

The Microfoundations of Monetary Theory*

By Norbert Hentschel, Vienna

I. Introduction

Recent discussions of the optimality of monetary exchange have directed the attention of economists to several important but previously unappreciated weaknesses in the microfoundations of monetary theory. In the *Walras-Hicks-Patinkin* tradition, the goal of monetary theory has been to present a picture of a monetary economy which would be a logical extension of the standard theory of value. *Walras* brought the equation of the offer and the demand for money into line with the rest of his system by making a distinction between the stock of money, assumed to be without utility of its own, and the “services of availability” of the stock which does contribute to one’s well-being. Just as no inquiry is made into the sources of satisfaction from other goods, the services of availability are similarly unquestioned. Money, that “unique” asset, is generally treated as just another consumer durable good which yields a flow of ill-defined nonobservable services, offering the individual “convenience, security and liquidity”. The traditional neoclassical monetary approach underlying much of the important work of *Patinkin, Samuelson, Friedman and Johnson*, introduces real cash balances directly into the utility function, and refers to the costs of exchange between money and goods although these costs are not made explicit in the analysis. However, once money is treated as an argument of the utility function, many of the interesting questions concerning why an economy uses money rather than barter, or how it chooses its money, are essentially suppressed (*Brunner and Meltzer, 1971*). In other

* The paper was written while the author was visiting the Institute of Social and Economic Research and the Department of Economics, University of York (England). I benefited greatly from an extensive conversation with Professor Robert *Clower* and I would like to thank him for his helpful comments. Thanks are due to the participants of a Staff Seminar in the Department of Economics, University of York, for a number of valuable suggestions on an earlier draft of this paper.

words, the analytical device of treating real money balances as an argument in utility functions serves formally to generate a demand for money, but it simultaneously rules out deeper analysis of the economics of monetary exchange.

Recently, several theorists have suggested that it might be useful to dig a little more deeply, and to ask why money is held at all. This poses a dilemma. How to make money appear without making the standard theory of general equilibrium disappear? The theory of value has been cultivated to its present high level as a model of exchange in which money does not appear. *Arrow/Debreu*-type models work “without the help of a good serving as a medium of exchange” (*Debreu*, 1959, p. 28). Unlike the *Patinkin* approach (representing the modern attempt to develop a monetary theory on Walrasian foundations), which left the standard theory intact and relied on conceptual appendages to introduce money, the recent approaches force us to look for modifications within the body of the theory.

In the last few years, monetary theorists seem to have reached a consensus that Walrasian general equilibrium theory provides an inadequate microfoundation of monetary theory. Walrasian theory cannot even explain the simplest and most commonplace monetary phenomena. That this became apparent may be attributed to the works of *Clower* and *Hahn*. To illustrate these deficiencies, consider *Clower's* (1967) proposal to introduce money into the standard theory. His suggestion was to add to the existing budget constraint the injunction that current purchases be financed by sale of money only, not by current supplies of other commodities. This modification, however, contradicts the belief that the introduction of money improves the allocation of resources because it narrows the set of permissible exchanges compared to its barter counterpart. *Clower's* constraint makes no sense in the Walrasian model of exchange, but for a perfectly sensible reason: one cannot append what is a trading constraint to a model which ignores trade.

One further deficiency was presented by *Hahn* (1965) and has to do with the equilibrium properties of *Patinkin's* system. Suppose the accounting price of money in a *Patinkin* economy were set equal to zero. This would mean that money had no value in exchange, and clearly would not be demanded by anyone free from “money illusion”. However, *Hahn* showed that whenever its accounting price is equal to zero, an equilibrium will necessarily exist to the system (given the appropriate continuity assumptions) for which this accounting price will be

equal to zero. In other words, the *Patinkin* economy has an equilibrium in which no one uses money. Thus, doing away with money in *Patinkin's* economy might have no significant consequences.

These two examples are enough to demonstrate that the essential elements of monetary theory are missing from the Walrasian framework (*Howitt, 1973*). When *Patinkin* tried to integrate the Walrasian analysis with monetary theory he introduced money beginning of the analysis. But he failed to constrain the transactor's exchange opportunities by prior possession of money (*Clower, 1967*). Just as *Walras* had done, *Patinkin* rationalized the demand for money by the need for a transactor to present it in order to receive the goods delivered after the pricing mechanism had determined (so we were told) which exchanges were to take place. In truth, there is no reason to suppose that any exchanges were implied by the analysis, because the budget constraints of the transactors do not refer to specific exchanges. Hence we arrive at *Hahn's* conclusion that *Patinkin's* economy could function without money. Because *Patinkin* failed to restrict the transactors to monetary exchange, it follows that he could not avoid *Clower's* findings that money plays no essential role in the bargaining process. Furthermore, *Clower* has shown convincingly that the designation of "medium of exchange" cannot be applied to any single commodity in a Walrasian model.

All these deficiencies obviously arise from the failure of the Walrasian theory to contain a rich enough description of the process of exchange. In *Clower's* words: "... there exists no accepted or acceptable microeconomic formulation for the theory of an economy in which money plays an essential role as a means of payments" (*Clower, 1971*). Consequently, the microfoundations of monetary theory have not yet been laid (*Hahn, 1973 a*).

The natural place to start is by taking *Clower's* claim that money has something to do with the activity of exchange, and in fact many monetary theorists consider bargaining and exchange to be the key elements in describing a monetary economy.¹ The central fact of a monetary economy is that goods are not traded for goods. Going from

¹ An approach dealing more directly with the transaction aspects of money is the *Baumol/Tobin* inventory theoretic framework. Although the theory focuses explicit attention on the costs of exchanging bonds and money, it ignores the costs of exchanging money for commodities (*Feige and Parkin, 1971*).

a barter exchange system to a monetary exchange system involves a change in the exchange technology (*Hirshleifer, 1973*): Goods are traded (sold) for money and money is traded for (buys) goods (*Clower, 1967*).

The task then is to write out a general equilibrium model which embodies this aspect of a monetary economy. The obvious alternative to the traditional approach is to link the services of money directly with exchange activities which requires that exchange activities be characterized more precisely than is customary in established theory.

A far more fundamental task is to discover conditions which will ensure the establishment of a monetary economy. In actual economies, we observe that the use of money is almost universal. To the casual empiricist this would seem to be simply because monetary exchange is more efficient or more convenient than barter. From the viewpoint of the theorist, however, the interesting problem is to provide a more direct way to evaluate the efficiency implications of a monetary pattern of trade.²

Agreement on the need for replacing the Walrasian foundation has not yet led to agreement on how it should be replaced. It is unfortunately very much easier to say where the theory should go from here than to get it to go there. Money is used in transactions — one buys goods with it. It should then be a modest extension of our barter theories to allow money to enter the transaction process. But in the *Arrow/Debreu* world it is very difficult to see how or when transactions as such take place. The usual interpretation of the tatonnement process is that it is conducted by one centralized auctioneer who functions at zero cost to establish market clearing prices (*Arrow/Hahn, 1971; Uzawa, 1960*). The proof of the existence of equilibrium assures us that there is a set of prices that the Walrasian auctioneer could call out such that at those prices the sum of excess demands and supplies would be nonpositive. That is really all it tells us. In the *Arrow/Debreu* model it is not clear how trade actually takes place.

The standard story of exchange in the model is roughly this: the auctioneer announces equilibrium prices (which have been previously

² The common of media of exchange suggests a twofold problem: First, what economic gains, if any, accrue from use of a general medium of exchange over and above those accruing from direct trading. Second, how have certain commodities come to be exalted into general media of exchange? It is primarily to the first question that the work reviewed in this paper is addressed.

determined) for each and every commodity, all transactors go to a central market place and deliver there their excess supplies; they carry away from the market place their excess demands; since the prices are equilibrium prices, there is no unsatisfied excess demand. Both processes (i. e., the process of bargaining and of exchange) are assumed to operate independently from the main part of the equilibrium analysis which consists of the maximizing behaviour of firms and households subject to parametric prices.

Yet, what is the view of transactions presented here? So far as one can tell, the only transactions consist in delivering goods to or removing goods from some centrally located warehouse. Buyers (more properly, demanders) may never meet sellers (suppliers) because individuals do not confront each other but the (impersonal) “market”. Surely, in a model where transactors never meet there is no role for a medium of exchange passing between them.³ Furthermore, there is no uncertainty regarding prices or the reliability of contracts, and so no reason for trade to take place other than once and for all at the outset of the economy. Hence, there is no need for a store of value. In the *Arrow/Debreu* model one and only one of the three classical roles of money comes into play: unit of account which is, by assumption, not a commodity in the economy. Thus, the *Arrow/Debreu* model cannot easily be made to accommodate the process of exchange.

It is the purpose of this paper to provide a survey of the work that has been done to lay the foundations of monetary theory. Most of the work under review is concerned with how the process of transaction and money as medium of exchange can be meaningfully introduced into a pure exchange general equilibrium model, and the difference it makes to the results of the model.

Basically, there have been two approaches to this problem. One is to note that the essential characteristic of the process of exchange is that it is costly because it absorbs resources. Money enters it as a device to promote the technical efficiency of the process by reducing costs. This is

³ Payment for goods seems a concept almost absent from general equilibrium theory. It is only required there that the value of goods demanded equal the value of goods supplied, but there is no requirement that the supplier of goods demanded be the recipient of goods supplied. The only payment for goods consists of an addition to the seller’s budget and a subtraction from the buyer’s. These budgets seem to exist mainly in the memories or records of the agents in question (*Ostroy*, 1973, see Section 3 below).

the starting point of the literature on transactions costs which adjoins a transactions technology to a pure exchange general equilibrium model (Foley, 1970; Hahn, 1971, 1973 b; Starrett, 1973; Kurz, 1974 a, b).⁴

An alternative approach is, without specifying the underlying costs of transaction, to analyse models where exchange is subject to various rules. Examples are: commodity A can be traded against commodity B but not against commodity C (Clower, 1967); or trade can take place only between traders who have a double coincidence of wants (Starr, 1970, 1972); or exchange is restricted to pairs of traders (Ostroy, 1973; Ostroy and Starr, 1973; Feldman, 1973). The main virtue of this approach is that it emphasizes and seeks to explain the observation that most exchange in modern market economies is of desired goods and services for a single intermediary good. Instead of just assuming that money enlarges the set of feasible transactions, as the work pursuing the first approach does, a detailed comparison between barter and monetary exchange is given. The point made here is that it tries to present a rationale for which organisational structure of the economy will emerge.

The plan of the paper will be as follows. In Section 2 we shall review the first approach under the heading “Single and Multi-Market Models with Transactions Costs”. Section 3 will discuss the second approach under “Models of Barter and Monetary Exchange”. The last section will point out some directions for future work. It should be noted that much of the work reviewed in this paper is at a fairly high technical level, and we shall try to explain these ideas in a non-technical fashion.

⁴ A fairly different approach with transactions costs is pursued by Niehans (1969, 1971), Karni (1973) and Brunner and Meltzer (1971). This work is directed more towards the problem of why and how the use of a generally accepted medium of exchange developed in the first place. Niehans and Karni investigated the implications of transactions costs for the trading decisions made by utility-maximizing individuals, and they conclude that individuals will choose the monetary pattern of trade if the costs of doing so are sufficiently less than the costs associated with other patterns of trade. They have shown that, under certain conditions, some commodities with relatively low transactions costs may emerge as media of exchange as a result of optimization processes to minimize transactions costs. However, they offer no theory to explain the relative costs of alternative trading patterns. Also, it is likely that the development of money cannot be settled by relative transactions costs at a point in time within a static model under certainty; it must be seen as a dynamic process, where uncertainty and imperfect information come into play (see, for example, Brunner/Meltzer, 1971, and Section 3 below).

II. Single and Multi-Market Models with Transactions Costs

The problem of transactions costs is very tempting. This is a concept which can be made precise with comparative ease. Transactions costs enter in an intuitively appealing and essentially classical fashion the analysis of a market with money: In the standard *Arrow/Debreu* theory, any redistribution of commodities which preserves their totals is feasible. Into this model we can introduce the problems of exchange as a kind of transport cost of getting from one bundle of goods to another. We may then reason that monetary exchange represents a least cost network, so that without the money commodity the set of feasible transactions must shrink.

Unfortunately, the meaning of transactions costs varies from writer to writer. The term is a catchall for different items (*Hirshleifer, 1973*): transportation, inspection and legal transfer costs; costs of acquiring or disseminating information about the prices and characteristics of goods; costs of searching for trading partners; costs of checking that people operate within their budget constraint;⁵ costs of the tatonnement process of establishing equilibrium prices and trades. Considering a general equilibrium framework, there are good reasons for classifying these costs into two groups: (a) costs of setting up markets, establishing and calling equilibrium prices, and (b) costs of actually arranging trades at these equilibrium prices.

It is arguable that the first class of costs is of more interest to economists, but there are a number of problems involved in modelling such costs: there is some stochastic element in costs of search, and the set-up nature of these costs inevitably introduces increasing returns to scale.⁶ For most of the models discussed below it is only the second class of transactions costs that can be handled, since it is usually assumed that equilibrium prices are known and announced at the beginning of the model.

Generally speaking, there are two ways of incorporating transactions costs into general equilibrium models. The first is to assume that individuals themselves directly employ the resources required for transac-

⁵ For a detailed discussion of these "information costs" see Section 3 below.

⁶ Another assumption common to most models discussed below is that transaction technologies are convex sets, that means they show non-increasing returns to scale. But standard techniques are available to get around this (*Heller, 1972; Heller and Starr, 1973*).

tions. Each individual agent is assumed to have a set of feasible transactions activities, its transactions technology, which specifies the resources it will need to carry out planned purchases and sales. (The transactions technology sets have all the usual properties of production possibility sets in the *Arrow/Debreu* world.) The second point of view is that transactions resources are employed by some intermediary. One then thinks of the transactions technology set of the intermediary.

Let us now turn to the simplest treatment of transactions costs in general equilibrium theory which is given by *Foley* (1970). *Foley's* model is fairly close to that of *Arrow/Debreu*, with a single market able to deal in all commodities. However, transactions have to be carried out through intermediaries who buy goods from some households and sell them to others. The margin between buying and selling prices has to cover the costs of resources used in transacting. An equilibrium exists in the economy and also it will be efficient.⁷

Kurz (1974 a) has also presented a single market model of transactions costs, and his results agree broadly with those of *Foley*. *Kurz*, however, assumes that it is individuals who directly employ resources required for transactions rather than intermediaries.

But while this work clarifies some of the claims on behalf of money by reference to the work it does in facilitating exchange, it is surprising how difficult it is to get money into a model with transactions costs. *Foley* does not introduce it, and *Kurz* succeeds only partially after making some heroic assumptions about money: it is rather a half-used appendage to the model. As neither model provides a full explanation for the existence of money, there is no point in commenting on them in any detail. Thus, all that has been demonstrated in the single market models is that many of the markets assumed to exist by *Arrow/Debreu* may not operate. Furthermore, these models cannot explain why trade occurs sequentially or in a series of exchanges between pairs of traders rather than with a market.

To find a more satisfactory treatment of these phenomena we turn to the study of multi-market models. The similar models of *Hahn* (1971,

⁷ *Pareto* efficiency now has to be defined relative to both the transactions technology and the distribution of initial endowments. (In the *Arrow/Debreu* world, *Pareto* efficiency is defined relative to aggregate initial endowments). This has important implications for welfare economics, but it would take us too far afield to comment on the complications that arise along this route of theoretical inquiry.

1973 b), *Starrett* (1973), *Kurz* (1974 b) and *Heller* (1974) are similar and they represent the deepest general equilibrium analysis of this group. Their focus is on behaviour of the economy over time rather than at a point in time. *Hahn* (1971 a) has commented that the role of money in an economic model seems to depend essentially on how time enters the model. The very process of exchange requires time to take place, and *Ostroy* (1973), *Ostroy/Starr* (1973) and *Feldman* (1973) have developed models in which short time enters the transactions process essentially, creating a very substantial role for money.⁸

But there is also long time. Especially, it is the pre-existing structure of assets and obligations — denominated largely in monetary terms — which link one period with the following. Consequently, *Hahn* (1973 a, b) insists on the fundamental importance of the intrinsic sequential structure of a monetary economy.

But what does it mean for time to enter meaningfully a general equilibrium model? It means that we replace the instantaneous once-and-for-all-time market (i. e., all transactions are concentrated at the first date) of the *Arrow/Debreu* world by a sequence of markets, each at a different point in time. Each market meets with the knowledge that a similar market will reconvene in the future, but with no generally known future outcome. Thus, when time enters in this fashion uncertainty as to the outcomes of markets in the future enters as well (*Radner*, 1972). One must make provision then for what happens when agents have different, and often drastically wrong beliefs as to what will happen in the future (*Green*, 1971, 1972).

The most systematic investigation of the properties of sequence economies incorporating transactions costs has been that of *Hahn* (1971 a, 1973 a, b). *Hahn* assumes that transactions costs are deployed purely through an intermediary. We have a number of markets, in each of which there is a single intermediary handling all transactions for that market, and covering his costs by charging a margin between buying and selling price. The question now is, does this multi-market structure matter? As has been mentioned in the introduction, in the absence of transactions costs any multi-market structure would be inessential to the description of the economy in that the equilibrium quantities traded and the prices at which they were traded would be independent of the particular multi-market structure assumed, and further

⁸ See Section 3.

the actual structure of transactions would be indeterminate, and could be assumed to take place in a single market.

When transactions costs are recognised, we cannot expect this latter result to hold, that is, we must expect to be able to determine the markets in which exchanges take place, since the intermediaries will be using prices to determine how much trade to conduct in their markets. Can we claim, however, that prices and equilibrium quantities traded are, in some sense, independent of the precise transactions structure? *Hahn* found a way of formalising this question.

Suppose that while there are a number of markets, nevertheless prices (both buying and selling prices) are the same in all markets, and that individual agents can plan their purchases and sales so that the total value of what they purchase does not exceed the total value of their sales, which means that the financial constraints on individuals are binding over the whole horizon. This strange institutional set-up is in fact the analogue we want of the single market *Arrow/Debreu* economy in the costless model, since the equilibrium quantities traded in such an economy are independent of the fact that there are many markets. Since this is so close to the standard *Arrow/Debreu* model, *Hahn* calls such an economy a *Debreu* economy.

The more natural institutional arrangement, whereby prices are potentially different in different markets (i. e. dependent on the transaction date), and the financial constraints on agents are binding period-by-period (i. e. agents must balance their books at each transaction date), *Hahn* calls a sequence economy.

Following *Hahn*, we can now formulate the question concerning the importance of the multi-market structure by saying that the sequence economy is *inessential* if the relation of consumption-equivalence holds both ways between it and the *Debreu* economy.⁹ Then the question becomes, are sequence economies inessential? If they are inessential then they offer little explanation of the role of money in general equilibrium and also little advance over the standard *Arrow/Debreu* models.

Now *Hahn* (1973 b) shows that *Debreu* equilibria are *Pareto-efficient*, but that sequence equilibria will be efficient if and only if

⁹ A *Debreu* economy is consumption-equivalent to the sequence economy or vice versa if for every equilibrium of the *Debreu* economy there exists an equilibrium of the sequence economy yielding the same amount of consumption for every household.

sequence economies are consumption-equivalent to *Debreu* economies. This in turn is true if and only if every equilibrium of the sequence economy can be characterised by having the same prices in all markets. Thus, in a multi-market economy with transactions costs, the properties of competitive equilibria differ greatly from those discussed by *Debreu*.

Consequently, the inefficiency property suggests some role for money to restore efficiency. This question has been examined by Hahn (1973 b), Starrett (1973) and Kurz (1974 b).

Concentrating on *Hahn's* paper, we may characterize this group of studies in the following way. An extra commodity is added to the model with the properties that it is not desired for consumption purposes by any agent nor is it a resource to be used up in the transactions process. The stock of money is constant, and money is only a store of value. This is ensured by introducing a very artificial motive for holding money: each agent must return whatever money he has been endowed with to "the government". This assumption is needed to give money a positive price.¹⁰ Money can be costlessly traded spot and forward in every market which is a way of allowing debt into the model. This type of monetary arrangement allows individuals to run up credits or debts in one market which they can offset against debt or credit in other markets. The implication of the introduction of this form of money is that money has restored efficiency to the economy. It is then not surprising that the set of equilibria of the *Debreu* economy with money is equivalent to that of the *Debreu* economy without money, and that the sequence economy with money is inessential.

Hahn then drops the unrealistic assumption that it is costless to arrange for borrowing for the future. He therefore investigates the case in which money can be costlessly traded spot, costlessly stored, but cannot be traded forward. In this case it is still true that *Debreu* equilibria with money are equivalent to those without money, and that the *Debreu* economy with money is consumption equivalent to the sequence economy with money. What can be shown, however, is that if every agent holds a strictly positive quantity of cash at all dates, then equilibrium is efficient (i. e., the sequence economy with money is inessential).¹¹ But

¹⁰ We shall consider this problem in greater detail below.

¹¹ That every individual holds money in every period to meet all needs for intertemporal transfers of purchasing power means that no individual is forced to enter a costly bond market or futures market when it runs out of cash.

of course it is unlikely that this condition will in general be met, and so money will not necessarily restore efficiency. What *Hahn* has really shown is that no sequence economy in equilibrium with borrowing and lending of money can be *Pareto*-efficient if such borrowing and lending is costly; only an inessential sequence economy which is identical with a *Debreu* economy can be *Pareto*-efficient relative to a transactions technology and initial endowments.¹² This result also has been obtained by *Starrett* (1973) and *Kurz* (1974 b) in the case when transactions are handled by an intermediary, and by *Ulph* and *Ulph* (1974) for the case where transactions costs are borne by the individuals themselves.

A closely related point should be mentioned here. Monetary equilibrium, following *Hahn* (1965, 1973 a), is defined as an equilibrium where money has positive value in exchange, a positive price. Therefore it has been suggested that the major aim in the integration of monetary and value theory is to construct a model of a monetary economy in which money has a positive price. There is then the by now well-known difficulty that a paper money economy can become demonetized if the price of money becomes zero which means that money is useless. It turned out that it is not easy to succeed in keeping the economy off the non-monetary equilibrium: It is well known that in a single market exchange economy the “end” of trading presents a specially difficult problem because agents have no incentive to hold fiat money after the “close” of the market. This is also true in any economy with a finite sequence of markets in the sense that when the “last” market closes, no agent wants to hold fiat money. It seems fairly clear that in an exchange economy the only way to ensure the existence of a monetary equilibrium is to provide additional assumptions on the backing or utility of fiat money. Thus writers like *Marschak* (1950), *Hahn* (1965, 1971, 1973 b), *Kurz* (1974 a, b), *Sontheimer* (1972), *Pethig* (1973), *Starr* (1974), *Hayashi* (1974) and *Heller* (1974) have either “required” the agent to demand fiat money at the end, or motivated such holdings by the requirement that terminal money be used for tax purposes.

Consequently, the sequential budget constraints are not really binding and individuals are able to make all the transfers of debts and credits between periods that they wish.

¹² It seems worth emphasizing that even in inessential, and therefore, *Pareto*-efficient equilibria none of the standard *Pareto*-optimality rules hold. Consequently, it is premature to formulate theorems of the optimum quantity of money which start from the *Pareto* rules in view of the unsettled basis of monetary theory (*Clower*, 1970, 1971; *Hahn*, 1971 b, 1973 a).

The chief defect of this approach seems to be the finite-horizon assumption with the consequent necessity for the terminal money constraint. One tentatively concludes that all the artificialities of the work just mentioned may be dissolved once one decides to work in a model with infinite time horizon. *Grandmont/Younes* (1972, 1973) have done this. Their approach is a temporary equilibrium approach that builds on infinitely living traders with their expectation patterns given.¹³ In the *Grandmont/Younes* economy the only means of transferring wealth from one date to another is by means of storing money. All commodities, including money, can only be traded spot, though this is costless. This is then just a special case of the transactions technology assumed by *Hahn*. However, *Grandmont/Younes* consider that there might be difficulties in synchronizing purchases and sales. Rather than modelling this directly, they assume that this frictional trading problem shows up in the transactors' budget constraint (see *Clower*, 1967). The role of money as medium of exchange is given by the following device: all purchases require the exchange of money and only a part of the money receipts from the sales can be used for purchases of the same date as the sales. The rest of the value of the sales is used to augment the money holdings of transactors, while their money held over from the previous period can be used to finance current purchases. This makes it likely that traders would choose to hold money in each period.¹⁴

However, *Hahn* (1973 a) has argued convincingly that money is still inessential in every sequence equilibrium of the *Grandmont/Younes* economy. Their constraint which ensures that transactors hold money can always be exactly met in a stationary equilibrium of a *Patinkin*-type economy by an appropriate distribution of money stocks, and in

¹³ One of the features of the *Hahn*, *Starrett* and *Kurz* models was that agents knew prices in all markets at the outset. *Grandmont/Younes* have replaced this unreasonable assumption with the concept of temporary equilibrium in which agents at any one time forecast the prices they expect to prevail in future markets. However, in their model there is no possibility of going into debt and so no possibility of agents going bankrupt if their price forecasts turn out to be drastically wrong (see Section 4 below).

¹⁴ The sufficient conditions for the short run equilibrium involved the agents' expectation pattern for future prices. As for the long run stationary equilibrium, *Grandmont/Younes* demonstrated that a stationary monetary equilibrium will exist if money plays a role in the exchange process and if the traders are willing to hold as an asset (in the long run) the existing stock of money, provided the traders do not discount future utilities "too much".

general by an appropriate sequence of money stocks and prices of money. It turns out that traders may not use money as a medium of exchange in every sequence equilibrium which means that money has no positive value in exchange. Moreover, it is easy to show that *Pareto-efficiency* in this construction (*Grandmont/Younes, 1973*) requires money to be inessential (see *Hahn, 1973 a, b*).

Concluding this section, certain points seem worth bearing in mind. The present discussion in the literature suggests that transactions costs are essential to the microeconomic analysis of monetary phenomena and that a good theory will include nonconvex transactions costs. The studies we have discussed so far do manage to incorporate transactions costs, though it is very difficult to see in these models that money matters much. This is important since most of the models used to analyse the role of money in general equilibrium are inessential. Accordingly, in such an economy money is inessential in the sense that no monetary variable need enter into the description of that economy's equilibrium. However, it is fairly clear that any proper integration of monetary and value theory has to deal with non-inessential economies (*Hahn, 1973 a*).

III. Models of Barter and Monetary Exchange

In the literature discussed so far it was implicitly assumed that the set of feasible transactions without money is wholly contained in the monetary set. It was then reasoned that monetary exchange represents a least cost network, so that without money the set of feasible transactions must shrink. However, exploring this sequential interpretation of multi-market economies, no detailed comparison between barter and monetary exchange is given.

In this section we shall review studies which use in various forms rules as to which commodities can be traded for one another. The main virtue of this approach is that it emphasizes and seeks to explain the observation that most exchange in modern market economies takes place by a process of bilateral exchanges between transactors using a single intermediary good. Instead of just presenting alternative organisational structures for the economy and analysing their consequences, as the work of the previous section did, this approach tries to present a rationale for which structure will emerge.¹⁵

¹⁵ It is worth noting that this approach may be open to some methodological objections. No doubt a historical account of a transition between a barter and a monetary economy is possible, but an analytical one is hard. Firstly,

This exchange interpretation is just another way of regarding the multi-market model of the previous section. If we think of exchange taking place in a series of many two-sided trades between agents, in terms of the multi-market model, this would mean that every pair of traders constitutes a separate market — there are as many markets as there are pairs of traders.¹⁶

Consequently, the crucial question of this approach is: why does exchange not take place in one large market rather than in the many two-sided exchanges we observe? A tentative answer may be that there are very significant costs associated with bringing large numbers of transactors together. These costs are so high as to make it preferable to have large — and presumably also costly — flows of goods acting as media of exchange rather than incur the costs of bringing people together.

One possible and most direct way to investigate this point is in a model containing both bilateral exchange and the standard general equilibrium model as special cases. One would hope that from the model

there is the important feature of a monetary economy that it allows specialisation which makes the extension to production difficult (*Hahn*, 1973 a). Secondly, explaining the emergence of a monetary economy out of the decentralized decisions of utility maximizing agents, it may well be possible to get commodity media of exchange to come from a model of barter exchange, but hard to get fiat money in a natural way. This is so because, historically speaking, the function of money as a store of value, medium of exchange, and unit of account developed with the emergence of a specific commodity like gold which was generally accepted for exchange purposes. But this historical fact became possible as a result of the fact that those commodities had an intrinsic utility for consumption purposes and that was the reason why they had any value to begin with. The act of establishing money as money without an intrinsic value is fundamentally an act of social choice — fiat money acts in a social system as a public good. No simple decentralised mechanism is known to explain how such a social contract develops. It would take an invincible belief in the “invisible hand” to make the potential optimality of monetary exchange into a rationale for its prevalence.

¹⁶ Another conception of barter exchange is of a trading-post pattern of trade — there is a distinct market for each pair of goods to be traded against one another. This was originally suggested by *Walras* in his famous theory of tatonnement when he was trying to portray the actual working of the pricing and exchange processes in a decentralized system of markets. (*Walras*, 1954; *Jaffe*, 1967; *Howitt*, 1973). — Recently, the approach of a trading post-pattern of trade has been pursued by *Niehans* (1971). For a critical investigation of the analytical consequences see *Veendorp* (1970) and *Howitt* (1973).

of multilateral exchange we might well seek an explanation of why most transactions take place bilaterally using a medium of exchange.

Starr (1970, 1972) has related these ideas to the familiar discussion of barter in terms of the double coincidence of wants: He investigates the classical point of view that the role of money is to overcome the problems of exchange which derive from a failure of double coincidence of wants. Suppose we have an equilibrium for the multi-market model which is said to exist when the sum of individual excess demands is zero for each commodity. Nevertheless, from the individuals' point of view, they are disequilibrium as long as not all individual excess demands are zero for each commodity. *Starr* then describes an equilibrium set of trades as monotonically excess demand diminishing if for every individual, every market, and every commodity, the sign of the trade in a commodity is the same as the sign of excess demand for that commodity. This means that any commodity entering an exchange, if purchased, is not resold, and if sold, is not repurchased, and in every market, individuals are only buying what they want to consume finally, and selling what they want to get rid of. Clearly this is part of what is usually meant by double coincidence of wants. The other part is that individuals must balance their books market by market. These conditions imply that transactors are able to find swaps of commodities which exactly meet their requirements, without any need for mediating exchanges.

Starr has shown that imposing budget balancing market by market leads to inefficiency.¹⁷ To restore efficiency it may be advantageous to use pairwise trade with a medium of exchange. In fact, *Starr* shows that the introduction of money allows the economy to reach a competitive equilibrium via a finite series of bilateral trades constrained by a quid pro quo or bilateral balance requirement which could otherwise be achieved only as a many-side trade.

However, one may be sceptical as to the extent to which this model illuminates the role of money. The main weakness of this approach is that the need for double coincidence of wants is taken as given, without investigation of underlying causes. Consequently, the crucial question remains: If the imposition of budget constraints market by market leads to inefficiency why does the economy not just use a single budget

¹⁷ As mentioned above, the exchange interpretation is just another way of regarding the multi-market model of section 2. Therefore all the results concerning efficiency and inessentiality carry over.

constraint? The answer seems to be that it is cheaper, in some sense, to operate with many budget constraints because the amount of record keeping could be smaller under such a system.

To clarify the issue at stake, it may be useful to approach the problem in a slightly different way. In the previous section we saw that formal notice has been taken of the fact that the valuable exchange service rendered by the auctioneer are costly to provide. We learn from these studies that costly exchange can be introduced without giving up the assumption that exchange is coordinated by a central agency — an auctioneer who charges for his services. The introduction of transactions costs in an equilibrium context does not necessarily lead to a motive for the replacement of direct simultaneous market clearing by indirect transactions involving a medium of exchange.

For example, we may learn from *Niehans* (1971) that even when exchange is restricted to pairs it need not be completely decentralized. The selection of a least cost bilateral trading network can be made by a central planner who solves a complicated programming problem. A similar difficulty occurs in *Starr* (1970) where individuals choose optimal sets of bilateral transactions but require a central agency to hook them together.

However, according to several authors¹⁸ it is only when the exchange process is decentralized that the role of money can be understood. It can be argued that one of the social benefits arising from the use of a commonly accepted medium of exchange is that it allows the bargaining and exchange process to proceed in a decentralized fashion.¹⁹ Once we give up the task of a centralized agency and concentrate on the logistics of more disaggregated trading arrangements, monetary exchange becomes explicable.

Starr's conclusion that imposing budget constraints market by market leads to inefficiency is just another way of saying that the Walrasian

¹⁸ *Clower* (1971), *Veendorp* (1970), *Starr* (1972), *Howitt* (1973), *Ostroy* (1973), *Ostroy and Starr* (1973).

¹⁹ An economic system is described as decentralized if it involves individual agents making decisions based on a fairly small body of universally communicated information (i. e. prices) and on information which the agents themselves may be supposed to possess (i. e. individual tastes and endowments and, the pair's trading history). — A centralized system is one in which the trading decision depends on the trading histories of everyone in the economy, not only those of the two traders in a pair.

(barter) system cannot be decentralized.²⁰ Bearing in mind the findings of *Clower* (1967) and *Hahn* (1965) pointed out in the introduction to this paper, both *Walras* and modern theory (which has not gone much further) failed to describe a decentralized exchange process because they omitted to limit the possibilities for exchange except through the one familiar budget constraint.

If we have no central exchange agency, exchange is a do-it-yourself affair. In the actual trading process individuals do not exchange with “the market”; they exchange with each other and they have to search for a trading partner. This consideration is the basis upon which the authors mentioned above construct an argument for monetary exchange. Operating a decentralized system with many budget constraints and a medium of exchange could be cheaper, in some sense, than operating a centralized system with a single budget constraint. The difficulty run into here is that though one can tell plausible stories about efficiency, one has to look for a more direct way of examining the costs of operating the alternative systems. *Ostroy* (1973) and *Ostroy/Starr* (1973) have provided such a method.

To fix ideas, *Ostroy* and *Starr* note that when a sequential bilateral trading arrangement is introduced into the description of a Walrasian exchange economy, the issue of the existence of a competitive equilibrium allocation can no longer be divorced from the dynamic problem of execution. Therefore, they propose a model of a trading economy in which individuals have the opportunity to exchange, bilaterally, in each of several periods — the number of periods to be determined by the number of individuals as the minimum necessary to duplicate any conceivable multilateral exchange by a sequence of bilateral exchanges.

The hypothesis for the trading process is as follows: The Walrasian auctioneer announces equilibrium prices but leaves the expedition of

²⁰ See *Jaffe* (1967), *Walker* (1970) and *Howitt* (1973) for a similar conclusion on the deficiencies of *Walras*' theory of exchange. — The fundamental weakness of the Walrasian system that it cannot be decentralized has been shown explicitly by *Veendorp* (1970) and *Howitt* (1973). When equilibrium is defined as the equality of total offers and total demands for each commodity, this definition clearly leaves open the possibility that equilibrium might not be established in all $n(n-1)/2$ trading posts. Therefore, the bargaining process must be interpreted as a completely centralized process, guided by a central coordinator in order for it to converge on a set of consistent exchange plans. A similar result has been discovered by *Ostroy* (1973). Proposition 5) and *Ostroy/Starr* (1973, Theorem 2).

trades to the individuals themselves. The common knowledge of prices is used to define *quid pro quo* in exchange (i. e. the delivery of goods of equal value, or bilateral balance).²¹ *Ostroy* and *Starr* then ask the following question: suppose during a unit interval of time, an individual meets with only one other so that during the interval an individual's trades are limited by his own and his trading partner's current endowments. When one pair meets, other pairs are also making contact, so that exchange occurs as a sequence of simultaneous bilateral trades. When n is the number of individuals, there are $n/2$ markets operating in every time interval. Call such an operation a round, then what is the fewest number of round that will be needed to exchange all the excess demands and supplies specified in the equilibrium?

Answering this question, the authors show the following: If each individual is fully informed about the excess demands and supplies of all individuals, imposing bilateral (budget) balance in each period leads to a greater number of rounds than without imposing this restriction. We get the usual inefficiency result — the outcome with many constraints is less efficient than the single budget constraint equivalent.

Suppose now that we limit the information, so that at each round individuals are required to make exchange while in doubt as to the excess demands and supplies of their trading partner. Then it turns out that restricting information about trading opportunities leads to using more rounds to attain the set of equilibrium trades. In other words, the equilibrium in the case of imperfect information is inefficient in the sense that there is a *Pareto* preferable outcome which could be achieved with the same resources if information were perfect.²² Again it is still faster not to impose round by round budget balancing.

²¹ As we shall see, without some requirement of this sort there is no point in discussing media of exchange, inasmuch as there is no need to pay the seller for goods purchased. The bilateral balance condition is merely the abstraction of the obvious fact verified by casual empiricism that when one buys something, one pays the seller for it. — The origin of this restriction is strategic. It will be shown that without a bilateral balance constraint, individuals would not be effectively prevented from violating their overall budget constraints.

²² Thus, there is a trade-off between time and information in achieving full execution: The number of rounds is a measure of the value of resources lost through lack of information. Unless information is quite detailed, or the number of individuals small, the competitive equilibrium allocation of resources will be unattainable. — It is worth noting that no explicit account is taken of the physical or psychic costs of exchange. The analysis is about

The question remains, why use this device at all? The answer is relatively straightforward. Once there is incomplete information about what the equilibrium excess demands and supplies are, and no bilateral balance requirement at any round, one cannot generally assume that people tell the truth: they have a strong incentive to overstate their demands. The result is that at the end of the exchange process the overall budget balance will be violated. With limited information, the only way of ensuring that individuals meet their overall budget constraint is to impose bilateral balance round by round.

However, there is another way of enforcing budget balance without imposing bilateral balance. This can be achieved by the introduction of a monetary payments arrangement — a centralized record keeper who forces transactors to act truthfully.²³ Moreover, this device of a kind of transfer credit system ensures that the equilibrium set of trades can be reached once more with fewer rounds. In other words, money can be used to economize on information costs²⁴ (allowing a *Pareto* superior outcome) as a transferable signalling device through which the value of one's past contribution is recorded. The sole purpose of trade in the money commodity is to establish a counting device to ensure that the sum of additions to and subtractions from the value of one's holdings during the course of trade is zero. That the device is embodied in a tangible commodity is inessential.²⁵ These findings are important for it also means

costly trade only in the sense that all bilateral trades incur lower costs than multilateral ones, and the single criterion is the number of rounds it takes to accomplish the task of executing all exchanges.

²³ The monetary authority's function is to collect and collate the bits of information individuals have about each other's trading histories. Each will require his trading partner to write a signed statement, a cheque, indicating the amount by which the partner's purchases exceed his sales. This record is forwarded to the monetary authority who revises individual accounts on the basis of this new information. Of course, there is every incentive for sellers to require and deposit this information with the monetary authority; otherwise, one would not receive credit for sales and so have to cut back on purchases. Credit balances with the monetary authority are the money of the market. However, this kind of money is not simply a unit of account.

²⁴ If we define transactions costs as those losses arising from differences in information, we may well say that money reduces transactions costs.

²⁵ *Ostroy* and *Starr* point out very clearly that the essential feature of monetary exchange has its origin in the trading arrangement and not in the nature of the money commodity. They choose to introduce a monetary authority and bookkeeping entries as a kind of ideal monetary arrangement because the record-keeping function of money is conceptually distinct from

that the store of value and means of payment functions of money are inseparable.²⁶ From this analysis we get an interesting and elaborate structure of monetary exchange. It is worth bearing in mind that the models discussed in the previous section introduce the problems of exchange as a kind of transport cost getting from one bundle of goods to another. One may then reason that monetary exchange represents a least cost network, so that without the money commodity the set of feasible transactions must shrink. *Ostroy* and *Starr* argue that while this may be adequate metaphorically, it misses the point: Monetary exchange does not enlarge the set of feasible transactions; it merely enables trades, which must be feasible in the first place to be realised.

Also we have seen in Section 2 that one of the outstanding questions in the integration of monetary and value theory is what supports the price of a medium of exchange in equilibrium. Attention was given to this quandary which accompanies any general equilibrium construction involving paper money, and various conditions have been suggested to support the price of money in equilibrium. The ad hoc nature of these constructs suggests that the problem of integrating monetary and value theory is not necessarily equivalent to the demonstration of a positive price for money. *Ostroy* and *Starr* therefore, pursuing the view taken by *Clower* (1967), ask a different question: For a commodity with positive value, are there any conditions under which it could be usefully employed as a medium of exchange? In their model, Theorem 4 answers affirmatively using a trading rule which assigns a unique, asymmetric role to the money commodity: As long as there is a generally acceptable, universally held medium of exchange, no communication of mas-

the properties of the commodities traded. — Of course, to understand a particular monetary arrangement, it becomes a matter of recognizing a minimum cost method of imposing budget balance. In a society unfamiliar with double entry bookkeeping, bilateral balance might be the only means of ensuring that individuals keep within their overall budget constraint and one would have to look for a minimum cost method of imposing bilateral balance. Then one might well choose as a method of enforcing budget balance a commodity which is most portable, durable, divisible and recognizable (see *Brunner* and *Meltzer*, 1971, who argue that the advantages of money have their origin in the properties of the money commodity).

²⁶ Essentially, money is a record of past transactions and of the right to conduct future transactions. This is the basis of the functions of money as a store of value and a medium of exchange. It would not fulfil the latter function unless it was a record which lasted over time i. e. unless it fulfilled the former.

sive amounts of data is necessary. Each trade merely consists in the exchange of a desired commodity for the medium of exchange. All one need know about trading partners is that they accept the medium of exchange. The informational requirements of barter imply the need for a central coordination of trade; the function of a common medium of exchange is to allow decentralization of the trading process.

Yet there is the very strong assumption that equilibrium prices have been established and are known at the outset of the model. Admittedly, one may well argue that if we cannot find a role for money when equilibrium prices are known, we shall not find one when they are unknown (*Ostroy, 1973*).

Recently, however, *Feldman* (1973) developed a model of exchange in which no prices are known, and in which traders having no information or subjective probabilities about trading opportunities, only make exchanges when they can make themselves better (or no worse) off by so doing. Transactors are duly groping in the dark; nevertheless *Feldman* shows that under general conditions their myopic trading will lead to a pairwise optimal allocation, and that, if there is a universally held money commodity, that pairwise optimal allocation will also be *Pareto* optimal. In other words, *Feldman* demonstrates that the existence of a good which everyone desires and holds, such as money, guarantees that bilateral trading can exhaust all opportunities for *Pareto*-improvements in the allocation of resources.

While there are some unsatisfactory elements in these recent studies of *Starr, Ostroy* and *Feldman*, nevertheless they point out how important a money commodity might be. Representing the most elaborate comparison of the efficiency of monetary exchange over other kinds of trading arrangements, any rigorous theory of money will have to pay attention to the problems they raise. What their arguments suggest is that there are good reasons to approach monetary exchange as a reflection of imperfect information about large numbers of transactors in a decentralized exchange system. There may be a very substantial theory of the role of money based on costs of search.²⁷ Such a theory would depend essentially on the technology of search and communication mechanisms by which offers to buy and sell are made. It is plain that the use of a price system and the use of money are inextricably linked up with

²⁷ Another example of what can be achieved by exploring the interpretation of money as a medium of communication is *Brunner and Meltzer* (1971).

the transmission of information between agents: their role is to contribute to the coordination of economic activities where information is imperfect and costly. This point has been emphasized very forcibly by *Clower* (1965) and *Leijonhufvud* (1968, 1973).

IV. Conclusion

The microfoundations of money do constitute a perennially unsettled area of economic analysis. From *Walras* on, there has been an attempt to grapple with the salient features of a monetary economy. Recently, monetarists have reached an agreement that the essential elements of monetary theory are missing from the Walrasian framework. If one looks back at the work reviewed in this paper one sees that the common element in it is a recognition that Walrasian theory describes the operation of perfect, frictionless markets where exchange activities play no essential role. The discussion on the modification of the analysis when a medium of exchange is present owes its point of departure to *Clower*. Work towards replacement of the Walrasian foundations of monetary theory has focused on the introduction to the general equilibrium framework of systematic imperfections and failures of markets. These include inactivity of markets, transactions costs, incomplete information, costs of acquiring information, sequential markets. The hope is that an understanding of the difficulties in executing trade will lead to the development of a theory of devices for facilitating trade, including a general equilibrium theory of money and finance. In this paper we have tried to review part of the work which has been done to obtain representations of an economy in which money is essential.

Given the simplicity of the models we have discussed it would be wrong to pretend that they represent anything more than a beginning of a proper integration of monetary and value theory. Work towards a properly formulated monetary theory has proceeded in many different directions. The result has been a variety of theoretical approaches, and it is not clear where the family of studies should go. As *Hahn* notes, it is likely that in retrospect it will be seen that some false steps have been taken.

For example, if we pursue completely the approach of *Hahn* and others the result is a theory of a monetary economy over time in which money enters only as a zero transactions cost store of value. Money is significant over time but there is no role of money at a point in time.

Money will move us from one sequential equilibrium to the next without entering the workings of any single equilibrium. In other words, any properly formulated monetary theory is expected to deal with non-essential economies.

Conversely, if we were to follow the short time rather than long time approach we would run into corresponding difficulties. If *Ostroy's* fundamental analysis were carried through we should have a deep detailed view of an economy in equilibrium at a point in time with a clear view of transactions and the economy's financial sector. But there is little reason to believe that this can get us from one period to the next.

To the obvious suggestion that one marry the two approaches yielding a long period sequence of short period economies, the reply is that this is worth investigating but that the approaches are so different one doubts that the marriage would last — one might well end up with two different moneys in the same economy, serving the two functions of medium of exchange and store of value.

One is tempted, therefore, to try something less ambitious and in particular to study the short period only. Bearing in mind the description of the models of *Hahn* and others, one is concerned with an economy which is sequential and yet has announced prices and no uncertainty. It would be a possible direction of research to eliminate these unrealistic restrictions. This may be achieved either by using the concept of temporary equilibrium and incorporating debt into the *Grandmont/Younes* model, or, alternatively by introducing uncertainty into the models of *Hahn* and others. Some of the difficulties which now arise have been explored by *Radnor* (1972) and *Green* (1971, 1972). Also, the structure of the *Ostroy/Starr* model suggests approaches for further research, for example, introducing specialization in production and exchange, making monetary exchange even more essential.

Perhaps the most important problem is that any careful analysis of economies where prices are to be determined by agents in the economy involves consideration of price setting behaviour out of equilibrium.²⁸

²⁸ The telling argument against the sequential equilibrium (or moving equilibrium) type of monetary theory is that the theory underlying equilibrium analysis assumes that bargaining is no problem. Such an equilibrium analysis dichotomizes the process of exchange and the process of bargaining. The bargaining starts at the beginning of each period and continues until an equilibrium set of prices is established. Equilibrium trades occur only after the bargaining process has nowhere else to go. Such a theory is misleading,

There is now a substantial literature on this topic but it pays no explicit attention to money. Furthermore, “real” transactions costs may well divert one’s attention from the more critical transactions costs which are due to information processing requirements (*Shubik, 1972*). All these are serious problems and they will not be easily solved.

After all it will not come as a surprise that the problem of constructing an adequate microfoundation for monetary theory at this time cannot be called settled. So far, no general equilibrium system has been developed that fully respects the singular set of arrangements under which transactions occur in a monetary economy, though it is only such a system that could be used to evaluate macroeconomic arguments (*Clower, 1971; Hahn, 1971, 1973 a*). The present situation of monetary theory would be merely annoying if the monetary sector of the economy and the macro disturbances which can occur only in a monetary economy were not so important. In the actual world the monetary and financial system is the neural network, or “controlling cocoon surrounding and guiding the real system. It than can be argued that if one’s goal is to illuminate the role of money in the economy the returns from the type of work reviewed may not be commensurate with the effort required (*Johnson, 1974*). From the viewpoint of a monetary institutionalist, money in general equilibrium systems it a very mouselike money — it is only a pale shadow of the real thing. It is precisely this sort of criticism that led many authors to reject the entire Walrasian framework in favour of a Marshallian one which is not lacking descriptive realism. But this is really beside the point of dealing with the central issue of economic analysis — that of doing away with the division between micro and macro theory.

We think that there is little choice in this field. Either microeconomic theory investigates the foundations of money and makes progress or we shall eventually have to decide that pure theory based in microeconomics is of little or no help in understanding the important problems of macroeconomics (*Leijonhufvud, 1973*). Microeconomic analysis would then be restricted permanently to the more traditional questions of

for it avoids giving any crucial theoretical role to the bargaining process (*Howitt, 1973*). As *Leijonhufvud* (1968, 1973) has pointed out, equilibrium analysis presupposes that the coordination of economic activities through the price system can be taken care of without impinging upon the activities themselves. This point is also made by *Ostroy* (1973). For attempts to work toward a monetary theory following this argument, see *Howitt* (1974).

equilibrium, optimization, and efficiency. The gap between micro and macroeconomic analysis would then remain, we believe to the detriment of both.

References

- Arrow*, K. J.; *Hahn*, F. H. (1971): *General Competitive Analysis*, San Francisco. — *Brunner*, K.; *Meltzer*, A. H. (1971): The Uses of Money: Money in the Theory of an Exchange Economy, in: *American Economic Review*, 61, 784 - 805. — *Clower*, R. W. (1965): The Keynesian Counterrevolution: A Theoretical Appraisal, reprinted in: *Clower* (ed.): *Monetary Theory*, Harmondsworth 1969, 270 - 297. — *Clower*, R. W. (1967): A Reconsideration of the Microfoundations of Monetary Theory, reprinted in: *Clower* (ed.): *Monetary Theory*, 202 - 211. — *Clower*, R. W. (1970): Is There an Optimal Money Supply? in: *The Journal of Finance*, 25, 425 - 433. — *Clower*, R. W. (1971): Theoretical Foundations of Monetary Policy, in: *Monetary Theory and Monetary Policy in the 1970's*, London, 15 - 28. — *Debreu*, G. (1959): *Theory of Value*, New York. — *Feige*, E. L.; *Parkin*, M. (1971): The Optimal Quantity of Money, Bonds, Commodity Inventories, and Capital, in: *American Economic Review*, 61, 335 - 349. — *Feldman*, A. M. (1973): Bilateral Trading Processes, Pairwise Optimality and Pareto Optimality, in: *Review of Economic Studies*, 40, 463 - 472. — *Foley*, D. K. (1970): Equilibrium with Costly Marketing, in: *Journal of Economic Theory*, 2, 276 - 291. — *Grandmont*, J.-M.; *Younes*, Y. (1972): On the Role of Money and the Existence of a Monetary Equilibrium, in: *Review of Economic Studies*, 39, 355 - 372. — *Grandmont*, J.-M.; *Younes*, Y. (1973): On the Efficiency of a Monetary Equilibrium, in: *Review of Economic Studies*, 40, 149 - 165. — *Green*, J. R. (1971): Temporary General Equilibrium in a Sequential Trading Model with Spot and Future Transactions, C. O. R. E. Discussion Paper 7127, August 1971. — *Green*, J. R. (1972): Pre-Existing Contracts and Temporary General Equilibrium, Harvard University Discussion Paper 246, June 1972. — *Hahn*, F. H. (1965): On Some Problems of Proving the Existence of an Equilibrium in a Monetary Economy, in: *Clower* (ed.): *Readings in Monetary Theory*, Harmondsworth 1969, 191 - 201. — *Hahn*, F. H. (1971 a): Equilibrium with Transaction Costs, in: *Econometrica*, 39, 417 - 439. — *Hahn*, F. H. (1971 b): Professor Friedman's View on Money, in: *Economica*, 38, 61 - 80. — *Hahn*, F. H. (1973 a): On the Foundations of Monetary Theory, in: *Essays in Modern Economics*, ed. by M. *Parkin* with A. R. *Nobay*, London, 230 - 242. — *Hahn*, F. H. (1973 b): On Transaction Costs, Inessential Sequence Economies and Money, in: *Review of Economic Studies*, 40, 449 - 461. — *Hayashi*, T. (1974): The Non-Pareto Efficiency of Initial Allocation of Commodities and Monetary Equilibrium: An Inside Money Economy, in: *Journal of Economic Theory*, 7, 173 - 187. — *Heller*, W. P. (1972): Transactions with Set-Up Costs, in: *Journal of Economic Theory*, 4, 465 - 478. — *Heller*, W. P.; *Starr*,

R. (1973): Equilibrium in a Monetary Economy with Non-Convex Transactions Costs, Technical Report 110, Economic Series, Stanford, September 1973. — Heller, W. P. (1974): The Holding of Money Balances in General Equilibrium, in: *Journal of Economic Theory*, 7, 93 - 108. — Hirshleifer, J. (1973): Exchange Theory: The Missing Chapter, in: *Western Economic Journal*, 11, 129 - 146. — Howitt, P. W. (1973): Walras and Monetary Theory, in: *Western Economic Journal*, 11, 481 - 500. — Howitt, P. W. (1974): Stability and the Quantity Theory, in: *Journal of Political Economy*, 82, 133 - 152. — Johnson, H. G. (1974): Major Issues in Monetary Economics, in: *Oxford Economic Papers*, 26, 212 - 225. — Karni, E. (1973): Transactions Costs and the Demand for Media of Exchange, in: *Western Economic Journal*, 11, 71 - 80. — Kurz, M. (1974 a): Equilibrium with Transaction Cost and Money in a Single-Market Exchange Economy, in: *Econometrica*, 42, 1 - 20. — Kurz, M. (1974 b): Equilibrium in a Finite Sequence of Markets with Transaction Costs, in: *Journal of Economic Theory*, 7, 418 - 452. — Leijonhufvud, A. (1968): *On Keynesian Economics and the Economics of Keynes*, New York. — Leijonhufvud, A. (1973): Effective Demand Failures, in: *Swedish Journal of Economics*, 75, 27 - 48. — Marschak, J. (1950): The Rationale of the Demand for Money and of 'Money Illusion', in: *Metroeconomica*, 2, 71 - 100. — Niehans, J. (1971): Money and Barter in General Equilibrium with Transactions Costs, in: *American Economic Review*, 61, 773 - 783. — Ostroy, J. M. (1973): The Informational Efficiency of Monetary Exchange, in: *American Economic Review*, 63, 597 - 610. — Ostroy, J. M.; Starr, R. (1973): Money and the Decentralization of Exchange, Discussion Paper 41, Department of Economics, University of California, Los Angeles, October 1973. — Patinkin, D. (1965): *Money, Interest and Prices*, 2nd edition, New York. — Perlman, M. (1971): The Roles of Money in an Economy and the Optimum Quantity of Money, in: *Economica*, 38, 233 - 252. — Pethig, R. (1973): Equilibrium and Media of Exchange in a One-Period General Equilibrium Model with Transactions Costs and Paper Money, University of Mannheim, Faculty of Economics and Statistics, August 1973. — Radner, R. (1972): Existence of Equilibrium of Plans, Prices and Price Expectations in a Sequence of Markets, in: *Econometrica*, 40, 289 - 303. — Samuelson, P. A. (1968): What Classical and Neo-Classical Monetary Theory Really Was, in: *Canadian Journal of Economics*, 1, 1 - 15. — Shubik, M. (1972): A Theory of Money and Financial Institutions, Part VIII, Transactions Costs in a Market Economy, Cowles Foundation Discussion Paper No. 336. — Sontheimer, K. (1972): On the Determination of Money Prices, in: *Journal of Money, Credit and Banking*, 4, 489 - 508. — Sontheimer, K. (1973): A Technological Representation of Money, in: *Metroeconomica*, 25, 136 - 152. — Starr, R. M. (1970): Equilibrium and Demand for Media of Exchange in a Pure Exchange Economy with Transactions Costs, Cowles Foundation Discussion Paper No. 300, Yale University, October 1970. — Starr, R. M. (1972): The Structure

of Exchange in Barter and Monetary Economies, in: Quarterly Journal of Economics, 86, 290 - 302. — *Starr*, R. M. (1974): The Price of Money in a Pure Exchange Monetary Economy, in: *Econometrica*, 42, 45 - 54. — *Starrett*, D. (1973): Inefficiency and the Demand for 'Money' in a Sequence Economy, in: *Review of Economic Studies*, 40, 427 - 448. — *Ulph*, A. M.; *Ulph*, D. T. (1974): Efficiency, Inessentiality and Money, Discussion Paper in Economics 19, University of Stirling, April 1974. — *Uzawa*, H. (1960): Walras' Tatonnement in the Theory of Exchange, in: *Review of Economic Studies*, 27, 182 - 194. — *Veendorp*, E. C. H. (1970): General Equilibrium Theory for a Barter Economy, in: *Western Economic Journal*, 8, 1 - 23. — *Wallace*, N. (1972): An Approach to the Study of Monetary and Non-monetary Exchange Structures, in: *Journal of Money, Credit and Banking*, 4, 838 - 847. — *Walker*, D. A. (1970): Leon Walras in Light of His Correspondence and Related Papers, in: *Journal of Political Economy*, 78, 685 - 701. — *Walras*, L. (1954): *Elements of Pure Economics*, translated by William Jaffé, London.

Zusammenfassung

Die mikroökonomischen Grundlagen der Geldtheorie

Nachdem in der Einleitung zunächst einige grundlegende Probleme der mikroökonomischen Geldtheorie angesprochen werden, wird im weiteren gezeigt, wie rudimentär die Gleichgewichtsmodelle vom *Arrow/Debreu*-Typ unter transaktionstheoretischem Gesichtspunkt sind.

Die traditionelle Gleichgewichtstheorie erklärt nicht, warum es in realen Volkswirtschaften Objekte gibt, die die Funktion eines Tauschmittels ausüben. Sie erklärt daher auch nicht, warum einige wenige Güter als dominante Tauschmittel verwendet werden. Außerdem ist es völlig unklar, wie die ökonomische Interaktion der Individuen bei der Transformation der Anfangs- in die Gleichgewichtsallokation bewältigt wird. Die Theorie geht zwar implizit davon aus, daß dieser Vorgang informationsmäßig dezentral abgewickelt wird, jedoch nur auf Kosten der Annahme einer nicht spezifizierten, perfekten Tauschorganisation, was zur Folge hat, daß alle aus der Interdependenz der individuellen Tauschaktivitäten resultierenden Informations- und Koordinationsprobleme wegdefiniert werden. Die traditionelle Gleichgewichtstheorie erklärt ferner nicht, warum die Individuen mit einer Einheit eines stoffwertlosen Gutes (Papiergeld) einen positiven Beitrag eines „nützlichen“ Gutes erwerben können. Die Funktion des Geldes als allgemeines Tauschmittel ist in der Modellstruktur nicht ausreichend fundiert. Da ferner dieselbe Gleichgewichtsallokation sowohl mit als auch ohne die Hilfe von intermediären Transaktionen erreichbar ist, liegt es nahe, alle positiven intermediären Transaktionen als funktionslos zu betrachten. Die Theorie gibt schließlich keine Antwort auf die Frage, warum sich die in der Realität zu beobach-

tende Tauschorganisation gebildet hat, da der Tausch in diesem Ansatz nicht als eine Ressourcen beanspruchende ökonomische Aktivität konzipiert ist, das heißt, es gibt keine Wahl zwischen verschiedenen Tauschorganisationen (Transaktionstechnologien).

Ausgehend von diesen Überlegungen wurden in der Abhandlung Ansätze diskutiert, die das transaktionstheoretisch unbefriedigende Ausgangsmodell zu modifizieren suchen: Durch die Berücksichtigung von Transaktionskosten läßt sich der Tausch als eine ökonomische Aktivität konzipieren, bei der die Wahl zwischen verschiedenen Tauschwegen zu einem ökonomisch relevanten Entscheidungsproblem wird. Transaktionskosten können alternativ durch folgende Vorgangsweisen berücksichtigt werden: Einerseits kann man jedem Individuum die Doppelfunktion des Konsumierens und Tauschens zuordnen; andererseits kann man aber auch die beiden ökonomischen Aktivitäten des Konsums und des Tausches analytisch isoliert behandeln, indem einem aus Nur-Haushalten bestehenden Haushaltssektor ein nur aus Tauschintermediären bestehender Sektor gegenübergestellt wird. Doch scheint dieser Ansatz wenig Möglichkeiten zu bieten, in der Frage der Tauschmittelverwendung wesentlich über das Ausgangsmodell hinauszugehen. Die Grundlagen dafür bietet ein weiterer Ansatz, in dem (unter Vernachlässigung von Transaktionskosten) durch die Konzeption des Tausches als bilaterale Interaktion die Tauschmittelfunktion des Geldes modellmäßig fundiert und erklärt werden kann.

Summary

The Microfoundations of Monetary Theory

Following an initial brief mention of some fundamental problems of micro-economic monetary theory in the introduction, it is shown how rudimentary equilibrium models of the *Arrow-Debreu* type are from the viewpoint of transaction theory.

Traditional equilibrium theory does not explain why there are objects in the real national income which perform the function of a medium of exchange. Consequently it also fails to explain why just a few goods are used as dominant media of exchange. Furthermore, it is completely unclear how the economic interaction of individuals is coped with in the transformation from the initial to the equilibrium allocation. The theory proceeds implicitly from the assumption that this process is of a decentralized nature as far as information is concerned, but only at the cost of assuming a non-specified perfect exchange organization, with the result that all information and co-ordination problems deriving from the interdependence of individual exchange activities are eliminated by definition. Traditional equilibrium theory further fails to explain why individuals can acquire a positive amount of a "useful" good with a unit of a good having no inherent value (paper money). The function of money as a

general medium of exchange is not sufficiently well grounded in the model structure. Moreover, since the same equilibrium allocation is attainable both with and without the help of intermediate transactions, the idea suggests itself of regarding all positive intermediate transactions as functionless. Lastly, the theory gives no answer to the question why the exchange organization observed in reality came into being, because in this approach exchange is not conceived as an economic activity that requires resources, that is to say, there is no choice between different exchange organizations (transaction technologies).

Starting out from these deliberations, this essay discusses approaches which set out to modify the initial model, which is unsatisfactory from the standpoint of transaction theory. By allowing for transaction costs, exchange can be conceived as an economic activity in which the choice between various modes of exchange becomes an economically relevant decision-making problem. Transaction costs can be taken into account by the following alternative procedures: On the one hand, every individual can be assigned the dual function of consumption and exchange; on the other hand, however, the two economic activities of consumption and exchange can be isolated from each other for analysis, drawing a distinction between a household sector comprising households only and a sector consisting solely of exchange intermediaries. However, this approach seems to afford few possibilities of advancing very far beyond the initial model in the matter of the use of media of exchange. The groundwork for this is provided by another approach in which (neglecting transaction costs) the function of money as a medium of exchange can be well founded and explained in the model by the conception of exchange as bilateral interaction.

Résumé

Les Microfondations de la Théorie monétaire

Après une approche dans l'introduction de quelques problèmes fondamentaux de la théorie monétaire microéconomique, l'on démontre à quel point sont rudimentaires, du point de vue des théories transactionnelles, les modèles d'équilibre du type Arrow-Debreu.

La théorie traditionnelle de l'équilibre n'explique pas pourquoi il existe dans les économies réelles des objets exerçant la fonction de moyens de substitution. Elle n'explique d'ailleurs pas non plus pourquoi quelques biens rasissimes servent de moyens dominants d'échange. Manque en outre totalement de clarté le moyen de la prise en main de l'interaction économique des individus lors de la transformation des allocations originaires en allocations équilibrées. La théorie est bien implicitement basée sur le fait que ceci se déroule sur le plan de l'information d'une manière décentralisée, mais seulement au dépens de l'admission d'une organisation d'échange parfaite, non spécifiée. Ceci a pour

conséquence que tous les problèmes d'information et de coordination résultant de l'interdépendance des activités d'échange individuelles sont éliminés de la définition. La théorie traditionnelle de l'équilibre n'explique en outre pas pourquoi les individus peuvent acquérir avec une unité d'un bien dépourvu de valeur (monnaie-papier) une contribution positive d'un bien « utile ». La fonction de la monnaie en tant que moyen général d'échange n'est pas suffisamment fondée dans la structure du modèle. Comme en plus la même allocation d'équilibre peut être atteinte aussi bien avec que sans l'aide de transactions intermédiaires, il n'y a qu'un pas à considérer toutes les transactions intermédiaires positives comme dépourvues de fonction. La théorie ne répond finalement pas à la question, pourquoi s'est formée en réalité l'organisation d'échange observée, car dans cette perspective l'échange n'est pas conçu comme une activité économique exigeant des ressources, c'est-à-dire qu'il n'existe pas de choix entre diverses organisations d'échange (Technologies de transaction).

Partant de ces considérations l'article en question examine les éléments essayant de modifier le modèle de départ insatisfaisant sur le plan de la théorie des transactions: par la prise en considération des coûts de transaction l'échange se laisse concevoir comme une activité économique à l'occasion de laquelle le choix entre plusieurs voies d'échange devient un problème de choix économiquement pertinent. Les coûts des transactions peuvent alternativement être pris en considération dans les perspectives suivantes: d'une part on peut octroyer à chaque individu la double fonction de consommer et d'échanger; mais d'autre part on peut également considérer isolément de manière analytique les deux activités économiques de consommer et d'échanger, d'où ressort une juxtaposition d'un secteur composé uniquement de budgets ménagers et d'un secteur composé uniquement d'intermédiaires d'échange. Mais cette perspective paraît offrir peu de possibilités de dépasser réellement le modèle de départ dans la question de l'affectation des moyens d'échange. Ceci n'est offert que par une autre perspective, dans laquelle (abstraction faite des coûts de transaction) par la conception de l'échange en tant qu'interaction bilatérale la fonction de moyen d'échange de la monnaie est fondée et justifiée conformément à un modèle.