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Some Simple, Consistent Models of the Monetary Circuit

by

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INTRODUCTION

The Theory of the Monetary Circuit (*TMC*) has received a growing interest among post-Keynesians in the last two decades. New developments have recently appeared from contributors to the two conferences in honor of Augusto Graziani,[1] and a detailed analysis has recently appeared in Graziani (2003), where this approach is compared both to the classical and neoclassical tradition, and to other post-Keynesian approaches.

In this paper, following Lavoie (2004), we investigate the implications for TMC models of laying down the corresponding set of stock-flow accounting, which must imply that every monetary flow comes from somewhere and goes somewhere, so that there are no "black holes"[2]. As the accounting is analyzed, it appears that several, if not all, contributors to the TMC fail to take properly into account how banks' profits can be spent in the goods or the financial markets: in several models, interest payments on loans made from firms to banks are not accounted as part of national income, and simply disappear, instead of being treated as a possible source of demand for goods and/or financial assets. By ignoring the accounting and behavioral implications of interest payments, TMC models are usually characterized by a "Paradox of profits": in a pure credit economy and considering a single production period, if firms receive an initial loan M to cover for their current expenditure, by selling goods and financial assets they can at most recover the amount of money M being injected into the economy at the beginning of the period. Firms can therefore pay back the principal to banks at the end of the period, but will not possibly have enough liquidity to pay for interests, unless (a) they pay interest in kind, or (b) at the end of the production period they remain indebted with banks, by an amount equal to interest payments.

In our view, this result depends on interest payments disappearing from income or stock-flow accounting, and we will show how simple TMC models can be made consistent on this respect. In our approach, the TMC will also be reconciled with the Godley and Cripps (1983) approach, which laid the foundation for Godley's developments in stock-flow consistent modelling in the post-Keynesian tradition.

A further important point of TMC is related to whether investment is financed entirely from retained profits, and by issuing equities, or whether firms obtain additional loans from banks to finance investment. We will show that the distinction is not straightforward for the production sector as a whole, since an increase in demand for capital goods which is perfectly

anticipated from firms producing capital goods will imply an equivalent increase in costs of production for this sector, and hence an increase in the initial loan required from banks.

In section 1 we present the simplest possible model of the Monetary Circuit, to recall the major hypothesis and results for this approach, and we show in section 2 how to modify the approach in the literature to deal with interest payments. In section 3 we discuss implications of our approach, and compare our simple TMC model with consistent stock-flow models *a la* Godley. In section 4 we extend the model to an economy with two productive sectors, laying down the "paradox of profits" in greater detail. Section 5 summarizes and concludes.

1. THE SIMPLEST TRADITIONAL MONETARY CIRCUIT

Let us consider the simplest[3] possible model of the TMC, namely that of a single production period in a pure credit economy with no government[4]. A central idea of this approach is that real wages are paid in advance, and this requires firms to have enough liquidity <u>before</u> production occurs. Firms therefore need to obtain an initial loan (L_0), equal to the wage bill (*W*).

$$L_0 = W \tag{1}$$

Money, in the form of bank deposits, is created as soon as firms pay wage earners. When production is complete, wage earners may either buy consumption goods (*C*), or save, increasing their stock of financial assets (*V*). The budget constraint of households is thus

$$W = C + \Delta V \tag{2}$$

Let us assume that only two forms of financial assets exist: namely, equities (*E*) issued by firms to finance investment, and bank deposits (*D*). Therefore it must be the case that

$$\Delta V = \Delta E + \Delta D \tag{3}$$

At the end of the production period, firms pay back the initial loan, plus interests. Firms receipts are given by sales of consumption goods plus sales of investment goods (*I*). Firms profits (*Π*), net of expenditure on capital goods, are thus given by

$$\Pi = C + I - W - rL \tag{4}$$

where rL is interests paid on loans. Using (3) and (2) into (4) we obtain

$$\Pi = W - \Delta E - \Delta D + I - W - rL \tag{5}$$

If investment is entirely financed by issuing equities

$$I = \Delta E \qquad\qquad (6$$

Using (6) into (5) we get

$$\Pi = -\Delta D - rL \qquad\qquad (7$$

The best possible situation for firms is when households invest all of their savings into equities, so that $\Delta D = 0$, investment decisions can be financed entirely by issuing equities, and profits (net of investment expenditure) are zero. If this is the case, at the end of the production period firms will have enough liquidity to pay back the initial loan, but <u>no liquidity to pay for interests</u>. This is a very simple version of the "profit paradox" of the TMC[5].

Proposals for solving the profit paradox have recently been reviewed in Parguez (2003), but none seemed entirely satisfactory, since at least two more contributions[6] appeared later, addressing the same topic.

2. THE SIMPLEST CONSISTENT MONETARY CIRCUIT

A simpler solution can be obtained by treating interest payments consistently. If we want to keep the model within a single production period, the only rationale for banks asking for interest payments is either to pay for their "costs of production," namely wages, or to distribute profits to bank owners, or to cumulate wealth, and since we can rule out that banks cumulate wealth in the form of their own deposits, we can safely assume that any level of undistributed profits obtained by the banking sector is used entirely to purchase equities.

The <u>ex-post</u> accounting for this simple model is reported in Table 1. Table 1 is organized, following Stone (1966), so that monetary payments from a sector are recorded in a column, while rows record receipts. Including a row and a column for transaction on capital account, accounting consistency requires that the total for each row to be equal, ex-post, to the total for the corresponding column, yielding a system of accounting identities, one of which is linearly dependent from the others.

Table 1. Social Accounting Matrix – Model 1: The Simplest Monetary Circuit					
	Firms	**Households**	**Banks**	**Capital Account**	**Total**
1. Firms		C		I	S
2. Households	W		Wb $(+rD)$		Yh
3. Banks	rL				Yb
4. Capital account	Π	ΔV	Πb		SAV
Total	S	Yh	Yb	I	

Comparing the second row and column in Table 1, households budget constraint is now given by

$$W + Wb = C + \Delta V \tag{8}$$

While banks profits are given, in the third row and column, by[7]

$$\Pi b = rL - Wb \tag{9}$$

Table 2 reports the ex-post flow of funds related to flow accounting in Table 1.

Table 2. Flow of funds for Model 1				
	Firms	**Households**	**Banks**	**Total**
Deposits		$+\Delta D$	$-\Delta D$	0
Loans	$-\Delta L$		$+\Delta L$	0
Equities	$-\Delta E$	$+\Delta Eh$	$+\Delta Eb$	0
Capital	$+I$			$+I$
Total	Π	$+\Delta V$	$+\Pi b$	

Demand for equities arises from household savings and banks' profits

$$\Delta E = (\Delta V - \Delta D) + \Pi b \tag{10}$$

If we look at the budget constraint of banks, in the third column of Table 2, we will see that our assumption behind (10) implies that the end-of-period increase in the stock of loans will exactly match the end-of-period increase in the stock of banks deposits. We will turn to this issue later.

If we keep our assumption that investment is entirely financed by issuing equities, the value of firms' profits is given by

$$\Pi = C + I - W - rL \tag{11}$$

And using our assumptions in (8) and (9), and the definition of bank profits in (10)

$$\Pi = (W + Wb - \Delta V) + (\Delta V - \Delta D) + (rL - Wb) - rL \tag{11}$$

And simplifying,

$$\Pi = - \Delta D \tag{12}$$

So that, if households' demand for new bank deposits is zero, $\Delta D = 0$, firms' receipts from sales are sufficient to pay back the initial loan *plus* interests. Consistency implies that interest payments are made in advance, so that the initial loan firms require covers both the wage bill *and* interest payments, namely[8]

$$L_0 = W + rL \tag{13}$$

As Parguez (2003) notes, a solution to the paradox of profits requires the rejection of one of the postulates of the TMC, namely that in a pure credit economy firms require an initial loan equal to the wage bill.

At the end of the production period, under the assumptions that supply equals demand for both sectors, firms recover entirely the amount of money they borrowed at the beginning of the production period: all loans are extinguished, including the payment of interests. There is no shortage of liquidity for the payment of interests on the initial loan, and monetary profits are exactly equal to investment.

If the demand for bank deposits increases, firms will not be able to recover enough liquidity from sales and equities to pay back their initial loan entirely, and at the end of the production period the stock of firms' debt will be exactly equal to the amount of bank deposits. Loans create deposits, in the sense that in this credit economy money is injected into the system by an initial loan made from banks to firms, and the liquidity transferred from firms to households will generate a stock of deposits which is always equal, in any instant of the production period, to the outstanding stock of loans. But deposits determine loans at the end of the period, since if households decide to keep their savings in the form of bank deposits, rather than purchasing equities, firms will remain indebted towards banks by an amount which is exactly equal to households desired holdings of bank deposits. In our approach, deposits determine loans in a way which is entirely different from the "conventional" view, where the single bank is allowed to lend money only when it has collected deposits from households. As Graziani (2003) and other circuitists note, while this is true for the single bank, it cannot be true for the banking system as a whole.

In our view, by neglecting a proper representation of the accounting of their model, most circuitists fail to see that interest payments on loans constitute a source of income for

banks which will be used in a way consistent with the model. Graziani comes very close to making this point. When analyzing the payment of interests on loans he first states that "if the only liquidity in existence originates from bank loans, the firms, by selling commodities and issuing securities, will at best get back the money they have initially spent. This means that firms will be able at best to repay the principal but not the interest on the loans granted them by banks."[9] But immediately afterwards he states "The interest payments that the banks receive from firms are partly used to cover current costs (such as wages and salaries to employees), and partly are net profits to be used for purchasing real goods"[10]. Therefore, interest payments made from firms to banks imply a further monetary payment from banks (or bank owners) to firms for purchasing goods. The payment of interests implies that banks acquire part of firms production, but does not imply that interests are paid "in kind." Graziani does not pursue his own point to its conclusions, as we have suggested in our simple model, and when presenting formal models in his latest contribution he neglects net bank profits when specifying either disposable income or demand for equities.

3. SOME FURTHER RESULTS

On Banks' Behavior

Our result about the end of period stock of firms' debt changes if we modify our assumption about banks' behavior, so that demand for equities from banks is given by bank liquidity, e.g. profits *plus* the increase in banks' deposits[11]. Looking again at banks' budget constraint in Table 2, we can verify that this assumption implies that the end of period stock of loans will always be zero. If this is the case, at the end of the production period firms will always be able to pay back the initial loan plus interests, and money disappears entirely: wealth is cumulated only in the form of equities.

On Households' Behavior

In our simple model, we implicitly adopted that consumption and savings decisions are based on current income. However, the only possible rationale for an increase in households' holdings of bank deposits is given by an increase in future consumption. If this is the case, consistency would require that current consumption decisions be based both on current income and on past cumulated savings. This would alleviate the finance problem for firms,

since in each period they will recover at least part of the liquidity which was "missing" in previous periods of production.

Moreover, we believe that even when modelling a single production period, it should be assumed an initial stock of wealth for some sectors, such as land or "capital" owned by firms. By providing loans to firms, banks will therefore be able to appropriate either part of the current production of goods, or part of the existing stock of wealth.

Using a single period of production may be appropriate to outline the basic principles of the TMC, but proper models for monetary economies should be developed in a dynamic context.

A Post-Keynesian Version

It would be reasonably simple to modify our model along post-Keynesian lines, splitting the households sector into wage earners, who spend all of their income, and firms' owners, who have a positive propensity to save. Results would not change as far as the paradox of profits is concerned, provided that interest payments on bank deposits, and banks' distributed profits, are properly taken into account in determining households disposable income.

TMC, Say's Law And The Keynesian Approach

At a first look, the TMC outlined here may resemble the neoclassical approach, where it is savings decision to determine investment, rather than the Keynesian approach of effective demand, where investment decisions determine the level of output. As shown in our accounting in Tables 1 and 2, investment needs to be financed by issuing equities, and demand for equities ultimately arises from savings, so it may seem that saving decisions ultimately determine investment.

Even though we consistently used the assumption that supply equals demand, we believe TMC to be compatible with a Keynesian approach: assuming that firms have excess capacity, an increase in investment will stimulate an equal increase in the production of capital goods. This will in turn require an increase in the wage bill for the capital goods sector, and an equivalent increase in loans demanded by this sector. The increase in the wage bill will stimulate production in the consumption goods sector, following the standard multiplier effect. TMC is thus entirely Keynesian in spirit, but stresses that increases in

production, generated by a rise in effective demand, may be constrained by credit rationing, if firms pay real wages in advance.

The Simplest Monetary Circuit With Disequilibrium

Analysis of our accounting in Tables 1 & 2 makes it possible to compare the TMC approach with that in Godley and Cripps (1983), where demand for bank loans is assumed to depend on changes in the stock of inventories.

To show how, let us drop our assumption, which is common to most simple models of the Monetary circuit, that demand equals supply. We assume instead that households unexpectedly decide to save part of their income in the form of bank deposits. Firms producing consumer goods will see their inventories increasing by an amount which is exactly equal to the unexpected savings of households, and will not be able to recover entirely the initial loan obtained from banks at the beginning of the production period.

At the end of the period, therefore, firms' debt with banks is increased exactly by the increase in the amount of deposits held by households, and is also exactly equal to the (unexpected) increase in inventories.

This result, in our view, clearly shows the similarity between TMC approach to credit, and that adopted in the works by Godley[12]: while in the former approach the emphasis is on the initial loan granted from banks, in the latter the emphasis is on the end-of-period value of stocks, but the two approaches are entirely compatible[13].

4. A TWO SECTOR MODEL

To enrich our discussion of investment and the determination of profits in the TMC, we now move to a Neo-Kaleckian approach, according to the taxonomy proposed by Parguez (2003). Namely, we split firms into a sector producing consumption goods, and a sector producing investment goods. We begin our analysis following the model in Rochon (2003), namely that firms do not issue equities, and finance investment only through profits, but we modify Rochon's model to treat interest payments on loans consistently as in our simpler model, and we therefore assume that the initial loan demanded is given by the real wage bill plus interests.

Table 3. Social Accounting Matrix – Model 2: a two sector model							
	Firms		Households		Banks	Capital account	Total
	Cons.goods	Inv. goods	Wage e.	Bank owners			
1. Cons.goods			*C*				*C*
2. Inv. goods						*Ic+Ii*	*I*
3. Wage earners	*Wc*	*Wi*					*W*
4. Bank owners					*Fb*		*Yhb*
5. Banks	*r·Lc*	*r·Li*					*Yb*
6. Capital account	*Πc*	*Πi*	*Sh*		*Πb*		*Sav*
Total	*Yc*	*Yi*	*Yh*		*Yb*	*I*	

Table 4. Flow of funds for Model 2					
	Firms		Households	Banks	Total
	Cons.goods	Inv. goods			
Deposits			*+ΔD*	*-ΔD*	*0*
Loans	*-ΔLc*	*-ΔLi*		*+ΔL*	*0*
Equities	*-ΔEc*	*-ΔEi*	*+ΔEh*	*+ΔEb*	*0*
Capital	*+Ic*	*+Ii*			*+I*
Total	*Πc*	*Πi*	*Sh*	*Πb*	

Model accounting is now summarized in Table 3 for flows, and Table 4 shows the corresponding allocation of savings to financial assets and physical capital. To make our analysis as close as possible to that in Rochon (2003), let us assume first that firms do not issue equities, and that banks distribute all of their profits. Households' savings will therefore take the form of an increase in the stock of banks deposits.

If banks distribute all of their profits ($\Pi b = 0$), distributed profits will be given by row and column 5 in Table 3:

$$Fb = r·Lc + r·Li \tag{14}$$

Assuming that wage earners and bank owners have the same propensity to save we can consolidate rows 3 & 4, and the corresponding columns, to obtain demand for consumption goods:

$$C = Wc + Wi + Fb – Sh \tag{15}$$

Profits in the consumption and investment sector will be given by rows and columns 1 & 2, respectively:

$$\Pi c = C - r·Lc – Wc \tag{16}$$

$$\Pi i = Ic + Ii \text{ - } r{\cdot}Li – Wi \qquad\qquad (17$$

Using (14) and (15) in (16) we obtain

$$\Pi c = Wi + r{\cdot}Li – Sh \qquad\qquad (18$$

The hypothesis in Rochon that firms investment is given by profits implies

$$Ic = \Pi c \qquad\qquad (19$$

$$Ii = \Pi i \qquad\qquad (20$$

Using (18) and (19) in (17) we get

$$\Pi i = - Sh + Ii \qquad\qquad (21$$

If households spend all of their income ($Sh = 0$), at the end of the production period firms in the consumer goods sector will recover enough liquidity to pay back the initial loan plus interests, and will have positive profits to cover for investment. Demand for capital goods from this sector will have a value exactly equal to costs of production in the investment goods sector, which will be able to pay back its initial loan. However, comparing (20) and (21) it becomes apparent that investment in the capital goods sector remains undetermined: the assumption that firms in this sector invest all of their profits is inappropriate, since profits in this sector are ultimately given by investment in the same sector, so that the equations hold for any level of investment. We must drop equation (20), and keep investment in this sector as exogenous, to determine profits in this sector.

$$Ii = Ii* \qquad\qquad (20'$$

If households' saving is positive, profits in the consumer goods sector will be lower by an amount equal to saving, and profits will however be positive as long as

$$Sh < Wi + r{\cdot}Li$$

Sales of investment goods will be lower, and the capital goods sector will not be able to recover enough liquidity to reimburse the initial loan. At the end of the production period the increase in the stock of banks deposits will equal the increase in the outstanding debt of firms, as in our simpler model.

Let us now allow firms to issue equities to finance investment. Equations (19) and (20')[14] need to be changed into

$$Ic = \Pi c + \Delta Ec \qquad\qquad (19'$$

10

$$\Delta Ei = Ii* \tag{20''}$$

We may also assume that banks distribute only a share γ of their profits, and cumulate wealth by acquiring equities. We will have

$$Fb = \gamma \cdot (r \cdot Lc + r \cdot Li) \tag{14'}$$

$$\Delta Eb = (1-\gamma) \cdot (r \cdot Lc + r \cdot Li) \tag{22}$$

The model may now be closed with appropriate assumptions on households and banks demand for financial assets, given their relative rate of return.

It remains true, as in our simpler model, that, if households' demand for banks deposits increases, firms will not recover the initial loan plus interests from sales in the goods or the financial market, unless we modify our equation (22) for banks behavior, allowing banks to convert any increase in deposits to an increase in their demand for equities.

A more complex model including a central bank and the government sector, which we believe to be entirely compatible with this approach, can be developed along the lines in Zezza and Dos Santos (2004), where it is shown that the major features of the TCM approach, and in particular the endogeneity of money, are maintained.

5. CONCLUSIONS

In this paper we have addressed some puzzles in the Monetary Theory of Production, or Monetary Circuit, namely the determination of aggregate profits within a single period of production when firms have to pay interests on an initial bank loan.

We have shown that the "profit paradox" disappears when one of the postulates of TMC is dropped, i.e. that the initial loan required to start the production process is equal to wages, and it is assumed instead that the initial loan covers interest payments as well as wages. Our assumption is required consistent modelling of the banking sector: if interest payments are obtained, they must be used within the production period either for purchasing goods or to acquire financial assets.

We have examined the implications of our approach to TMC: a first major point is that, if households' have a positive demand for bank deposits, this implies that consumption and saving decisions must depend on cumulated wealth, and that the analysis of a single production period becomes inappropriate. We also showed how the TMC approach may be

reconciled with Keynesian and Kaldorian approaches, and we have shown the similarities with the stock-flow approach adopted, among others, by Godley.

We have finally extended our results to a two sectors model, showing that some hypothesis on investment decisions proposed in the TMC literature may be inappropriate.

We hope our contribution will help the development of robust post-Keynesian models compatible with the TMC approach.

ENDNOTES

[1] Arena and Salvadori (2004) ; Fontana and Realfonzo (forthcoming).

[2] Godley (1996).

[3] The model could be even simpler, but even less realistic, assuming that only consumption goods are produced. The core of our analysis would remain unchanged.

[4] See Graziani (2003) for a discussion of the differences among a barter economy, a credit economy and a monetary economy.

[5] I am grateful to Shaikh for pointing out — in comments on a previous draft — the similarities between the story behind the "paradox of profits" and the Schemes of Simple Reproduction in Marx. Several contributors to TMC pointed out the similarities with the analysis in Marx: we believe our approach to be applicable to this category of models as well, but we will not pursue this point furher in this contribution.

[6] Messori and Zazzaro (2003); Rochon (2003). The former contribution shows that either firms' debt with banks increases without limits, or that a given percentage of firms go bankrupt, and therefore do not reimburse their initial loan, while others earn profits. The latter paper solution depends on assuming that part of the initial loan is long-term, and does not require to be repaid in full at the end of the production period. We refer the interested reader to Parguez (2003) for a detailed review of different approaches. Lavoie pointed out — in a comment to a previous draft of this paper — that the same topics we are discussing were present in Lavoie (1987).

[7] If we assume that households' demand for bank deposits is positive, households obtain an additional source of income from interest payments on deposits. Such payments will reduce banks' profits by the same amount, so that changes in the interest rate on deposits in this simple model will affect the distribution of final demand between consumption and investment goods, but will not alter the value of liquidity that firms can recover by selling either consumer goods or equities.

[8] We can assume that interests are paid on the full amount of the initial loan. If this is the case, $L_0 = W/(1-r)$. Different assumptions will not change the story substantially. It is important to stress that, if we model a single monetary circuit, the rationale for getting interests on loans requires that interests can be used within the production period: whether they are paid in advance, or later, is irrelevant as long as bank owners can use the revenue from interest payments to acquire either goods or financial assets.

[9] Graziani (2003) pag. 118.

[10] Ibidem

[11] I am grateful to Messori for addressing this point in a comment on a previous draft. Messori notes that, if banks are able to obtain goods or equities in exchange for money created by opening a line of credit, they may also create money to acquire any level of

equities they desire to hold. In our view, addressing this point properly would require extending our model to define in detail how the market price of equities is determined. We simply note that, in our simpler approach, if we assume that firms finance their investment decisions by obtaining credit from banks, it does not matter whether credit is obtained by opening a line of credit on firms' deposits, or by selling equities to banks, but the amount of money created at the beginning of the circuit should depend on firms' decisions, which may or may not be met by adequate supply of funds from banks, but we don't see how banks can pump more money into the system over the amount which is demanded from firms.

[12] Godley and Cripps (1983)

[13] Lavoie (2004) has pursued this point. Cavalieri (2003), adopting a point of view critical of the circuitists approach, states that "In a circuit approach aimed at describing a circular process of creation, utilization and destruction of money, the possibility of using a stock-flow monetary framework … appears problematic."

[14] We still need to keep investment in the capital goods sector to be exogenous: if we revert to equation (20) investment and profits in this sector will still be undetermined with the addition of equities.

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