The Monetization of Profits in a Monetary Circuit Framework

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ABSTRACT This paper offers an explanation of the realization of profits in money. Following Edward Nell’s lead, we place Marx’s spheres of production and circulation at the centre of the analysis. Production is represented à la Sraffa–von Neumann while circulation is analysed following the basic insights of the Franco-Italian theory of the monetary circuit. Once production has taken place, money is created by banks ex nihilo and then circulates through certain channels allowing the reproduction of the system and monetizing profits plus the payment of interest on long-term debts within one single circuit. The novelty of our approach lies in the treatment of the financing of investment in fixed capacity.

1. Introduction
The central aim of this paper is to offer a solution to the monetization of profits in the tradition of the theory of the monetary circuit. This approach provides a coherent description of how money puts the wheels of production in motion. However, some problems remain within this strand. One of them (its ‘main difficulty,’ according to Zazzaro, 2003, p. 233) is how profits are realized in money. This problem can be described as follows: banks create money to finance firms’ production costs, in order to start new production processes. Such liquidity is assumed to remain inside the economy until production processes finish and indebted firms recoup it through the sale of their output or, alternatively, by the issue of assets in financial markets. If the maximum amount of money that firms can get is limited to production costs, how can profits (and interest on debts) be monetized?

Four types of solutions to this problem have been put forward: (i) banks advance more money than required to finance firms’ working capital, thus including part of the investment in fixed capacity; (ii) there is always a third
agent injecting increasing amounts of money, typically the government, through public deficit; (iii) the economic system consists of several growing and overlapping circuits where the production costs of one circuit provide another one with the liquidity required to monetize its profits; (iv) there is internal circulation across firms of the capital goods sector.

While the second option should be rejected, because it makes fiscal policy highly dependent on the monetary requirements of the system, the solution presented in this paper shares certain aspects with the first, third and fourth solutions. Nevertheless, it involves some differences as well. First, we assume that money enters the system after one period of production has finished and before the next one starts. Thus, the growth of one industry provides another one with the liquidity required to monetize profits. Yet, all money can be destroyed in the monetary reflux of one single circuit. Second, not all wages need be financed through bank credit. However, the normal working of the system requires part of the investment in fixed capacity to be financed by banks through long-term bank credits. And third, each monetary unit monetizes more than one unit of output (in value terms). It is assumed that money circulates through channels and they can be visualized when considering a whole economic system from a disaggregated standpoint.

The novelty of our approach consists of grounding the theory of the monetary circuit on the classical theory of production, as revived by Sraffa (1960). The latter provides a sound theory of value and a coherent framework for the treatment of output, technology, prices and distribution while the former fills the void for the role of money and financial issues. The integration of both strands, together with the Keynesian principle of effective demand leads to what Nell (2002, p. 528) calls a ‘theory of circulation’ as a solid basis for understanding the working of a monetary production economy. We acknowledge the influence of some contributions by Edward Nell although our paper contains a different treatment of fixed capital and reaches somewhat different conclusions.

2. Explaining the Realization of Profits in Money

This section is divided into two parts. In the first, the real side of the economic system is presented. Here, we deal with production, prices and distribution. The second part is devoted to the circulation of output and the monetization of the distributive categories. It also addresses an apparent contradiction: Nell’s influence on this paper is fully realized, though our conclusions differ from Nell’s main one.

2.1. The Real Side of the Economy

We shall assume a closed, capitalist economy with four groups of firms gathered in three sectors. Sector I produces a new machine \((NM)\) by means of circulating capital \((Kc_{NM})\) and labour \((C_{NM})\). Sector II includes two groups of firms. Firm
Table 1. Quantity system

<table>
<thead>
<tr>
<th>Industries</th>
<th>Inputs</th>
<th>Outputs</th>
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<tr>
<td>S.I</td>
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<tr>
<td>S.IIa</td>
<td>$K_{c1}$</td>
<td>$C_{NM}$</td>
</tr>
<tr>
<td>S.IIb</td>
<td>$K_{c2}$</td>
<td>$C_{kC}$</td>
</tr>
<tr>
<td>S.III</td>
<td>$K_{cC}$</td>
<td>$C_{C}$</td>
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IIa produces circulating capital ($K_{c1}$) by means of the new machine, circulating capital and labour. As a byproduct, it produces an old machine ($OM$) as well. The second firm in the second sector, firm IIb produces circulating capital ($K_{c2}$) by means of circulating capital, labour and old machines. We assume that the lifetime of the machine amounts to two periods of production. Sector III produces consumer goods, $C$, by means of circulating capital and labour. All production processes start and finish on the same dates and last the same period of time (say, one year). Table 1 may be helpful.

Additionally, we shall assume that wages are paid *ex ante* and that workers’ propensity to save is nil. Labour inputs are measured in terms of the consumption basket required for the reproduction of the labour force. Competitive conditions, in the classical sense, prevail: all industries earn the same profit rate. Capitalists’ propensity to save equals unity: all profits are saved and ploughed back into growing capacity. The system is assumed to expand *à la* von Neumann (1945) and the labour force does not constrain growth.

We can write the algebraic expressions for the price and quantity systems as follows:

\[
p' A (1 + r) = p' B \tag{1}\]
\[
A q (1 + g) = B q \tag{2}\]

Equation (1) describes a price system: $p'$ is a row vector of prices; $A$ and $B$ are input and output matrices respectively, and $r$ is a scalar accounting for a uniform profit rate.\(^3\) Equation (2) is a quantity system, where $q$ is a column vector of commodities, and $g$ is the uniform rate of growth. The usual axioms for the viability of this system are assumed (cf. Kurz & Salvadori, 1995, chapter 7) and to this we shall add the constancy of the technical coefficients. Both are eigensystems with one degree of freedom.

The price vector is the left-hand side eigenvector associated with the maximum eigenvalue of matrix $AB^{-1}$ while $q$ is given by the right-hand side eigenvector associated with the maximum eigenvalue of matrix $B^{-1}A$. The

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\(^3\)It should be noted that matrix $A$ includes not only material inputs, but also, implicitly, a distributive variable, in the form of the wage goods required to support the labour force; accordingly, we might call $A$ a socio-technical matrix.
profit rate equals the growth rate (von Neumnan, 1945), inversely related to the maximum eigenvalue of $\mathbf{AB}^{-1}$, and we shall assume that the interest rate $i$ equals $r$ and $g$.

2.2. Monetary Circulation

Following the well-known Marxian spheres of production and circulation (i.e. circuits of money – commodity ... production ... commodity – money; see Marx, 1893, chapter I), we place our analysis immediately after the finalization of one period of production and before the beginning of the next one: commodities can circulate only after they have been produced. And a new production process cannot start, in general, if commodities have not circulated. Firms have to decide how much output should be produced, usually according to expected demand at normal prices. Thus, uncertainty is at the very heart of the economic process. And, to state the obvious, money has to be available before agents can spend it.

A Wicksellian pure credit economy (see Wicksell, 1936; Nell, 1967) shall be assumed in which there is no central bank and bank deposits are used as a means of payment.

Although several circuits are possible, the following circuit has particularly interesting properties. Let us focus on the end of the production process described in Table 1. Output has already been produced and must now be exchanged across sectors before a new production process can start. In the next period, the second upper row describes the operation of sector (firm) IIb (which will use $\mathbf{NM}$ to produce $\mathbf{KC}$), and the third row corresponds to sector (firm) IIa (which will use $\mathbf{OM}$).

1. Sectors I, IIa and IIb ask for short-term credit to pay wages. Sector IIa can start its corresponding new production process.
2. Labour in the capital goods sector spends its income on consumer goods produced by sector III.
3. Sector III pays wages from its sales. If its sales proceeds are not enough, it requests short-term bank credit. However, this is a closed circuit: these wages are spent on consumer goods and liquidity returns to sector III.
4. Sector III purchases $\mathbf{KC}$ from sectors IIa and sector IIb, and is now ready to start a new production process. Sectors IIa and IIb use part of the proceeds to pay back their short-term debt to the bank.
5. Sector IIb asks for a long-term bank credit to purchase new machines. The amount of credit needed will depend on how much money sector III spends on the goods produced by sectors IIa and IIb. We assume that this long-term credit matches maturity with the long-term real asset (in our example, two periods). This firm can start its production process.
6. Sector I uses the proceeds from the sale of new machines to sector IIb to repay short-term debt (the payment of wages at the beginning of the circuit) and to purchase $\mathbf{KC}$ from sectors IIa and IIb in order to produce more new machinery to be delivered to sector IIa at the end of the period which now starts. It has already got the inputs required to produce more new machines.
7. At the end of the circulation phase, we discover that sector IIa has a surplus equal, in absolute terms, to the deficit of sector IIb. Two conclusions can be derived from this. (i) All the money that had been created when banks met the demand for credit, either short- or long-term, is destroyed at the end of the circulation phase. (ii) Circuit closure is compatible with the existence of pending debts.

Contrary to Nell (2004, p. 187), who considers the surplus of sector IIa as retained earnings that are lent to sector I to produce more new machines in the next period, we assume that it is used to repay a fraction of a long-term bank loan (created in the previous period) plus the interest on it. In this case, the deficit of sector IIb corresponds to pending debt on the purchase of new machinery, which has to be paid in the next period, plus interest. Moreover, this current deficit makes the surplus of sector IIa possible. And if we repeat the circuit for the next period, we see that sector IIb will obtain a surplus equal to its current bank debt times \((1 + g)\) and that sector IIa will show a deficit of equal amount.4

In this model, output is monetized after it is produced and before it is used either for consumption or as an input for the next process of production. Money is created and destroyed within the circulation sphere, in a single circuit without having to resort to other circuits or outside sectors.5 In this logical stage the distributive categories are monetized along with the circulation of commodities. As Nell (2002, p. 529) states, ‘it is important to spell out the structure of production and distribution. In the classical view, exchange takes place in order to distribute the surplus and put goods in place for a new round of production.’

The influence of Nell’s approach on the present work can be grasped in the set-up of our model: the Marxian separation of circulation from production, the multisectoral approach, the use of the classical theory of prices, the proportionality of industries’ activity levels, the relation of surplus distribution to the rate of growth of output within the classical expenditure hypothesis, the assumption of a Wicksellian pure credit economy, the circulation of money after it has been introduced into the circuit, and so on.

However, in our view, Nell’s conclusion that only wages in the capital goods sector are financed with bank credit (Nell, 2004, p. 189) does not hold. As we show in our numerical illustration of the issue below, the wage bill of the capital goods sector is not enough to monetize the purchase of fixed capacity. Therefore, the system requires either commercial credit (something that cannot be accepted as an explanation for the general case because it involves a certain form of barter) or additional bank credit for the completion of the circuit.

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4The solution for the monetization of profits provided in this paper is compatible with the one offered by Rochon (2005) with two qualifications: (i) he argues that the amount of money required at the beginning of the circuit amounts to all wages plus all capital goods; (ii) he does not provide a detailed description of how money circulates within the system in order to monetize all transactions and profits.

5Rochon (2005, p. 133) states that a proper explanation of the monetization of profits has to fulfil both requirements: they have to be explained within a single circuit and without recourse to outside sectors.
3. Some Comments on the Literature

Our model provides an explanation for:

- the monetary realization of profits
- the asymmetry of profits in the consumer and the capital goods sectors
- the financing of fixed capacity
- the payment of interest on debt

This explanation is an alternative to others in the tradition of the theory of the monetary circuit.

3.1. The Monetary Realization of Profits: A Comment on Some Alternative Explanations

The realization of profits in money poses a problem for circuit theorists. If banks create money to finance production, profits in the consumer goods sector are not problematic: they are monetized within the expenditure of wages paid to the workers of the capital goods sector. But as soon as these profits are used to purchase capital goods, the recipients of this liquidity only recoup their costs. Therefore, profits in the capital goods producing firms are nil. As Rochon (2005, p. 131) writes, ‘Clearly, this is an unacceptable situation.’

At least four types of solutions have been offered for the realization of profits in money in the capital goods sector. Yet, none of them is completely satisfactory. The first one consists of assuming that banks advance not only the wage bill but also the value of investment capacity. This solution has been suggested by, among others, Secareccia (1996, 2003), Parguez & Secareccia (2000) and Rochon (1999, 2005). Renaud (2000) shares this view as well, because an alternative solution consisting of banks advancing only the wage bill presents problems of asymmetry and lacks realism. The problem with this solution, as Nell (2002) has pointed out, is that the amount of money is excessive. Why should some firms incur the financial costs of borrowing when they are going to obtain liquidity from their sales proceeds? (Messori & Zazzaro, 2005, make the same claim.)

The second solution to the problem of monetizing profits requires an external sector pouring liquidity into the circuit, traditionally the government through public deficit. This solution is unacceptable because it makes fiscal policy extremely dependent on the requirements of liquidity of the economic system (see Graziani, 2003, pp. 15–16).

The third solution consists of assuming growing and overlapping circuits (see Gnos, 2003, pp. 332–334). Then the creation of money by banks *ex nihilo* for the financing of production costs at the beginning of one circuit provides indebted agents from a previous circuit with liquidity to monetize profits and pay interest on debts. This seems clear when Gnos writes:

>[T]he start of production entails the superposition of different phases of the circuit (and so different individual circuits). When buying manufactured goods, firms spend pre-existing incomes (even when they spend newly created money). This
is part of the reflux phase of a circuit previously initiated. Simultaneously, the payment of wages initiates a new circuit. (Gnos, 2003, p. 332)

The problem with this solution is that it implicitly accepts that profits cannot be monetized and the circuit cannot be closed without resort to additional circuits (see Rochon, 2005, pp. 127, 133).

The fourth solution consists of subdividing and linearizing production within the capital goods sector (see Renaud, 2000; Nell, 2002). Here, it is assumed that a sub-sector, namely A, provides the consumer goods sector with the required capital input. Part of its sales proceeds are used to reimburse banks with short-term debt and the rest is used to purchase capital inputs from sub-sector B which, in turn, does the same with sub-sector C and so on. Renaud assumes, in his first solution, that this can be repeated ad infinitum with a proportion of wages to output equal for all sub-sectors. Nell (2002) rejects this complete linearization: he introduces a ‘machine tools’ sub-sector. He also objects to Renaud’s assumption that all sub-sectors exhibit the same ratio of wages to profits. But he appears to be sympathetic to the general approach. Apart from the lack of realism, a shortcoming of this argument is precisely that is conceives of production as a linear process instead of, as in Sraffa (1960), a circular process in the general case. In addition to this, profits from the consumer goods sector cannot monetize all transactions within the capital goods sector (particularly, the investment in fixed capacity).

We believe that these approaches encounter the problem of excessive money because they overlap production and circulation. If we assume that circulation takes place after one production process has concluded and before the next one starts we can easily see that within the circulation of commodities capital goods sectors are monetizing profits linked to past production pari passu with the investment transactions required to adapt capacity to meet future demand. Taking into consideration the Marxian distinction of circulation and production of commodities makes this problem fade away.

3.2. The Asymmetry Problem

The reader may well claim that our theory of circulation suffers from some asymmetry (see for instance Renaud, 2000, p. 298, Rochon, 2005, p. 134). This could happen at two levels. First, firms in the capital goods sector have to request short-term credit to pay their wage bill while firms in the consumer goods sector can wait. Second, the monetization of profits is different when firms belong to the capital or the consumer goods sector.6

With regard to the first asymmetry, we show in the numerical example below that the consumer goods sector has to request additional credit to pay its wage bill,

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6Rochon (2005), following Secareccia (1996, p. 407) points to another asymmetry: some firms would be financed with bank credit while others received commercial (intersector) credit. This critique does not apply to the model of the present paper, where all transactions are completely monetized. Nell too may be immune to this criticism, because his machine tool firms sell output to other firms in this sub-sector in exchange for money, not through commercial credit.
because the mass of wages paid in the capital goods sector is not enough. Furthermore, we should not discard an alternative circuit in which the consumer goods sector asks for short-term credit to purchase circulating capital from sectors IIa and IIb, thus providing them with some liquidity to pay their corresponding wage bill (this is also recognized in Nell, 2004, p. 186). Hence, this critique is rather weak.

And with respect to the second asymmetry, as Nell (2002, p. 525) has pointed out, the asymmetric monetary realization of profits simply reflects a real asymmetry: capital goods-producing firms request bank credit and sell their produce to other firms; consumer-goods producing firms obtain proceeds chiefly from the sale of their output to workers. Although this critique may hold for explanation of the monetization of profits in the capital goods sector through an internal circulation repeated *ad infinitum*, it does not hold for the explanation presented in this paper because such an assumption is unnecessary.

### 3.3. The Financing of Fixed Capacity

Although some heterodox authors accept that investment is at least partially financed by bank credit (e.g. Parguez, 1996, Rochon, 1999, Secareccia, 2003) others (e.g. Davidson, 1986, 2002; Graziani, 1989, 2003; Wray, 1990) claim that the costs of production of fixed capital provide the system with liquidity to fund its purchase after production. This argument is known as the ‘revolving fund of finance’ and can be summed up as follows. A firm expects an increase in demand for its product in the near future; it will naturally want to adapt its productive capacity to the level necessary to meet this demand. It comes to an arrangement with the producer of fixed capital. The same contract is used as collateral by the latter to get fresh finance and to purchase the working capital required for the production of the investment goods in question. Graziani (1989) calls this ‘initial finance’ and it is short-term.7 Once the goods are produced, liquidity remains in the system. If liquidity preference is nil, the purchaser of the investment goods will issue bonds or equity securities in order to capture this liquidity to fund the purchase of fixed capital on the long term. The proceeds from the sale of securities are final finance, in Graziani’s terminology. Equilibrium requires initial finance to completely cover final finance. Alternatively, when liquidity preference is complete, banks provide long-term credit through ‘intermediation.’

This argument raises some questions. (i) If banks only advance the cost of production of fixed capital, where does the money required to monetize the profits of the producer of investment goods come from? (ii) It is implicitly assumed that the circuit starts with no agent indebted to anybody and that initial finance remains inside the circuit until the payment for the finished investment goods is made. However, we have seen that this initial finance makes the

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7In Graziani’s view, initial finance consists exclusively of bank credit for the payment of wages: ‘If we consider firms as a whole, their only external purchase is labour force. All other exchanges being internal transactions, no further monetary payment is required’ (Graziani, 1989, p. 4).
payment of old long-term bank debts possible (corresponding to the purchase of a machine that has already been produced). (iii) Empirical evidence indicates that most investment goods purchases are financed with retained profits, yet banks constitute a more important source of finance than financial markets in many cases and they provide a substantial percentage of the funding for physical investment. In the case of Japan, for instance, Corbett & Jenkinson (1997) inform us that, on average, 26.7% of all physical investment was funded by banks during the period 1970–94 (see also Secareccia, 1996).

In our view, and contrary to the ‘revolving fund argument’, long-term bank finance for the purchase of fixed capacity is empirically relevant and has two consequences. It leads, on the one hand, to internal finance (to sector I in our example, for the purchase of working capital to produce more long-term real assets in the future), and, on the other hand, to amortization funds which, in turn, are used to repay old bank debts. Hence, as Nell (2004, p. 187) has pointed out ‘there could not be an investment-saving circuit.’

3.4. The Payment of Interest on Debt

How is it possible for firms to reimburse banks with $M' = M(1 + i)$, where $M$ is the amount of credit advanced by banks and $i$ stands for the interest rate, if they can only recoup $M$ at most?

When banks are the only agents that can create money, the payment of interest is only possible if banks advance this amount of money to the system. Heterodox authors have considered different mechanisms.

Wicksell (1936, chapter IX, section B) assumes that banks remunerate deposits at the same rate charged on credits. It is the expenditure of the former which makes it possible for firms to pay interest on debts. The traditional explanation for the payment of interest on debt, provided by circuitists, and first suggested by Joan Robinson (1956), consists of assuming that banks advance $iM$ in the form of expenses corresponding to production costs (see e.g. Graziani, 2003, p. 118; Nell, 2004, p. 183). Alternatively, the interest on debt may be paid at the end of a period of time with new (rolled over) debt (e.g. Wray, 1996). Then, increasing indebtedness makes it possible to pay the interest on past debts.

In our model, we can distinguish two mechanisms for the payment of interest on debt. The first one is based on bank advances for the payment of their working expenses. In our circulation model, we have assumed an infinite velocity of circulation of money. Because of that, short-term debt, for the payment of wages, does not generate any interest. If we remove the infinite velocity assumption, we would have to admit that banks advance some of the liquidity for the payment of wages

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8Since these are retained profits. However, this requires explaining how and why a third agent (probably the government through deficit spending) becomes increasingly indebted in order to provide the system with liquidity.

9However, as Nell (1967, p. 391) has asked, why should banks pay interest on deposits for which they have no use?

10Messori & Zazzaro (2005) conclude that interest on long-term debt cannot be paid at the aggregate level and, thus, the traditional concept of equilibrium should be abandoned.
and circulating capital at the beginning of the circuit at the same time as sectors I, IIa and IIb make wage payments. Output proportions need not change because we can assume that the banking industry has been integrated within the capital goods sector.

The second mechanism for the payment of interest has to do with long-term debt. In our model of circulation we have assumed that users of investment capacity ask for long-term credits matching maturities. Amortization funds are used to repay pending debt plus the interest on it. These amortization funds can be generated for one firm when another asks for credit to purchase fixed capital in an amount which is higher than the factor \((1 + i)\) times what was spent on fixed capital in the previous period.\(^{11}\)

In contrast, Nell (2004, pp. 189–189) argues that amortization funds are retained by users of fixed capital and lent to the producers of these inputs. This provides the latter with liquidity to purchase the working capital needed to undertake production. Additionally, producers can keep pace with the rest of the economy if users combine an already given amount of capital with increasing labour and material inputs.

But Nell’s argument is problematic. (i) Final users of fixed capital can retain amortization funds if they own them and are no longer indebted to any agent after their purchase. This occurs if they pay for the purchase of investment goods with retained earnings, or with short-term credit. However, in our model, the amount of liquidity corresponding to wages in the capital goods sector may not be sufficient for the monetization of such transactions. And, furthermore, why should a firm fund the purchase of a long-term real asset with a short-term credit? (ii) Nell is forced to assume that the efficiency of fixed capital increases as time goes on. Although he introduces this assumption with due qualification (Nell, 2004, p. 188, fn. 2), it is both unnecessary and unrealistic.

4. A Numerical Illustration

Let us assume a closed capitalist economy, with the same industries and firms as in Section 2. Technology is defined by the following matrices:

\[
A = \begin{pmatrix}
0 & 1 & 0 & 0 \\
0 & 0 & 1 & 0 \\
10 & 6 & 6 & 10 \\
6 & 4 & 5 & 20
\end{pmatrix} \quad ; \quad B = \begin{pmatrix}
1 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 \\
0 & 0 & 18 & 16 \\
0 & 0 & 0 & 40
\end{pmatrix}
\]

A is a matrix of inputs, where labour is represented by the amount of consumption goods required for its reproduction (in the lower row). B is a matrix of outputs. Columns in A represent techniques of production (i.e. inputs); rows stand for types of commodities. Columns in B are the outputs of the economy’s various production processes.

\(^{11}\)We have assumed that the long-term interest rate equals the rate of growth of output and the profit rate. However, it should be noted that if the interest rate is lower, the circuit can be closed, all debts being repaid, with some money remaining undestroyed.
The price system, as stated in expression (1) above, can be arranged as follows:

\[ p'AB^{-1} = \frac{1}{1 + r} p' \]  

(3)

This is an eigensystem whose economically meaningful solution, taking the consumption good as a *numeraire* \((p_C = 1)\), is:

\[ p' = (25.0614 \quad 10.7289 \quad 1.74868 \quad 1) \]

\[ r = 0.0670411 \]

We shall assume that the economy is on a Golden Rule growth path (the system expands *à la* von Neumann). The quantity system is given by the following expression:

\[ B^{-1}Aq = \frac{1}{1 + r} q \]  

(4)

where the output vector \(q\) is the right-hand side eigenvector of \(B^{-1}A\) associated with the maximum eigenvalue of that matrix. It gives us the level of activity of each industry. If we assume that after period \(t\) sector I has produced one new machine, we have:

\[ q = \begin{pmatrix} 1 \\ 0.93717 \\ 0.878287 \\ 0.80862 \end{pmatrix} \]

Table 2 depicts a temporal sequence of inputs and outputs (in physical terms):12

And if we multiply each commodity by its respective price we obtain the sequence of productive processes in price terms (Table 3).

Let us now assume that we are at the end of period \(t\) so we have outputs ready for sale at the firms’ gates. These outputs have to circulate in order for a new process of production to start. Our circuit may be described as follows:

1. Capital goods firms, I, IIA and IIB, request short-term credits to pay wages. This amounts to 15.0881 monetary units (let us say euros). Sector IIA has all the requisite inputs to begin the production of circulating capital \(K_c\).
2. Workers spend their income on consumer goods, so liquidity goes to sector III. It is not enough to pay wages to its workers so it will have to ask for short-term loans to pay the rest of the payroll. Nevertheless, this is a closed circuit: we assume that all wages are spent on consumer goods so all liquidity returns to sector III so it can pay back its bank debt.

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12 It should be noted that the row corresponding to sector IIA in period \(t\) represents sector IIB in period \(t + 1\) and vice versa: in the former case sector IIA uses new machines whilst in the latter it produces circulating capital with old machines.
3. Sector III uses its proceeds to purchase circulating capital $K_c$ from sectors IIa and IIb. We assume that its outlays go to each firm according to its contribution to net output. Then, sector III purchases €8.7924 from sector IIa and €6.2957 from sector IIb. Now, sector III can start its production process.

4. Sector IIb needs one new machine ($NM$). With the proceeds from the sale of circulating capital to sector III it can reimburse its short-term debt to the bank and it still retains €2.9557. It now needs a long-term credit amounting to €22.7657. Once it gets this, it purchases a new machine and can start to produce circulating capital.

5. Sector I sells a new machine and obtains €25.0614. It repays its corresponding short-term debt to the bank and with its remaining liquidity, €18.6591, purchases circulating capital to produce more of the new machines. It purchases €10.8734 worth of goods from sector IIa and €7.7858 from sector IIb.

Table 2. Flows of inputs and outputs in physical terms

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<thead>
<tr>
<th></th>
<th>Inputs</th>
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<th>Outputs</th>
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<tr>
<td></td>
<td>NM</td>
<td>OM</td>
<td>Kc</td>
<td>C</td>
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<tr>
<td>Period $t$</td>
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<td></td>
<td></td>
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<tr>
<td>S.I</td>
<td>0</td>
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<td>6</td>
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<td>S.IIa</td>
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<td>0</td>
<td>0</td>
<td>8.0862</td>
<td>16.1723</td>
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<tr>
<td>Period $t + 1$</td>
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<td></td>
</tr>
<tr>
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</tbody>
</table>

Table 3. Flows of inputs and outputs in price terms

<table>
<thead>
<tr>
<th></th>
<th>Inputs</th>
<th></th>
<th>Outputs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NM</td>
<td>OM</td>
<td>Kc</td>
<td>C</td>
</tr>
<tr>
<td>Period $t$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S.I</td>
<td>0</td>
<td>0</td>
<td>17.4868</td>
<td>6</td>
</tr>
<tr>
<td>S.IIa</td>
<td>23.4868</td>
<td>0</td>
<td>9.8329</td>
<td>3.7487</td>
</tr>
<tr>
<td>S.IIb</td>
<td>0</td>
<td>9.4231</td>
<td>9.2152</td>
<td>4.3914</td>
</tr>
<tr>
<td>S.III</td>
<td>0</td>
<td>0</td>
<td>14.1401</td>
<td>16.1723</td>
</tr>
<tr>
<td>Period $t + 1$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S.I</td>
<td>0</td>
<td>0</td>
<td>18.6591</td>
<td>6.4022</td>
</tr>
<tr>
<td>S.IIb</td>
<td>25.0614</td>
<td>0</td>
<td>10.4921</td>
<td>4</td>
</tr>
<tr>
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<td>9.8329</td>
<td>4.6859</td>
</tr>
<tr>
<td>S.III</td>
<td>0</td>
<td>0</td>
<td>15.0881</td>
<td>17.2565</td>
</tr>
</tbody>
</table>
6. Once all of the commodities have circulated, we realize that the balance is zero for sectors I and III, whereas sector IIa shows a surplus amounting to €14.98 and, simultaneously, the deficit for sector IIb is €14.98.

If readers repeat the circulation for period \( t + 1 \) they will realize that sector IIb will obtain a surplus of €15,9842, which equals its past debt times \((1+i)\). And, \textit{pari passu}, sector IIa will show a deficit equal in amount.

To sum up, wages paid in the capital goods sector (I, IIa and IIb) partly monetize the profits from the consumer goods sector (III). These profits return to some firms in the capital goods sector, but they are not enough to monetize investment in fixed capacity. Profits plus additional credit make the complete circulation of commodities possible, the monetization of profits in all sectors and the generation of amortization funds, which can be used to face future instalments at the right dates. There are two intersecting sub-circuits: one connects capital goods sectors with the consumer goods sector, the other one links users and producers of fixed capital goods. The reflux can be complete (that is, all money can be destroyed) with some pending debts left over to be cancelled.

5. Conclusions

All models are simplifications of reality, and the model presented above is no exception. Here we have made a number of unrealistic assumptions: the velocity of circulation in each circuit is infinite, the coordination amongst trades is perfect, workers’ savings are nil, uncertainty is of secondary importance, the economy is on a Golden Rule growth path, there are no idle balances etc. Still, the model sheds some light on what Keynes called a monetary economy of production. In particular,

- Banks may finance the purchase of productive capacity with long-term credit.
- In a steady state, and when fixed capital is present, bank debts may last more than one period of time. Therefore, even if all the money that has been created is destroyed within the same period of time, some pending debts may remain.
- In a steady state, the credit for the purchase of capital goods that have already been produced provides prior purchasers of these goods with the liquidity required to accumulate amortization funds which, in turn, are used to cancel past pending debts plus interest. It also provides producers of investment goods with liquidity to fund the working capital needed to produce new investment goods.
- Contrary to the revolving fund argument there is no investment-saving circuit in the general case.
- Two interest rates can be distinguished, a short- and a long-term rate. The Kalecki–Robinson–Nell argument that banks, on the whole, earn what they spend explains the payment of short-term interest. Long-term interest is paid \textit{pari passu} with the expansion of the productive capacity of the economy. When the long-term interest rate is lower than the rate of growth of fixed capacity (which, following our assumptions, equals the profit rate) the circuit can get closed with some money remaining undestroyed.
In the present paper, an alternative account of how profits are realized in monetary terms has been put forth. This explanation does not attempt to preclude other views: the world is so complex a place that we could never encapsulate all its intricacies in a single model. Yet, simplifications, when they are apt, can broaden our understanding of how the world works.

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References


