MONEY AND EQUILIBRIUM: TWO ALTERNATIVE MODES OF COORDINATION OF ECONOMIC ACTIVITIES

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Working Paper No. 27

June 1989

Submitted to
The Jerome Levy Economics Institute
Bard College

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This paper has been written during a stay at the Jerome Levy Economics Institute where I have benefited from very good working conditions. I acknowledge the financial support of NATO. I am grateful to Carlo Benetti for his helpful suggestions and to Jean French for correcting my English. They are obviously not responsible for the shortcomings of this paper.

Economic theory has undergone a very deep transformation during the last forty years. Its method and its tools of analysis have evolved dramatically. The standards by which theoretical statements are now appreciated are far more demanding, especially from a formal point of view, than was the case before World War II. Precision and logical validity in raising questions and problems have increased as well. The set of hypotheses necessary to deal with the usual issues of political economy has been made more explicit, allowing everyone to have a more clearer interpretation of what has been done in the different fields.

The content and the relevance of the concept of equilibrium have been strongly affected by these transformations. This paper, obviously, does not attempt to give an account of all these changes. It will focus on just one consequence of this evolution: the relevance of the concept of equilibrium in dealing with the traditional question of the working of the market, the central institution in our economies.

To put the matter very briefly, the question addressed here concerns the place of equilibrium in economic theory: does mainstream economics allow for another theoretical reference? For two centuries at least, equilibrium was referred to as a particular situation towards which the market mechanism was supposed to drive the economy. An important issue was to prove this conjecture. Whereas mainstream economists (Smith, Ricardo, Stuart Mill, Marshall and Walras) endeavoured to prove the stability of the market, critical authors tried to show that certain fundamental flaws of the market mechanism make instability and crisis the rule in a capitalist economy. Among the factors said to be responsible

for this result, the monetary character of the economy seems the most important (as was emphasized by Boisguilbert, Sismondi and Marx in the past and by Keynes in our time).

In modern theory, this issue has been less and less discussed'. Modern debates concern the properties of different equilibria and rarely the way the equilibrium of the market is reached. This shift in emphasis is the consequence of the intrinsic difficulties inherent in the study of global stability and of the development of a great variety of equilibria. In its broadest sense, equilibrium denotes a situation where efforts made by the agents to carry out their planned actions create conditions such that these actions would be selected again by the agents if they had the possibility of repeating their choice. This definition may be used in very different sets of assumptions (fixed prices, incomplete markets, asymmetric information etc.). It becomes clearer and clearer that any situation may be viewed as an equilibrium position as soon as the "right" ingredients are put into the model. For instance, unemployment appears to be a particular equilibrium (D- or K- equilibria) and no longer a consequence of an inherent instability preventing the economy from reaching a full employment equilibrium. Even business cycles, traditionally studied by non-orthodox theorists who found in the persistence of appreciable fluctuations of economic activity some presumptions in favour of the intrinsic instability of the economy, are now conceived as equilibria positions! Moreover, we have been taught that, according to the hypothesis of rational individuals, equilibrium was the only conceivable position for the economy. This shows how far modern theory has moved from common intuitions and widely accepted propositions[2]. This last observation, although not necessarily a criticism, tends to point to the need for a better understanding of what economic

theory actually tells us about the working of the market, still the main economic institution in our societies.

Rational expectations theorists have claimed the exclusivity and the universality of equilibrium to be a consequence of the optimal utilization of the available information. In this perfect foresight framework, the question of the market becomes irrelevant since each agent knows all the actions of other people or, at least, the outcome of their actions. The problem of coordination between individual actions is then overlooked. If this view is accepted, the question **of the convergence towards** equilibrium, whatever it may be, would be ruled out ex hypothesi. In a framework leaving no room for non-equilibrium positions, it is meaningless to address the traditional and fundamental question of how the market reaches a position of equilibrium.

Even if one is not ready to subscribe to the rational expectations point of view, one may, however, be grateful to R. Lucas and his followers for reminding us of the intrinsic difficulty of handling non-equilibrium positions. Every attempt to deal with non-equilibrium positions has to be rationally justified in one way or another and can no longer be viewed as self-evident.

Traditional dynamic analysis, which shows that the economy may behave in various ways around a situation of equilibrium, seems to have been founded on very weak behavioral assumptions (adaptative expectations, for example) and can no longer be accepted as an accurate description of the actual motion of the economy. Accordingly, non-orthodox economists must go beyond a verbal critique of equilibrium methodology and make the foundations of alternative theories more explicit.

In mainstream theory, equilibrium tends to be both the result of the market and the rule under which it works. Without equilibrium, no economic action is going to be

effective; thus, equilibrium becomes the device by which individual actions are coordinated and no longer the ultimate outcome of a market mechanism working under rules of its own[3].

In other words, equilibrium is now the alpha and omega of economic theory. The tool-box of the modern economist contains only one item adapted to multiple tasks - with the exception of the task to which economic theory was devoted by Smith and others.

An investigation of the ability of the market mechanism to drive the economy towards equilibrium requires that non-equilibrium situations be regarded as effective. If not, it would be impossible to speak of a convergence towards equilibrium but only of a convergence of a series of equilibria (for example, temporary) towards another equilibrium (for example, full equilibrium), which leaves unsolved the question of how any equilibrium is reached. Within this framework, the impossibility of conceiving of effective actions outside equilibrium is the main obstacle which must be overcome.

The purpose of this paper is not to give an answer to the question outlined above, nor even to attempt to sketch its general features. Its aim is more modest: to point out the existence of the problem and to indicate some directions which further research may profitably take.

In the first section, some arguments are put forth in favour of a broader concept, viability, which appears closely related to the monetary character of economic relations. Viability denotes a situation where the efforts made by individuals to carry out their planned actions create effective conditions such that individuals desire to modify their plans (non-equilibrium) and such that the unexpected results of these voluntary actions do not lead individuals to bankruptcy, because the rules of the monetary system allow individuals to postpone the fulfilment of some of their

commitments. Money is conceived of as a system of coordination between individual agents which is an alternative to equilibrium. Viability is not the negation of equilibrium but rather a generalization of it, equilibrium being the limit point, if it exists, of the effective path generated by the actions of the individuals in the viability set. This approach seems more in accordance with the older tradition of political economy.

The second section proposes a simple illustration of the argument. Using an oversimplified model, it is possible to show some of the specificities of the adjustment actually taking place in a monetary economy, by contrast with the mythical one more or less implicitly referred to in mainstream economics.

I

Let us start with the following simple question: why could flow-of-funds data, i.e. the basic form of economic facts, not be interpreted as describing non-equilibrium situations? To state it more in accordance with economic theory, what prevents people from accomplishing their desired actions (without consideration of their complete mutual compatibility or without being sure that the results will conform to their expectations)?

As far as I know, there is no direct and explicit answer to that question. Most modern economists would agree that restricting the focus on equilibrium positions is worthwile since non-equilibrium positions are arbitrary and not compatible with rational behaviour. The argument goes as follows: if it were possible for the agents to discover a better situation, they would act to realize it; if it were not possible, according to the assumptions of the model, it

would be an equilibrium position. Equilibrium is then the only interesting situation to be considered. The argument implies either that any individual has beforehand a perfect knowledge of the outcome of the market (rational expectations hypothesis) or that the process of adjustment is nonexistent and, therefore, exempt from any path-effect (no effective transactions are taking place out of equilibrium). For instance, an agent experiencing excess supply on a market is led to modify his supply in the next period, but without being burdened with effective unvoluntary inventories. In other words, making mistakes is not thought to modify the' final outcome of the market (if stable).

According to this view, equilibrium is more than a presumed outcome of the market mechanism: it is the market mechanism itself! Since equilibrium is the only position where individual actions are realized, it becomes the exclusive mode of coordination between individual actions.

Now we must be aware of the exact meaning of that point and of the gap between what economic theory does and what it is alleged to do. Equilibrium as a mode of coordination between individual agents is not what most economists have in mind; rather, they argue that equilibrium is the final outcome of the coordination of individual actions which take place on the market. The market is intuitively viewed as the tool by which the economy can reach an equilibrium position[4]. At the same time, the same economists admit that the proof of the existence of general equilibria in an exchange economy (with perfect competition) is a very important result. Debreu interprets it as an explanation of "the state of equilibrium reached by a large number of small agents interacting through markets" (Debreu [4] p.698), the fundamental question he thinks Walras raised (F.Hahn would add Smith as well).

However, this interpretation is off the mark. The proof of the existence of (at least) one set of prices which makes

the desired transactions of all agents compatible at an aggregate level is neither a proof that these transactions actually take place nor a demonstration that a device called market plays any role in it. To establish that the market, as a typical way of organising economic relations, is responsible for achieving equilibrium requires, **at least**, that the process of adjustment towards equilibrium has been made explicit, which in turn implies that non- equilibrium positions may be considered. This takes us back to our starting point...

In order to provide an analytical foundation **fbr' the** common claim that eauilibrium is an outcome of a market adjustment process one must not use eauilibrium as the necessary condition of the realization of planned decisions'.

But is there any alternative? The question now is: what are the (necessary and sufficient) conditions under which a private individual intention becomes a social and effective reality?

Within the framework of general equilibrium theory some work has been done on that issue. The theory of non-tâtonnement processes takes up frontally the question of non-equilibrium transactions. In each period, prices having been fixed by the auctioneer, transactions take place even if the prices do not equalize aggregate supply and demand on the markets. Effective transactions obey some predetermined rules[6]. The outcome is a non-equilibrium situation.

At this point, a parallel with Fix-price theory is instructive. Fix-price economists do not consider effective non-equilibrium situations. Instead, they assume that the difference between aggregate supply and demand generates some quantity signals which lead agents to change their plans which, in turn, generates other quantity signals and so on. No transactions are realized until quantity signals are such

that they generate supplies and demands which produce again the same signals (fixpoint). This is indeed the definition of a K-equilibrium. The process of adjustment between plans and quantity signals is purely a myth (Walrasian tâtonnement on quantities) and is noneffective. The only effective outcome of the process is an equilibrium position. The use of the term "effective demand" to denote the demand constrained by the quantity signals is misleading, as is the designation of Fixprice theory by "disequilibrium theory".

Discussions on non-tbtonnement processes, have convincingly shown that the behaviour of the economy in disequilibrium is a major issue. Two aspects of this issue seem crucial. One is related to the way economic agents determine their plans when they are aware of the disequilibrium[7]. The other concerns the way economic agents can carry out their decisions independently of their mutual compatibility. The second aspect only will be considered in the present paper and we shall see that money is at the heart of the matter.

Two propositions have been established:

(i) The non-tatonnement is globally stable. One interpretation of this result may be that the mere possibility of individuals transacting out of equilibrium changes the meaning of the auctioneer's rule. Prices vary according to the result of the working of the market (and not according to the sign of the aggregate notional excess demand - which sounds like a partial equilibrium criterion)[8]. If the market is well organised (Hahn's condition), this amounts to saying that each individual is affected in the same way by the change of prices: a positive (negative) excess demand agent will face higher (lower) prices on the market in the next period. Effective transactions (out of equilibrium) affect decisively the path of the economy.

(ii) The proposition (i) makes sense only if we justify the fulfilment of Hahn's condition. This implies the introduction of a general means of payment, which is called money.

The reason for introducing money into the picture is straightforward: money is assumed to be the most appropriate device to facilitate exchange. To be more precise, the existence of money is the condition for the existence of n markets (if there are n goods) where the trading of each particular good is centralized. In barter, markets do not exist: the trading of any particular good is disseminated on (n-1)/2 posts of exchange (the economy is compounded of n(n-1)/2 posts of exchange).

The reason given above for introducing money into the theory is not that which rules the equilibrium theory of money'. In fact, the main motivation for dealing with money in the general equilibrium framework is not clear. What are considered the most important results of the theory (equilibrium existence and welfare theorems) do not require the existence of money (it is true even for the Fixprice theory). As a matter of fact, the usual way of dealing with money makes one think that the introduction of money is interesting only in order to check the conditions under which money does not matter (neutrality)...

According to this approach, money is introduced as an additional good. Its singularity, which defines money among the goods, is that it is not an argument of any utility function (this is a negative way of saying that money is worthwile only for the purpose of transactions). The problem then is as follows: how can such a good exist in the economy (read: at equilibrium)? The problem is considered solved if it is shown that a good without utility may have a positive equilibrium price.

Overlapping generations models allow a positive price for a durable good deprived of utility. It is not the purpose of this paper to discuss this result. We just need to be reminded that important qualifications limit the validity and the interest of the overlapping generations view of money. Not only does the positive price of money depend on very special assumptions (value of some parameters even if all functions are well-behaved, nonexistence of another durable asset bearing a higher rate of return) but the role of that money in exchange is limited to the relation between different generations. Money does not intervene in the exchange relations between agents of the same generation".

However, we should not be worried by the limited ability of mainstream economic theory to give an accurate account of money. The reason for money, as well as its mode of introduction, is not clear. Furthermore, the organization of the transactions does not require that money should be part of the initial endowments of agents and that it should be treated as a good. Therefore, it is preferable to look for another starting point. In a different context, it has been shown that the choice between different organizations of transactions cannot be solved by recourse to usual criteria". For instance, monetary exchange equilibria may be Pareto inferior to barter under very general conditions. The "bootstraps" aspect of money - it is because it is generally accepted to settle transactions that a particular means of payment is . . . a means of payment - does not allow its existence to be explained and derived from the usual assumptions of economic theory. Money has to be presupposed at the very outset of the story, not as a contingent element of a particular theory but as an essential feature of it.

We are quite naturally led to introduce money not as an additional good but rather as an hypothesis about the way individual actions are carried out and coordinated.

Potentially, money appears as an alternative to eauilibrium in describing the working of the market .

The Finance-constraint theory of money[12], which relies on Clower's idea that "goods do not buy goods", aims to establish a rationale for liquidity preference in emphasizing the role of money in the transactions mechanism. In that sense, it challenges the usual treatment of money as a particular commodity and seems to offer an ideal tool for developing some of the intuitions just mentioned above. But, in fact, finance-constraint models appear to be very close to the overlapping generations models and cannot provide a basis for an alternative theory.

According to finance-constraint theory (especially in cash-in-advance models), agents are constrained by the amount of money they have in the current period. For any given period, effective purchases have to be less than the money balances inherited from the previous one. In other words, the sales of one period cannot finance the purchases of the same period. Money works as if it were a commodity, gold for instance. Even when this is not the case, as in fiat money economy, it is assumed at the outset that money is an element of wealth. It fixes the level of the budgetary constraint in the same way as initial endowments do in the Walrasian world. By definition, money is thought to be a commodity. The role played by this commodity implies that it must be transmitted from one period to another. Taking for granted that money is a durable commodity (a store of value), the only problem to be solved is the traditional one: to prove that money has a positive value.

The following general argument is at the root of the dominant conception of money, embodied in overlapping generations models as well in finance-constraint models: "The existence of this time wedge between purchase and sale is fundamental to finance constraint models. If purchases and

sales were simultaneous, the finance constraint would disappear, goods would buy goods directly, and money would have no explicit role in the formal model as a medium of exchange" ([8] p.8).

The essential elements of an alternative approach have to be found elsewhere, namely in a brand of monetary thinking common to Banking Principle proponents and to more recent, but neglected, authors (R.G.Hawtrey or Keynes of the Treatise). According to this conception, the banking system is at the center of the stage, ensuring the carrying out of economic actions through credit creation. Although it is possible to introduce money in a perfect competition framework, where prices are not fixed by the agents[13], it is more natural to express the monetary nature of the economy in an imperfect competition economy, where agents are price-makers. The remainder of this section is devoted to this task.

Let us briefly describe the way economic actions are carried out before dealing with their determination. This order of presentation, the reverse of the usual one, makes sense as soon as one realizes that individual economic plans are established in view of their execution and can no longer be considered independent of the institutional framework[14]. In what follows, the banking and financial system is the main institution to be taken into consideration.

Banks perform the function of intermediary of exchange in substituting their signature for that of individuals. Individual i has no reason to be confident of individual j's ability to pay. The signature of the bank has greater worth because a bank acts as a representative of many individuals. Individuals cannot pay with their own debt. They use the debt of "middlemen" who are specialized in the task of evaluating the solvency of agents and their ability to carry out their actions in a satisfactory way. These middlemen are private agents but their existence implies some "bootstrap" effects:

no one can trust a bank unless a sufficient number of other people do the same. Moreover, as debt transactions managed by banks are nothing but the consequence of the transactions of their customers, the question of the relations between banks raises, at a higher level, the same problem as barter: what makes a bank accept for payment an asset on another bank? Again appears the "bootstrap" aspect of the mechanism of payment: as any particular bank represents its customers, we have to suppose a "superbank" which represents all the banks (and indirectly all the individuals of the economy).

Now the question is: what are the criteria by which banks agree to finance agents's current transactions? It is not possible to give here a detailed account of the behaviour of banks. However, three basic propositions may be advanced:

- (i) The "bootstrap" aspect of the means of payment makes it impossible to conceive of banks, as a whole, as purely private agents. Because they deal with money, banks are in charge of a social institution which cannot be reduced to individual rationality.

- (ii) Banks are still economic agents. Their behaviour, although constrained by some global and specific considerations, is not arbitrary. Banks determine their operations by taking into account the maximization of their profits. In that sense money is endogenous[15].

- (iii) To reconcile the two contradictory aspects of the banking system, it is convenient to assume the existence, on the one hand, of private agents specialised in the trade of debts, and, on the other hand, of a <u>lender of last resort</u> endowed with a social rationality. This is expressed by the fixation of the rate of interest according to policy rules established by the lender of last resort. Private banks will fix their prices (particular rates of interest on loans) according to the same considerations as other agents and will accept at these prices all the

operations meeting some predetermined criteria (prudential ratios, collaterals, etc.). If necessary, the lender of last resort may refinance the banks at the rate of interest he determines. As Basil Moore puts it: "Banks are price setters and auantitv takers in both their retail loan and their deposit market. As a result both loans and deposits are demand determined. (...) Any short-run excess or deficiency of loan demand over deposit supply of funds can be met in the wholesale markets where banks in contrast are price takers and quantity setters."([10] pp. 381-382).

The finance constraint faced by economic agents takes the form of the set of conditions banks require for according credit to individuals". In that sense, the agreement of the banks is a prerequisite for **actual transactions** to take place. The conditions under which banks give their agreement, i.e. the working rules of the banking system, supersede the ad hoc device of the auctioneer. Banks are an essential gear of the modern market mechanism.

Individual plans are determined within the context outlined above. Being in some sense rational, agents determine simultaneously the set of prices (if price makers) and quantities which maximize their utility (or their profit). For a given state of expectations, agents are presumed to be able to determine the whole set of operations they desire to carry out in the period under consideration[17]. Consequently, for a given transaction period, corresponding to the realization of the planned transactions, sales and purchases are regarded as simultaneous.

Economic agents are assumed to decide freely (under some specified constraints) what is to be produced and brought to the market. As is true for all agents, each individual plans his transactions without knowing **the** desired actions of others (the assumption that he has a thorough knowledge of the past and that he has some precise opinions about what will happen

does not change the point). Agents making decisions to be carried out on the market know, of necessity, that they are subject to errors and failures. Nothing can be done to eliminate that uncertainty[18]. A very distinctive feature of market coordination (as distinct from relations relying upon authority, law, custom, central planning or . . . consultation by an auctioneer) is the necessity for agents to actively engage in the market in order to know what other people do. All agents are perfectly aware that the complete realization of their notional actions is unlikely. This is not primarily because their information is imperfect (high informational costs) but rather because the relevant information is, by definition, missing. The market cannot be bypassed since it is the only place where people can perform their actions and check the accuracy of their plans. The working of the market has to be made explicit - which is another way of saying that money has to be taken into consideration.

Any planned transaction cannot be effective unless the (at least) two agents involved accept it (as being more or less in accordance with their intentions). But without the presence of an auctioneer, the agents themselves have to make known their intentions. Since money is the exclusive means of payment, the desired transactions must be expressed in money. They will be carried out on the different markets (a market for each good) and not on $n(n-1)/2$ exchange places as in barter.

A complete transaction is compounded of, at least, a purchase and a sale. As a consequence of the monetary character of the exchange, it is not possible for any agent to conclude the two parts of a complete transaction with the same other agent (the possibility of achieving a complete transaction between only two agents defines barter). Transactions are split between markets and not between different periods. The separation of agents is the

straightforward consequence of the market coordination and of the fact that each semi-transaction takes place between different people. It is not possible for any agent to make one of the semi-transactions the condition of the other.

Do individuals have sufficient means of payment in order to carry out their plans? The question is the same as in finance-constraint theory, but the answer is very different. Instead of reasoning in gold currency (or the equivalent), we have to think of a modern banking system where the necessary amount of means of payment is advanced to the **agents, for** the period of transaction. There is no longer a time wedge between purchases and sales.

Transactions on the market take place according to precise rules. To specify these rules (and to check the robustness of the theory in the face of minor changes in these rules) is a necessary and difficult task. A very crude attempt will be given in the second section of this paper.

At the present level of abstraction it is enough to insist on the most obvious consequence of the uncertainty inherent in the market: in general, actual transactions will be such that each agent is left at the end of the period with a discrepancy between his receipts and his expenditures. In order to avoid bankruptcy, deficit agents must find a corresponding amount of money to pay back to the bank. This cannot be done except by incurring debt (which postpones the effects of the "sanction" of the market).

Purchases of some agents are sales for others. Therefore, the algebraic sum of the differences between purchases and sales is zero over the economy. In other words, the absolute value of deficits is identical to the absolute value of excesses. If it were not for the voluntary choices of individuals, it would always be possible to match deficits and excedents over the economy.

Two general cases may be considered[19].

<1> If individuals agree freely to lend and borrow (either directly or indirectly through the banks) the amounts of money needed to avoid bankruptcy, the period closes with the following characteristics:

- all individuals are still alive (economically speaking)
- at least two individuals (and possibly all) are left with commitments for the next period(s)
- no money is held in the economy as a whole (no outside money)

This last point requires further explanation. The 'fact that no (outside) money is left at the end of the period (although the economy is out of equilibrium) is partly the effect of a particular hypothesis which excludes intertemporal allocation of resources and, by the way, any need for a store of value. What is interesting is precisely the fact that it is not necessary to presuppose any store of value in order to **deal with** the monetary aspect of economic transactions. Money as a means of payment is a uniperiod notion. It is obviously not the case for money as unit of account. In the economy described above, the commitments of individuals are expressed in units of accounts and they have to be fullfilled in those units of accounts[20]. The permanence of the unit of account, which is clearly a condition for the working of a monetary economy, does not require that money should be considered as a durable sood (store of value).

<2> If individuals or banks are reluctant to lend the required amounts of money (either directly or indirectly), the lender of last resort may intervene and make possible the closure of the market without bankruptcy. In issuing a sufficient amount of his liability (by lending to banks), he allows the system to be viable, i.e. to last over time with the same individuals.

The main difference from the previous case lies in the fact that money is held in the economy as a whole (outside money). Banks, at least, held some positive amounts of the asset issued by the lender of last resort. To put it in very general terms, the presence of money (independently of any intertemporal allocation of resources) is tied to the fact that bankruptcies have been avoided. The type of non-equilibrium situation encountered here differs from the previous one in that the economy as a whole is left with a debt to be repaid in the future. The non-fulfillmentof this overall commitment is nothing but inflation.

The existence of effective non-equilibrium positions is thus the natural consequence of the special way economic transactions are carried out on the market. Making explicit the monetary character of the coordination of individual actions allows one to think of an actual dynamic process of the market and not only, as in equilibrium methodology, of a fictitious one.

In the following section, this general idea will be illustrated by a very simple model.

II

Let us consider an oversimplified economy where autonomous agents produce commodities for the market. The coordination of these agents is ensured by a monetary mechanism following the general lines described above.

We shall suppose that each agent is specialized in the production of a particular commodity, so that the number of agents is the same as the number of commodities, say n.

The technique of production is given by fixed coefficients a_{ij} and l_j, respectively quantity of commodity i and labour 1 necessary to produce one unit of commodity j. Labour is performed by wage earners. Wage earners are not

considered as individuals. Hypothetically, they do not have the ability to carry out economic activities on their own account. Banks are not ready to give them any means of payment. In order to be able to buy commodities on the markets, workers have to get money from individuals (entrepreneurs) and to become wage earners. The nominal wage w is constant and predetermined (by negotiations between entrepreneurs and workers or by maximization of the effort supplied by workers according to the efficiency wage theory). It is assumed that labour does not limit the production of the individuals.

Entrepreneurs are price-makers. The elasticity of the perceived demand curve of entrepreneur i is equal to e_i. As a consequence, maximization of profits leads entrepreneur i to fix his price p_i in applying to his cost a mark-up $m_i=e_i/1+e_i$. Price p_i is then:

$$(1) \qquad p_i = m_i (\Sigma_j a_{ji} p_j + l_j w)$$

Prices p_j cannot be observed on the market at the time entrepreneur i determines his price. They are expected prices.

Prices are in a steady state if, for the economy as a whole, we have for all (t):

$$(2) \qquad p'_{(t)} = p'_{(t)} AM + w\, l'M$$

where p' is the row vector of prices of the period (t), A the matrix of a_{ij} and M the diagonal matrix of the m_i. The steady state is:

$$(2') \qquad p'^* = w\, l'M(I-A)^{-1}$$

if (I-A)-' exists, which, supposedly, will be the case. Moreover, to simplify the story, we shall assume that the process of adjustment of prices is globally stable so that, henceforth, prices may be considered constant over time.

The monetary economy is working according to a generalized version of Kalecki's principle: expected incomes and costs are spent at the same time. Considering the economy

as a whole, it does not make sense to determine the incomes independently of the uses agents make of them. In a flow-of-funds description of the economy, it is impossible to assess an economic quantity **without taking** into consideration its two sides: receipt and use".

Expected profits per unit of commodity i are:

$$z_i = p_i - \Sigma_j(a_{ji}p_j + wl_j) \quad (3)$$

The row vector of expected profits is then:

$$z' = p'^* (I-A) - w\ 1' \quad (4)$$

Expenses out of profits are assumed to be distributed between industries according to a vector c of fixed coefficients the sum of which is unity (entrepreneurs have a unique Cobb-Douglas utility function) so that the vector of demand out of profits is:

$$q_e = (1+\alpha)P^{*-1}\ c\ z'\ q \quad (5)$$

where α is a rate of external financing, P^{*-1} the diagonal matrix of p^* and q the vector of the quantities of commodities produced and **brought to** the market. Assuming no intertemporal allocation of resources α is equal to zero.

For the sake of simplicity, expenses out of wages are presumed to be distributed in the same way as expenditures out of profits. As a consequence, the vector of demand out of wages is:

$$q_w = \beta\ P^{*-1}\ c\ z'\ q + P^{*-1}\ g \quad (6)$$

where β is the marginal propensity to consume and g a vector of exogenous expenditures (autonomous consumption for instance).

The vector of total demand is the sum of q,, q_w and of Aq which is the demand of inputs:

$$q_d = H\ q + P^{*-1}\ g \quad (7)$$

where $H = A + (1+\alpha)P^{*-1}\ c\ z' + \beta\ P^{*-1}\ c\ z'$.

The vector of excess demand is:

$$q_d - q = (H - I)\ q + P^{*-1}\ g \quad (8)$$

As prices are assumed to be constant over time, profits are functions of quantities alone. The greater the excess demand, the greater the difference between effective and expected profits.

A very usual assumption about the process of adjustment is to make the variation of quantities produced and brought to the market a function of profits. The simplest form is:

$$[dq/dt]_{(t)} = K(H - I)\, q_{(t)} + KP^{*-1} g \qquad (9)$$

where K is a diagonal matrix of positive coefficients.

It is easy to see that the unique steady-state solution is given by:

$$q^* = (I - H)^{-1} + P^{*-1} g \qquad (10)$$

if $(I - H)^{-1}$ exists.

The stability of the ajustment process generated by (9):

$$q_{(t)} = q_{(0)}\, e^{[K(H - I)t]} + q^* \qquad (11)$$

depends on K(H - I). If all the eigenvalues of K(H - I) have negative real parts, the process is globally stable. Henceforth, this will be considered the case.

Putting aside the technical discussion of the conditions of stability, it is worth noticing that the process given by (9) does not reflect what happens in an economy where transactions are effective. The unexpected gains or losses are not only information supplied to entrepreneurs, they are also actual gains and losses revealing an actual non-equilibrium position as a consequence of which some entrepreneurs may go into bankruptcy. Taking into consideration the monetary organization of economic transactions makes explicit the consequences of the differences between what was expected and what is actually realized.

An important task, nearly always neglected by Keynesian economists, is to **specify the** actual **transactions** taking place out of equilibrium. As a first and crude approximation, it is possible to suggest the following rules:

(i) Individuals purchase the planned quantities even if the observed prices differ from the expected ones. In defence of this heroic assumption, it may be argued that the quantities expended out of net expected value do not depend on prices (because of the Cobb-Douglas utility functions) and that inputs are dependent on the quantity previously decided. It is true, however, that a revision of the expected net income should be taken into account. But, as emphasized above, the monetary character of exchange makes this revision difficult.

This assumption plays no role in the model since we have assumed that prices are equal to p^*. It would be very important, however, if the model were to be extended.

(ii) It is assumed that quantities are, in any case, sufficient to match the demand (costless past inventories are presumed to fill the difference). This assumption is nothing but a device to make the story as simple as possible.

(iii) The difference between the money borrowed and the money paid back - which is equal to zero for the economy as a whole since payments are simultaneously expenses and receipts - has to be matched by lending or borrowing.

If excess agents agree spontaneously to lend directly to deficit agents, the financial position of entrepreneurs may be considered safe. Even if their profitability is less than expected, they run no risk of bankruptcy: claims held by other agents show only that the capital has been redistributed in the economy.

If excess agents do not find it expedient to lend to deficit agents and prefer assets on the Bank (liquidity preference), bankruptcies will occur, unless banks agree to accept the risk. In that case, entrepreneurs, although not going into bankruptcy, are in a worse financial position than in the previous case. One would assume that they will be aware of that in shaping their plans for the next period.

If banks are not ready to take the risk of lending to deficit entrepreneurs, a major crisis may take place and the viability of the economy will no longer exist. The lender of last resort has the ability, to a certain extent, to avoid such a situation by making banks lend what the deficit agents need.

The existence of a non-zero excess demand is expressed by a difference between receipts and expenditures. The vector of these differences is:

$$(12) \qquad s = P(q_d - q)$$

where $e's = 0$, e being the unit vector (the algebraic sum of differences is equal to zero).

The vector s represents the unexpected profitability (windfall losses or profits) resulting from the working of the market. But it ought not to be treated only as inducing a variation in quantities: its actual effectmustbe elucidated.

The deficits have to be covered, which implies that deficit entrepreneurs run into debt either to other entrepreneurs and wage-earners or to banks. Debt is carried over into the next period and influences the decisions taken for that period.

Moreover, the problem of the modality of the debt is important (although completely neglected in the standard adjustment process above).

First of all, the condition of feasibility of the required financial operations has to be fullfilled. As stated above, this depends on the rules governing the working of the banking system as a whole. In other words, the issue is that of the viability of the economy. If the current conventions ruling the behaviour of economic agents are not compatible with what is required to make non-equilibrium positions effective, the very existence of the economy is at stake. This point is not only of theoretical interest. In the past, we have experienced situations of major crisis when a change

in the rules of the game was the condition of the survival of the economic system (Great Depression, abandonment of Gold Exchange Standard etc.). Even if we discard these extreme situations by assuming that viability conditions are satisfied, the fact remains that the financial closure of the market may take different forms; the most obvious point here is whether the lender of last resort must intervene or not. Within this simple framework, it is not possible to take into account the complexity and the variety of financial situations. It is, however, possible to formalize, in rough draft, the main issue.

Each entrepreneur is not only concerned with his own position but with the macroeconomic situation as well. If the financial closure of the market is very difficult and requires a massive intervention on the part of the lender of last resort - which will be the case if the absolute value of deficits and excesses is great - all entrepreneurs will be subjected to a change in the general conditions of business (raise in rates of interest, credit rationing etc.) and will be induced to lower the level of their activity..

The simplest way to incorporate this idea into the adjustment process is to make the variation in the quantities a function not only of the unexpected individual profits or losses but also of a global measure of the disequilibrium. As a matter of fact, entrepreneurs are concerned only indirectly by the situation of the economy as a whole. The link between the macroeconomic situation and the decisions of entrepreneurs is provided here by the rate of interest. The lender of last resort is assumed to make the rate of interest vary according to the global financial situation, defined by the excesses and deficits. As a measure of disequilibrium, we shall adopt the Euclidian norm of the vector of the individual discrepancies between receipts and

expenses (i.e. the square root of the sum of the squared deficits and excesses)[22].

The risk incurred by the economy is not a linear function of the global disequilibrium. Accordingly, the reaction of the lender of last resort is proportionally more drastic when the risk of non-viability increases. This non-linearity is inherent in an economy where viability is an issue. In contrast to the mythical adjustment associated with equilibrium methodology, where nothing happens except in equilibrium, a monetary-regulated economy is bound to undergo a great variety of situations, some of which are even capable of questioning its mere existence. The uncertainty stemming from the market mechanism is not only a matter of degree (how much?) but also of nature (will the economy continue to exist?)

To take into account this essential feature, the rate of interest will be assumed to vary with the squared measure of the global disequilibrium:

$$(13) \qquad [dr/dt]_{(t)} = \delta [\phi_{(t)} - \phi]^2$$

where δ is a coefficient of reaction, ϕ a predetermined target of economic policy for ϕ defined as:

$$(14) \qquad \phi = [p_1(q_d-q)_1^2+ \ldots +p_n(q_d-q)_n^2]^{1/2}$$

The entrepreneurs are assumed to adjust their decisions according to;

$$(15) \qquad [dq/dt]_{(t)} = K(H- I)(qd - q)_{(t)} - kf[dr/dt]_{(t)}$$

where kf is a vector of reaction coefficients.

In putting the value of dr/dt given by (13) into (15) we get a process of adjustment in a monetary framework:

$$(16) \qquad [dq/dt]_{(t)} = K(H- I)(qd - q)_{(t)} - kf\delta[\phi_{(t)} - \phi]^2$$

If kf = 0 (or if 6 = 0), the system (16) reduces to system (9), which is a special case where the mechanism of transactions is overlooked.

The discussion of the stability of the solution(s) of (16) is not easy and will be restricted to the simple case of

a two-commodity economy (see appendix for a sketchy examination of a three-commodity economy).

In a two-commodity economy, where it is assumed **that wage** earners do not save, the excess (deficit) of one entrepreneur is the deficit (excess) of the other. Moreover, we have a very simple relation between ϕ and sl:

$$(14a) \qquad \phi_{(t)} = 2^{.5}|s_1|_{(t)}$$

System (16) may be written:

$$(16a) \qquad [dq_1/dt]_{(t)} = k_1 s_{1(t)} - kf_1\delta(\phi-\underline{\phi})_{(t)}^2$$
$$[dq_2/dt]_{(t)} = -k_2 s_{1(t)} - kf_2\delta(\phi-\underline{\phi})_{(t)}^2$$

From equations (8) and (12) we have:

$$(12a) \qquad s_{1(t)} = p_1(h_{11}-1)q_{1(t)} + p_1h_{12}q_{2(t)} + g_1/p_1$$

and, consequently:

$$(17) \qquad [ds_1/dt]_{(t)} = p_1(h_{11}-1)[dq_1/dt]_{(t)} + p_1h_{12}[dq_2/dt]_{(t)}$$

Substituting (16a) in (17) gives the evolution of s_1 over time:

$$(18) \qquad [ds_1/dt]_{(t)} = a\, s_{1(t)} - b\,[\phi_{(t)}-\underline{\phi}]^2$$

where $a = p_1[k_1(h_{11}-1)-k_2h_{12}]$ and $b = \delta p_1[kf_1(h_{11}-1)+kf_2h_{12}]$. Since $h_{11} < 1$ and k_1, k_2, and $h_{12} > 0$, $a < 0$. Sign of b is positive or negative according to $kf_1(h_{11}-1) >$ or $< kf_2h_{12}$. Taking into account (14a) leads to the final step:

$$(19) \qquad [ds_1/dt]_{(t)} = a\, s_{1(t)} - b\,[2s_1^2+\underline{\phi}^2-2\underline{\phi}2^{.5}|s_1|]$$

Let us first assume $\underline{\phi} = 0$. Clearly, the process (19) has two equilibrium points $s_1^* = 0$ and $s_1^{**} = a/2b$. It is easy to check that s_1^* is locally stable (derivative for $s_1^* = a < 0$) and that s_1^{**} is locally unstable (derivative for $s_1^{**} = -a > 0$). Any initial condition $s_{1(0)} > |s_1^{**}|$ generates an explosive path. If $\underline{\phi}$ is different from zero, the two equilibria imply a permanent non-zero debt!

The three-commodity economy reviewed in the appendix exhibits the same properties.

*

* *

The general purpose of the model above is to give some formal illustration of the thesis advocated in the first section of the paper. One of its main outcomes is to show the destabilizing character of the debt related to the non-fulfillment of the entrepreneurs' expectations. To understand the meaning of this result, the reader has to keep in mind that the debt under consideration is not related to any voluntary intertemporal allocation of resources but is the consequence of a disequilibrium and, at the same time, the condition of its effectiveness. In other words, the '<u>actual</u> process of the market (as opposed to the fictitious adjustment associated with the exclusivity of equilibrium) generates consequences of its own. Even if entrepreneurs react in the right direction, the economy keeps traces of the maladjustments in the form of financial commitments. By its very nature, the evolution of the monetary economy undergoes path-effects. Ensuring the viability of the economy (represented in the model by the effects of the action of the lender of last resort on the rate of interest) induces specific phenomena and alters dramatically the dynamic properties of the market.

In the model presented here, the market mechanism turns out to be stable only if entrepreneurs are not too far from the stable equilibrium. Beyond a certain range, market mechanism fails to drive the economy towards equilibrium and the conditions of the viability of economy are no longer fulfilled.

Drawing economic policy conclusions from such an elementary model would be hazardous. However, it is worth noticing that the issue at stake suggested by the model is not a choice between interventionism and liberalism. The lender of last resort is an inescapable component of market economies and it would not make sense to speak of non-

interventionism. The approach advocated here leads rather to an insistence on the necessity for making the rules of the game more explicit and for inquiring into the relations existing between these rules and the stability of the market economy.

APPENDIX

In a three-commodity economy where it is assumed that wage earners do not save, the excess (deficit) of an entrepreneur is the deficit or excess of the others taken as a whole. System (15) may be written, putting $\phi = 0$:

$$(a)\qquad \begin{aligned} [dq_1/dt]_{(t)} &= k_1 s1_{(t)} - kf_1 \delta \phi_{(t)}^2 \\ [dq_2/dt]_{(t)} &= k_2 s2_{(t)} - kf_2 \delta \phi_{(t)}^2 \\ [dq_3/dt]_{(t)} &= -k_3 [s1_{(t)} + s2_{(t)}\ 1 - kf_3 \delta \phi_{(t)}^2 \end{aligned}$$

In putting the value of $(q_d - q)$ given by (8) into (12) and in differentiating over time, we get ds_i/dt as functions of s_i and ϕ (H and p are constant over time):

$$(b)\qquad \begin{aligned} [ds_1/dt] &= p_1(h_{11}-1)[dq_1/dt] + p_1 h_{12}[dq_2/dt] + \\ &\quad p_1 h_{13}[dq_3/dt\ 1 \\ [ds_2/dt] &= p_2 h_{21}[dq_1/dt] + p_2(h_{22}-1)[dq_2/dt] + \\ &\quad p_2 h_{23}[dq_3/dt\ 1 \end{aligned}$$

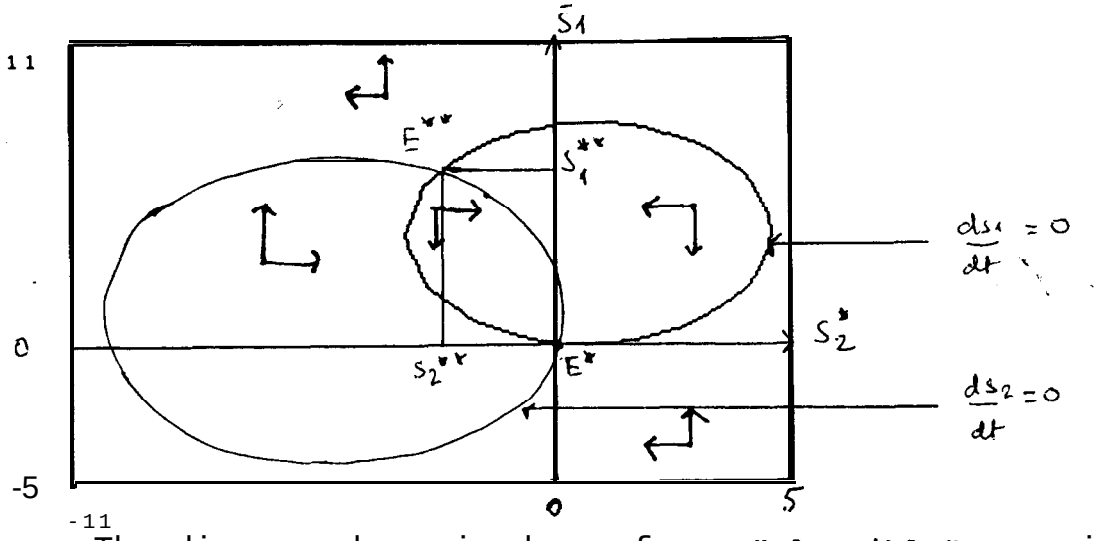
Using (14), (a) and (b) we get the following non-linear system of two differential equations:

$$(c)\qquad \begin{aligned} [ds_1/dt]_{(t)} &= z_{11} s_{1(t)} + z_{12} s_{2(t)} - z_{13}[s_{1(t)}^2 + \\ &\quad s_{2(t)}^2] \\ [ds_2/dt]_{(t)} &= z_{21} s_{1(t)} + z_{22} s_{2(t)} - z_{23}[s_{1(t)}^2 + \\ &\quad s_{2(t)}^2] \end{aligned}$$

where $z_{11} = k_1 p_1 (h_{11}-1) - k_3 p_1 h_{13}$, $z_{12} = k_2 p_1 h_{12}$, $z_{13} = kf_1 \delta p_1 (h_{11}-1) + kf_2 \delta p_1 h_{12} + kf_3 \delta p_1 h_{13}$, $z_{21} = k_2 p_2 h_{21} - k_3 p_2 h_{23}$, $z_{22} = k_2 p_2 (h_{22}-1)$ and $z_{23} = kf_1 \delta p_2 h_{21} + kf_2 \delta p_2 (h_{22}-1) + kf_3 \delta p_2 h_{23}$.

The process (c) has two stationary solutions given by the intersections of the two curves:

$$z_{11}s_{1(t)} + z_{12}s_{2(t)} - z_{13}[s_{1(t)}^2 + s_{2(t)}^2] = 0$$
$$z_{21}s_{1(t)} + z_{22}s_{2(t)} - z_{23}[s_{1(t)}^2 + s_{2(t)}^2] = 0$$



The diagram above is drawn for a "plausible" numerical example (given below). It gives some hints at the properties of the system (c). The arrows give a crude idea of the vector field. It is enough for our purpose to recognize that the zone at the northwest of E** is one zone of instability.

NUMERICAL EXAMPLE FOR A THREE SECTOR ECONOMY

$$A := \begin{bmatrix} .2 & .1 & .25 \\ .3 & .3 & .25 \\ .2 & .3 & .2 \end{bmatrix}$$ matrix of tecnique

$$M := \begin{bmatrix} \frac{10}{9} & 0 & 0 \\ 0 & \frac{10}{9} & 0 \\ 0 & 0 & 10 \\ & & 9 \end{bmatrix}$$ matrix of mark-up

$l := (.2 \quad .2 \quad .2)$ vector of wage-labour

$w := 1$ nominal rate Of wage

$$c := \begin{bmatrix} .2 \\ .4 \\ .4 \end{bmatrix}$$ consumption coefficients

$z := (.1 \quad .1 \quad .1)$ profits per unit

$\bullet st := 0$ • rtornal finance ratio

$prc := .75$ wage-• arnarr marginal *rat.0* of consumption

$H := A + (1 + ext) \cdot c \cdot z + prc \cdot c \cdot l$

$$H = \begin{bmatrix} 0.25 & 0.15 & 0.3 \\ 0.4 & 0.4 & 0.35 \\ 0.3 & 0.4 & 0.3 \end{bmatrix}$$ demand coefficients matrix

$$g := \begin{bmatrix} 1 \\ 2 \\ 1 \end{bmatrix}$$ • xogrnrous • xpendituros

coefficients of reaction

$k1 := .8$ $k2 := .5$ $k3 := .6$

$kf1 := 250$ $kf2 := 200$ $kf3 := 200$ $\delta := .001$

FOOTNOTES

1. The non-tatonnement models are the most important attempts to deal with the question of the convergence of an effective dynamic path towards equilibrium (as opposed to tâtonnement processes where the path is imaginary). See F. Fisher [6].

2. For example, the proposition according to which fluctuations in the level of activity are caused by the economic policies endeavouring to fight disequilibrium inflation or disequilibrium unemployment - widely admitted by economists - is not rationally founded on economic theory.

3. An interesting example of the bias induced by the exclusivity of equilibrium may be found in the development and evolution of the Fix-price theory of temporary equilibria. Partially founded on Clower's claim that the monetary mechanism ought to be taken into account to explain the persistence of unemployment, the theory turned out to interpret durable unemployment as an example of Nash-equilibrim where money has no role to play.

4. This proposition is one of the central contentions in the development of political economy since Adam Smith. One may be tempted to call it Smith's conjecture, just to remind ourselves that it has not yet been proved...

5. Even if it is sometimes acknowledged that equilibrium is not a sufficient condition for transactions to be effective (because of the impossibilities of barter for instance), economists nearly always tend to forget it and to accept the proof of the existence of an equilibrium as the final word in the question of the existence of a market economy.

6. A detailed account of these rules is to be found in K. Arrow and F. Hahn [1] and F. Fisher [6].

7. See F. Fisher and D.O.Stahl [13]

8. If Hahn's condition is fulfilled (the sign of the individual excess demands is the same as the sign of the market excess demand), there is an equivalence between the rule of tatonnement and that of non- tatonnement. This is why they are not distinguished in the literature: the formal identity hides the fact that they do not apply to the same excess demand (respectively before and after the market).

9. There are interesting exceptions. It is not possible to cite all of them. See however Starr [13], Ostroy [11] etc.

10. On these points see C. Benetti [2].

11. See K.Iwai [7]

12. See M. Kohn [8]

13. See C. Benetti and J. Cartelier [3]

14. Mainstream theory presupposes implicitly a particular institutional context: the auctioneer, in the Walrasian tatonnement, drives a process of consultation which ends just before the opening of the effective market (where transactions can be observed)(see M. Devroey [5]). In that sense, the debate is not between institutional economics and pure economics but between the accuracy of the institutional framework implicitly or explicitly assumed.

15. For an extensive exposition of this point see B. Moore [10]

16. In what follows, the only credits considered are those which finance current purchases. For the sake of simplicity, we assume there is no voluntary intertemporal allocation of resources. Thus, an equilibrium position implies that no debts are to be carried beyond the period. Any indebtedness at the end of the market reveals a non-equilibrium situation.

17. The question of the nature of these expectations is crucial. It is not possible here to develop the point except to suggest that expectations of economic agents are necessarily related to those of banks. As banks are partly the reflection of their customers, it becomes clear that the formation of expectations has something to do with conventional behaviour.

18. Even if we presume that this uncertainty may be discussed in terms of subjective probabilities, it is impossible to avoid the fact that people are diversely confident about the probabilities they attribute to diverse events.

19. In a continuous time, agents learn at each point of time how things are operating on the market. They can adjust their plans (prices or quantities) and engage in unexpected financial operations continously. As we reason within discrete periods, we shall adopt, for the sake of convenience, the assumption that economic transactions are first carried out and then that unexpected financial transactions follow. This is purely a device of presentation which entails no special conclusion.

20. It is tempting here to remind the reader of the old-fashioned debate between Realists and Nominalists. Under modern disguise, the protagonists still play their usual role. The critique of value theory and the rehabilitation of nominalism are one and the same way of considering money.

21. The so-called problem: "where does the money financing the profits come from?" is raised only because some economists forget the two-sided aspect of any monetary quantity. Transposing for the whole economy what seems to be the experience of a single individual (the income has to be earned before being spent, a doubtful proposition indeed) is misleading. If expected profits were not spent it would be impossible to have positive profits in the economy as a whole. The proof is staightforward. Let us suppose that only costs were spent (inputs and wages). As the total of receipts is identical to the total of expenses for the economy as a whole, receipts would be equal to costs...

22. As the algebraic sum of excesses and deficits is identically zero, it cannot be used for that purpose.

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