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Monetary Theory of Production.
A Classical-Circuitist Alternative Interpretation.

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ABSTRACT

Our aim in this paper is to offer an interpretation of what Keynes called a monetary economy of production, grounding our view on elements taken from the Theory of the Monetary Circuit and from the Classical Theory of production, as revived by Sraffa. The former provides a coherent explanation of the role of money and credit for the circulation of commodities, required for the expansion of the system. The second offers a sound view of the *real* side of an economic system for output, prices and its relation to distribution and modes of production.

Taking Edward Nell's lead, we assume a set of money channels through which money circulates in order to make possible the expansion of an economic system. This approach clarifies some of the interactions between the financial and real sides of an economic system.

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1. Introduction

In this paper we develop a wide-ranging viewpoint that takes under its belt the Classical theory of production as revived by Sraffa and the Theory of the Monetary Circuit (TMC from here onwards), associated with Parguez and Graziani, amongst others. Our aim is to provide a theoretical framework for what Keynes called a monetary economy of production. To do so, we follow Nell's lead (cf. Nell, 1998, 2004).

On the one hand, Sraffa (1960) provides us with a sound theory of value built in the Classical theory of production (cf. for instance, Kurz and Salvadori, 1995). Although, monetary and financial issues are almost totally absent in that theoretical strand. On the other hand, the TMC provides a coherent description for how money puts the wheels of production in motion. Yet, prices and distribution are explained in a Kaleckian fashion, without making explicit references to production.

We contend that Keynes himself might be a feasible link between both theoretical strands. He provides an explanation for output quantities in Sraffian systems and also (more in the *Treatise* and his post General Theory writings in the *Economic Journal* than in the *General Theory*) anticipates some aspects which are central to the TMC. Nonetheless, we are more than aware of the problems involved in this task. Particularly troublesome, we believe, is that the Sraffian approach assumes a long period standpoint whilst Keynes' analysis, and that of a TMC, adopt a short period view. For this reason, we shall adopt what Nell (1998), chapter 10, suggests as a *benchmark equilibrium methodology*. This involves assuming an economic system placed in *normal* or *natural* positions. Firms have to determine prices and adopt investment

decisions in the light of the expected growth of output. The benchmark equilibrium serves as a guideline for current behaviour. Within this we are neither assuming that the economy fluctuates around a centre of gravity for output nor that firms always make the right predictions. It is simply an initial approximation to the real world taking this equilibrium position as a reference point. Thus short period analysis can be framed into a long period approach, with the former affecting the latter and *vice versa*.

2. The Theory of the Monetary Circuit

The central message of the TMC states that a bank (either private or the central one) creates money *ex nihilo* when it grants a credit to a creditworthy borrower (the government, a firm or an individual agent) to make a payment to a third agent. This is a balance sheet operation in which a bank simultaneously issues a liability (a bank deposit) and an asset (credit) on its own. Bank liability is an accepted means of payment by all members of the community. It commands purchasing power on the basis of existing and / or future wealth. Like the ebb and flow of the sea, it is created *at the borrower's order* and destroyed when the debt is paid back to the bank (cf. for instance, Graziani (2003) or Parguez and Seccareccia (2000) amongst others).

The TMC can be described as follows. For simplicity's sake, we start by assuming a closed capitalist economy in which three (groups of) agents exist: firms, workers (households) and a (private) bank. Production takes time and all economic activities are coordinated (i.e. all production processes start and finish on the same dates). Once all processes have finished, each firm has its output *at the plant's gate*. Commodities have to circulate before new processes can start.

- *Stage 1: Output decisions.* Once a production process has taken place, and before the next one can start, firms have to decide how much productive output should be produced, usually according to expected demand at *normal* prices. Such decisions also determine the amount of factors that should be hired (or purchased).
- *Stage 2: Monetary efflux*. A group of firms ask for a bank credit so a new production process can start. If banks consider that the collateral is adequate, credit claims will be accepted and borrowers will be provided with sufficient liquidity to make corresponding payments.
- *Stage 3: Monetary circulation*. Once some agents have access to liquidity, they can buy commodity inputs and hire labour to start new processes. So output starts to circulate and this spending provides other producers with the liquidity needed to purchase further commodities and so on.[2]
- *Stage 4*: *Monetary refflux*. After circulation, the initial borrowers should recoup the liquidity required to reimburse their banks loans. When debts are cancelled money is destroyed as both sides of the bank's balance sheet cancel each other out.
- *Stage 5*: *The collection of savings*. We have implicitly assumed that no leakage exists in the monetary circuit (i.e. neither households nor firms hoard money). This being the case, the initial borrowers capture all the liquidity that they introduced into the circuit to pay back bank debt through the sale of their produce. However, usually households save and some firms spend less on capital goods than what they receive from the sale of their output. When this happens, initial borrowers will not be able to recoup the

[2] Note that what circulates is output produced in t which is ow input tfor a process in period t+1.

liquidity needed to cancel their pending debts with the sale of their output. Here, two solutions to this problem can be highlighted: (i) firms may issue assets in financial markets, or (ii) they may negotiate the conversion of short-term debt into long-term debt with the banks. Depending on savers' liquidity preference, savings will go to financial markets or to bank deposits.

The introduction of additional agents (e.g. the government, the central bank and international trade), alternative circuits (i.e. households may ask for credits for durable consumer goods or financial assets) or the possibility of banks creating money to fund not only circulating capital but also investment in fixed capacity or financial assets for speculative motives, does not radically alter the central message of the TMC. Furthermore, taking into consideration these factors enriches the analysis and may provide the answers to some pending questions (e.g. the fixing of the interest rate, the workings of fiscal policy, *et cetera*).

3. The real side of the economy

The real analysis can be broken down into three parts: (i) technology, (ii) the quantity system and (iii) the price system.

(i) *Technology*

We shall assume a closed capitalist economic system with four sectors gathered into two groups: one, in Sraffian terminology, is basic and the other one is non-basic. Regarding the former, it includes three industries with four (groups of) firms. The first industry produces new machines (NM) by means of labour (L) and circulating capital (Kc), the second industry has two (groups of) firms: the first one produces circulating capital with new machines, circulating capital and labour, whilst the second one uses old machines (OM). The third industry produces consumer goods (C) by means of labour and circulating

capital. The non-basic sector, which we shall call government, produces public services (PS) with labour alone.

The following table may be helpful:

Table 1

	Inputs							Outputs					
		Commodities						Commodities					
		NM	OM	Kc	L	PS		NM	OM	Kc	C	PS	
Industries	S.I.			Kc_1	L_1			$NM^{(1)}$					S.I.
	S.II.a	NM_{2a}		Kc_{2a}	L_{2a}				$OM^{(2a)}$	$Kc^{(2a)}$			S.II.a
	S.II.b		OM_{2b}	Kc_{2b}	L_{2b}		$\rightarrow$			$Kc^{(2b)}$			S.II.b
	S.III			Kc_3	L_3						$C^{(3)}$		S.III
	Gov.				L_G							$PS^{(4)}$	Gov

We shall assume the usual axioms for the viability of this system (cf. Kurz and Salvadori (1995) chapter 7, Schefold (1989) Part II, section B) and to this we shall add the constancy of technical coefficients. All processes start and finish on the same dates and workers spend all their proceeds on consumer goods so that the labour vector can be replaced by a vector of consumer goods (Nell, 1998). The labour supply does not constrain output growth.

Next we define the following matrices:

(3.1) $$\mathbf{A}^* = \begin{pmatrix} \mathbf{A_{4x4}} & \mathbf{a_{4x1}} \\ \mathbf{0}_{1x4} & \mathbf{0}_{1x1} \end{pmatrix}$$

(3.2) $$\mathbf{A} = \begin{pmatrix} 0 & nm_{2a} & 0 & 0 \\ 0 & 0 & om_{2b} & 0 \\ kc_1 & kc_{2a} & kc_{2b} & kc_3 \\ c_1 & c_{2a} & c_{2b} & c_3 \end{pmatrix}; \mathbf{a} = \begin{pmatrix} 0 \\ 0 \\ 0 \\ c_G \end{pmatrix}$$

(3.3) $$\mathbf{B}^* = \begin{pmatrix} \mathbf{B_{4x4}} & \mathbf{0}_{4x1} \\ \mathbf{0}_{1x4} & \mathbf{b_{1x1}} \end{pmatrix}$$

(3.4) $$\mathbf{B}=\begin{pmatrix} nm^{(1)} & 0 & 0 & 0 \\ 0 & om^{(2a)} & 0 & 0 \\ 0 & kc^{(2a)} & kc^{(2b)} & 0 \\ 0 & 0 & 0 & c^{(3)} \end{pmatrix};\mathbf{b}=\begin{pmatrix} ps^{(4)} \end{pmatrix}$$

(3.5) $$\mathbf{Q}^{*}=\begin{pmatrix} \mathbf{Q}_{\mathbf{4x1}} \\ \mathbf{q}_{\mathbf{1x1}} \end{pmatrix}$$

(3.6) $$\mathbf{Q}=\begin{pmatrix} NM \\ OM \\ Kc \\ C \end{pmatrix};\mathbf{q}=\begin{pmatrix} PS \end{pmatrix}$$

Matrices **A** and **a** encapsulate the input coefficients of the basic and the non-basic systems, respectively. Matrix $\mathbf{A}^{*}$ accounts for the whole set of input coefficients. Similarly, **B** and **b** stand for basic and non-basic output coefficients, whilst $\mathbf{B}^{*}$ is the output matrix for all output coefficients. Finally, **Q** and **q** are (4 x 1) and (1 x 1)–dimension column vectors for basic and non-basic output levels. $\mathbf{Q}^{*}$ is a (4+1 x 1)–dimension column vector of output.

(ii) *The quantity system*

The quantity system can be written as:

$$\mathbf{A}^{*}\mathbf{Q}^{*}(1+g)+\begin{pmatrix} \mathbf{0} \\ \mathbf{q} \end{pmatrix}=\mathbf{B}^{*}\mathbf{Q}^{*}$$

(3.7) $$NM=N\bar{M}$$

$$g\leq\frac{1}{\lambda_{\max\left(\mathbf{B}^{-1}\mathbf{A}\right)}}-1$$

Thus we fix, from the outside, the activity level for the industry producing new machinery and the rate of growth of the economic system, g. $\lambda_{\max\ (\mathbf{B}^{-1}\mathbf{A})}$ is the maximum eigenvalue of matrix $\mathbf{B}^{-1}\mathbf{A}$ (i.e. the rate of growth is lower than the maximum growth allowed by the basic system). Column vector $\mathbf{Q}^{*}$ has the

attribute of making the ratio between each commodity output (given by $\mathbf{B}^*\mathbf{Q}^*$) and each commodity used as input (given by $\mathbf{A}^*\mathbf{Q}^*$) equal (1+*g*), except obviously for the non-basic commodity. The size of such an industry (government) is a residual which shall be inversely related to the effective growth rate and directly related to the size of the rest of the industries. By no means does the economy have to be permanently in a full employment position: but labour should not constrain output.

The system will expand proportionally at a rate *g*. All of the surplus in the basic system is invested:

(3.8) $\mathbf{Q}_{t+1}^{*} = \mathbf{Q}_{t}^{*}(1+g)$

(iii) *The price system*

We shall adopt the following assumptions:

- Wages are paid *ex ante*.
- Workers do not save and spend all proceeds on consumer goods.
- Consumer goods are properly normalized so one unit of labour equals one unit of consumer goods.
- Industries S.I, II and III are organized in a capitalist form: they earn a positive profit.
- The industry called 'government' is a non-profit making enterprise. It earns no profits since the product value of its product equals production costs.
- Competitive conditions prevail in the capitalist block: all industries earn the same profit rate.
- The government's budget is balanced.
- The tax burden is sustained by wages alone.
- All profits are saved and ploughed back into expanding capacity.

We define the input matrix **A**':

$$(3.9)\quad \mathbf{A}' = \begin{pmatrix} 0 & nm_{2a} & 0 & 0 \\ 0 & 0 & om_{2b} & 0 \\ kc_1 & kc_{2a} & kc_{2b} & kc_3 \\ c_1(1+t) & c_{2a}(1+t) & c_{2b}(1+t) & c_3(1+t) \end{pmatrix}$$

Where *t* is the tax rate on nominal wages.

Hence the price system is as follows:

$$(3.10)\quad \begin{aligned} &\mathbf{pA}'(1+r) = \mathbf{pB} \\ &p_C c_G (1+t) = p_G ps^{(4)} \end{aligned}$$

$$(3.11)\quad \mathbf{p} = \begin{pmatrix} p_{NM} & p_{OM} & p_{Kc} & p_C \end{pmatrix}$$

In (3.10) we have 5 equations and 5+3 unknown variables (the five prices, the profit rate, the nominal wage and the tax rate). To resolve this, we take p_C as a *numeraire*, the profit rate will equal the growth rate (see below) and then we can calculate the nominal wage and the tax rate according to the following equations.

$$(3.12)\quad \begin{aligned} &p_C = 1 \\ &1L = 1C \\ &w = p_C(1+t) \\ &t\sum wL_i = wL_G(1+t) \end{aligned}$$

One unit of labour consumes one unit of consumer goods, the nominal wage per unit of labour equals the price of the consumption basket times one plus the tax rate, *t*, and the tax rate is such that the sum of collected taxes (from labour alone, civil servants included) equals public spending, so that the government's budget is balanced.

One further condition is required to ensure the equilibrium of the system: the interest rate *i* should equal the profit rate *r* and the growth rate *g*.

4. Monetizing growth

We shall assume that a period of production has already finished. Before the next one can start, commodities have to circulate amongst industries. We are faced with a Marxian Commodity – Money – Commodity circuit where no value is created.

For simplicity's sake we adopt the Classical hypothesis on saving and spending: workers spend all their wages whilst capital owners save and plough back all their profits.

Now firms will expand their productive capacity according to their predictions of future demand. Uncertainty is at the very heart of the accumulation process and production is a lengthy process. Additionally, barter or commercial credits are the exceptions to the rule. To state the obvious, money has to be available before you can spend it.

Let us now see how the circulation of commodities between periods of production is monetized. What follows is a description of a monetary circuit understood as a set of money channels. This description does not preclude either the existence of alternative circuits or the co-existence of more than one.

(i) To start production processes wages have to be paid. Although, not all trades have to apply for credit to pay wages: those from the consumer goods sector should be paid with money that has already been created. Here we assume that the government asks for a credit from the central bank to pay civil servants' wages (cf. Bell 2000).[3] The central bank creates the money required. Additionally, S.I, S.II.a and S.II.b ask for

[3] When this is not possible, the government should apply for credit from commercial (i.e. private) banks. Our main conclusions remain unaltered within this assumption.

credits from commercial banks. If borrowers are seen as creditworthy by banks, they will create deposits (i.e. bank money) when they grant them credits. S.II.a can start a new production process: it has labour, circulating capital (its output) and old machine (which was new in the previous period). This is the monetary efflux.

(ii) Workers in these sectors pay taxes and the rest will be spent on consumer goods.

(iii) Now the consumer goods sector S.III has liquidity. It pays wages to its workers. And again, the latter pays taxes and spends the rest on consumer goods.

(iv) The government, which had spent first, has now collected taxes from all of its workers and can cancel its debt with the central bank if the amount of taxes matches previous public spending. As Bell, *op.cit.*, states, taxes (and bonds) do not finance public spending. They are the mechanisms of the monetary refflux.

(v) S.III, the producer of consumer goods, has monetized its profits. With the liquidity from the sale of its output it will purchase circulating capital from S.II.a and S.II.b. Once it gets this input it can start a new production process.

(vi) S.II.b needs new machine. In the general case, its proceeds from the sale of circulating capital to S.III minus the short-term debt for wage payments will not be enough to pay for this so it will have to ask for a long-term bank credit (the maturity of the debt should match the life time of the machine; in our example two periods). With this additional borrowed money it purchases new machine from S.I. Now it can start its

own process of production. And with the proceeds from the sale of new machine to S.II.b, S.I purchases circulating capital from S.II.a and S.II.b. What is leftover is used to reimburse the bank's initial debt (for the payment of wages). By and large, we can follow Davidson (1986) and assume that the producer of fixed capacity (S.I) will reach an agreement with its future purchaser (S.II.a) in order to deliver a particular type of output for a certain date, in exchange for a definite sum of money.

(vii) At the end of the circuit, S.I and the government have cancelled their debts. S.III did not ask for a bank credit. It got liquidity from third agent debtors. And S.II.a has a surplus equal in absolute terms to the deficit of S.II.b. The explanation for this finding is as follows: S.II.a, the producer of circulating capital with new machinery, obtained liquidity to pay for the second instalment of the long-term bank loan needed to purchase the fixed capital input one period earlier. This surplus equals the pending debt of S.II.b which has purchased new machinery during this period of time. In the next period, S.II.b will have to reimburse the bank with the second instalment plus interest. This is possible when the system expands at a rate *g* which equals the long term interest rate.

Now we shall consider the possibility of household savings. When firms expect a rate of growth of the economic system, say, *g* and the government expands its spending at the same rate, workers in sectors S.I, S.II.a, S.II.b and government will obtain proceeds according to what has been described above. However, if workers spend less than their incomes, the sales of S.III will be lower than its production. This will probably lead it to reduce its output growth and to hire less labour than in the situation described above. The first

consequence is that the government will be unable to collect enough taxes to cancel its debt with the central bank. Secondly, S.III will purchase less circulating capital from S.II.a and S.II.b. Then S.II.a will not obtain sufficient proceeds to cancel its pending long-term bank debt (i.e. the liquidity for the second instalment). Thirdly, as S.II.b sales do not match production, it will probably shift its predictions for future demand of its output downwards and will try to purchase less fixed capacity than previously agreed with S.I. And fourthly, S.I will reduce its growth rate of output as demand for it falls. This process is fittingly described by means of multi-sectoral multipliers.

The Keynesian paradox of thrift can be clearly seen in this framework: workers' savings result in a fall in output that leads to a problem of effective demand. However, this model sheds light on some further problems: (i) Agents with long-term debt will not be able to accumulate the amortization funds required to make loan repayments on time. (ii) If liquidity preference is complete, all savings will be held in the form of bank deposits. Although, contrary to conventional economic theory (i.e. the loanable funds theory), this does not mean that banks are accumulating excess reserves which would lead them to bring down interest rates on loans. These deposits are the counterpart of pending debts (i.e. illiquid assets). We should expect an increasing liquidity preference from banks, resulting in fewer loans instead of a lower interest rate as a result of all of this. Alternatively, if liquidity preference is nill, all savings will go to financial markets. This makes it possible for firms to recoup all of the liquidity injected into the circuit so it can be destroyed at the end. Although, because of the lack of effective demand, the rate of growth of output for the next period is going to be lower. (iii) Current savings are the result of prior investment (from deficit-

spending units).Thus, although savings and investment spending are made by different agents, the former depends on the latter[4] and such savings can take place later (in a logical temporal sense). This means that we cannot combine savings and investment in a market in order to determine the interest rate: it was already fixed when the demand for credit to finance investment took place.

(iv) Lower interest rates reduce the requirements of liquidity to cancel the pending debts of long term indebted agents. Thus, a reduction in interest rates may help to alleviate the debt burden, reducing the default rate. Nevertheless, when there is a problem of lack of effective demand low interest rates will not drive the economy towards a full employment position, as the capital controversies showed a long time ago (cf. for instance Cohen and Harcourt 2003).

5. Interest rates in the Classical-Circuitist monetary economy of production

In this section we shall provide an explanation of how interest rates are determined and how the payment of interest is possible.

(i) *Determination of the short term interest rate*

Let us assume that there are two commercial banks, A and B. Bank A grants credit to firm F for wage payments. Once these payments are made:

Commercial bank A			
M	Credit to Firm F	Deposit of L_F	M

[4] Actually, as Moore (2004) has put it, saving is the accounting record of investment.

Next workers of firm F, L_F wish to move their deposits to commercial bank B.[5] Now bank B will have an excess reserve whilst bank A will owe that amount of money to bank B:

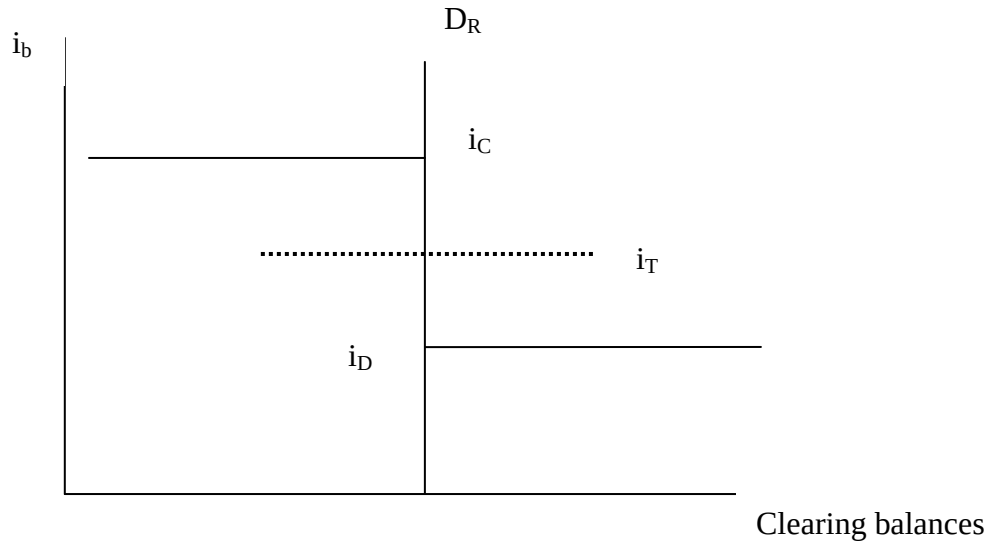
Commercial bank A			
M	Credit to Firm F	Loan from Bank B	M

Commercial bank B			
M	Reserve	Deposit of L_F	M

The net debt of the commercial banking system, taken as a whole, is zero.

At the end of the day no bank should have a negative balance. The central bank offers credit / deposit facilities to commercial banks at the end of the day. The following figure describes this (cf. Clinton 1997):

Figure 1



[5] Cf. Rochon and Rossi (2004).

The commercial banking system taken as a whole shows a zero net debt: the deficit of bank A equals the surplus of bank B in absolute terms. Hence, the aggregate demand for reserves, D_R is a vertical line on the zero position. In order to control the interest rate, the central bank offers bank B the possibility of depositing its surplus in the central bank and remunerating this surplus at interest i_D. The horizontal line on i_D shows the supply of deposits at the central bank. Also, it offers bank A the possibility of borrowing the amount of liquidity needed to reach a balanced position from the central bank, at interest i_C. Now, the horizontal line at i_C shows the supply of reserves from the central bank. Hence bank B will prefer to lend its surplus to bank A, and the latter will prefer to borrow from bank B at a middle interest rate, i_T. The latter is the central bank's targeted short-term interest rate. Commercial banks will offer credits at a rate which is a mark up on i_T.

Next, as Wray (1998) chapter 5, has pointed out, when the government makes a payment to private agents (e.g. pensions) with newly created money from the central bank, and this payment does not match current tax collections, there will be an injection of liquidity into the commercial banking system leading to a shift leftwards of the aggregate demand for reserves. So i_T would shift downwards to i_D because (most) banks would not need to request reserves from other banks.

In order to prevent this shift from the target rate, the central bank has to wipe out commercial banks' excess reserves by either shifting deposits held by the government in commercial banks towards the central bank or through open market operations.

Additionally, when the central bank wishes to shift to another target rate, it formally announces its intention and the change takes place automatically.

(ii) *Determination of the long- term interest rate*

The long-term interest rate can be viewed as the sum of two components: a weighted average of short-term interest rates plus a premium which depends on risk, liquidity and other factors regarding the desirability of the financial instrument in consideration (e.g. Bernanke (2005) p. 5). In essence, it reflects all future short-term rates expected by market participants.[6] This is a market variable which the central bank can indirectly affect though it cannot fix it. When the central bank wants to influence the long-term rate it signals what it is going to do with the short-term rate in any particular context.

Circuitists provide an explanation about the mechanisms used to fix the long-term interest rate grounded on what Keynes termed the liquidity preference. This theory can be summarized as follows (cf. Graziani, *op.cit.* p. 123 and ff.). We are positioned in the last phase of the monetary circuit (stage 5 above): that is, agents have saved some of their proceeds and this amount equals outstanding firms' and government debt (excluding interest) to banks.

On the one hand, indebted agents with pending debt repayments may collect savings issuing debt assets in financial markets or, alternatively, renegotiate short-term bank loan conditions in order to postpone payments. On the other hand, savers can hold their monetary savings either in the form of bank deposits or in debt assets purchased in financial markets.

The supply of debt assets (D^S) will depend positively on the interest on bank credit (i_c) and negatively on the interest on securities (i_B), which is our long-term interest rate. The demand for debt assets (D^D) will be an increasing function of the interest on securities and a decreasing function of interest on bank deposits

[6] Cf. for instance Moore (1988) p. 285-6.

(i_D). This means that, in equilibrium, we have three unknown quantities (i_c, i_B and i_D) and one equation ($D^S = D^D$). We can assume that i_D equals zero and that i_c is determined as a mark up on the interest at which the central bank provides reserves (these assumptions are not far from the truth). Then, the equilibrium condition above determines i_B.[7]

This view adopts a purely subjective standpoint for the determination of the equilibrium long-term interest rate whose spread can *a priori* reach any level. Yet, we may wonder whether there exists any limit for the long-term interest rate in the long period.

For Circuitists, firms can always pay nominal interest rate (without any limit) on securities.[8] Though, as Sraffa (1960) clearly demonstrated, once the real wage is given there exists a ceiling for the real interest rate, given by the profit rate which, in turn and in our view, depends on the rate of growth of output and productive capacity.

Four points will be raised to ground our argument: (i) Money or credit is not a produced commodity so the interest rate cannot be subjected to any natural law as, for instance, the profit rate. (ii) When credit is used for productive ends, the interest on borrowed funds will be limited by the profit that the entrepreneur is going to obtain from these funds.[9] (iii) The (long-term, real) interest rate will be lower than the (real) profit rate during long periods of time. Yet, the opposite

[7] It should be noted, as Graziani clearly states, that the equilibrium in the market for securities does not mean that all savings are held in securities.

[8] Graziani (2005) p. 115-6 states that when the interest on securities paid by firms is spent either on consumer goods or securities, they can pay any amount, no matter how high, without any real cost.

[9] For points (i) and (ii) see Marx (1894) chapters XXII and XXIII.

may hold for short periods.[10] (iv) Contrary to what some Sraffians have stated (e.g. Pivetti 1991) and not unrelated to the points made above, the interest rate cannot be taken as the centre of gravity for the profit rate.[11]

(iii) *Interest payments*

Briefly, how is it possible for firms to reimburse banks with M' = M (1 + *i*) > M, if banks create an amount of money M at the very beginning of the circuit?

Two explanations are offered here.

Our first explanation takes its lead from Robinson (1956) where we take into consideration the very fact that even banks need labour and capital to *produce* financial services. These factors are *paid* before banks make a profit (ruled by the interest rate). And it is this expenditure which makes the payment of (a part of) interest on debt possible. It could be argued that this assumption involves accepting that banks can create money for themselves (contrary to what, for instance, Graziani (2003) p. 60, states. But see Graziani, *op.cit*. p. 117-118). However, we believe that this is not the case. What banks cannot do is to create more money for themselves than the profit they expect to earn. Otherwise the refflux mechanism would not work. [12]

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[10] The reader should note that the demand for financial assets can be funded not only with savings but also with credit (e.g. speculative motive). In this case, the expectation of huge future yields may turn into current inflation of asset prices, leading to interest rates that are higher than the *normal* profit rate for certain periods of time (cf. Nell, 1999). Although this situation cannot be sustained for long since predictions of future profits need to be confirmed within the firms' accounts.

[11] Cf. Nell, *supra*.

[12] Actually, the interest on short-term debt, $i\ wL_K$ (where L_K stands for labour in sectors S.I, II.a and II.b) should equal the outlay required for the banking sector to supply its credit services: cf. Nell (2004) p. 196, Ciccarone, *op.cit.* p. 407.

As for our second explanation, we have already seen in our model that users of used fixed capital can pay interest on long-term debt when the economy expands at a rate *g* greater or equal to the interest rate. The mechanism which makes the payment of this interest possible resembles that of the former circuit: banks advance money so the economy can expand. And this money is channelled towards long-term indebted firms: thus, banks create the money for the payment of interest on debt. Yet, in this circuit this type of liquidity is not used by banks themselves, but by other borrowers.

In our model, we have implicitly assumed that the circulation of commodities only occurs between periods of production and at an infinite velocity. It is for this reason that short-term debt has not been explicitly dealt with. Of course, we realize that this is an oversimplification. Yet, this does not alter our main conclusion in this section, which is that banks create the money required to pay interest on debt.

To sum up, the expansion of the banking industry (its real productive assets) together with the expansion of the productive capacity of the *real* economy makes the payment of interest on debt possible. There is a hierarchy of variables in this model, in the sense that the rate of growth of output is *the* exogenous variable. Then, this affects (positively) the profit rate and creates a ceiling for the interest rate. On the other hand, the central bank controls the short term interest rate which is a floor for the interest rates at which commercial banks offer credits.

6. The interest rate, the profit rate and the prices of production

In his *Production of commodities* Sraffa (1960) p. 33, cryptically observes that interest rates may be taken as the centre of gravity for profit rates.[13] Ciccarone (1998) pp. 403-5 points out that this statement *"has been traditionally justified on the basis of the two-step view that: (1) the monetary authority can determine the money rates of interest* […]; *(2) there exists a definite relationship between the rates of interest and profits"*. Following Kurz and Salvadori (1995) pp. 481-3, the second step can be divided into two approaches: (2a) the rate of profit results from adding up the rate of interest and the rate of profits of enterprise; (2b) the banking sector is considered a basic sector and it earns the average profit rate which is ruled by the interest rate. The following equations encapsulate the latter view:

$$\begin{aligned} &\mathbf{pA'}(1+r)+i_C\mathbf{a}-i_D\mathbf{d}=\mathbf{pB} \\ &i_C=\mathbf{pa_b}'(1+r)+i_T V+i_D D \end{aligned} \qquad (6.1)$$

Where **A'** is a socio-technical matrix (including both technical requirements and wage payments per unit of output: see expression 3.9 above) for the basic sector, excluding the banking system. i_C is the interest rate on credits requested by basic industries, **a** is a vector of bank credit advanced to basic industries per unit of output, i_D is the interest rate on deposits and **d** is a vector of industry's deposits. The price equation for the banking industry is in the second row. i_C is the price of one unit of credit, $\mathbf{a_b}$' stands for the vector of socio-

[13] In a letter to Garegnani dated 13 March 1962, quoted in Bellofiore (2001) pp. 366-7, Sraffa writes: "In conclusion, I'd say that the review [that Garegnani was intending to write of Production of Commodities for Moneta e credito] would do well not to insist too heavily on the passing remark about the monetary interest rate" (originally in Italian; translation by R. Bellofiore).

technical inputs of the banking industry, i_T is the interest rate on reserves V, and D are collected deposits.[14]

On the one hand, a rise in the interest rate i_C increases the price of basic commodities. On the other hand, this leads to an increase in the profit rate of the banking industry. Moreover, **p** will experience a further increase when firms discover that the profit rate they are obtaining is too low (compared to the current profit rate in the banking sector).

However, in our opinion this viewpoint is troublesome. There are some arguments that counter this (cf. Nell, 1988, 1999): (i) the central bank has the ability to control short- term nominal interest rates, not long-term real ones; the long-term interest rate is not subjected to any *natural* law unlike the profit rate, because money is not a produced commodity; (ii) in the real world, the rate of growth of demand is usually negatively correlated with the interest rate; when the rate of growth of output is high (low) the profit rate has to be high for firms to finance the requisite expansion of productive capacity; (iii) when the rate of growth of demand changes and this shift becomes longstanding firms will expand productive capacity *pari passu*. Only when the rate of growth of demand changes temporarily will the adjustment occur through changes in the degree of utilization of productive capacity.[15]

Additionally, we believe that there is a further drawback. Competition, in the Classical-Marxian sense, leads to the equalization of the profit rate in all trades, on the amount of value which is advanced to the process of production. In this

[14] In the reference, i_T is replaced by r, the *normal* profit rate.

[15] To these arguments we draw attention to the problematic meaning of vector **a** for the determination of production prices, a question posed by Mongiovi and Rühl (1993).

sense, following Marx (1894) chapters XXII and XXIII, it makes no difference whether the amount of money advanced was first owned by the entrepreneur or the bank when we fix the prices of production. The interest rate is a mechanism for the re-distribution of surplus between industrial and financial capitalists. What this means is that if a production process needs an investment of, say, 100 monetary units to yield a 20% profit rate in *normal* conditions, the industrial capitalist will borrow some liquidity if the interest rate is no higher than 20%. Once profits have been realized, they will be distributed between the two types of capitalists according to the amount of money advanced and interest rates.

When this happens, the Sraffian approach for the calculation of production prices remains perfectly valid, as in expression (3.10), i.e. the interest rate should not enter the price system. And this raises, at the very least, a couple of questions: (i) What determines the profit rate? And (ii) what is the relation between the profit rate and the interest rate?

Regarding the first question, in the case of even conditions of accumulation, it is the rate of growth of output and capacity, through capitalists saving behaviour, which determines the profit rate, making the wage rate a residual (e.g. Kaldor (1956), Pasinetti (1974)). In our view, this is a fruitful standpoint for integrating the Classical and the Circuitist approaches (Cf. Nell (2004). Alternatively, see for instance Pivetti (1991)).

As for our second question, we share Marx's view, *op.cit.* that there is no natural law regulating interest rates.[16] The rate of growth of output (seen through the behaviour of savings) determines the *normal* profit rate and

[16] The same holds for Keynes when he writes: "… the rate of interest is a highly conventional […] phenomenon" (1936, p. 203).

additionally sets a ceiling on the interest rate. Simultaneously, the central bank, under *normal* conditions, has the ability to influence the long-term interest rate (by manipulating the short-term one) and to set limits on it. The rate of interest affects the profit rate of the banking system (cf. Ciccarone, *op.cit.*) but does not affect the profit rate of the industrial system.[17] Unlike some Sraffians, we believe that causality runs the other way around: the profit rate in the industrial system affects the mark up on the base interest rate (determined by the central bank) on which commercial banks calculate the rate of interest at which they make loans, to enable the banking system to earn the *normal* profit rate.

When the interest rate matches the rate of growth of output and the profit rate, all the money introduced at the beginning of the circuit can be destroyed at the end. When interest rates are lower than the profit and output rates, some liquidity can remain at the end of the circuit without the system running down.

7. Summary.

This paper has presented an interpretation of what Keynes termed a monetary economy of production, taking elements from the Theory of the Monetary Circuit and from Sraffa. To do so, we have assumed that the economy is in a long period equilibrium. This is an instrumental assumption to facilitate an understanding of how an economy works.

The central variable is the growth rate of output, ruled by the Keynesian principle of effective demand. Under the Classical hypothesis of savings and spending, it determines the profit rate and then, together with technical conditions, the set of relative prices. Furthermore, it also determines the ceiling

[17] The disparity between the profit rate, the rate of growth and the interest rate can unleash as Nell, *supra*, has put it, a process of financial instability which we have not dealt with in this paper.

for the long-term interest rate. The central bank sets a floor on it. We have assumed that the degree of utilization of productive capacity remains at a *normal* position in a long period analysis.

Money is required for the growth of output. But what is crucial here is that we are talking about credit money not commodity money. Thus, banks have the ability to create money *ex nihilo* to finance the payments which are required to put the wheels of production in motion. In our idealized model, money begins with the circulation of commodities once a production period has finished and before the next one begins. It ends when this circuit is completed (i.e. all trades get rid of all of the requisite inputs).

Following Nell, we adopt a Monetary Circuit (understood as a set of channels through which money circulates). Here we visualise how interest payments can be made, how much money is needed to make the requisite commodities circulate, how profits are monetized and how this money is created and destroyed when credits are granted and debts are repaid. This Circuit also demonstrates how household savings or government surpluses are leakages which complicate the reimbursement of pending debts by indebted units to banks.

Obviously, our paper is not conclusive and many questions still have to be answered. For example:

- What happens when there is an uneven demand for growth and accumulation?
- What are the consequences of household borrowing?
- Under what circumstances does financial instability appear and what are its consequences?

- Open economy considerations.

Nevertheless, we hope that this Classical-Circuitist alternative provides a fruitful starting point for improving our understanding of how the real world works.

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