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MICRO FOUNDATIONS OF MONEY AND FINANCE

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by

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1. Money in frictionless general-equilibrium models

Money and Banking textbooks have litte difficulty explaining the use of
money. Money facilitates the exchange of goods and the division of
labour by lowering transaction costs. There is nothing wrong with that
story, but when it comes to incorporating money in microeconomic gene-
ral-equilibrium models, it proves extremely difficult to explain why
people would be willing to hold a non-interest-bearing asset whilst
riskless assets with a positive return are available (time or savings
deposits) and why the use of such an asset could lower transaction
costs. All kinds of plausible models have been developed to explain the
volume of money demanded, but they presuppose an economy where money
does already exist in the first place. In the textbook story money does
away with the need for a double coincidence of wants for a transaction
to take place or, in the absence of such a coincidence, with the need
for a series of transactions. More generally, the use of money reduces
the transaction costs which a seller incurs in order to find a buyer
and a buyer incurs in order to find a seller. Those transactions costs
are predominantly of an informational character: they result from the
need for communication between prospective buyers and sellers, from
gathering information on the market and inspection of goods but also
from the keeping of records and the drawing up of accounts (Niehans
1969 p. 709). These costs must be distinguished from the minimal costs
of physically transferring goods from seller to buyer, which should
really be seen as production costs.

Walrasian equilibrium models with money are not very satisfactory

because they provide no reason why goods shouldn't exchange directly
for other goods (cf. Hahn 1973 p. 23). Arrow-Debreu models, where
transaction decisions are taken at one moment for all future dates,
provide no place for money either (cf. Debreu 1959). The Walrasian
auctioneer who, or the tâtonnement mechanism that, regulates the buying
and selling process ijn these models are devices expressly introduced
to abstract from information costs, the very rationale of the use of
money. Patinkin's attempt to integrate monetary and value theory in his
painstakingly written Money, Interest, and Prices (Patinkin 1965),
which can be seen as the culmination of the Walrasian tradition, is a
glaring example of the ultimate futility of introducing money in a
general-equilibrium model where all goods exchange against all goods.
Patinkin tries to "conceive of a barter economy as the limiting posi-
tion of a money economy whose nominal quantity of money is made smaller
and smaller" (Patinkin 1965 p. 75). This attempt was doomed to failure,
because prices go down in step with the nominal money supply so that
the real quantity of money is not reduced. Patinkin realised full well
that one cannot compare a barter economy with a monetary economy in
this way. His argument, however, was that "in a barter economy there is
obviously neither an excess-demand equation for money nor a dependence
of commodity excess-demand equations on real balances" (ibidem), which
would to his mind make a comparison between a barter economy and a
monetary economy more or less impossible. But a comparison between a
monetary economy and a frictionless barter economy really serves no
purpose, even if one adds real balances as an argument to individuals'
utility functions (Patinkin 1965 Ch. VI, Patinkin and Levhari 1968);
the only meaningful comparison is with a barter economy where transac-
tions are costly because of the higgling and haggling involved. Patin-
kin neglects the fact that the exchange technology in a monetary eco-

nomy is more efficient than in a barter economy. A given initial supply of resources will result in differing amounts of goods and services and, in a production economy, in different paths of capital accumulation under the two systems. In monetary growth models, to which Patinkin incidentally also contributed, this is taken account of by adding real balances as an argument to a macro-economic production function (Patinkin and Levhari 1968). Such a procedure may intuitively be more appealing than the addition of real balances to utility functions. It suffers, however, from the lack of a micro-economic foundation, which is hard to supply because markets in those monetary growth models are usually frictionless (cf Sijben 1978). Anyway, if macro-economic models assume a productive contribution of money balances, micro-economics should provide an explanation why this is so.

2. Money in a single-period model

A step forward was made by writers who constructed general-equilibrium models with transactions costs, prominent amongst them Niehans (1969, 1971, 1975, 1978 Ch. 6). Niehans (e.g., 1978 p. 101) simply posits that there are no IOU's or more generally that there is no credit (with the exception of Niehans 1975, but in that article bonds are added to the system only in order to explain the rate of interest). This effectively precludes triangular trade. Under a Walrasian auctioneer system, A could sell goods to B and B goods to C whilst C sells goods to A. In a system where transactions are not concluded in an all-embracing single decision as in the Walrasian world, A demands a quid pro quo from B instead of agreeing to wait for delivery of goods by C. C may have to pay C - goods to B, who has no need for them and uses them to pay A. In

a multi-agent world without a generally accepted medium of exchange long chains of transactions may be called for before a preferred redistribution of goods has taken place. If instead some goods, say C - goods, are used as a medium of exchange, the number of transactions is drastically reduced (the medium of exchange may also, but need not, be a means of payment: the transfer of a means of payment cancels outstanding claims, it functions as ultimate payment, whilst the transfer of a medium of exchange need not in itself cancel a debt; it may only be a means for bringing about the transfer of a means of payment, e.g., a cheque).

The reduction in the number of exchange transactions achieved by deploying a generally accepted means of payment and the consequent reduction in transactions costs is analysed in a model developed by Jones (1976). Jones argues that indirect exchange can be cheaper than direct barter because fewer search contacts are on average needed between prospective sellers and buyers before an exchange is made (see for a further development of Jones's model Oh 1989). In contrast to transportation, storage and inspection costs, the information costs of finding a trading partner may be assumed to be non-additive. Indirect exchange may double transportation costs, but not information costs, over direct barter. Let a supplier of good i enter the market and search for a supplier of good j. All agents in the market hold one unit of a good and demand one unit of another good. Note that prices are given and that the market is assumed to clear eventually at these prices. The (subjective) probability that a randomly met trader in the market demands good i, or, for that matter, supplies good i, is denoted by p_i. The probability that he or she supplies good j is denoted by p_j. The probability that an agent offering good i and demanding good j meets another agent who demands good i and supplies good j therefore is

$p_i p_j$. The number of search contacts which the agent expects having to make before the desired transaction can be made consequently is $1/p_i p_j$. With indirect exchange through the medium of a good n, the expected number of search contacts is $1/p_i p_n + 1/p_n p_j$. The expected number of contacts, and with it the expected search costs of exchange, is smaller with indirect trade than with direct barter if

$$1/p_i p_n + 1/p_n p_j < 1/p_i p_n$$

or

$$p_i + p_j > p_n.$$

This may the case for some goods but not for others. Jones's model leaves open the possibility of direct barter and indirect exchange existing side by side. Note that chains of barter transactions are precluded by the assumption of additive transportation and related costs.

The question which good becomes the money commodity is taken up by Brunner and Meltzer (1971). In their view, transaction costs are, apart from costs of transfer and storage (which can best be seen as production costs), in fact costs of acquiring information on assets or, more precisely, the costs of identifying qualities of a good, including the location and identity of other traders (see also Alchian 1977). Repeated use of some assets and some transaction sequences will lower the marginal cost of acquiring information. This means that patterns of indirect exchange emerge in which some specific assets are deployed as media of exchange.

The assets used in indirect trade evolve into money. Their

function is to enable individual agents not to balance the value of
sales and the value of purchases at every moment of time. In the
absence of a Walrasian auctioneer, money enables agents to demand goods
without being certain of the quantities they will be able to sell and
the prices at which they will sell. In a timeless Walrasian economy it
may be somewhat difficult to imagine repeated use of assets and, conse-
quently, of learning processes, but time could be thought of as consis-
ting of periods within which all purchases of goods and services are
paid for by payments of goods and services. This implies that money
must either be a good that ends up as a producer or consumer good with
an economic agent at the end of each period, or a claim to such goods,
or that it is credit-money that is destroyed when all claims are sett-
led at the end of each period. Goods and services are ultimately paid
for by goods and services. In terms of Niehans's example, C could pay A
by transferring a claim in the books of a financial institution, a
bank, to A against the creation of a debt to the bank. A would transfer
the claim to B against receipt of B-goods and finally B transfers the
claim to C, after which C's claim and C's liability both vanish through
compensation. This implies that for every individual agent the total
value of sales (expressed in the numeraire) must equal the total value
of purchases within any period. Forced sales (in order to make up net
debit positions at the bank) or forced purchases (in order to get rid
of a net credit position) are conceivable. With the demise of the
Walrasian auctioneer, perfect markets are gone too (some models, such
as Jones's, assume that prices are given to agents, but that is only
because (in Jones's case) modelling both his central idea of informa-
tion costs as a stochastic variable depending on chance meetings be-
tween prospective trade partners and flexible prices proved an insur-
mountable task).

Within self-contained periods of time, it is hard to conceive of agents that would wish to hold end-of-period balances of intrinsically worthless pieces of paper, or more generally of fiduciary money, rather than goods. The holding of fiduciary money, such as bank notes or book entries, that is not destroyed at the end of each period only makes sense in models of _sequence economies_. Sequence economies differ not only from Walrasian economies where the future does not figure, except perhaps in a roundabout way by shaping expectations (and in that way, e.g. _via_ inflation expectations, by affecting the rate of interest). They also differ from Arrow-Debreu economies where all decisions are made in one fell swoop at the dawn of (model) time. From then on till Kingdom Come nothing happens but the realisation of plans, if not with certainty then with known probabilities. As in Walrasian one-period economies, there would be no point in holding money beyond the span of time during which contracts are concluded. It would serve no purpose after the once-and-for-all decision had been made. In contrast, sequence economies require new decisions to be taken and new transactions to be made every new time period. It appears that sequence economies provide a better setting for analysing the foundations of monetary economies than single-period models, as single-period models are hard put to explain the continued holding of money.

3. Money in a sequence economy

Niehans (1978, further on in Ch. 6) does not confine himself to a one-period model but also considers a multi-period situation. Transactions and storage costs, again, are simply assumed to exist, with those for the money commodity the lowest. An explanation of those costs is not given, apart from the suggestion that they are mostly search and information costs (Niehans 1978 pp. 63-'3; again, he rules out credit). Brunner and Meltzer's analysis on first sight does not take us much further, as it leaves one somewhat in the dark about the nature of the information sought. A clue is given in a footnote, which says that "If there are no costs of acquiring information, differences in the timing of receipts and payments are adjusted by issuing verbal promises in exchange for goods and, later, delivering goods" (Brunner and Meltzer 1971 p. 785 nt. 4). Though Brunner and Meltzer's idea was not taken up at the time, recent developments follow a similar track. E.g., Gale argues that in a world without a complete Arrow-Debreu system of markets, trading continues after the first date. The value of sales will not at every moment in time equal the value of purchases for all actors. Money holdings then serve to absorb the difference, at which point Gale, like Brunner and Meltzer before him, observes that "If agents were really trustworthy there would be no need for a sequence of budget constraints" (Gale 1982 p. 186, see also pp. 197, 235, 245). Or, as Niehans notes, "If one could be perfectly certain that everybody always stays within his budget constraint, everybody could be allowed to obtain goods without a specific quid pro quo", which would make exchange otiose (Niehans 1978 p. 63 nt. 4; as with Brunner and Meltzer, the most fundamental observations are relegated to footnotes; see also Ostroy 1973 p. 597, Ostroy and Starr 1974 p. 1093). Agents could, in a

one-period model, issue debt (IOU's) or entries could be made in an accounting system in the understanding that after a round of dealings the claims would be cancelled (i.e., every agent would both be willing and able to meet his or her budget constraint). In a sequence economy, A could sell to B at time t and be certain of receiving something in return at time t + 1 from C (Goodhart 1975 p. 3). Without uncertainty, but a known probability distribution of future 'states of the world', that is of exogenous circumstances such as the weather, claims on contingent commodities can be exchanged. To fix ideas, an order may be made for umbrellas to be delivered at a certain date if it rains and for parasols if the sun shines (see for an extremely lucid non-technical exposition of such an Arrow-Debreu economy Meade 1970).

The point of trustworthiness is also stressed by Illing (1985). Even if agents were immortal, there would be no complete Arrow-Debreu system of contingent future markets, if only because of moral hazard problems which follow from asymmetric information (Brunner and Meltzer, 1971 p. 786, also stress the uneven distribution of information between buyers and sellers as a reason for seeking alternatives to barter). In other words, trade would not only take place at the initial date, but there would also be spot markets at future dates. Illing's thought experiment runs as follows. Households are at the start of every period supplied with endowments of perishable consumption goods. These endowments are risk variables, with a known probability distribution. Households could even out the fluctuations in individual endowments by concluding insurance contracts. But there is asymmetric information. At any moment in time, households know their own endowment. Others do not, which means that the insurance company has to incur costs to collect information on individual endowments. There is, therefore, an incentive for households to cheat. It may in these circumstances be advantageous

to hold money as a substitute for costly insurance. But why, again, money rather than IOU's? Illing here follows Gale: because financial assets other than money imply information costs (Illing 1985 pp. 81-'2). An idea of the information costs involved in actual practice is given by the commission paid by retailers to the credit card company when payment is made through a credit card, which is a form of credit, of course (Gale 1982 p. 187). It should also be obvious that only a subset of transactions can be settled in this way, and that only some fraction of the set of agents can make use of this kind of credit, precisely because of the costs involved.

It might be objected that a model such as Illing's is far removed from reality, but such an objection would be beside the point. The aim is to find the essential or minimum requirements for a monetary economy, not to give a realistic description of a monetary economy. It is not surprising to find that transaction costs, and, if money is to be more than the rather bloodless construct it is doomed to be in a timeless or a one-period model, a time duration are minimum requirements of a monetary economy. It may be thought rather striking, though, that uncertainty as to prices or interest rates, which looms large in Keynesian money demand functions, is not a precondition. Uncertainty as to agents' creditworthiness by contrast does seem to have to be assumed in order to explain why money rather than IOU's is used. It has been argued that there will only be monetary exchange if there are costs of negotiating exchange transactions and if commodities have certain physical characteristics, i.e., some commodities have low storage costs (Clower 1977), but that begs the question why IOU's could not do the job. These last-named conditions may be necessary, but are by no means sufficient. Variations on the theme of moral hazard could be thought of. If contracts, e.g., contracts for the immediate delivery of goods

against the future provision of labour services are made, the difficulty arises of ensuring that the work be done well (Hahn 1988 p. 971).

Money is, in the above analysis, useful because it saves on transactions costs. More precisely, the use of money saves on the costs of acquiring information (in the same vein King and Plosser 1986). The crucial characteristic in this connection is the trustworthiness of the issuer (Gale 1982 p. 189). Fiduciary money therefore can only be the result of a long development. People accept intrinsically worthless paper money only because they expect other people to accept it in their turn on a later date. Their readiness to accept it can be fostered by the government announcing that people may pay taxes in that kind of money (cf Starr 1980 p. 262; in line with this approach, De Roos, 1989 p. 30, proposes to further the use of the Ecu through European governments doing their spending and collecting their taxes in Ecu's). If money were restricted to commodity money, enormous amounts in terms of the unit of account would be needed, which would entail high costs in terms of resources and would drive up the relative price of the money commodity to the detriment of its function as a production or consumption good.

It seems that a sequence economy not only results from moral hazard, but also from the costs of making decisions. In an Arrow-Debreu world, where incidentally households are infinitely lived, preparing for all possible future 'states of the world' by exchanging claims on contingent commodities would imply an infinite number of decisions. If we drop the fiction of a costless Walrasian/Arrow-Debreu auction mechanism, an infinite number of decisions implies infinite costs. Because of computational limitations of economic agents, it may be too costly to write contingent contracts or resort to insurance (providing, e.g., for the untimely death of a labour supplier) (cf Radner 1968 p. 31,

Hahn 1988 p. 971). It is cheaper then not to decide on all future
dealings and postpone most decisions to later dates. Besides, even if
it were conceivable to conclude contingent contracts for all future
dates and all future 'states of the world', with positive costs of
concluding contracts it would surely not be welfare-optimising to
concentrate all efforts at the initial date (Hahn 1985b p. 76). If
households are not infinitely lived, or if the future is not only risky
but also uncertain in the sense of Frank Knight, decisions for all
future dates and all possible 'states of the world' are not even con-
ceivable. Not all factors that make for a sequence economy also explain
the use of money. Computational limitations would not in all cases
exclude the use of IOU's if there were no moral hazard problems -
though cases that would be expensive to insure against even without
moral hazard, such as the untimely death of a prospective supplier of
future labour, also seem to call for money rather than IOU's.

The last word has certainly not been said on this subject. There
is no lack of fine ideas, but to model these ideas is no mean task. One
thing at least is clear: timeless general-equilibrium models won't do
if we want to explain not only the use but the holding of money. We
need models that provide for sequences of trades, as emphasised by
people such as Gale and Illing. The information costs that may well be
the key to the use of money also explain its typical characteristics of
divisibility and liquidity, plus its power to lower transactions costs
(cf. Gale 1982 pp. 187-'8, 194-'7).

Having found the minimum requirements of a monetary economy, the
next step should be to incorporate production in the model and to take
account of the better specialization made possible by the use of money,
which means that the endowments in monetary economies differ from those
in barter economies (cf. Hahn 1973 p. 234). But this poses enormous

technical problems. On top of that, there seems at present to be no way to model the scale economies made possible by the use of money (cf Hahn 1985a p. 2, Niehans 1969 p. 106). It would be difficult to conceive of a Pareto-optimal competitive equilibrium in such a situation, to mention one problem. With scale economies, if internal to firms and households, pure competition is impossible and with perfect markets gone as well, no tidy general-equilibrium model can be applied.

4. Overlapping-generation models

Economists associated with the Federal Reserve Bank of Minneapolis in particular have made attempts to find the essential characteristics of money with the help of overlapping-generation models (Kareken and Wallace 1980). In overlapping-generation models, there are at any moment in time two generations of people, an older one and a younger one. Older people must have saved resources or claims to resources in order to survive after retirement. Storing resources over a number of decades is a costly affair and society can achieve considerable savings if people build up a store of claims to resources instead. Those claims could be intrinsically worthless pieces of paper, i.e., fiat money. A generation then first works and sells part of its produce to the older generation against money and when it in its turn has become the older generation it uses up its money treasure and receives consumption goods from the then younger generation, and so on (see for an extremely formal model, in which the young are at the start endowed with consumption goods and the old with both consumption goods and money, Wallace 1980).

Intrinsically worthless fiat money is certainly one means of

transferring resources from one generation to another. There seems, however, to be no compelling reason why it should be more efficient or convenient than other means, such as claims to ownership of land which has the benefit that the acceptability of the claims by next generations

can hardly be in doubt. It may be asked why commodity money could not be used, but that would mean that people store commodities, which the use of money was supposed to make otiose in the first place. In a multilateral trade world where exchanges are not restricted to inter-generational transfers (and agents are even taken to be immortal, following the Arrow-Debreu convention) money first may take the form of commodity money and fiduciary money may gradually come into use as trust in its acceptability by other agents grows until at some point in time intrinsically worthless fiat (paper) money gains currency. Over-lapping-generation models restrict the class of exchanges and conse-quently the possibilities of a medium of exchange to save on transac-tions costs severely. In fact, transactions costs are conspicuous by their absence in these models, because there are no search or other information costs, there being only one (consumption) good. In fair-ness, it must be mentioned that the proponents of this line of attack themselves see the assumption of costless communication, i.e., the absence of information (transactions) costs, as a major problem. They only wonder how such costs can be adequately modelled (Kareken and Wallace 1980 p. 9).

It may be concluded that overlapping-generation models fail to capture the medium-of-exchange function of money adequately (cf Ostroy 1989). Money has only a distinct role to play in the world pictured in those models if it is fiat money and it is not explained why money can exist alongside other claims to commodities, even when agents are

immortal or behave as if they are and people trust that money balances can be exchanged for goods in the future (cf Tobin 1980 p. 84).

5. Cash-in-advance models

Patinkin struggled with the problem of finding a rationale for the use of money in a general-equilibrium. Clower attempted to cut the Gordian knot that Patinkion failed to untie by simply positing that, in a monetary economy, "money buys goods and goods buy money; but goods do not buy goods" (Clower 1969 pp. 207-'08). That, though, is not much better than adding money as an argument to the utility function, which Clower incidentally does too, as it leaves the contribution of money to welfare unexplained. In Patinkin's case money is held even if transactions could easily be made without money; Clower sets out to correct this situation by putting an arbitrary restriction on the system. For it is quite an arbitrary procedure to postulate the use of money in all transactions, as is common practice in this kind of models (e.g., Lucas 1980, Eden 1986). On top of that, there is the restriction that at the beginning of any period the total demand for goods, expressed in the unit of account, cannot exceed the total volume of money, which excludes purchases paid for by receipts of money against goods and services sold during the period under in question (Clower 1969 pp. 208-'09).

The introduction of money can hardly be shown to have welfare-increasing effects if a Clower or cash-in-advance restriction is simply added to an already existing system of demand and supply equations. Nonetheless, if the aim is not to compare barter and monetary economies but to explore the effects of the use of a generally accepted medium of exchange, the procedure might be of some use. It can be of no more than

limited use, though, as an inflexible transactions technology is imposed on the system which leaves no room for, e.g., trade credit as an alternative to the generally accepted medium of exchange. Even if the capital market is not so perfect as to give borrowers an unlimited access to it at constant costs, to exclude trade credit altogether is going to the other extreme.

Lucas (1987 Ch. VI) uses a moderate variant of the cash-in-advance procedure in order to introduce both the Tobin portfolio demand and the Baumol-Tobin inventory-theoretic demand aspects of money demand in his model. He assumes that goods on any day can be bought with money acquired before, e.g., at the securities market, but he provides for the possibility of obtaining trade credit. His model is a general-equilibrium model where the relative price of cash goods (goods paid for in cash on the spot) and credit goods (goods to be paid for one period later) is exactly equal to one plus the rate of interest. In other words, trade credit costs you exactly the same amount of interest as selling securities now in order to pay spot and foregoing the interest on these securities. IOU's apparently carry no risk premium in this model and the introduction of money can hardly be shown to increase welfare, because it does not save on information costs. It is simply postulated that agents have specific preferences over cash and credit goods.

6. Financial intermediation

It turned out that money arises first and foremost because it saves on information costs. Financial intermediaries have sprung up for similar reasons. If an economic agent needs a big loan, a number of investors

will be involved. If every investor separately invested in the production of information on the borrower, there would be an enormous duplication of costs. Alternatively, there could be a <u>free-rider problem</u>, as every investor would try to make use of the information produced by another investor, which might even lead to an absence of information production (cf Diamond 1984 p. 393). Financial intermediaries specialising in information production can spare the investors the trouble and expense of gathering information themselves. Another service that financial intermediaries can provide is monitoring without disclosing the information found to a wider public, which firms may demand for reasons of competition strategy (Diamond 1984 p. 395).

If investors delegate information production to financial intermediaries, problems of a <u>principal-agent</u> type arise. The financial intermediary, acting as the agent of the investors, is inclined to spend as little as possible on information production. Again, we run into a moral hazard problem. Ramakrishnan and Thakor (1984 p. 417) suggest that compensation of each information producer (intermediaries in their model being made up of a number of individual information producers) should be contingent on some ex post indicator of the quality of the information. The market could be trusted, though, to provide incentives for intermediaries to give investors reliable information: investors that employ successful intermediaries make high returns. Such intermediaries build up an intangible asset: a good name; and if they want to stay in business it is in their own interest to maintain that name. Still, there is a problem here which suggests that fixed payments to investors are the optimal arrangement (Diamond 1984 p. 404). Arrangements that give the investors a fixed payment and provide the intermediary with a residual income provide strong incentives for intermediaries not to let things slip, whilst minimising

the need for investors to monitor the intermediaries.

Apart from saving on information costs, financial intermediaries of course provide investors with the opportunity of spreading risks at low transactions costs. Diversification of the intermediary's loan portfolio increases the probability that it will be able to pay the agreed returns to its investors or depositors. Like the principal-agent or moral-hazard problem, this results from market imperfections. Participations in or claims on borrowing agents are not infinitely divisible, because transaction costs are at least partly independent of the amount of the investment. Market imperfections not only explain the use of money but also the existence of financial intermediaries.

7. Conclusions

It has proved quite a struggle to break loose from the Walras/Arrow-Debreu world in building monetary models. If money is simply added to a frictionless eneral-equilibrium system, it is well-nigh impossible to find a rationale for the holding of money. Nothing in terms of the consumption set available or the volume of production is gained by using money. Walrasian and Arrow-Debreu models do not provide a satisfactory framework for a meaningful study of money. They provide no room for introducing alternative transactions technologies other than restrictions on the possible set of transactions that can only be seen as arbitrary within the context of those models. General-equilibrium models with transactions costs that favour the use of a generally accepted medium of exchange, as developed by Niehans, leave unexplained what has to be explained first of all. Though this may be a step forward, still the use of money is imposed on the model rather than ex-

plained from the model (cf Fischer 1988 p. 300), which takes us not much further than the inclusion of real balances as an argument in the production function or the introduction of a cash-in-advance restriction does. Explanations of the use of money, and of financial intermediaries for that matter, by the saving it provides on information costs resulting mostly, but not exclusively, from moral hazard look much more convincing.

In single-period models, money is useful because it saves on information costs. In sequence models, money of course fulfills the same function, but in addition a sharp distinction between money and debt (IOU's) can be made there. Money is generally preferred over debt to settle transactions. In single-period models, no such distinction seems possible because the book entries deployed to keep track of the transactions can be viewed as inside money, i.e., money created against IOU's. Outside (fiat) money, which continues to be held by agents after claims are settled, can only find a satisfactory place in sequence economies.

Models that assume the use of a generally accepted medium of exchange without explaining its use can in principle be useful in analysing the effects, if not the causes, of the use of money. Yet, it is not clear to what extent, if at all, macromodels should take account of the work done in this area (Barro and Fischer 1976 p. 155, Fischer 1975 p. 158). Postulating a general cash-in-advance restriction, e.g., is a rather crude procedure. Possibly less account has to be taken of it the smoother the monetary mechanism functions. In cases of poorly functioning markets a cash-in-advance restriction might come in useful to characterise the working of the system. One problem involves price setting, as a monetary economy must do without a Walrasian auctioneer and prices are set out of equilibrium (Hentschel 1976 p. 93).

Finally, it is worth noticing that the function of money as a medium of exchange is really that of an asset that people prefer to hold between transactions. The medium-of-exchange quality follows from its quality as an asset. This fits in quite well with the standard textbook assertion that money is an asset, namely the asset with the highest degree of liquidity (e.g., Ritter and Silber 1970 p. 17). Attempts by Hicks (1967) to construe a system with a money lacking the asset or store-of-value character therefore were bound to fail. His system resembles Niehans's one-period model, with agents who buy before they have been able to sell running up a debt with a bank that has to be settled before the period ends. Now against agents who buy before they sell there are agents who sell before they buy. They are credited by the bank and can use their claim on the bank to buy goods and services, indeed are obliged to do so. Even if the claims on the bank can only be used within one period and cannot be held till a next period, they represent purchasing power during that period and therefore must be considered assets, i.e., a store of value, if only for a restricted period of time.

It goes without saying (or nearly so) that money and financial institutions presuppose imperfect markets, where agents, unlike in a Walrasian or Arrow-Debreu world, are not all price-takers and cannot be sure of the market accepting or supplying any amount of goods or financial instruments at the going price.

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