Working Paper No. 325

Endogenous Money in a Coherent Stock-Flow Framework

by
Marc Lavoie
Department of Economics
University of Ottawa
Ottawa, Canada
mlavoie@uottawa.ca
March 2001

For the conference:
"Monetary Foundations of Macroeconomic Policy: Old Puzzles and New Issues"
Frei Universität Berlin
Berlin, Germany
March 23-25, 2001

The main aim of the present paper is to advocate a methodology that Wynne Godley first proposed in Godley and Cripps (1983) and then clearly formulated in recent papers (1996, 1999). Godley's methodology was itself inspired by the reading of a series of papers by Tobin and some of his associates (Tobin 1969, 1982, Tobin and Brainard 1968, Backus, Brainard, Smith and Tobin 1980). What both Tobin and Godley have emphasized is the need for a coherent macroeconomic framework, that links together the flow dimension of macroeconomics, as simple Keynesian analysis does, and the stock dimension of real capital, financial assets and debts, with their associated rates of return.[1] Godley's particular contribution is that he has a series of fully determined models, where the dynamic adjustments towards a possible steady-state are fully explicit, within an accounting framework from which no flow is omitted. These models incorporate historical time, inventories, capital gains, and inflation accounting. All the key variables are endogenous and are dependent on the adjustment behaviour of agents and institutions with respect to their flows, stocks, and norms. Except for financial markets, there is no market-clearing price mechanism.

A key difference between Godley and Tobin is that Godley's contribution is clearly influenced by the Cambridge UK post-Keynesian school, *à la* Nicholas Kaldor, whereas Tobin's, notwithstanding his clear Keynesian stand when debating with New Classical colleagues, has a mainstream pedigree, with its standard neoclassical assumptions, such as exogenous money, market-clearing price mechanisms, profit maximization, a profit rate equal to the marginal productivity of capital, and banks acting as intermediaries, optimally allocating their deposits among loans and securities.

A clear implication from Godley's models is that money is endogenous and cannot be otherwise. This conclusion arises from a fully coherent accounting framework, to which are superposed behavioural equations that get the models running. Although Godley has developed his heterodox monetary views on his own, having long been puzzled by the neoclassical assumption of a constant money supply, Godley's method and work have substantial repercussions on post-Keynesian monetary theory because they provide formal means to assess the legitimacy of the claims made by this theory, and they also help to assess some of the subsidiary debates that have been arising within post-Keynesian theory. Indeed, we shall see that Godley's monetary economics enlighten the so-called circuit approach to money that has been proposed by French and Italian *circuitistes* (Graziani 1990).

A key factor is that Godley's accounting framework provides a general fully-coherent tool, which takes into consideration the various interdependences that link income flows to changes in financial assets. This is important because, in my opinion, several debates around the issue of endogenous money arose as a consequence of the lack of such a general all-round model. There is no need for post-Keynesian economics to lack coherence, formalism and logic, as it is sometimes accused of, as reported by Chick (1995).

The outline of the paper is the following. In the first section, the principles of the framework put forth by Godley are being presented. In the second section, a simple example is presented, without government debt but with private money, initially developed within a growth model. In the third section, another simple example, with government debt but without banks, is being discussed. In the fourth section, some of the results achieved by Godley in his most complex model are being recalled, and some implications with regards to post-Keynesian debates are being drawn.

A Coherent Stock-Flow Framework

For a long time, some macro economists have been lamenting about the lack of proper accounting foundations for macroeconomics. In a book that was well-known in France, Jean Denizet (1969) complained about the fact that standard macroeconomic accounting, designed upon Richard Stone's social accounting, left monetary and financial phenomena in the dark. In standard accounting, little room is left for banks and financial intermediaries and the accounts are closed on the basis of the famous Keynesian equality, that savings must equal investment, following the current accounts. There is no discussion of the changes in financial stocks of assets and of debts, and their relation with the transactions occurring in the current or the capital accounts of the various agents of the economy. In addition, in the standard textbook representation, households and firms are amalgamated within a single private sector, and hence, since financial assets or debts are netted out, it is rather difficult to introduce discussions about such financial issues, except for public debt.

This lack of integration between the flows of the real economy and its financial side greatly annoyed Denizet. For Denizet, J.M. Keynes's major contribution was his questioning of the classical dichotomy between the real and the monetary sides of the economy. It is thus paradoxical to see that standard national accounting, which was developed by Richard Stone, reproduced the very dichotomy that Keynes had himself attempted to destroy. The sets of national accounts that were being proposed by Stone and his collaborators were initially in competition with those proposed by the French national accountants (Denizet having been one of them), who integrated financial operations within the transaction flows of the current accounts.[2] But the dichotomic national accounts of Richard Stone became the world-wide standard, either because they were the norm in Anglo-saxon countries or because Stone was perceived as the faithful disciple of Keynes.

In his book, Denizet (1969: 19) proposed a transactions flow matrix that has *implicitly* all the features of the matrices that were later produced *explicitly* by Tobin (only in the Backus et al. (1980) article however) and *systematically* by Godley in his more recent work (1996, 1999). All the rows must sum to zero: they represent the flows of transactions for each asset or for each kind of flows; in addition, all the columns, each representing a sector, must sum to zero as well: they represent the budget constraint of each sector. Within this framework, the budget constraints for each sector describe how the balance between flows of expenditure, factor income and transfers generate counterpart changes in stocks of assets and liabilities. These accounts are comprehensive in the sense that everything comes from somewhere and everything goes somewhere. Without this armature, accounting errors may pass unnoticed and unacceptable implications may be ignored. With this framework, "there are no black holes" (Godley 1996: 7).[3]

Once a fully-integrated and fully-coherent accounting framework is put in place, it still remains to propose behavioural equations, in particular the asset demand functions of agents. Although Denizet was fully aware that a stock analysis was required at that stage, he remained within the confines of flows, assuming that households would split their newly acquired wealth, their flow of saved income. It was Tobin's (1969) and Brainard and Tobin's (1968) contribution to propose an explicit and coherent framework for the analysis of the portfolio decisions of the households. They assumed that households desire to hold a certain proportion of their assets in the form of, say, money;[4] and this proportion is modulated by the rates of return that are expected on the other assets; this proportion may also be affected by the level of income relative to wealth. The demand functions are subject to an adding-up constraint.[5] It is the combination of this portfolio theory with the transaction flow matrix, combined with other more standard Keynesian behaviour, where flows depend on stocks of the previous periods, which provides for a fully-coherent macroeconomic model.

Now a feature of the transactions stock matrix used by Denizet, Backus et al., and Godley is that if there are N rows, then there are only N-1 independent equations. This means that the Nth equation can be left out of the analysis. This is highly reminiscent of Walras's Law, and indeed some authors present this feature in light of Walras's Law. Within standard models, it is usually ascertained that the bond market (or the equity market will be left out), and that the search for supply and demand equilibrium will be conducted in the money market. This choice is not without consequences. What the money market stands for is not always clear. For instance, when money is assumed to be bank deposits, what is the supply function for deposits, i.e., "in what manner do banks supply demand deposits?" (Goodhart 1984: 268). In what manner can we say that the supply for and the demand of bank deposits are different from each other? It seems clear that it is much more sensible to speak of demand and supply on the bonds market, or to speak of demand and supply on the equities market, where it is simple to assume that the equilibria on these markets are reached quasi-instantaneously by fluctuations in asset prices. This is what will be done in the examples offered in the next sections.

A Growth Model With Private Money

The transactions flow matrix

Take as a first example the transactions flow matrix of Table 1. This matrix can be found in Lavoie and Godley (2000). It describes the accounting of a growth model. There is no government sector and no central bank. Here the banking sector has been restricted to its most simple form: it is assumed that the banking sector makes no profit whatsoever. This implies that the rates of interest on loans and deposits are the same, or it implies that the profits made by the banks are entirely redistributed to the households (although banks do not issue equity!). The production sector is more realistic: it has undistributed profits and it issues shares. Households receive wages, dividends and interest payments, which they can either consume or use to purchase new assets. As in all such transactions flow matrices, all rows and all columns sum to zero. The rows describe the nominal amounts which are being exchanged from one sector to another. Similarly, the columns sum to zero and represent the budget constraint that each of the sectors must respect.

Take the perhaps less obvious case of the production sector. This sector is subdivided into a current account and a capital account. Both accounts must sum to zero. All variables with a plus sign represent a source of funds; all variables associated with a negative sign represent the use of funds. In the current account, the flows of funds arising from the sales of consumption goods and of investment goods must equate the payments on wages, interests and dividends, plus the sums that the corporations can set aside for themselves - the undistributed profit. In the capital account, the additions to the stock of capital, fixed capital and inventories, must be financed by undistributed profit, share issues, and new borrowing from the banks.

The matrix serves to illustrate some well-known claims by some post-Keynesians and circuitistes regarding credit and money. The first claim is that the demand for and the supply of money are necessarily equal; the second claim is that the amount of loans supplied by banks to firms must necessarily be equal to the amount of deposits held by households (in a simple model). The matrix of Table 1 clearly shows that this cannot be otherwise. The question is, what is the mechanism that will allow such an equality?

This question has puzzled various authors (Chaîneau 1977: 14; Goodhart 1984: 232-233; Howells 1995) for some time now, for apparently the demand for money and the supply of credit are determined by two independent mechanisms. In the Lavoie and Godley (2000) model for instance, the demand for credit, *at the end of the period* , depends on the part of investment expenditures which has not been financed by retained earnings and new equity issues. On the other hand, the demand for money deposits is determined by a Tobin-like portfolio mechanism, where the demand for money and the demand for equities depend on a given proportion of expected wealth, modulated by expected income, the rate of interest and past rates of return on equities.[6] In obvious notations, the equations are as follows:

$$(1)\ (p_e.e_d)^* / V^* = \lambda_0 - \lambda_1.r_m + \lambda_2.r_{e(-1)} - \lambda_3.(Y_{hr}^* / V^*)$$

$$(2)\ M_d^* / V^* = (1 - \lambda_0) + \lambda_1.r_m - \lambda_2.r_{e(-1)} + \lambda_3.(Y_{hr}^* / V^*)$$

The fact that these mechanisms appear to be totally independent has led some authors to claim that there could be a discrepancy between the amount of loans supplied by banks to firms and the amount of bank deposits demanded by households. It has been said, for instance, that an excessive amount of credit could lead to an excess creation of money, which would presumably lead to excess demand and inflationary pressures (Dalziel 1996).

This view of the money creation process is however erroneous. It omits the fact that while the credit supply process and the money holding process are apparently independent, they actually are not, due to the constraints of coherent macroeconomic accounting. In other words, the decision by households to hold on to more or less money balances has an equivalent compensatory impact on the loans that remain outstanding on the production side.

The monetary circuit

Suppose, as we did in our model, that firms distribute wages in line with production, that dividends are distributed according to past profits, and that interest payments, as shown here, depends on the past stock of deposits and on a rate of interest administered by the banking system. Suppose further that firms borrow, at the beginning of the production period as the French and Italian circuitistes would have it, the amount needed to pay the wages of the current period. This is, as the circuitistes say, the first step of the monetary circuit (Lavoie 1992: 153). Thus in the first step of the circuit, both the loans and the deposits newly created by the banking system belong to the production sector. This situation however, can only last for some split moments. Firms only draw on their lines of credit when they are required to make payments. In the second step of the circuit, the deposits of the firms are transferred by cheques or electronic payment to the workers who provided their labour to the firms. The moment these funds are transferred, they constitute households' income. Before a single unit is spent on consumer goods, the entire amount of the bank deposits constitutes savings by households.

This is all shown in Table 2. The matrix requirement that all rows and columns must sum to zero makes clear the requirements of step 2 of this monetary circuit. The unsold production - the increase in inventories - must necessarily rise by an amount equal to the production costs, the wages paid W .[7] This means that investment (in inventories) in the current account of firms is equal to the value of wages. On the side of the capital account, it is clear that the value of this investment in inventories must be financed by the new loans initially fetched for. Table 2, contrasted with Table 1, helps to understand the distinction between *initial* and *final* finance which has been underlined by the circuitistes (Graziani 1984).

The transition from Table 2, which represents the second step of the circuit, to Table 1, which represents the third and last step of the monetary circuit, is accomplished by households getting rid of the money balances acquired through wages, and the additional money balances received on account on their dividend and interest payments. As the households get rid of their money balances, firms gradually recover theirs, allowing them to reimburse the additional loans that had

been initially granted to them, at the beginning of the period. Firms decide on the amount of new equities they will issue, Δe_s, but they cannot decide on the price p_e that these new issues and the existing ones will carry. This will be decided by the confrontation, on the market for equities, between the total supply (old and new) of equities and the demand for such equities arising from the proportion of their expected wealth that households would like to keep in the form of equities.

The key factor is that, as households increase their consumption, their money balances fall and so do the outstanding amount of loans owed by the firms. Similarly, as households get rid of their money balances to purchase newly-issued equities by firms, the latter are again able to reduce their outstanding loans. In other words, at the start of the circuit, the new loans required by the firms are exactly equal to the new deposits obtained by households. Then, as households decide to get rid of their money balances, the outstanding loans of firms diminish *pari passu* .[8] Although determined by apparently independent mechanisms, the supply of loans to firms and the holdings of deposits by households cannot but be equal.

An excess supply of credit?

Still, there is a sense in which one could say that the demand for money and the supply of money are not equal. There could be a discrepancy between the amount of money initially demanded by households , M_d^*, based on their expectations of wealth and income for the current period, and the amount of money M_d , which households eventually wind up with. When household income, and hence household wealth, turn out to be different from expected levels, the adjustment factor is the amount of money left with households, $M_d = M_s$, compared with M_d^*.[9] Money balances play the role of a buffer for households, just like bank lending played the role of a buffer for the production sector.

For instance, suppose that actual household income is higher than its expected level: $Y_{hs} > Y_{hs}^*$. As a result, as long as consumption only depends on expected rather than actual current income, there will be a corresponding gap between the actual and expected change in wealth: $\Delta V > \Delta V^*$. As a consequence, the amount of money held by households will be higher than what they expected to hold by exactly the amount that income has been underestimated. In other words, it is possible to have: $M_s > M_d^*$. But this has no bearing on whether or not an excess supply of money can arise. This inequality is due to mistaken expectations; it has no causal significance of its own. In particular, it cannot be said that the excess money supply, defined here as $M_s - M_d^*$, can be a cause of an excess demand on the goods market, or of an excess demand on the equities market (which would push down financial rates of return).[10]

However, there is some grain of truth in the above assertion. Suppose that wealth (as measured at the end of the previous period) enters into the consumption function, so that there is an implicit wealth to income ratio target (the effects to be described will not occur if the consumption function only depends on income flows). Take the case where actual household income exceeds its expected level, so that actual wealth ends up exceeding expected wealth, the actual money to wealth ratio exceed sits desired level, and the actual equities to wealth ratio is lower than its desired level. *In the next period* , the extra accumulated wealth will induce households to spend (relatively), so as to help reestablish the wealth to income ratio target. In addition, households will get rid of their accumulated money balances in order to acquire equities and reestablish the targeted money to wealth ratio and equities to wealth ratio. These effects seem very similar to those attributed to an excess money supply, as described in the previous paragraph. However, in my view and that of Godley, these spillover effects are entirely to be attributed to mistaken expectations on the part of households. They have nothing to do with excessive advances granted to the production sector or to an excess supply of money.

Is it for a moment surprising that the stock of money people end up with, whether or not they have made wrong predictions, is identically the same amount as the loans which firms find that they have incurred -- although this follows from a distinct set of decisions. The Lavoie and Godley (2000) model is simple enough that it reveals with unusual clarity why this must be so. Kaldor's (1982) and Moore's (1988) intuition -- that there can never be an excess supply of money, a claim often associated with the reflux principle -- is vindicated.

Kaldor's and Moore's assertion has often been called into question. Some authors have noted that, because money deposits are created as a result of loans being granted to firms, money supply could exceed money demand. Coghlan (1978: 17) for instance, says that: "If we accept that advances can be largely exogenous ....then the possibility must exist that bank deposits can grow beyond the desires of money holders". That claim is wrong, however. As shown here, such a misunderstanding arises as a result of ignoring the overall constraints imposed by double-entry financial bookkeeping.

It has sometimes been claimed that the Horizontalist assertion regarding the impossibility of an excess supply of credit-money should be attributed to the absence of a proper portfolio demand for money (Goodhart 1991: 33; Howells 1997: 433). By contrast, in the present model, there is an *explicit* demand for money function, given by equation (2). However, in a fully-coherent accounting framework, this portfolio demand for money can only be an *apparently* independent function. So, although Moore (1997: 427) has been rather cryptic in his explanations, he is nonetheless right when he states that: "*there is no separate and independent demand for money* that must somehow be 'reconciled' with the demand for credit".[11] In all proper models of a monetary economy, there should be a separate demand for money function, but this function, ultimately, is not independent of the rest of the model.

Adding loans for speculative purposes

It is sometimes conceded that credit granted for production purposes might not lead to an "excess supply" of money, as a consequence of the reflux principle, but that credit granted (mainly to households) for speculative purposes will lead to such a result (Howells 1999). There is little doubt that credits generously granted for speculative purposes on the stock market or on the housing market will generate high prices on these markets. If more people are now able to purchase equities or buildings, or if potential purchasers now have access to larger funds, the potential demand for these assets has risen. The potential demand becomes effective demand when households become willing to use their improved lines of credit to modify the proportion of their wealth which they desire to hold in the form of equities. It is only when the λ_0 parameter of equations (1) and (2) moves upwards that this potential demand gets transformed into higher equity prices. But is it possible to assert that these credits supplied by banks for speculative purposes have led to an excessive amount of money? This, it seems to me, is an entirely different question.

The capital gains that have accrued or that have been realized in the process of credit-induced speculation may induce some households to spend more on consumption than they would otherwise have done. For instance, part of the last US consumer boom, and lack of household savings, was attributed to the rising equity prices.[12] For a given transaction income, rising stock market prices generate increased consumption out of capital gains or out of larger wealth. This yields lower measurements of the apparent saving rate out of national income. But there is nothing here besides straightforward Keynesianism. Demand rises because in the end the proportion of national income that has been consumed has risen. It has nothing to do, as far as I can figure, with a supply of credit that would be excessive compared to some demand for money. Consumption does not rise because there is an excess supply of credit or an excess supply of money. Consumption rises because of capital gains and larger wealth. If, as we shall see in the next section, the central bank were to decide to set interest rates on long-term bonds at a lower level, a similar phenomenon would arise: bond holders would benefit from a capital gain which could induce them to increase their consumption relative to regular income.

Loans for speculative purposes may be added to the accounting framework of Table1. The new situation, where bank loans are granted to households for speculative purposes, i.e., with the intent of purchasing equities on the stock market, is illustrated with the help of Table 3.[13] For simplicity, only transactions in assets are recorded, so that each row sums to zero, but not the columns. The matrix makes clear, I believe, that if loans are now granted to households, on the (extreme) assumption that households do not increase (or decrease) their money balances and on the assumption that they do not at first modify their level of consumption expenditures, then compensatory movements must be observed in equity prices. The rise in equity prices must be such that the increase in *the value of new*

issues must compensate for the increase in the amount loaned to household speculators.[14] This increase in the value of new issues will however allow firms to diminish the required amount of loans by an equal amount. As a result, there will be no change in the total amount of loans granted by the banks, just as there was, by hypothesis, no change in the increase in money balances. All the accounts balance.

The above remarks also show that one should beware of claims to the effect that loans made for speculative purposes could crowd out productive loans, as written by Dow (1986: 102-103) for instance. She claims that, because there are "limitations on credit creation, then the possibility of crowding out emerges", adding that "a speculative boom will see banks diverting progressively more credit to speculative borrowers". Our analysis shows that such a re-proportioning will indeed occur, but simply because there are now households in the economy that are willing to go into debt, thus sparing the productive sector from being forced to do so. The fact that speculators are willing to borrow to purchase securities *ipso facto* allows firms to reduce their requirements in newly borrowed funds. There is no crowding out of productive borrowers by speculative ones. On the contrary, one could almost say that there is a form of crowding in. The transactions flow matrix allows to go beyond partial equilibrium analysis.

The portfolio equations, under the assumption that the funds borrowed by households are mainly used for speculative purposes, i.e., to allow a larger proportion of wealth to be held in the form of equities, could now be written as follows:

$$(3)\ (p_e.e_d)^* / V_n^* = \lambda_0 - \lambda_1.r_m + \lambda_2.r_{e(-1)} - \lambda_3.(Y_{hr}^* / V_n^*) + \lambda_4.(L_h / V_n^*)$$

$$(4)\ M_d^* / V_n^* = (1 - \lambda_0) + \lambda_1.r_m - \lambda_2.r_{e(-1)} + \lambda_3.(Y_{hr}^* / V_n^*) \lambda_4.(L_h / V_n^*)$$

Increases in loans taken by household L_h imply that households wish to speculate on the stock market and wish to target a higher proportion of equity wealth.[15] Note that their gross wealth is V, but that their net wealth would be $V_n = V - L_h$. One could suppose that household borrowing is some function of their past regular income, modulated by the excess of the rate of return, net of a risk premium, over the lending rate of interest. When the two rates are equal, there would be no borrowing for speculative purposes. For instance, we could have:

$$L_h / Y_{hr(-1)} = \Phi\{(r_{e(-1)} - \sigma_e) - r_l\}$$

One would then need to determine how the usual consumption function used by Godley would have to be modified. Where consumption is a function of expected income and the wealth level of the previous period, the last term could be replaced by net wealth.

Credit rationing and the principle of increasing risk

The comparison of Tables 1 and 2 also allows to clear up another debate within post-Keynesian theory. Various authors have claimed that theorists of endogenous money (the so-called Horizontalists *à la* Moore and Kaldor) have tended to ignore the issues raised by credit rationing or credit constraints imposed by banks.[16] An excellent presentation of a post-Keynesian view of credit rationing, compatible with the present arguments, has been provided by Wolfson (1996). Wolfson points out that banks face a notional demand for credit. Banks however are only concerned with credit-worthy customers. They will grant credit to all credit-worthy borrowers. The demand for credit of these credit-worthy customers constitutes the effective demand for credit.[17] The production that will actually be carried in Table 2 depends on the credit-worthy status of the producers. They will be able to go ahead with their production plans only insofar as they are credit-worthy, and in the case of the production of investment goods, only insofar as the customers who have ordered these goods can provide financial guarantees that they will be able to honour their orders.

Credit constraints thus appear at the stage of initial finance (as in Table 2), not at the stage of final finance (as in Table 1).[18] The credit constraints will imply a restrained level of production,. In a growth model, they will imply a restricted amount of capital accumulation by entrepreneurs, and hence credit restraint is incorporated within the investment function, with the later being sensitive to debt ratios or the weight of debt payments for instance. This justifies the assumption, made for instance in Lavoie and Godley (2000: 12), that the credit requirements of firms, as they appear at the end of the period, as shown in Table 1, are always fulfilled by banks. In other words, as pointed out by Godley (1996: 8), the change in bank loans are the *residual* source of finance. Bank finance is a buffer. The initial finance provided by banks to allow production, as in Table 2, is in all cases larger than the final finance requirements of firms at the end of the period, as described by Table 1. If finance has been granted to start the production process, problems of credit restraints cannot arise at the end of the accounting period.[19]

Credit rationing can only arise at the beginning of the next period. And indeed, this is how it appears in the Lavoie and Godley (2000) model. If households decide to hold a larger proportion of their wealth in the form of money deposits, the debt ratio of firms will be larger and this will slow down the rate of accumulation, either because of borrower's risk or because of lender's risk. An additional mechanism could be incorporated within the model, whereby the interest rate on loans is raised whenever the debt ratio of firms rises. But this mechanism, in line with Kalecki's principle of increasing risk, would not necessarily generate the expected results at the macroeconomic level. This is because the model shows that faster growth does not necessarily induce higher debt ratios.

A Model With Government Money

A two-asset model

The present section deals with the same issues, but seen from a different angle. We now consider another simplified economy, based on a service economy, with no investment by firms. The production sector does not go into debt and consequently there are no private banks. There is however a government sector, with a central bank. When government must finance its deficit, it issues Treasury bills B, short-term assets the price of which is assumed to be fixed to unity, and which convey an interest payment of r_b. These bills are purchased by the central bank and by the public, i.e., the households. The public has the choice between holding government notes, i.e., (high powered) money H issued by the central bank, or interest-earning assets - the Treasury bills.

Once again the national accounting of the transaction flows is provided within the framework of a matrix, given by Table 4, where all rows sum to zero and where all columns do likewise.[20] It can be seen in particular, that since the central bank is collecting interest payments on its stock of bonds, while paying out no interest on the notes that it issues, it will be making profits. It is assumed, in line with current practice, that the profits realized by the central bank are being reverted to the government sector.

As is well-known now, the stationary equilibrium of such a model requires that no new debt be issued by government. The steady state is reached when the budget of government is balanced, so that taxes are equal to government purchases G plus the net interest payments on outstanding government debt (net of the profits of the central bank).

In the model developed by Godley, the central bank sets the rate of interest r_b of its choice on Treasury bills. On the basis of this rate, households decide of the proportion of their wealth which they wish to hold in the form of bonds and in the form of money. The Tobin-like portfolio equations are similar to those of the previous model. Again in obvious notations, we have:

(6) $B_h^* / V^* = \lambda_0 + \lambda_1 . r_b - \lambda_3 . (Y^* / V^*)$

(7) $H_d^* / V^* = (1 - \lambda_0) - \lambda_1 . r_b + \lambda_3 . (Y^* / V^*)$

Here note that the adjustment cannot occur through the price of bonds, since it is assumed to be set to unity. How is it that the central bank is able to sustain a fixed rate of interest, whatever the demand for bonds of the public, and whatever the fluctuations in the government deficit? The answer lies in the accounting constraints of a fully coherent macroeconomic model and in the assumed behaviour of the central bank. If the households now desire that a larger proportion of their wealth be held in the form of bonds, the central bank will restrict its own demand for bonds or even will sell the demanded bonds on the open market. Reciprocally, if households have high liquidity preference and wish to get rid of their bond holdings, the central bank will purchase the offered bonds. In other words, the central bank clears the market at the price of its choice, by providing an endogenous demand for bonds, which is equal to the difference between the supply of bonds resulting from the government deficit and the demand for bonds arising from the household sector. In net terms, as Godley puts it, i.e, when the central bank is integrated to the government sector, the supply of bonds by the integrated government sector is endogenous and equal to the demand of the public.

As in the previous model, when the adequate behavioural equations have been added, there is no need for any equation requiring that $H_d = H_s$. Once the bond market has been taken into consideration, the so-called money market drops out of the picture. In the computer model, introducing this equation would make the model over-determined, and the model could not solve. There just cannot be any excess supply of money. The contrast with the standard view, where the bond rate is endogenous and the money supply exogenous, is that in the standard story -- as told for instance by Tobin (1982: 182) and Backus et al. (1980: 267) but also by heterodox authors Franke and Semmler (1991: 340) and Moudud (1999: 22-23) - the central bank (or government) decides arbitrarily on the proportion of the deficit that will be financed by bond issues and by the creation of high powered money. In the models of these authors, this proportion is an exogenous variable.

This is the crucial difference between the post-Keynesian view and the neoclassical one. In the post-Keynesian view, cash is provided on demand to the public. The government, or the central bank, does not decide in advance on the proportion of the deficit that will be "monetized". This proportion is set by the portfolio decisions of the households, at the rate of interest set from the onset by the monetary authorities. As is noted by Bertocco (2001: 104), this post-Keynesian view was clearly spelled out by Kaldor (1982: 14) when he claimed that neither the government nor the central bank could decide what portion of the government deficit would be held in the form of cash or in various forms of public sector debt. The proportion of the deficit that is financed by bond issues is an endogenous variable, in line with the theory of endogenous money.

The monetary circuit again

The steps of the monetary circuit can once again be used to help understand how money creation and government deficits are being related to each other. At the beginning of the circuit, the government orders the production of some goods to the private production sector. Once these goods have been produced, they must be purchased by government. To do so, the government issues new bonds, which are purchased by the central bank.[21] The counterpart of these bonds, in the books of the central bank, is the amount of high powered money credited to the government account. This money will circulate, first to pay the firms, which will in turn pay wages to their workers and remunerate their owners. The money balances so created will thus wind up in the deposit accounts of households. Provided there is some income tax, payable at the source, only a net amount of money balances will remain. In other words, under these conditions, only the deficit, rather than the entire government expenditure, will be initially financed by money creation.

All this is illustrated with Table 5. Once again, all rows and columns must sum to zero. Before households decide what to do with their newly acquired money balances, spending them on consumption or acquiring interest-earning assets, all accounts must balance. As a consequence, the deficit cannot but be "monetized" initially, in line with what neo-chartalist post-Keynesians have been recently arguing (Wray 1998, ch. 4-5; Mosler and Forstater 1999). Once households revise their demand for bonds, in line with their new expectations with regards to income and wealth, and in line with the rate of interest on bonds set by the monetary authorities, the additional demand for bonds by households must be accommodated by the central bank, if the central bank is to keep the interest rate at its target level. The central bank must sell to the households the bonds that they lurk for, and by so doing, the central bank will absorb the money balances that households do not wish to hold.

Liquidity preference complications

Godley (2000) shows that another kind of bond could be introduced in such a model, a long-term bond. In such a case, households have the choice between cash money, Treasury bills -- the price of which is fixed - and long-term bonds, perpetuities for instance, the value of which fluctuates inversely with the discount rate which is applied to their coupon. Godley shows that government, through the central bank, has the ability to fix *both* the short-term rate and the long-term rate. Once again, the net supplies of Treasury bills and of long-term bonds (net of the demand schedules of the central bank) have to be endogenous and equal to the demand of the households for these assets. This is a remarkable result, for it shows that central banks, if they so wish, have the authority to set both the short and the long rates of interest. That the central bank were able to control the former has long been asserted by Keynes (1936: 203), post-Keynesians and even New Keynesians; its ability to control the latter has however been questioned by most economists of all persuasions. In view of this contradiction, could there be anything wrong with Tobin's portfolio approach?

Let us consider once more the portfolio equations suggested by Godley's model:

(8) $B_h^* / V^* = \lambda_{01} + \lambda_{11} . r_b + \lambda_{21} . r_{bL} + \lambda_{31} . (Y^* / V^*)$

(9) $(BL_h . p_{bL})^* / V^* = \lambda_{02} + \lambda_{12} . r_b + \lambda_{22} . r_{bL} + \lambda_{32} . (Y^* / V^*)$

(10) $H_d^* / V^* = \lambda_{03} + \lambda_{13} . r_b + \lambda_{23} . r_{bL} + \lambda_{33} . (Y^* / V^*)$

where $\Sigma\lambda_{0i} = 1$, while for $j \neq 0$, $\Sigma\lambda_{ji} = 0$, as the adding-up conditions.

If the long term bond is indeed a perpetuity, the coupon of which is assumed to be one accounting unit, its price is simply: $p_{bL} = 1/i_{bL}$, where i_{bL} is the rate of discount on the perpetuity, provided it is being held forever. This is usually called the yield of the bond, which is what is meant when speaking of the rate of interest on long-term bonds. If however the long-term bond is to be sold before the end of time, the asset holder has to consider the fact that the price of the bond will change and that a capital gain or a capital loss is to be expected. Naturally, as is well-known since Keynes (1936: 202), the lower the yield on long-term bonds, the higher the probability that a capital loss (arising from a fall in the price of this bond following an increase in the yield on long-term bonds) will entirely wipe out this interest payment. The expected rate of return, r_{bL}, must thus include both the yield on long-term bonds and their expected rate of change in prices, say g^e_{bL}, so that: $r_{bL} = i_{bL} + g^e_{bL}$.

When the long-term rate of interest is lower than what the public considers to be the normal rate, expectations regarding future capital losses will be widespread, and the expected rate of return on long-term bonds will fall below the value of the yield. As a result, the demand for long-term bonds by households will fall. This will put further pressure on the central bank, which will be forced to acquire more of these long-term bonds, presumably in exchange for short-term bills, but possibly in exchange for cash. Thus, again as Keynes (1936: 201) claimed in a slightly different form, there will not be a definite quantitative relation between the amount of bonds detained by the central bank and the rate of interest on these bonds. If however the central bank does not accommodate, i.e., if it does not purchase the long-term bonds that households do not wish to hold any more, the rate of interest on long-term bonds will rise towards its level considered normal by the public (Parguez 1975: 93; Chick 1983: 204).

Another way to model the above arbitrage operation is simply to introduce the yield i_{bL} of the long-term bonds in the above equations, in place of their expected rate of return r_{bL}, and to suppose that there is a series of difference equations, where the proportions $_{0i}$ are gradually modified, subject to the adding-up constraint, as long as the rate of interest on long-term bonds (their yield) does not come back to its normal level. For instance, we could have:

$$(11)\ \Delta\lambda_{01} = -\Delta\lambda_{02} = \Phi.(i^{*}_{bL} - i_{bL})$$

where i^{*}_{bL} is the normal long-term rate of interest, as perceived by households. The daunting question then is by what factors this normal rate is itself being determined.[22]

The Implications of a More Complete Model

Controversies between post-Keynesian money theorists

The matrices presented so far describe an overly simplified banking system. In fact, in the model of the previous section, there is not even a banking system. It is quite possible to complicate at will the banking system within the accounting framework endorsed in this paper. Enlarging the banking sector allows one to discuss more sophisticated issues.

One such issue is the slope of the credit supply function or of the money supply function. This slope has generated an enormous amount of attention and debates among post-Keynesian authors. The debates are usually organized around two groups: Horizontalists argue that the credit supply curve should be seen as an horizontal line in the credit, interest rate axes; the so-called Structuralists argue on the other hand that such a curve should be drawn as upward-sloping.[23] Various arguments have been put forward to justify the upward-sloping curve, ranging from the reaction function of the central bank to Kalecki's principle of increasing risk.[24] Another argument that has been advanced recently is that the increased use of lines of credit will eventually generate an imbalance between credits on the asset side of the balance sheet of banks and deposits on the liability side. This imbalance should generate increases in interest rates, to attract bond holders into holding bank deposits. The positive relationship between interest rates and the amount of loans in the economy, i.e., the upward sloping credit-supply curve, would thus be recovered.

Horizontalists on the other hand have been rather wary of this insistence on an upward-sloping supply curve for credit or for money. There are two reasons for this. First, Horizontalists doubt that the principle of increasing risk, or Minsky's financial fragility hypothesis for that matter, can justify the positive relationship between the supply of credit and interest rates, or the relationship, explicit in the mainstream LM curve, between larger income levels and higher interest rates. This is because, within a macroeconomic framework, by contrast with a partial equilibrium microeconomic framework, all sorts of paradoxes can appear, which contradict intuitive beliefs. The second reason is that Horizontalists fear that the standard demand and supply view of neoclassical economics could be reintroduced within post-Keynesian economics. In particular, an upward-sloping curve must be associated with a rising LM curve, even though the money supply is correctly identified as endogenous. This insistence on an upward-sloping curve by most post-Keynesian authors is rather ironic, since some New Keynesian authors are now insisting in discarding the standard IS/LM apparatus, claiming in particular that the LM curve should be seen as a completely horizontal curve in the real income/ real interest rate axes (Romer 2000).

Experiments within an economy where banks have some liquidity preference

One would believe that the fully-coherent model of Godley (1999), which incorporates a relatively complex banking sector, should enable us to settle these controversies between members of the same school of thought. And indeed Godley (1999) proceeds to an experiment with his model which does have some bearing on the controversies between Horizontalists and Structuralists.

But before we examine the results of this experiment, let us check the banking system constructed by Godley. The balance sheet of this banking system is presented in Table 5. It is assumed that banks hold three kinds of assets: loans made to firms, Treasury bills, and cash reserves (i.e., money issued by the central bank). Banks have two kinds of liabilities: demand deposits, which carry no interest, and time deposits. It is assumed that the profits of the banks are entirely reversed to households, which explains why no own funds appear among the liabilities. It is further assumed that time deposits are mainly in competition with Treasury bills: an increase in the rate of interest on time deposits will induce some bills holders to sell their bills to the banks, to acquire the now more attractive time deposits.

In Godley's model, banks are driven by the need to remain profitable and by two liquidity constraints. Because of the profitability constraint, interest rates on loans must reflect the main cost of funds, that of time deposits. In addition, as in several financial systems, banks must maintain a fractional reserve requirement, by holding in cash a given fraction of their total deposits. This is equivalent to a primary reserve ratio. Finally, banks also wish to maintain a kind of secondary reserve ratio: banks target a norm, a Treasury bills to deposits ratio (demand and time deposits).[25] To achieve this ratio, banks modify the rate of interest on time deposits. When banks are below the norm, they raise this rate.[26] This induces some households to sell their holdings of Treasury bills, acquiring instead time deposits. This allows banks to acquire the missing Treasury bills. The balance sheet of banks thus increases on both sides by an amount equal to the value of the sales, thus bringing back the secondary ratio to its targeted norm.

Godley (1999: 400-401) reports an experiment that he conducted. Starting from a full equilibrium at the steady state, there is an exogenous expansion of inventories. This increase, as shown in Table 2, requires an immediate and equal increase in bank loans and money balances. However, as the various agents react to their new situation, loans rise faster than deposits, and eventually, despite the fact that interest rates on bills and bonds are fixed by assumption, banks must raise the rates of interest on time deposits (and hence loans) to recover the target norm on secondary reserve requirements. In the end, the balance sheet of banks has grown in size, and higher interest rates are associated with a higher level of loans and of money deposits.

At first sight, these results are rather congenial with the Structuralist story. And indeed, Godley (1999: 401) takes Moore (1988) to task for claiming that deposits expand automatically in line with the additional supply of loans "so there is no need for the hierarchy of interest rates to change". Post-Keynesian authors like Wray (1995) have long been claiming that, save for a change in the liquidity preference of banks (i.e., a relaxation in the norms of primary or secondary reserve requirements), any increase in the size of the balance sheet of banks ought to lead to increases in interest rates on loans, even if the central bank maintains Treasury bills rates at a constant level. In other words, the supply curve of credit is upward-sloping, even under the assumption of a perfectly horizontal supply of reserves. In a recent paper, Sawyer (2000) has argued just that: he claims that the analysis of Godley (1999) provides results which are compatible with the Structuralist view, in particular the upward-sloping supply curve of credit. Various people at conferences have recently expressed the view that Godley's model provides ammunition to the Structuralists. But contrary to expectations, it does not.

Counter-experiments

The model and analysis provided by Godley (1999) do not yield any support to the Structuralist position, understood here as the belief in an upward-sloping supply curve of credit and an upward-sloping LM curve. First, it should be pointed out that the experiment conducted by Godley, the increase in inventories, leads to a *fall* in the new steady-state level of income. This is because the increase in inventories leads to a decrease in the share of wealth arising out of government debt, and since the steady-state income depends on the level of government expenditures, inclusive of interest payments on debt, the fall in government debt generates a fall in steady state income. The higher level of interest rates on loans and deposits, resulting from the higher loans, are thus associated with a lower level of income. The experiment generates a rising credit supply curve, *but a downward-sloping LM curve* !

But there is an even more aggravating factor for the Structuralist position. Another experiment can be conducted with Godley's (1999) model. Impose an exogenous (permanent) increase in government expenditures. This entails ultimately a higher level of activity, accompanied by larger inventories, and larger banking balance sheets, more precisely larger loans and deposits. All this however is accompanied by *lower* rates of interest on loans and time deposits.[27] This is because a larger proportion of wealth now has to be detained in the form of government debt, bills and bonds, instead of money deposits. We now have a *downward-sloping* supply curve of credit, and again a *downward-sloping* LM curve.

The results achieved in this other experiment should lead us to take into account the fact that the supply of government debt plays an important role in the evolution of realized leverage ratios of private firms or in the various asset ratios of banks and households. This factor was, in my view, rightly emphasized by Lintner (1977: 204) in his critique of Minsky's financial fragility hypothesis, as I pointed out earlier (Lavoie 1986: 20). The evolution of leverage or liquidity ratios cannot be ascertained within the context of a partial equilibrium model. It must be ascertained within the context of a fully integrated macroeconomic model.[28]

One cannot know a priori whether increased activity or larger asset stocks should or should not be associated with higher interest rates in an economy with endogenous credit money, even if banks do entertain some notion of liquidity preference. It is true that, in Godley's 1999 model, loans and deposits do not usually move in step, and hence, insofar as banks target some norms vis-à-vis the composition of their balance sheets, that relative interest rates must change, as has been underlined by Howells (1995). But, as pointed out by Lavoie (1999:108), the fact that changes in interest rates are required to reshuffle portfolios was never seriously questioned by Horizontalist post-Keynesians.[29] What is denied is that there exists a necessary positive relationship between interest rates on one hand, and the volume of loans or income on the other. For this reason, it is best to assume that the supply curve of credit is horizontal in the credit/interest rate space, i.e., the best simplification is that of Horizontalism.

CONCLUSION

I have here been advocating a method put forth by Wynne Godley. I believe that much progress in the comprehension of monetary phenomena can be achieved by systematically using balance-sheet matrices and transactions-flow matrices, which insure that nothing has been left out hanging in the air and that all interdependences have been taken into account. This method at long last should bring a better understanding of the monetary circuit of production. It should help to understand what are the exact roles of credit and monetary aggregates, and of liquidity preference in contrast to the propensity to save, within an endogenous money approach.

No doubt, controversies will remain between various authors operating in the non-orthodox traditions, but hopefully the recommended accounting framework will help all those involved to be more careful in their claims and to settle their differences faster. It should become possible to associate divergent views with alternative ways of modelling behaviour and time, and with the choice of different sets of variables.

REFERENCES

Backus, David, William C. Brainard, Gary Smith, and James Tobin. 1980. "A Model of U.S. Financial and Nonfinancial Economic Behavior." *Journal of Money, Credit, and Banking* 12 (2), May: 259-293.

Bertocco, Giancarlo. 2001. "Is Kaldor's Theory of Money Supply Endogeneity Still Relevant?" *Metroeconomica* 52 (1), February: 95-120.

Boulding, Kenneth E. 1944. "A Liquidity Preference Theory of Market Prices" *Economica* 11, May: 55-63.

Brainard, William C., and James Tobin. 1968. "Pitfalls in Financial Modelling." *American Economic Review* 58 (3), May: 99-122.

Chaîneau, André. 1977. *La mécanique de l'équilibre économique* . Paris, France: Presses Universitaires de Paris.

Chick, Victoria. 1981. "On the Structure of the Theory of Monetary Policy." In Currie, D., R. Nobay, and D. Peel, eds. *Macroeconomic Analysis: Essays in Macroeconomics and Econometrics* . London: Croom Helm.

Chick, Victoria. 1983. *Macroeconomics After Keynes: A Reconstruction of the General Theory* . London: Philip Allan.

Chick, Victoria. 1995. "Is There a Case for Post Keynesian Economics?" *Scottish Journal of Political Economy* 42 (1), February: 20-36.

Coghlan, Richard. 1978. "A New View of Money." *Lloyds Bank Review* , July: 12-27.

Dalziel, Paul. 1996. "Central Banks and Monetary Control When Credit-Money Finances Investment." *Économies et Sociétés* 30 (2-3), February-March: 117-136.

Davidson, Paul. 1982. *International Money and the Real World* . London: Macmillan.

Denizet, Jean. 1969. *Monnaie et Financement: Essai de Théorie Dans un Cadre de Comptabilité Économique* . Paris: Dunod.

Dow, Sheila C. 1986. "Speculation and the Monetary Circuit with Particular Attention to the Euro-Currency Market." *Économies et Sociétés* 20 (8-9), August-September: 95-110.

Dow, Sheila C. "Endogenous Money." In Harcourt, G. C., and P.A. Riach eds. *A Second Edition of The General Theory* , volume 2. London: Routledge.

Eichner, Alfred S. 1986. *Toward a New Economics: Essays in Post-Keynesian and Institutionalist Theory* . Armonk: M.E. Sharpe.

Franke, Reiner, and Willi Semmler. 1991. "A Dynamical Macroeconomic Growth Model with External Financing of Firms: A Numerical Stability Analysis." In Nell, E.J. and W. Semmler eds. *Nicholas Kaldor and Mainstream Economics: Confrontation or Convergence?* London: Macmillan.

Godley, Wynne. 1996. "Money, Finance and National Income Determination: An Integrated Approach." Working Paper no. 167. Annandale-on-Hudson, N.Y.: The Jerome Levy Economics Institute.

Godley, Wynne. 1999. "Money and Credit in a Keynesian Model of Income Determination." *Cambridge Journal of Economics* 23 (2), April: 393-411.

Godley, Wynne. 1999. *Seven Unsustainable Processes: Medium-Term Prospects and Policies for the United States and the World* . Special Report. Annandale-on-Hudson, N.Y.: The Jerome Levy Economics Institute.

Godley, Wynne. 2000. *Monetary Economics* . Manuscript. Annandlae-on-Hudson, N.Y.: The Jerome Levy Economics Institute, February.

Godley, Wynne, and Francis Cripps. 1983. *Macroeconomics* . London: Fontana.

Goodhart, Charles A. E.1984. *Monetary Theory and Practice: The UK Experience* . London: Macmillan.

Goodhart, Charles A. E. 1989. "Has Moore Become too Horizontal." *Journal of Post Keynesian Economics* 12 (1), Fall: 29-34.

Graziani, Augusto. 1984. "The Debate on Keynes's Finance Motive." *Monte dei Paschi di Siena Economic Notes* 1: 5-33.

Graziani, Augusto. 1990. "The Theory of the Monetary Circuit." *Économies et Sociétés* 24 (6), June: 7-36.

Hicks, John. 1989. *A Market Theory of Money* . Oxford: Clarendon Press.

Howells, Peter G. A. 1995. "The Demand for Endogenous Money." *Journal of Post Keynesian Economics* 18 (1), Fall: 89-106.

Howells, Peter G. A. 1997. "The Demand for Endogenous Money: A Rejoinder." *Journal of Post Keynesian Economics* 19 (3), Spring: 429-436.

Howells, Peter G. A. 1995. "The Source of Endogenous Money." *Economic Issues* 4 (1), March: 101-112.

Kaldor, Nicholas. 1982. *The Scourge of Monetarism* . Oxford University Press.

Keynes, John M. 1936. *The General Theory of Employment, Interest and Money* . London: Macmillan.

Lavoie, Marc. 1984. "Un Modèle d'Économie Monétaire Fondé Sur la Théorie du Circuit." *Économies et Sociétés* 18 (4), April: 233-258.

Lavoie, Marc. 1985. "Credit and Money: The Dynamic Circuit, Overdraft Economics, and Post Keynesian Economics." In Jarsulic, M. ed. *Money and Macro Policy* . Boston: Kluwer-Nijhoff, 63-84.

Lavoie, Marc. 1986. "Minsky's Law or the Theorem of Systemic Financial Fragility." *Studi Economici* 29: 3-28.

Lavoie, Marc. 1992. *Foundations of Post-Keynesian Economic Analysis* . Edward Elgar: Aldershot.

Lavoie, Marc. 1996. "Horizontalism, Structuralism, Liquidity Preference and the Principle of Increasing Risk." *Scottish Journal of Political Economy* 43 (3), August: 275-300.

Lavoie, Marc. 1999. "The Credit-Led Supply of Deposits and the Demand for Money: Kaldor's Reflux Mechanism as Previously Endorsed by Joan Robinson." *Cambridge Journal of Economics* 23 (1), January: 103-114.

Lavoie, Marc, and Wynne Godley. 2000. "Kaleckian Models of Growth in a Stock-Flow Monetary Framework: A Neo-Kaldorian Model." Working Paper no. 302. Annandale-on-Hudson, N.Y.: The Jerome Levy Economics Institute.

Lintner, John. 1977. "Comment" In Altman, E. I., and A.W. Sametz, eds. *Financial Crises: Institutions and Markets in a Fragile Environment* . New York: John Wiley & Sons: 204-209.

Minsky, Hyman P. 1975. *John Maynard Keynes* . New York: Columbia University Press.

Moore, Basil J. 1988. *Horizontalists and Verticalists: The Macroeconomics of Credit Money* . Cambridge: Cambridge University Press.

Moore, Basil J. 1997. "Reconciliation of the Supply and Demand for Endogenous Money." *Journal of Post Keynesian Economics* 19 (3), Spring: 423-428.

Mosler, Warren, and Matthew Forstater. 1998. "A General Framework for the Analysis of Currencies and Commodities." In Davidson, Paul, and Jan Kregel eds. *Full Employment and Price Stability in a Global Economy* . Cheltenham: Edward Elgar.

Moudud, Jamee K. 1999. "Finance in Classical and Harrodian Cyclical Growth Models." Working Paper no. 290, Annandale-on-Hudson, N.Y.: The Jerome Levy Economics Institute.

Parguez, Alain. 1975. *Monnaie et Macroéconomie: Théorie de la Monnaie en Déséquilibre* . Paris: Économica.

Rochon, Louis-Philippe. 1999. *Credit, Money and Production: An Alternative Post-Keynesian Approach* . Cheltenham: Edward Elgar.

Rochon, Louis-Philippe, and Matias Vernengo, eds. 2001. *Credit, Interest Rates and the Open Economy: Essays on Horizontalism.* Cheltenham: Edward Elgar.

Romer, David. 2000. "Keynesian Macroeconomics Without the LM Curve." *Journal of Economic Perspectives* 14 (2), Spring: 149-169.

Sawyer, Malcolm. 2000. "The Kaleckian Analysis of Money." Working Paper, University of Leeds, May.

Seccareccia, Mario, and Marc Lavoie. 2001. "Long Term Interest Rates, Liquidity Preference and the Limits of Central Banking." Working Paper. University of Ottawa.

Tobin, James. 1969. "A General Equilibrium Approach to Monetary Theory." *Journal of Money, Credit, and Banking* 1 (1), February: 15-29.

Tobin, James. 1982. "Money and Finance in the Macroeconomic Process." *Journal of Money, Credit, and Banking* 14 (2), May: 171-204.

Wolfson, Martin H. 1996. "A Post Keynesian Theory of Credit Rationing." *Journal of Post Keynesian Economics* 18 (3), Spring: 443-470.

Wray, L. Randall. 1992. "Alternative Theories of the Rate of Interest." *Cambridge Journal of Economics* 16 (1), March: 69-91.

Wray, L. Randall. 1995. "Keynesian Monetary Theory: Liquidity Preference or Black Box Horizontalism?" *Journal of Economic Issues* 29 (1), March: 273-280.

Table 1: Growth model with private debt

	Households	Firms		Banks		Σ
		Current	Capital	Current	Capital	
Consumption	$-C_d$	$+C_s$				0
Investment		$+I_s$	$-I_d$			0
Wages	$+W_s$	$-W_d$				0
Net Profits	$+F_D$	$-(F_U + F_D)$	$+F_U$			0
Interest on loans		$-r_l.L_{d(-1)}$		$+r_l.L_{s(-1)}$		0
Interest on deposits	$+r_m.M_{d(-1)}$			$-r_m.M_{s(-1)}$		0
Δ in loans			$+\Delta L_d$		$-\Delta L_s$	0
Δ in money	$-\Delta M_d$				$+\Delta M_s$	0
Issue of equities	$-\Delta e_d.p_e$		$+\Delta e_s.p_e$			0
Σ	0	0	0	0	0	0

Table 2: Step 2 of the monetary circuit with private money

	Households	Firms		Banks		Σ
		Current	Capital	Current	Capital	
Consumption						0
Investment		$+I_s$	$-I_d$			0
Wages	$+W_s$	$-W_d$				0
Net Profits						0
Interest on loans						0
Interest on deposits						0
Δ in loans			$+\Delta L_d$		$-\Delta L_s$	0
Δ in money	$-\Delta M_d$				$+\Delta M_s$	0
Issue of equities						0
Σ	0	0	0	0	0	0

Table 3: Introducing household debt for speculative purposes

	Households	Firms		Banks		Σ
		Current	Capital	Current	Capital	
Δ in loans	$+\Delta L_h$		$+\Delta L_f$		$-\Delta L_s$	0
Δ in money	$-\Delta M_d$				$+\Delta M_s$	0
Issue of equities	$-\Delta e_d.p_e$		$+\Delta e_s.p_e$			0

Table 4: Transaction matrix with government debt

	Households	Firms	Government	Central bank		Σ
				Current	Capital	
Consumption	$-C$	$+C$				0
Government expenditures		$+G$	$-G$			0
GDP (wages and profits of firms)	$+Y$	$-Y$				0
Interest payments	$+r.B_{h-1}$		$-r.B_{-1}$	$+r.B_{cb-1}$		0
Central bank profits			$+r.B_{cb-1}$	$-r.B_{cb-1}$		0
Taxes	$-T$		$+T$			0
Change in money	$-\Delta H$				$+\Delta H$	0
Change in bills	$-\Delta B_{h}$		$+\Delta B$		$-\Delta B_{cb}$	0
Σ	0	0	0	0	0	0

Table 5: Step 2 of the monetary circuit with a government deficit

	Households	Firms	Government	Central bank		Σ
				Current	Capital	
Consumption						
Government expenditures		$+G$	$-G$			0
GDP (wages and profits of firms)	$+Y$	$-Y$				0
Interest payments						
Central bank profits						
Taxes	$-T = -\theta Y$		$+T$			0
Change in money	$-\Delta H$				$+\Delta H$	0
Change in bills			$+\Delta B$		$-\Delta B_{cb}$	0
Σ	0	0	0		0	0

Table 6: The balance sheet of Godley's (1999) banks

Assets	Liabilities
Loans to firms	Demand deposits
Treasury bills	Time deposits
Cash reserves	

1. However, as Chick (1981: 187) points out, in his earlier portfolio models Tobin did not fully integrate the flow and the stock dimensions, because "substitution between money and consumer goods is not permitted. Consumption belongs to the flow sector of the model and is insulated from capital-accounts events". In later models, the integration was left rather vague.

2. Such an integration of financial transactions with real transactions, within an appropriate set of sectors, was also advocated by Gurley and Shaw (1960, ch. 2).

3. Similarly, the better-known balance-sheet matrix may also be put in place, although, the zeros-sum requirement is replaced by the requirement that the total of the rows and the total of the columns sum to the value of production capital.

4. This view of liquidity preference, and its associated determination of the rate of interest can be found in Boulding (1944), as shown by Wray (1992).

5. The adding up constraint is simply that the sum of the demand functions for money and other financial assets ought to equal expected wealth, i.e., the *proportions* in which the various assets are desired must sum to one.

6. The adding up constraint in this case is that the sum of money and equities ought to equal wealth.

7. Note that it is assumed as well that the new fixed investment goods have not yet been sold to the corporations which ordered them.

8. There is some resemblance with Moore's (1997: 426) point that "depositors can only 'supply' banks with deposits if they have somehow previously acquired them".

9. This assumption can be found in Godley (1996: 18): "It is assumed that mistaken expectations about disposable income turn up as differences in holdings of [money deposits] compared with what was targeted". Any revision must be done in the next period.

10. Still, this is precisely the claim made by Moudud (1999: 13).

11. I made the same claim when I wrote that: "The outstanding stock of bank advances and the demand for bank deposits cannot be considered to be independent variables" (Lavoie 1999: 106).

12. Howells (1999) also provides the example of the UK housing market in the 1980s.

13. All sorts of complications could be added to this framework. Firms could be holding money deposits as a certain proportion of their sales; banks could be purchasing equities issued by firms, and so on.

14. This seems like a rather exaggerated statement: one would expect the increase in the total value of equities to increase by the additional amount of funds being injected in the stock market, whereas here the claim is that the additional funds injected through bank credit will generate an equal increase in the value of *new* equities and hence a multiple increase in the *total* value of equities. Such a result arises from the extreme assumptions being entertained, in particular the assumption that households, overall, will not accept any increase in their money balances. As all households attempt to get rid of the money balances they have acquired by selling equities to the speculators, equity prices shoot up. Under a less severe assumption, such as the one proposed in equations (3) and (4), overall bank loans will increase as a result of speculative borrowing, and the borrowing requirements of the production sector will not fall one-for-one with the increase in speculative household borrowing.

15. As Hicks (1989: 85) put it: "[The successful speculator] has a security against which he can borrow, then perhaps using the proceeds of the loan to buy more shares. Thus a speculative boom is built up. Where does the money come from to support it? The answer, as economists are now well aware (though it took them much trouble to find it), is that the market as a whole, meaning by that the total of all those who are dealing on the market, ... is willing to hold less of its assets in monetary form than it was before the boom started".

16. I have presented a brief rebuttal of these assertions (Lavoie 1996), and Bertocco (2001) shows in great detail that Kaldor took credit rationing into account.

17. See Lavoie (1992: 177) and (1996: 287) for a brief similar argument.

18. A similar distinction is made by Davidson (1982: 48-49) when he refers to *construction finance* and *investment funding* .

19. A similar argument was already made in Lavoie (1985: 76), but without the strength of the matrix approach advocated here.

20. The model of Table 4 is basically Model 2 of Godley (2000), with the explicit addition of a central bank.

21. The bonds cannot be sold to commercial banks since such banks are not part of the (simple) model.

22. See Seccareccia and Lavoie (2001) for some empirical analysis.

23. Rochon (1999) presents an extended analysis of the issues at stake between Structuralists and Horizontalists. See also Rochon and Vernengo (2001) for essays extending the Horizontalist perspective.

24. See Lavoie (1996) for a reconciling survey of these debates.

25. Obviously, such a norm cannot exist in pure overdraft financial systems, where no Treasury bills exist and where banks hold no liquid safe assets. Also, I am not convinced that such a norm exists in a banking world dominated by liability management, but for the sake of the experiment I shall assume the relevance of such a secondary liquidity ratio.

26. This mechanism would seem to be in line with the empirical evidence brought out by Eichner (1986, ch. 5), who shows that interest rates on loans rise when the loans to deposits ratio falls compared to its trend value. But such a relationship could have no behavioural foundation; it could simply be the result of the means by which the central bank imposes a hike in the Treasury bill rate (Lavoie 1996: 290).

27. This follows a correspondence between the author and Wynne Godley, in September 1999.

28. This is also, in my view, the message of Godley (1999a), when analysing whether recent American fiscal policy is compatible with sustainable growth.

29. See for instance Lavoie (1984: 243-244, 251-252), where an interest rate adjustment affecting lending rates, not much different from Dow's (1996), is being proposed when households desire to hold a larger proportion of their assets in the form of money balances, or when they desire to hold a larger proportion of their assets in the form of government-issued bonds.