Review of Political Economy

ISSN: 0953-8259 (Print) 1465-3982 (Online) Journal homepage: www.tandfonline.com/journals/crpe20

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To cite this article: Lorenzo Di Domenico, Giovanna Ciaffi & Davide Romaniello (2024) The Monetary Theory of Production and the Supermultiplier: What Determines Savings?, Review of Political Economy, 36:5, 1746-1774, DOI: 10.1080/09538259.2024.2378373

To link to this article: https://doi.org/10.1080/09538259.2024.2378373

REVIEW OF POLITICAL ECONOMY
2024, VOL. 36, NO. 5, 1746–1774
https://doi.org/10.1080/09538259.2024.2378373

Routledge
Taylor & Francis Group

The Monetary Theory of Production and the Supermultiplier: What Determines Savings?

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ABSTRACT

The paper presents a closed-economy stock-flow consistent model aimed at outlining the natural synthesis between two fundamental pillars of the post-Keynesian approach: the supermultiplier (SM) model and the monetary theory of production based on the notion of endogenous money. Such integration allows the defining of the whole economic mechanism describing the financing of autonomous components and investments, as well as the determination of output and saving within a monetary economy of production. Our contribution argues that the endogenous money theory plays a non-ancillary role within the SM approach. By comparing different scenarios describing the financing of autonomous components of demand and investments (bank loans, retained profits, CB, and equity emissions), we point out that the endogenous process of money creation is the only structural mechanism through which the autonomous components can exist and be independent of current income, and Keynesian causality materializes in the long-run. In general, it is the initial finance of investments and autonomous components through endogenous money that allows them to be ex-post founded by household saving. Conversely, the initial finance through the existing stock of wealth, although it does not intact the investments-saving causality, can be considered only a temporary spin-off of the endogenous money process.

ARTICLE HISTORY
Received 21 June 2023
Accepted 1 July 2024

KEYWORDS
Supermultiplier; endogenous money; monetary theory of production; stock — flow consistent models; monetary savings

JEL CODES
E11; E12; E52; E63; E20

1. Introduction

The Classical-Keynesian approach has yet to establish a clear integration between demand-led growth models and endogenous money theory (EMT) (Cesaratto 2017). In this paper, we refer to demand-led growth models as multiplier-accelerator models that incorporate at least one autonomous component of demand. Our reference point is the Supermultiplier model (SM) (Freitas and Serrano 2015). Notably, two key features of the SM model are closely connected to the endogenous money theory: autonomous spending does not depend on the current circulation of income, and investments do not depend on ex-ante saving formation. Conversely, as long as deposits are created

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Supplemental data for this article can be accessed online at https://doi.org/10.1080/09538259.2024.2378373.

by loans in the EMT, saving is created by investments in the SM approach. A few theoretical contributions have sought to integrate the SM models with the PK-EMT (Cesaratto 2017; Cesaratto and Di Bucchianico 2020; Pariboni 2016). Pariboni (2016) examines the macroeconomic implications of debt-financed consumption within an extended SM model that incorporates endogenous credit money. Cesaratto and Di Bucchianico (2020) present a first attempt to complement the Supermultiplier with the endogenous money theory, demonstrating that credit-money creation pertains to autonomous consumption fueled by consumer credit, government spending that precedes taxation and saving, and investments that are only founded ex-post by saving. Drawing on the circuitist approach, they emphasize that endogenous money finances both investments and the autonomous components of aggregate demand (initial finance), which are later funded by saving (final finance).

Our contribution is strictly related to the so-called (implicit) classical-Keynesian received view, as defined in Cesaratto (2017). With the latter, the author refers to the apparently surprising absence of the financial and monetary dimension within the Classical-Keynesian theory of output, which, instead, necessarily requires an endogenous money theory. According to the author, since it is characteristic of autonomous expenditure not to be financed out of income revenues, unlike induced consumption, it must therefore be financed by endogenous money. Thus, the received view of the SM posits that endogenous money finances autonomous spending and investments which in turn generate induced spending, and both determine output. In this depiction, the separation between monetary and real analysis in macroeconomic systems disappears. As Cesaratto (2017) argues, there is no dualism between real and monetary sectors in the Classical-Keynesian approach which 'metaphorically represent the skeleton and circulation apparatus, respectively, while serving the muscles' (Cesaratto 2017, p. 229). Our paper provides an analytical framework to support this narrative. By employing the Stock-Flow Consistent (SFC) macroeconomic accounting, we further expand Cesaratto's thesis by showing how saving is generated as a result of liabilities creation when autonomous spending and investments are financed. Unlike Cesaratto (2017), we delve deeper into the connections between autonomous components, investments, and endogenous money, specifically examining the relationship between saving and investment, and deficit autonomous spending. In particular, we further investigate the implication of the financing of autonomous components and investments through the existing stock of savings.

We compare different sources of initial finance — such as loans, retained profits, and equity financing for investments, as well as central bank or household wealth financing for deficit public spending — to study whether they can be considered long-run mechanisms for affirming the Keynesian principle and the independence of autonomous components from current circulation. The discussion about the different methods of initial finance will be kept separate from the analysis of the final financing of these components through household savings.

Through this analysis, we show that the endogenous process of money creation is the sole structural mechanism that guarantees the existence of autonomous components of demand and their independence from current income in the long-run, as well as the independence of investments from saving. Alternative ways of financing, such as utilizing

the existing stock of wealth can be understood only as subordinated mechanisms to the endogenous process of money creation.

The paper investigates these issues making explicit the monetary dimension of the SM model to highlight why this approach implicitly contains an endogenous theory of money and, in particular, how this theory plays a non-ancillary role in such a framework, conversely to the neoclassic theory where it is auxiliary (Wicksell 1935). With this aim, we develop a Stock Flow Consistent (SFC) — SM model (see, among others, Brochier 2020; Brochier and Macedo e Silva 2019; Carnevali et al. 2024; Di Domenico, Góes, and Gallo 2023; Mandarino, Dos Santos, and Macedo e Silva 2020; Pedrosa, Brochier, and Freitas 2023; Teixeira and Petrini 2023) as the SFC approach has proven highly effective in illustrating the relationships between assets and liabilities across different sectors and how they are created (for a revised version, see Caverzasi and Godin 2013; 2015; Nikiforos and Zezza 2017). In this regard, this paper also relates to the literature on monetary circuit theory and developing SFC models where the initial and final finance are explicitly addressed (see Berr and Monvoisin 2023; Lavoie 2004; Sawyer and Passarella 2017; Zezza 2012).

On the one hand, the model provides a sound macroeconomic and monetary framework explaining the financing of the autonomous component of demand and underlying stock-flow relationships. It describes how exogenous purchasing power injections are realized and how current income circulation is created. On the other hand, it clarifies how monetary savings are ex-post determined symmetrically to the bookkeeping of the aggregate debt generated when financing such components.

In this sense, the integration of the SM model with EMT allows to shed light on two main issues: (i) how monetary savings are generated; (ii) how autonomous components and investments are financed.

The first point can be well understood by looking at the sequential analysis adopted by the monetary circuit approach (Graziani 1990; 2003; Lavoie 1987; Nell 1996; Parguez 1981; Poulon 1982), and the idea of 'initial' and 'final finance'. In this framework, deposits exist as a result of loans generation, and the generation of monetary savings ultimately depends on debt creation. In a monetary economy, unlike real assets, monetary/financial assets held by an agent or sector have an accounting counterpart in the liability side of the balance sheets of other agents or sectors (Fontana, Realfonzo, and Passarella 2020). Additionally, deposits are also created when the Central Bank (CB) or commercial banks finance deficit public spending (Godley and Lavoie 2007). More in general, one sector can hold positive wealth or monetary savings if one or more other sectors have incurred a debt creation. At the same time, when a loan is reimbursed, a corresponding amount of deposits is destroyed. To this extent, the ex-ante financing of production decisions and investments (initial finance) through endogenous money allows them to be ex-post founded by saving (final finance). It is the initial finance of bank loans that, generating a corresponding amount of deposits, allows investments to be ex-post founded by household equities. In a second step, households can convert a share of deposits created by bank loans to acquire firm equities, creating the illusion that the investments were financed by equity.

Within this wisdom, investments or other autonomous components of demand represent the form and reason for the realization of the lending process, and they are, in substance, the 'economic decision' through which newly created purchasing power is

injected into the system and because of which a liability is created. When a bank loan is created to finance investments or any autonomous component of demand, a corresponding amount of deposits is generated. Similarly, when the CB provides an overdraft or buys public bonds to finance public deficit spending, an equivalent amount of deposits is created. As for the ex-post financing of investments through equity, households can convert the deposit created by CB into public bonds, giving the illusion that the public deficit has been financed by collecting household savings. In short, it is the 'initial finance' of such expenditures that allows for their ex-post founding through household saving (final finance). Consistently with this causal relationship, investments create a corresponding amount of saving when financed by loans.

Regarding the second point, we show that different methods of financing autonomous components and investments are ultimately subordinate to the endogenous money-creation process. This process underlies the Keynesian principle of investment-driven saving, making the two points inherently interconnected. Integrating the Supermultiplier model with Endogenous Money Theory (EMT) provides a comprehensive framework for understanding the financing of autonomous components and investments, as well as the determination of output and saving in a monetary production economy. Autonomous components, such as public spending, serve as exogenous injections of purchasing power that, through the multiplier-accelerator interaction, determine long-run GDP. Their debt financing, alongside investments, determines the saving formation in the economy. Monetary savings emerge as a residual of this multiplicative process, with household saving decisions influencing the final net debts of each sector. Money enters circulation when autonomous demand or investment decisions are financed by the central bank or commercial banks. Consequently, the stock of wealth and changes in aggregate debt are determined by household saving and portfolio decisions. The close interconnection between the SM and the PK-EMT can be summed up in the following terms: as deposits cannot exist without prior loan creation, monetary savings cannot materialize without ex-ante investments.

Along these lines, the paper raises three main points: (i) investments and other autonomous components demand generate a corresponding amount of monetary saving only when financed out-of-debt creation; (ii) the long-run independence of investments from monetary saving, and more broadly, the Keynesian causality, can be revealed only through an endogenous process of money creation; (iii) the endogenous money causality, that goes from loans to deposits, is the substance of the causality that goes from investments to saving. While the first point doesn't necessarily imply the second, and the second doesn't preclude financing investments with existing wealth, these arguments are interconnected. Regarding the second point, the creation of liability-asset linkages does not necessarily entail endogenous money creation. For instance, a liability-asset linkage can be created through existing wealth, such as when investments are financed by equity or households acquire public bonds with existing deposits (initial finance). However, while any liability creation generates a corresponding amount of monetary saving, endogenous money creation is the structural mechanism ensuring the long-run independence of savings from investment and the 'autonomy' of the autonomous components. Any secondary mode of financing, like equity emissions or public bonds financed out of household wealth, does not create deposits but relies on them. Only bank loans or CB bond purchases create money and deposits, making the endogenous

money process the sole engine of direct and indirect (via secondary financing) monetary saving creation.

In the short-run, autonomous components of demand or investments could be financed through equities or bonds acquired by households, leading to an increase in debt and savings. However, this depends on the existing deposit stock. On the one hand, deposits can exist only as a result of the endogenous money creation process. Therefore, financing current investments through equities ultimately depends on past investments financed by bank loans, which created the current stock of deposits. On the other hand, a given amount of deposits can continue to exist only if the corresponding amount of bank (or CB) debt keeps existing. If this debt must be repaid, the corresponding deposits are destroyed. Then, the structural substitution of bank financing with equity financing implies a constant destruction of deposits, making the same equity financing of investments non-feasible. Alternatively, short-run equity financing necessarily requires assuming that debts previously created are perpetual and, therefore, do not have to be repaid. This reasoning can also be applied to the discussion on financing autonomous demand components.

Lastly, even if we consider the existing stock of deposits as a 'manna from heaven', it would not be possible to assume that, in a growing economy or an economy with positive inflation, a growing amount of nominal investments would be financed out of a fixed amount of deposits. A fixed amount of deposits can purchase only a fixed amount of equities. Therefore, it would not be possible to do without the creation of new spending capacity by means of new monetary creation.

These arguments briefly summarize why the Keynesian principle of investment determining saving and the independence of autonomous components from current income requires an endogens process of money creation.

The remainder of the paper is structured as follows. Section Two reviews the Supermultiplier model and Endogenous Money Theory. Section Three presents the Stock-Flow Consistent — SM model, which is used to examine the Keynesian causality by comparing loan-financed and retained-earnings-financed investments. Section Four further investigates the relationship between investments and saving, considering autonomous investments in place of the traditional SM investment function. In Section Five, we compare cases where the initial finance of autonomous components and investments is implemented out of the existing stock of wealth rather than through a genuine process of monetary creation. Section six concludes.

2. The Supermultiplier and the Endogenous Money Theory

The SM approach argues that a long-run relationship between demand and output exists, where the trend growth rate of output is determined by the growth rate of non-capacity-creating autonomous components of demand. Initially developed by Serrano (1995) and Bortis (1997), this model has been further enriched by several authors (Allain 2015; Cesaratto, Serrano, and Stirati 2003; Deleidi and Mazzucato 2019; 2021; Fazzari, Ferri, and Variato 2020; Freitas and Serrano 2015; Hein 2018; Lavoie 2016; Palley 2019). The SM extends the principle of effective demand to the long-run and introduces the role of non-capacity creating autonomous components of demand within an accelerator-multiplier mechanism (Harrod 1939). Specifically, the model combines the standard

multiplier effect on consumption with an investment function grounded on a flexible accelerator principle, where capital accumulation is endogenously shaped by the level of effective demand. Firms try to adjust productive capacity to achieve a normal degree of capacity utilization over time. In this framework, long-run output is the result of the interaction between the multiplier and the accelerator mechanisms, while savings adjust to investments through variations in the level of production and the corresponding production capacity (Garegnani 1992; 2015).

One of the central issues in the SM literature is the notion of non-capacity creating autonomous components of demand, namely those components of aggregate demand that are independent of the current level of income and do not directly affect the capital stock. Among these components, we can include: (i) government expenditure which is affected by policy decisions; (ii) exports which depend on the level of foreign demand; and (iii) autonomous consumption which is financed either in the credit market or through accumulated wealth. Other relevant aspects of the SM are that normal prices and capacity utilization,[1] in the long run, are combined with an exogenously given income distribution determined outside the economic system. Indeed, in line with the theory of the surplus approach grounded on the theory developed by Smith, Ricardo, Marx, and Sraffa (Garegnani 1984), income distribution is determined by social, historical, economic, and institutional factors, customs, and social norms that affect the bargaining power of opposite social classes, namely workers and entrepreneurs (Kalecki 1943; Levrero 2013; Stirati 1994).

Our study is grounded on the post-Keynesian Endogenous Money Theory (PK-EMT) (Deleidi 2020; Fontana 2003; Kaldor 1970; Lavoie 1996; Moore 1988; Rochon 1999; 2001). According to the PK-EMT, the quantity of money in the economic system is endogenously determined by the demand for loans, rather than exogenously determined by the central bank. Commercial banks are 'money producers' and are not mere intermediaries between saving and investment decisions. Following this perspective, commercial banks can create money *ex-nihilo*, that is without a prior volume of savings, the gathering of deposits, and a predetermined creation of monetary reserves by the central bank. In the PK-EMT, monetary aggregates are an outcome of the borrowers' demand for loans and the supply of loans by commercial banks. After the creation of bank loans and deposits, commercial banks demand a certain volume of the monetary base to the central bank, to comply with reserve requirements. Therefore, monetary reserves are a consequence of commercial banks' lending activity, rather than the cause of it. A logic chain exemplifying the PK-EMT can be summarized as follows: (i) the creditworthy borrowers' demand[2] determines the volume of loans granted by commercial banks; (ii) the volume of bank loans provided to borrowers creates an equivalent level of deposits; (iii) the volume of deposits and the value assumed by the credit divisor (Lavoie 1984) — which is the opposite of the money multipliers — affects the volume of reserves demanded by commercial

[1]For a discussion on the on the utilization controversy, see Nikiforos (2016), Girardi and Pariboni (2016), and Gahn and González (2020).

[2]Commercial banks do not merely accommodate all potential demands for loans (Lavoie 1996), but only the effective creditworthy demand for loans (Kaldor 1981; Moore 1988). This implies that banks select good borrowers (Robinson 1952) and ration credit by means of quantitative constraint, e.g., by varying the collateral requirements (Fontana and Setterfield 2009; Wolfson 1996).

banks to the central bank. Within this perspective, central and commercial banks set interest rates that are regarded as exogenous variables, independent of the volume of money demanded and supplied.[3] Once the central bank sets the short-run interest rate on reserves, commercial banks determine their interest rates on loans (Arestis and Eichner 1988), by applying a mark-up over the short-run interest rate pegged by the central bank.[4] The money endogeneity and the creation of bank money are central arguments in the *Theory of the Monetary Circuit*, where money is seen as a necessary tool to activate the production of commodities in a *Monetary Economy of Production* by paying workers and purchasing capital goods (Graziani 2003). In this sense, according to the Circuitists authors, the correct macroeconomic method to integrate money in the economy is to consider money creation (Poulon 1982). The endogenous character of money appears at the first step of the circuit: money creation doesn't depend on a money supply function but on firms' needs and entrepreneurs' anticipations to begin their activities (Accoce and Mouakil 2007). Entrepreneurs need to borrow money from banks to finance investments and production decisions. This is what Graziani (1990) calls initial finance. Money is created by banks when they grant loans to creditworthy economic agents. At the end of the production process firms recover part of the income generated by production through the consumption of workers and issuing securities. This is what Graziani (1990) defines as final finance. At this stage, entrepreneurs pay back a share of their loans. Workers' portfolio decisions determine the residual stock of money.

The PK-EMT has been extensively acknowledged and gained momentum in the international debate. This perspective disregards two main ideas of the marginalist perspective: (i) the Monetarist idea of a money supply exogenously determined by the central bank through changes in the monetary base and the money multiplier, and (ii) the marginalist Loanable Funds Theory (LFT) according to which saving determines investment. Recently, academics from different schools of thought (Ryan-Collins, Werner, and Castle 2016; Werner 2014), as well as monetary authorities (ECB 2011; Jakab and Kumhof 2015; 2019; McLeay, Radia, and Thomas 2014), have endorsed the view of an endogenous money creation process. In its first quarterly bulletin of 2014, the Bank of England (BoE) stated:

> In the modern economy, most money takes the form of bank deposits. But how these bank deposits are created is often misunderstood: the principal way is through commercial banks making loans. Whenever a bank makes a loan, it simultaneously creates a matching deposit in the borrower's bank account, thereby creating new money. (McLeay, Radia, and Thomas 2014, p. 1)

Within this depiction, since money is created when financing investments, the causal relation between saving and investments is reversed compared to the one described in the LFT (Bertocco and Kalajzić 2022). Just as in a corn (neoclassical) economy saving presupposes the production of corn, in an economy based on the use of bank

[3]Within the PK-EMT, a twofold perspective on the determination of interest rates exists, namely the horizontalist (Deleidi 2020; Lavoie 1996; Moore 1988; Rochon 1999; 2001) and the structuralist (Dow 1996; Palley 1994; 1996; 2017; Wray 1990; 1992) views. For an in-depth review of these issues, see, among others, Lavoie (1996), Rochon (2001), Fontana (2003; 2004), and Deleidi (2019; 2020). In this paper, following both the recent literature on SFC modelling and on the EMT, we endorse the horizontalist perspective.

[4]For a discussion on the determinants of the mark-up, see among others Eichner (1987) and Deleidi (2020).

money, saving decisions presuppose the production of money that will be accumulated by savers.

3. The Supermultiplier and the Post-Keynesian Endogenous Money Theory: A Stock-flow Consistent Model

This section presents an analytically solvable SFC — Supermultiplier model. The model considers a closed economy with public spending as the sole autonomous component of demand. Consumption and investments are fully induced. In line with the SFC approach, we make explicit the source of financing of autonomous components of demand and investments, including debt repayments. Firms invest according to the principle of capacity adjustment, households consume a fraction of disposable income and hold their wealth as deposits and public bonds. Central Bank acts as lender of last resort, commercial bank collects deposits and grants loans to firms to finance investment decisions. The difference between deposits and loans is held as reserves by commercial banks.

In this section, we highlight the natural interdependency between the Keynesian hypothesis of investments determining saving and the theory of endogenous money. In particular, we show that if investments are fully financed by loans, a corresponding amount of monetary saving originates. Conversely, if investments are financed through retained profits, they do not generate a corresponding amount of monetary saving and they figure as an increase in the average propensity to consume. In this case, the public deficit decreases and, with that, the flow of household saving[5] (see Di Domenico 2022 about the relationships between saving rate, public debt, and private savings).

For the sake of the discussion, we are considering two versions of the SM-SFC model. The first one rigorously reproduces the traditional version in which consumption depends only on disposable income. In the second one, consumption depends also on the stock of wealth. Latter is a typical feature of post-Keynesian SFC models (Godley and Lavoie 2007) and allows us to analyze the stationary state values of stock variables.[6] The SFC-SM model is described by the following system, from equation (1) to (17):

$$Y_t = C_t + \bar{G} + I_t \tag{1}$$

$$C_t = YD_{t-1}c_1 + V^h_{t-1}c_2 \tag{2}$$

$$YD_t = (Y_t - D_t - I_t\alpha)(1-\theta) \tag{3}$$

$$D_t = L_t\delta \tag{4}$$

$$I_t = Y^e_t\nu - K_t(1-\delta) \tag{5}$$

$$Y^e_t = Y_{t-1} \tag{6}$$

$$B_t = B_{t-1} + G_t - \theta(Y_t - D_t - I_t\alpha) \tag{7}$$

[5]In general, the debt-financing can occur through a money creation process (bank loans) or from the existing wealth stock when firms issue equities. Section Five is devoted to the latter aspect, studying the implications for the macroeconomic theory.

[6]In models with a propensity to consume out-of-wealth equal to zero and constant level of public spending, the public debt has a positive growth rate in the stationary state. Then, the public debt-to-GDP ratio constantly grows.

$$V_t^h = V_{t-1}^h(1 - c_2) + YD_{t-1}(1 - c_1) \tag{8}$$

$$K_t = K_{t-1}(1 - \delta) + I_{t-1} \tag{9}$$

$$L_t = L_{t-1}(1 - \delta) + I_t(1 - \alpha) \tag{10}$$

$$B_t^h = \min(\beta V_t^h, B_t) \tag{11}$$

$$M_t^h = V_t^h - B_t^h \tag{12}$$

$$M_t^c = YD_t \tag{13}$$

$$B_t^{CB} = B_t - B_t^h \tag{14}$$

$$M_t = M_t^c + M_t^h \tag{15}$$

$$H_t = M_t - L_t \tag{16}$$

$$H_t = B_t^{CB} \tag{17}$$

where Y_t is the national income, C_t is the consumption, $\bar{G}$ is the primary public spending, I_t is the flow of gross investments, YD_t is the disposable income of households, Y_t^e is expected demand, D_t is the debt repayment, V_t^h is the stock of household wealth, L_t is the stock of loans, B_t is the public debt, B_t^{CB} is the amount of public bonds held by the Central Bank, B_t^h is the amount of public bonds held by households, I_t^n is the net investment, K_t is the capital stock, M_t^h is the stock of time deposits, M_t^c is the stock of check deposits, H_t is the amount of reserves, δ is the capital depreciation rate, θ is the tax rate, c_1 is the propensity to consume out-of-income, c_2 is the propensity to consume out-of-wealth, α is the share of investments financed by retained profits, ν is the normal capital-to-output ratio, β is the share of household savings held in the form of public bonds. For the sake of simplicity, we are assuming an interest rate equal to zero. However, relaxing this assumption does not modify our results. Model results with positive interest rates can be sent upon request.

Equation 1 defines GDP as the sum of investments, public spending, and consumption. Current consumption (equation 2) depends on the disposable income distributed at the end of the previous period and the stock of household savings.[7] The income before tax of households in equation (3) is net of debt repayment and retained profit used to finance a share of gross investments. That is, the income before tax is net of depreciation allowances and retained profits used to finance a share of net investments (See Godley and Lavoie 2007, Chapter 7 for a similar treatment).[8] Since investments can be financed through a mix of loans and retained profits, depreciation allowances

[7]In the balance sheet, the disposable income distributed by firms to households at the end of the period figures as check deposits. Such income is held in the bank account but does not formally constitute savings.

[8]Note that disposable income can be rewritten as $YD_t = (Y_t - K_t\delta - I_t^n\alpha)(1 - \theta)$, where I_t^n is net investmetns. Indeed, depreciation allowances are equal to $K_t\delta = [K_t(1 - \alpha) + K_t\alpha]\delta = (L_t + K_t\alpha)\delta = D_t + K_t\alpha\delta$. Since a share of retained profit is used for replacing the corresponding depreciated capital ($K_t\alpha\delta$), and the remaining part is used to finance a share of capital expansion (net investments) we have that: $I_t^n\alpha = I_t\alpha - K_t\alpha\delta$. Then, $D_t + I_t\alpha = K_t\delta + I_t^n\alpha$.

consists of debt repayment (D_t) and retained profits needed to replace the depreciated capital. Note that if the leverage is equal to one ($\alpha = 0$), the amortization corresponds to the debt repayment and the income before tax corresponds to NDP. In equation (4) the dynamic of debt repayment is consistent with capital depreciation and interest rates are equal to zero.[9] As a result, the capital stock is equal to the stock of loans plus accumulated retained profits.

The SM investment function is expressed in equation (5), firms adjust capacity to match expected demand at the normal degree of capacity utilization.[10] Expected demand is equal to the demand realized in the previous period (equation 6). Equations 7–10 express the dynamic of stocks. As expressed by equation (11), the amount of public bonds held by households is a fixed share of wealth (β) which cannot exceed the supply of government bonds, and the remaining amount of wealth is held in terms of deposits (equation 12). Check deposits are equal to the income distributed to households at the end of the period (equation 13). CB acts as lender of last resort (equation 14) and the commercial bank holds the difference between the stock of deposits and loans as reserves at the CB (equation 16). Total deposits are equal to the sum of check and time deposits (equation 15). Equation (1) is the redundant equation that ensures the stock-flow consistency of the model, and states that the amount of reserves is equal to the amount of public bonds held by CB. The balance sheet and the transaction matrixes describing the economy are reported in Tables 1 and 2.

The dynamic of production and demand works as follows. Production depends on consumption demand, investments, and public spending. Consumption, in turn, depends on the disposable income distributed at the end of the previous period. Each period represents one production cycle. Public expenditure sets in motion the economic system, it represents the exogenous injection of purchasing power realized in each period and that triggers the income-expenditure sequence realized over the following periods. Investments financed by loans represent the second source of purchasing power injection. Investments are fully induced and respond to the capacity adjustment principle. The expected demand is equal to the demand from the previous period. A portion of the income distributed in period t is retained by firms to finance investments. The long-run income is the result of the overlapping of multiplier sequences triggered by the investments and public spending realized in each period.

First, we consider the traditional formulation of the SM, with the propensity to consume out-of-wealth equal to zero ($c_2 = 0$ in equations 2 and 8). By solving the system, we can derive the values of stock and flow variables in the stationary state (see Appendix B for mathematical derivations)[11]:

$$Y^* = \frac{G}{1 - c_1[(1-\theta) - \alpha v\delta - v(1-\alpha)\delta(1-\theta)] - v\delta} \tag{18}$$

[9]Being α the share of investments financed by retained profits, $K_t(1-\alpha)$ corresponds to the stock of debt.

[10]The investment function is the out-of-the stationary state version on the function adopted in the traditional SM model. In the stationary state, when the realized degree of capacity utilization is equal to normal, we can substitute $K_t = Y_t^e v$ and the investment function becomes $I_t = Y_t^e v\delta$.

[11]For the sake of analytical simplicity, we are assuming that also retained profit are taxed. In this way, it is possible to simplify investments and get manageable results. In this sense, equation (3) becomes: $YD_t = (Y_t - D_t)(1-\theta) - I_t\alpha$. Also equation (7) changes accordingly. Such an assumption does not modify the conclusion of the paper.

Table 1. Balance sheet matrix.

Assets	Household	Production	Bank	Government	CB	$\sum$
Check deposits	$+M^h$		$-M$			0
Time deposits	$+M^c$		$-M^c$			0
HPM			$+H_b$		$-H$	0
Loans		$-L$	$+L$			0
Fixed Capital		$+K$				$+K$
Public bonds	$-B_h$			$-B$	$+B_{cb}$	0
Net wealth	$-V^h$	$-V^f$	0	$+V^g$	0	$-K$
$\sum$	0	0	0	0	0	0

Table 2. Transaction matrix.

	Households	Production		Government	Bank		CB		$\sum$
		Current	Capital		Current	Capital	Current	Capital	
Consumption	$-C$	$+C$							0
Income	$+Y^N$	$-Y^N$							0
Ret. profits	$-FU$		$+FU$						
Investments		$+I$	$-I$						0
Public expenditure		$+G$		$-G$					0
Taxes	$-T$			$+T$					0
Debt rep.		$-L_t\delta$	$+L_t\delta$						0
Δ Deposits time	$-\Delta M$					$+\Delta M$			0
Δ Deposits check	$-\Delta M^c$					$+\Delta M^c$			0
Δ Loans			$+\Delta L$			$-\Delta L$			0
Δ Bonds	$-\Delta B^h$			$+\Delta B$				$-\Delta B^{bc}$	0
Δ Reserves						$-\Delta H$		$+\Delta H$	0
$\sum$	0	0	0	0	0	0	0	0	0

$$I^* = \frac{G\nu\delta}{1 - c_1[(1-\theta) - \alpha\nu\delta - \nu(1-\alpha)\delta(1-\theta)] - \nu\delta} \tag{19}$$

$$K^* = \frac{G\nu}{1 - c_1[(1-\theta) - \alpha\nu\delta - \nu(1-\alpha)\delta(1-\theta)] - \nu\delta} \tag{20}$$

$$u^* = u_n = \frac{Y^*}{Y^n} = 1 \tag{21}$$

$$\Delta L^* = 0 \tag{22}$$

$$\Delta B^* = \frac{G(1-c)\{1 - \theta - \nu[\delta + (-1+\alpha)\delta\theta]\}}{1 - c_1[(1-\theta) - \alpha\nu\delta - \nu(1-\alpha)\delta(1-\theta)] - \nu\delta} \tag{23}$$

$$\Delta V^{h*} = \frac{G(1-c)\{1 - \theta - \nu[\delta + (-1+\alpha)\delta\theta]\}}{1 - c_1[(1-\theta) - \alpha\nu\delta - \nu(1-\alpha)\delta(1-\theta)] - \nu\delta} \tag{24}$$

$$L^* = \frac{G\nu(1-\alpha)}{1 - c_1[(1-\theta) - \alpha\nu\delta - \nu(1-\alpha)\delta(1-\theta)] - \nu\delta} \tag{25}$$

$$M_t^{c^*} = \frac{G[(1-\theta) - \nu(1-\alpha)\delta(1-\theta) - \alpha\nu\delta]}{1 - c_1[(1-\theta) - \alpha\nu\delta - \nu(1-\alpha)\delta(1-\theta)] - \nu\delta} \tag{26}$$

Appendix C reports codes to reproduce both analytical and simulated results and checking their consistency.

Since we are assuming that the growth rate of public spending is zero, the economy reaches a stationary state where GDP is constant.[12] In the stationary state, gross investments are equal to capital depreciation, net investments are zero and the actual degree of capacity utilization is equal to the normal one. Then, the accumulation of household savings is solely due to a positive public deficit ($\Delta B^* = \Delta S^*$).

The initial finance of public spending is realized through CB overdraft. This is the first channel of endogenous money creation. At the end of the period, when the Government realize fiscal revenues and households update their wealth, households can convert a share of deposits to buy back a share of public debt. As a result, public debt is ex-post funded by household savings (final finance). The end of-the period accounting of SFC model may give the illusion that public deficit is financed by households' wealth, however, it is the CB overdraft that allows for the original creation of deposits, from which households can purchase the corresponding public debt.[13] Through the proceeding of the paper, and in particular, in Section Five, the difference between initial and final finance will become clear.

The second channel of money creation is the financing of investments through bank loans. Through the same mechanism, investments can be ex-post founded by households purchasing equities (Graziani 2003). Anyhow, the focus of the paper is to show the relationship between monetary savings and endogenous money, independently from the form they take and portfolio choices of households.

Firstly, to analyze the relationship between investments and saving, we must examine the dynamic of capital accumulation when net investments are positive. To do this, we proceed with our analysis by considering stock rather than flow variables. Figure 1 reports the levels of private and public debt, savings, and capital stocks as the share of investments financed by retained profits increases. In the full-leverage scenario, α is equal to zero and investments are fully financed by bank loans. In the zero-leverage scenario ($\alpha = 1$), investments are fully financed by retained profits. In the partial–leverage scenario α is equal to 0.5.

As shown in Figure 1, the stock of savings (including check deposits) is always equal to the stock of aggregate debt (private plus public debt). Depending on firms' leverage to finance investments, the level and composition of aggregate debt changes. Symmetrically, the level of household savings changes, and is originated by different sources of indebtedness.

When $\alpha = 0$, the capital stock is equal to firms' debt and the stock of savings is equal to the sum of public debt and private debt. Namely, the direct financing of investments through bank loans generates a corresponding amount of saving. When $\alpha = 1$, a share of profits is retained to finance investments, household savings are only generated by public debt.

Notably, the initial finance of investments through bank loans corresponds to an endogenous creation of money generating a corresponding amount of deposits.

[12]We chose a stationary-state model because it allows us to have not very complex analytical formulations of the stock values in the stationary state (see Di Domenico 2022 for a similar exercise with positive growth rates). Such an approach allows us to use the partial derivative of the stock of savings to study their relationship with the methos of financing and other parameters.

[13]In a system with only public spending and fiat money, the stock of deposits is equal to the amount of public bonds held by CB.

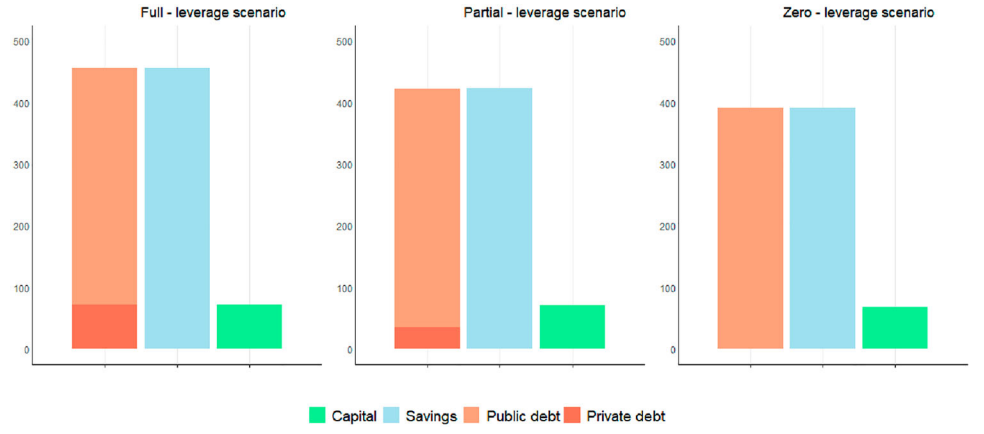

Figure 1. The effect of changes in α on the stock of debt and savings.

Conversely, when the initial finance of investments is realized through retained profits, the expansion of investment does not coincide with an exogenous injection of purchasing power into the system and does not generate any saving. Indeed, investment spending simply corresponds to a recirculation of existing income without affecting the liability-assets relationships of the system. Such difference is also understandable looking at the reduction in the output level as the share of investments financed out of retained profits increase. In the first step, the initial finance through retained profit corresponds to a reduction in households' disposable income and consumption (compared to the case of $\alpha = 0$). However, this amount is recirculated due to the investment and still leads to higher spending than if the income were distributed entirely to households and used only for consumption. In this sense, it is easy to verify that:

$$(YD_t - I_t)c_1 + I_t > YD_t c_1 \tag{27}$$

Hence, when calculated in terms of spending on disposable income, investment financed through retained profits figures as an increase in the average propensity to consume. In contrast, when investment is financed through debt it figures as an 'exogenous' addition to existing demand and has a greater expansionary effect. Indeed:

$$YD_t c_1 + I_t > (YD_t - I_t)c_1 + I_t \tag{28}$$

In this regard, it is possible to verify that the value of the (super) multiplier is maximum when $\alpha = 0$ and it is at the minimum level when $\alpha = 1$. The (super) multiplier when $\alpha = 0$ is:

$$m_{\alpha=0} = \frac{1}{1 - c_1[1 - \theta - \nu\delta(1 - \theta)] - \nu\delta} \tag{29}$$

The (super) multiplier when $\alpha = 1$ is:

$$m_{\alpha=1} = \frac{1}{1 - c_1(1 - \theta - \nu\delta) - \nu\delta} \tag{30}$$

Where:

$$\frac{1}{1-c_1[1-\theta-\nu\delta(1-\theta)]-\nu\delta} > \frac{1}{1-c_1(1-\theta-\nu\delta)-\nu\delta} \tag{31}$$

When investments are financed through retained profits, the reduction in consumption has a cascade effect on investments and aggregate demand, ultimately resulting in lower levels of income, debt, and savings (compared to the case of investments financed by loans). In this scenario, saving is primarily generated through the public deficit. Conversely, the model suggests that the maximum level of GDP and savings is achieved when investments are fully financed through loans. In this case, household savings are generated by both public debt and firms' debt.

To better highlight such relationships, we can consider the system with a positive propensity to consume out-of-wealth ($c_2 > 0$ in equations 2 and 8). In this scenario, it is possible to determine the stationary state values of stocks (debts and savings) and apply the partial derivatives of the stationary stock of savings with respect to α to study the impact of different types of investment financing. The stationary values of stock and flow variables are:

$$Y^* = \frac{G}{\theta[1-\delta\nu(1-\alpha)]} \tag{32}$$

$$I^* = \frac{G\nu\delta}{\theta[1-\delta\nu(1-\alpha)]} \tag{33}$$

$$K^* = \frac{G\nu}{\theta[1-\delta\nu(1-\alpha)]} \tag{34}$$

$$L^* = \frac{G\nu(1-\alpha)}{\theta[1-\delta\nu(1-\alpha)]} \tag{35}$$

$$M_c^* = \frac{G}{\theta}(1-\theta) \tag{36}$$

$$V^{h*} = \frac{(1-c_1)G(1-\theta-\delta\nu(1-\theta(1-\alpha)))}{\theta[1-\delta\nu(1-\alpha)]c_2} \tag{37}$$

$$B^* = G\frac{(1-c_1)\{1-\theta-\delta\nu[1-\theta(1-\alpha)]\}+c_2\{(1-\theta)[1-\delta\nu(1-\alpha)]-\nu(1-\alpha)\}}{\theta[1-\delta\nu(1-\alpha)]c_2} \tag{38}$$

The partial derivative of savings with respect to α is negative:

$$\frac{\partial V^{h*}}{\partial\alpha} = -\frac{(1-c_2)G\nu\delta(1-\nu\delta)}{c_2[1-\nu(1-\alpha)\delta]^2\theta} < 0 \tag{39}$$

When the share of investments financed by retained profits increases, the amount of savings generated by investments decreases. In particular, when $\alpha = 1$ and investments

are fully financed by retained profits, the stock of savings is simply equal to public debt minus current disposable income:

$$B^*_{\alpha=1} - M^*_{c_{\alpha=1}} = B^* = G\frac{(1-c_1)(1-\theta-\delta\nu)}{\theta c_2} \tag{40}$$

We can verify that the latter is equal to the stock of savings:

$$V^{h*}_{\alpha=1} = \frac{G(1-c_1)(1-\theta-\delta\nu)}{\theta c_2} \tag{41}$$

That is, investments do not generate any changes in the stock of monetary savings. Conversely, when investments are fully financed by an endogenous process of money creation, they generate a corresponding amount of monetary saving. In this case, the stock of savings is equal to the sum of public debt and private debt. The latter, in turn, is equal to the capital stock.

The sum of public and private debt, net of disposable income is:

$$B^*_{\alpha=0} + L^*_{\alpha=0} - M^*_{c_{\alpha=0}} = G\frac{(1-c_1)(1-\theta)}{c_2\theta} \tag{42}$$

The stock of savings is:

$$V^{h*}_{\alpha=0} = G\frac{(1-c_1)(1-\theta)}{c_2\theta} \tag{43}$$

Finally, it is possible to verify that, given the same initial conditions and the level of public spending, the stock of savings is higher compared to the case when investments are fully financed by retained profits:

$$V^{h*}_{\alpha=0} > V^{h*}_{\alpha=1} \tag{44}$$

Indeed:

$$(1-\theta) > (1-\theta-\delta\nu) \tag{45}$$

In case $\alpha = 1$, the circular flow of income only depends on the injection of purchasing power realized through public spending. For the same reason, the amount of saving that households retain from this circulation only determines the public deficit and is independent of investments.

In sum, when investments are fully financed by retained profits, they are indirectly financed by the public spending financed through the CB overdraft. In this case, the circular flow of income interlay originates from CB purchasing of public bonds. The latter, being the only mechanisms of endogenous money creation, results to be the only mechanism generating monetary saving. When investments are financed through bank loans, a second mechanism of money and debt creation comes into a play. As a result, investments add a second mechanism of monetary saving generation.

To further examine the relationship between investments and monetary saving and eliminate the effect produced by changes in total output and level of investments when α changes, the next section considers autonomous investments in the system.

This approach allows us to assess the impact on savings of an exogenous shock on investments in the two extreme cases, namely when investments are financed by loans ($\alpha = 0$) or when investments are financed by retained profits ($\alpha = 1$).

4. Autonomous Investments and Monetary Saving

This section considers the same SFC model presented in Section Three, with autonomous investments. Then, $I = \bar{I}$ replaces equation 5. The steady-state solutions of the system are:

$$Y^* = \frac{\bar{G} + \bar{I}\{1 - c_1[1 - \theta(1 - \alpha)]\}}{1 - (1 - \theta)c_1} \tag{46}$$

$$C^* = \frac{c_1\{\bar{G}(1 - \theta) + \bar{I}\alpha\theta\}}{1 - c_1(1 - \theta)} \tag{47}$$

$$K^* = \frac{I}{\delta} \tag{48}$$

$$L^* = \frac{\bar{I}(1 - \alpha)}{\delta} \tag{49}$$

$$\Delta L^* = 0 \tag{50}$$

$$\Delta V^{h*} = \frac{(1 - c)[\bar{G}(1 - \theta) - \bar{I}\alpha\theta]}{1 - c_1(1 - \theta)} \tag{51}$$

$$\Delta B^* = \frac{(1 - c)[\bar{G}(1 - \theta) - \bar{I}\alpha\theta]}{1 - c_1(1 - \theta)} \tag{52}$$

$$S_t = \bar{G}m_G^s + +\bar{I}m_I^s \tag{53}$$

$$m_G^s = \frac{(1 - c_1)f[(c_1f)^n + t(1 - c_1f) - 1]}{(c_1f - 1)^2} \tag{54}$$

$$m_I^s = \frac{1}{\delta(1 - c_1f)^2(-1 + \delta + c_1f)}(1 - c_1)$$
$$\left\{\begin{array}{l} (-1 + \delta)f(-1 + c_1f)[(-1 + (1 - \delta)^t)(-1 + c_1f) + \delta(-1 + (c_1f)^t)] \\ +\alpha[(-1 + (1 - \delta)^t)f\,(-1 + c_1f)^2 + \delta(-1 + c_1f)(-1 + (c_1f)^t \\ +t + f(-1 + c_1f + (1 - \delta)^n(1 - c_1f) - t - c_1t + c_1ft)) \\ +\delta^2(-1 + (cf)^t + t - f(t + c(f(-1 + (c_1f)^n - t) + t)))] \end{array}\right\} \tag{55}$$

Where $f = 1 - \theta$. As in the previous system, the stationary-state level of net investments is zero and the flow of saving is generated only by the public deficit. Now, we assess the impact of a positive shock on the permanent level of investments on the flow of saving. Figure 2 reports the effect of a permanent increase in gross investments in both full-leverage ($\alpha = 0$) and zero-leverage scenarios ($\alpha = 1$).

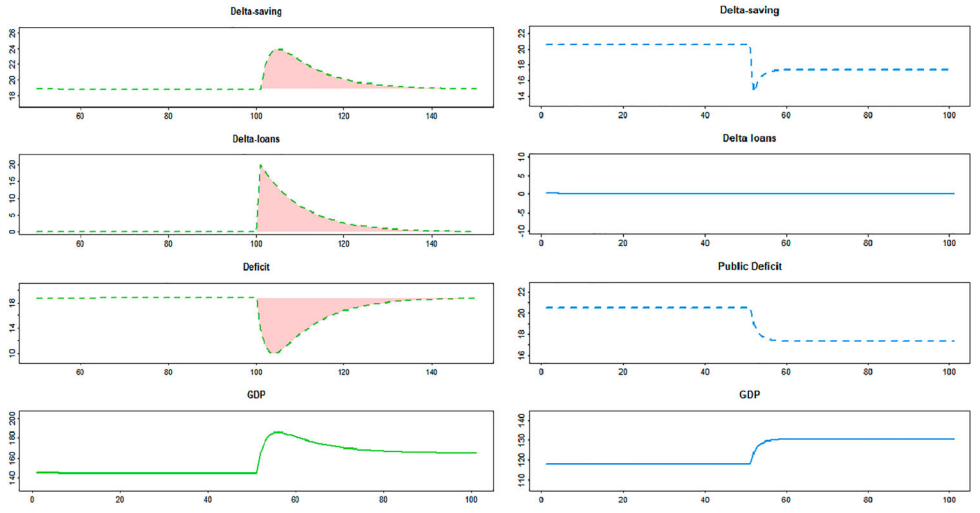

Figure 2. Impact of a persistent increase in gross investments. Left side ($\alpha = 0$). Right side ($\alpha = 1$).

When $\alpha = 0$, the partial derivative of equation (51) with respect to investments is positive and the flow of investments generates a proportional and positive amount of saving:

$$m_I^s > 0 \tag{56}$$

The increase in net investments generates an equal amount of saving that, in turn, is equal to the variation of firms' debt. The flow of investments corresponds to an exogenous injection of purchasing power and the amount of money that is retained by households (as savings/deposits) and the Government (through taxation) from such injection corresponds to the net variation in firms' debt. The flow of saving generated by investments is split into a reduction in the public deficit and an increase in household savings.

$$\sum_{i=s}^{T} \Delta L_i = \sum_{i=s}^{T} \Delta I_i = \sum_{i=s}^{T} \Delta S_i + \sum_{i=s}^{T} \Delta B_i \tag{57}$$

The cumulated flows of saving produced by the variation in net investments correspond to the shaded areas in Figure 2. Given a constant level of public spending, public deficit decreases since a higher amount of fiscal revenues is generated by the taxation on the income produced by the flow of investments. When $\alpha = 1$ the partial derivative is negative and the increase in investments leads to a decrease in the stock of savings:

$$m_I^s < 0 \tag{58}$$

As described in Section Three, the financing of investments through retained profits figures as a higher share of income that is spent and, thus, as an increase in the average propensity to consume. Since all the circular flow of income is financed (or generated) by public debt, a higher average propensity to consume implies a lower public deficit. Therefore, the accumulation of private savings decreases as well.

In detail, the increase in investments partially offset private consumption, but, since $\left|\frac{\partial C^*}{\partial I}\right| < \left|\frac{\partial Y^*}{\partial I}\right|$, GDP increases:

$$\frac{\partial Y^*}{\partial I} = \frac{1 + c_1}{1 - (1 - \theta)c_1} > 0 \tag{59}$$

$$\frac{\partial C^*}{\partial I} = c_1\left[\frac{(1 + c_1)\theta}{1 - c_1(1 - \theta)} - 1\right] < 0 \tag{60}$$

That is, the increase in investments more than offsets the decrease in consumption (this effect is like the one depicted in the Haavelmo theorem)[14] and figures as an increase in the average propensity to consume.

As shown in Di Domenico (2022), the accumulation of public debt is determined, among other factors, by the saving rate of the economy and is positively correlated with it. When investments are financed through retained profits, the public deficit becomes the only source of debt that can generate household saving. If the saving rate decreases, the public deficit also decreases, and the expansion of investment leads to a decrease in the flow of saving.

This analysis leads to an important conclusion: net investment generates a corresponding amount of household saving only when financed through bank loans. In this case, investments represent an exogenous injection of purchasing power into the system, leading to a symmetrical accumulation of debt and savings. Conversely, when investments are financed through retained profits, they are indirectly financed through the already existing income circulation that, in turn, is indirectly financed by public spending. In this case, a positive shock to the level of investments corresponds to an increase in the average propensity to consume and, therefore it produces a decrease in the flow of household saving by reducing public deficit.

5. Initial and Final Finance of Autonomous Components and Investments

In this section, we delve into the mechanism of initial and final finance that underpins the presented model. In particular, we compare the cases where the initial finance of autonomous components and investments is operated through the existing stock of wealth or endogenous money. This exercise is functional to highlight the mechanism by which the SM approach, and, more in general, the Keynesian principle of investment determining saving and the independence of the autonomous components from current income requires an endogens process of money creation.

In the framework we presented, as in the monetary circuit approach, it is the ex-ante financing through endogenous money, of autonomous components and investments (initial finance) that allows them to be ex-post founded by saving (final finance). It is the initial finance of bank loans that, generating a corresponding amount of deposits, allows investments to be ex-post founded by household equities. Households can convert a share of the deposits created by bank loans to purchase firm equities. At the

[14]The amount of income subtracted to consumption and used to finance investments is entirely spent, while only a fraction of such income would be spent if remains in the hand of households.

end of the process, the illusion that the investments have been financed by household saving can appear.

Similarly, government spending, financed by purchasing power creation (initial finance), allows the ex-post funding (final finance) by taxes and household savings. Usually, as pointed out by Modern Monetary Theory (MMT), government spending is typically financed by the CB, later funded by tax collection, and if tax revenues are insufficient, by collecting savings. However, as shown in Cesaratto and Di Bucchianico (2020) and Lavoie (2013), the same mechanism is implemented when the initial finance is performed by commercial banks. Regardless of a specific source of money creation, the point is that it is the act of spending financed by endogenous money that, through the multiplier, generates a residual amount of monetary saving.

For the sake of clarity, let's consider one type of expenditure at a time. As a first step, we consider only public spending by taking the SM model presented in Section Three and removing induced investments. Figure 3 presents numerical simulations in the scenario where households prefer to hold their wealth only in the form of deposits and the propensity to consume out-of-wealth is positive. At the beginning of the period, CB provides an overdraft of 50 to the government to finance public spending. This injection of purchasing power results, in the first period, in an equivalent increase in output, tax revenues of 15, and government debt of 35. At the end of the period, disposable income is distributed to households and recorded as check deposits. In period 2, demand is the sum of government spending and household consumption generated by the disposable income distributed at the end of period 1. At the end of period 2, households can decide to hold savings in the form of public bonds or deposits. In case $\beta = 0$, households desire to hold their wealth in the form of deposits, the change in the stock of deposits equals the change in public bonds held by CB. This sequence repeats in each period. After a number of periods, the economy reaches a stationary state, where GDP and stocks remain constant over time. The stationary value of GDP is the result of the overlapping of multiplier sequences triggered by public spending realized in each period. In each period, the amount of deposits is equal to the amount of public bonds held by CB which, in turn, is equal to the amount of reserves. As illustrated in Figure 3, it is the CB's process of money creation financing public deficit that allows the collection of taxes and generates a corresponding amount of deposits.[15]

In case households desire to hold a share of their wealth in the form of public bonds, at the end of the period, they can convert a share of deposits created by CB into public bonds. In this case, the public debt held by CB and the amount of reserves decrease proportionally. If households desire to hold the wealth completely in the form of public bonds, deposits and public bonds held by CB are zero. The ex-ante financing of public spending by endogenous money allows public deficit to be ex-post financed by household saving. Figure 4 displays such scenario.

Without the initial finance of public spending by CB, it would not be possible to generate deposits through which public debt is ex-post founded by households. This raises the question: is it possible that public spending is ex-ante financed by households? In other words, can the initial financing of a constant level of the autonomous component be structurally carried out through household saving, rather than endogenous money creation?

[15]Such mechanism would be activated also in the case public spending is ex-ante financing by commercial banks.

Time	Gov. exp.	Consumption	GDP	Publid debt	CB bonds	Time deposits	Check dep.	Households bonds	Loans	Reserves
1	50	0	50	28	28	0	28	0	0	28
2	50	25	75	44	44	3	41	0	0	44
3	50	37	87	55	55	7	48	0	0	55
4	50	44	94	62	62	11	52	0	0	62
..	..	..	..	..	..	..	..	..	..	..
48	50	61	111	121	121	60	61	0	0	121
49	50	61	111	121	121	60	61	0	0	121
50	50	61	111	121	121	60	61	0	0	121

Figure 3. Initial and final finance of public spending: households hold the stock of wealth in the form of deposits.

Time	Gov. exp.	Consumption	GDP	Publid debt	CB bonds	Time deposits	Check dep.	Households bonds	Loans	Reserves
1	50	0	50	28	28	0	28	0	0	28
2	50	25	75	44	41	0	41	3	0	41
3	50	37	87	55	48	0	48	7	0	48
4	50	44	94	62	52	0	52	11	0	52
..	..	..	..	..	..	..	..	..	..	..
48	50	61	111	121	61	0	61	60	0	61
49	50	61	111	121	61	0	61	60	0	61
50	50	61	111	121	61	0	61	60	0	61

Figure 4. Initial and final finance of public spending: households hold the stock of wealth in the form of bonds.

Firstly, there must be a pre-existing stock of deposits. Since deposits are only created through endogenous money, which occurs when the central bank or commercial banks finance government spending, investment or consumer credit, it is necessary that for a sufficient number of periods, the autonomous component has been financed through money creation. Then, the initial finance operated by households is eventually possible only after an ex-ante accumulation of public bonds by CB. Moreover, it must be assumed that for a certain number of periods, households prefer to hold their savings in the form of deposits. Only at this point, it is possible to force public spending to be initially financed by household deposits by imposing a change in portfolio preferences. Household deposits act as initial finance.

In the numerical example shown in Figure 5, the propensity to consume and the tax rate have been fixed in such a way as to generate a sufficient accumulation of deposits in

Time	Gov. exp.	Consumption	GDP	Publid debt	CB bonds	Time deposits	Check dep.	Households bonds	Loans	Reserves
49	50	61	111	121	121	60	61	0	0	121
50	50	61	111	121	121	60	61	0	0	121
51	50	61	111	121	121	60	61	0	0	121
52	50	61	111	121	121	60	61	0	0	121
53	50	61	111	122	121	60	61	0	0	121

Figure 5. Initial finance of public spending through household deposits.

the stationary state. In this case, in the stationary-state, the public deficit is zero and public spending generates an equal amount of fiscal revenues. Starting from period 50, we impose the initial finance must be realized through household deposits. At the end of the period, since public spending generates an equal amount of taxes, households do not hold any public bonds, and all their wealth is held in the form of deposits. Ultimately, it is necessary to assume previous financing through endogenous money of government spending to allow interim financing through the existing stock of savings.

Is it possible to finance a fiscal expansion through the existing stock of wealth? Figure 6 reports the case in which the increase in public spending is consistent with the existing stock of wealth. From period 50, the expansion of public spending is ex-ante financed by household wealth. The debt-financing of public deficit generates a corresponding amount of saving. As shown in Figure 6, household wealth increases by 6 (bonds increase by 12, while time deposits decrease by 6) although no process of endogenous money creation has been activated.

It is important to note that, for all the previous cases to be realized, two special hypotheses are required. The first hypothesis considers that the stock of debt financed by CB or commercial bank (namely, the stock that, though the endogenous money process has generated a corresponding amount of deposits) does not have to be reimbursed, or the related bonds must be renewed in perpetuity. Indeed, if this debt were to be repaid and rolled over through the sale of bonds to households, a corresponding amount of deposits would be destroyed. It follows that if all the debt held by the Central Bank were to be repaid at maturity, the stock of deposits would disappear, and it would precisely not be possible to finance government spending from household savings. Hence, an ongoing process of endogenous money creation, i.e., one aimed at renewing maturing securities, is always necessary to imagine some role of the stock of household savings in initial finance operations. The second hypothesis requires that, in correspondence with the fiscal expansion, there is a change in household portfolio preferences. In particular, it is necessary to assume that households preferred to hold wealth in the form of deposits initially and, from the shock onward, in the form of public bonds. The same applies to the scenario of refinancing a constant level of public spending.

These examples show that the initial finance of autonomous components and investments cannot be considered as a structural mechanism of financing. First, as above-mentioned, because the initial finance operated through household wealth requires the pre-existence of a stock of deposits.[16] Since deposits are created only through money creation, that is, when the central bank or commercial bank finances government spending, investment, or consumer credit, it is necessary that for a sufficient number of periods the spending components have been financed through endogenous money. In this sense, initial finance through the existing stock of wealth can exist only as a spin-off of the structural flow of deposit creation generated by expenditures financed through endogenous money. These possibilities will always be tied to the size of the former and cannot exist without it. Second, for a fixed/constant amount of deposits to keep existing, there is a need for an ever-living process of monetary creation aimed at renewing maturing debts.[17]

[16]In addition, such deposits have to be sufficient to finance the autonomous level of public spending or investments.
[17]While it could be realistically assumed that CB, the same do not apply for bank loans.

Time	Gov. exp.	Consumption	GDP	Publid debt	CB bonds	Time deposits	Check dep.	Households bonds	Loans	Reserves
49	50	61	111	121	121	60	61	0	0	121
50	50	61	111	121	121	60	61	0	0	121
51	55	61	116	124	121	58	64	3	0	121
52	55	63	118	126	121	56	65	5	0	121
53	55	65	120	127	121	56	66	6	0	121
..	..	..	..	..	..	..	..	..	..	..
70	55	67	122	133	121	54	67	12	0	121
71	55	67	122	133	121	54	67	12	0	121
72	55	67	122	133	121	54	67	12	0	121

Figure 6. Financing the fiscal expansion through household deposits.

Third, in a growing economy or one with positive inflation, it is not possible to imagine a structural financing of investments and autonomous components through a constant stock of deposits. A positive growth rate of expenditure components unequivocally requires an endogenous process of money creation. As argued by Rochon and Rossi (2004): 'In a monetary economy of production, credit is needed to enable firms to continue and expand production. There is a definitive link between bank credit and economic growth.'

Now, we can extend the analysis to the case of investments financed through the existing stock of savings. In this case, the initial finance is operated through equity emissions. For the sake of clarity, let's consider the income-expenditure model with autonomous investments ($\bar{I}$) and excluding public spending.[18] In this way, we can focus on the investments-saving nexus.

$$Y_t = C_t + \bar{I} \tag{61}$$

$$C_t = YD_{t-1}c_1 + V^h_{t-1}c_2 \tag{62}$$

$$YD_t = Y_t - K_t\delta \tag{63}$$

$$V^h_t = V^h_{t-1}(1 - c_2) + YD_{t-1}(1 - c_1) \tag{64}$$

$$E^h_t = E^h_{t-1} + min(M_t, \bar{I}\ \varepsilon - K^{eq}_t\delta) \tag{65}$$

$$L_t = L_{t-1}(1 - \delta) + I_t(1 - \ \varepsilon) \tag{66}$$

$$K^{eq}_t = K^{eq}_{t-1}(1 - \delta) + I_t\varepsilon \tag{67}$$

$$M^h_t = V^h_t - E^h_t \tag{68}$$

$$L_t = M_t \tag{69}$$

[18]For the sake of clarity, we are considering a system with autonomous investment in place of the traditional investment function because the latter necessarily require another autonomous component in the system, such as public spending. In that case, since the creation of deposits depends also on the deposits created by CB, the macroeconomic relationships could appear less clear.

With respect to the first system of equation (p. 11), equation (61) defines the GDP as the sum of autonomous investments and consumptions, while equation (62) is the same of equation (2). Disposable income (equation 63) is equal to the NDP.[19] E_t^h is the amount of equity, ε is the percentage of investments financed issuing equities, K_t^{eq} is the stock of capital financed by equity emissions, δ is the capital depreciation rate. According to equation 65, E_t^h is equal to stock of equity from the previous period plus the new amount of equity purchased by household, where this is equal to the minimum between the stock of deposits (M_t) and the new emission of equity by the firms ($\bar{I}\ \varepsilon - K_t^{eq}\delta$) [20]. The stock of loans is equal to the amount carried over from the previous year plus the share of investments financed by loans (equation 66). Equation 68 refers to the stock of deposits, which is equal to household wealth minus equity. Equation (69) is the redundant equation, according to which the stock of loans is equal to the stock of deposits in a closed-economy without public debt.

As before, we must assume that for a sufficient number of periods, investments have been financed through endogenous money (bank loans). In this way, it is possible to accumulate a sufficient stock of deposits. The results are reported in Figure 7.

Starting from period 80, investments are financed by issuing equities, hence households convert a share of deposits into equity. Parallelly, since firms must repay the debt previously incurred, in each period an amount of deposits is destroyed. As a result, after some periods, it is no longer possible to finance investments drawing on household wealth. After period 84, the stock of deposits is lower than the flow of investments. Trivially, a given amount of deposits can only continue to exist if a proportional amount of bank (or CB) debt continues to exist. If the latter must be repaid, the stock of deposits will decrease simultaneously.

Lastly, as done for the case of public spending, we study the case in which the initial finance of investment expansion is realized through equity emission (see Figure 8). First, as before, it is necessary to assume that investments have been financed by bank loans for a number of periods to generate a sufficient amount of deposits. Then, the investment expansion (financed by equity) initially leads to an increase in household savings. It is worth noticing that the fact that investments are financed through the existing stock of savings does not imply that saving determines investments. Indeed, still it is investment decisions that determines a corresponding amount of saving. To this extent, imposing that investments have to be financed by household savings means that savings are constraining investment possibilities, but not determining investments.

However, once the shock is imposed, the existing stock of deposits starts being reduced.[21] Indeed, deposits exist as a counterpart of an equal amount of debt that has to be reimbursed. As firms repay the loan, a proportional amount of deposits is destroyed. As long as net investments are positive (i.e., equity issuance exceeds capital depreciation, which includes a portion equal to the bank installments), they generate a corresponding amount of saving. After some periods, deposits are no longer sufficient to finance the increased level of investments, compromising the possibility of

[19]Please note that $K_t = L_t + K_t^{eq}$ that is the sum of loans plus the stock of capital financed by equity. As for the system at p. 11, the income before tax is net of depreciations allowances. These, in turn, are composed of a share of debt repayment and profits retained to replace the share of capital financed through equity.

[20]According to $\bar{I}\ \varepsilon - K_t^{eq}\delta$, the new amount of equity is equal to the of net investments financed by equity emission.

[21]Firms keep reimbursing the previous debt, this translates into a reduction in disposable income while households keep transforming the accumulated stock of deposits into equities over time. Then, a share of deposits is indirectly destroyed when households keep buying firms' equity and these keep paying back previous loans.

Time	Investments	Consumption	GDP	Publid debt	CB bonds	Time deposits	Check dep.	Households bonds	Loans	Equity	Reserves
2	60	0	60	0	0	0	60	0	60	0	0
3	60	54	114	0	0	6	108	0	114	0	0
4	60	98	158	0	0	16	146	0	163	0	0
..	..	..	..	..	..	..	..	..	..	..	..
79	60	300	360	0	0	300	300	0	600	0	0
80	60	300	360	0	0	300	300	0	600	0	0
81	60	300	360	0	0	240	300	0	540	60	0
82	60	300	360	0	0	180	306	0	486	120	0
83	60	305	365	0	0	120	317	0	437	180	0
84	60	315	375	0	0	62	331	0	394	240	0
85	60	329	389	0	0	5	349	0	354	300	0

Figure 7. Initial finance of investments through equity emission.

Time	Investments	Consumption	GDP	Publid debt	CB bonds	Time deposits	Check dep.	Households bonds	Loans	Equity	Reserves
2	60	0	60	0	0	0	60	0	60	0	0
3	60	54	114	0	0	6	108	0	114	0	0
4	60	98	158	0	0	16	146	0	163	0	0
..	..	..	..	..	..	..	..	..	..	..	..
77	60	300	360	0	0	300	300	0	600	0	0
78	60	300	360	0	0	300	300	0	600	0	0
79	60	300	360	0	0	300	300	0	600	0	0
80	60	300	360	0	0	300	300	0	600	0	0
81	90	300	390	0	0	210	330	0	540	90	0
82	90	327	417	0	0	123	363	0	486	180	0
83	90	357	447	0	0	39	398	0	437	270	0

Figure 8. Financing investments expansion through equity emission.

financing investments through equity emission. In this sense, the financing of investments through equity emissions can be considered only as temporary, as well as subordinated financing to the process of endogenous money.

In general, the financing of investments through equity (that is through the conversion of the existing stock of deposits) does not intact the causality that goes from investments to saving, however, taken alone, it undermines the hypothesis of independence of investments from saving. Namely, an increase in equity-financed investment raises the stock of savings (and debt), but needs ex-ante formation of savings (and, in particular, deposits).

Of course, when we include other autonomous components in the model and assume that these are financed through endogenous money, the possibility of financing investments through equity increases. Indeed, in that case, it is possible to draw on the stock of deposits continually fueled by the endogenous money aimed at financing such autonomous components. If bank loans are excluded, the only remaining source of money creation is the financing of public spending by CB.[22] If investments are fully

[22]In this case, it is necessary to assume that households prefer to hold equity and deposits, while they do not want public securities. Conversely, if they wish to hold public securities, the amount of deposits created by the public securities purchased by the CB would not exist and, therefore, it would not be possible to purchase equity.

financed by equities, they are indirectly financed by deposits generated by CB when financing public spending (assuming that households do not hold their wealth entirely in the form of public bonds).

In the same way, if investments are fully financed by retained profits, they are indirectly financed through the circular flow of income triggered by public spending financed by CB. In both cases, investments cannot be considered completely autonomous since they depend on the path of public spending and saving rate.

In conclusion, this section was intended to highlight how the initial finance realized through household savings, although it generates an equal amount of saving, can be considered only as a transitory way of financing. It cannot be considered as a structural mechanism since it constantly requires a parallel financing of the expenditure components through endogenous money which, by creating a stock of deposits, will allow it to partially exist as an appendage of the latter.

6. Conclusions

The paper contributes to the Post-Keynesian literature taking the first steps in building a monetary theory of demand-driven growth. Our contribution argues that the endogenous money theory plays a non-ancillary role within the Supermultiplier approach. On the one hand, we point out that the Keynesian principle of investments determining saving along with the existence of autonomous components of demand, naturally implies the notion of endogenous money. On the other hand, we demonstrate that integrating the Supermultiplier and the endogenous money theory allows to clearly define the whole economic mechanism describing the financing of autonomous components and investments, as well as the determination of output and saving in a monetary economy of production.

Our derivations stem from the recognition that in a monetary economy of production, monetary savings exist only as the counterpart of liabilities: a sector can have positive financial (or monetary) wealth only if one or more sectors have negative financial wealth. If one sector reduces its debt, the savings of other sectors necessarily decrease, and vice versa.

First, we show that the initial finance of deficit public spending through CB (or commercial banks) and investments through bank loans allows them to be (structurally) ex-post founded by household saving. Specifically, we point out that public deficit spending or investments generate a corresponding amount of monetary saving only when financed through debt creation. When investments are fully financed by loans, they directly activate a process of endogenous money creation, resulting in a higher amount of saving generated through a corresponding expansion in firms' debt. Conversely, when the expansion of investments is fully financed by retained profits, it figures as an increase in the average propensity to consume, while public deficit and household saving decrease.

Second, although debt-financing and liability-asset linkages can also be realized through the existing stock of wealth, the endogenous money creation process is the only structural mechanism that allows investments to be independent of and determine saving in the long-run, enabling autonomous components to be defined as such. In this sense, the initial finance of investments and public spending by issuing equities or selling public bonds to households can only be considered a temporary spin-off of the

endogenous money process. The subordination of the financing through the existing stock of wealth (deposits) to the process of endogenous money creation relies on three main points: (i) the pre-existence of a stock of deposits: investments and autonomous components must have been founded by endogenous money for a sufficient span of time to generate a 'sufficient' amount of deposits. (ii) The concept of 'perpetual deposits' and 'perpetual debt': the stock of deposits keeps existing over time only if the corresponding debt is not reimbursed, or if a rollover through endogenous money is continuously operating. (iii) Even in the case the stock of deposits is regarded as a 'manna from heaven', a fixed amount of deposits cannot fuel a growing economy or an economy with positive inflation.

Acknowledgements

The authors would like to thank the reviewers for their helpful and constructive comments and suggestions. All remaining errors are of the authors.

Disclosure Statement

No potential conflict of interest was reported by the author(s).

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