1989): 'Missing Markets: Consequences and Remedies', in F. Hahn

- (ed.), *The Economics of Missing Markets, Information and Games*, Clarendon Press, Oxford.
- Ostroy, J. and Starr, R. (1990): 'The Transaction Role of Money', in B. Friedman and F. Hahn (eds.), *Handbook of Monetary Economics*, pp. 3–62.
- Radner, R. (1972): 'Existence of Equilibrium of Plans, Prices and Price Expectations in a Sequence of Markets', *Econometrica* 40, No. 2, 284–304.
- Savage, L.J. (1954): *The Foundations of Statistics*, John Wiley, New York.
- Stahle II, D. (1988): 'Bertrand Competition for Inputs and Walrasian Outcomes', *The American Economic Review* 78 (1), 189–201
- Yannelle, M.O. (1989): 'The Strategic Analysis of Intermediation', *European Economic Review* 33, 294–301.