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FISCAL POLICY AS A LONG-RUN STABILIZATION TOOL. SIMULATIONS WITH A STOCK-FLOW CONSISTENT MODEL

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ABSTRACT. This study examines the real and financial requirements of a regularly progressive economy driven by an autonomous evolution of public expenditure. The proposed model attempts to reconcile features of Kaleckian, Sraffian and *horizontalist* strands of post-Keynesian economics in a stock-flow consistent framework, which includes a banking sector and a central bank, as well as workers, rentiers, and firms. It focuses on the long-run convergence to a normal capacity utilization rate in a credit economy, where money is endogenous and the interest rate is kept stable by the central bank. The results show that an increase in public expenditure aimed at stabilizing economic activity on a higher long-run trend does not face significant financial constraints. However, the expansion may result in inflation and changes in the income distribution. Furthermore, resolving the conflict between robust steady growth and tolerable inflation rests on political and institutional changes, rather than on tightening fiscal and monetary policies. Rentiers and the financial sector have good reasons to resist expansionary fiscal policies, given the relative decline in the real value of their financial rents and activities caused by inflation and by improvements in the income share of wage earners.

Key words: Fiscal policy, Public debt, Income distribution, Supermultiplier, Kaleckian growth models, Stock-flow consistent models.
JEL classifications: E6, E11, E12, E20, E25.

1. INTRODUCTION

A primary feature of the golden age of capitalism, which began soon after World War II and lasted until the 1970s, was the use of fiscal policy as an instrument to mitigate short-run fluctuations and to move the economy closer to full employment, as advocated by Keynes. When compared to the performance of the neoliberal era that followed, its success in providing rapid growth in output and employment is

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undisputed.[1] Notwithstanding its overall poor performance from the very beginning, the policy stance of the current neoliberal era continued to be restrictive, recommending austerity measures even after the global financial crisis of 2007-08. Today, such measures continue to keep the world economy in a state of 'secular stagnation'. This is especially true for the Euro area, where the governments reject expansionary fiscal policies, or even pursue reverse policies, on the basis that high deficits or debt have a negative impact on capital formation and economic growth.

In this study, we take the opposite view. The disappointing performance of the neoliberal era suggests that, in addition to exhibiting short-run positive effects on income and employment, public expenditure may even be a driving force in the long run, if supported by appropriate monetary and financial institutions. This view is strengthened by recognizing that government spending played a prominent role in generating demand during the post-World War II economic expansion.

Thus, we take the view that fiscal policy, which in the past has been used predominantly as a short-run instrument, may also help to offset the long-term tendency to stagnation in aggregate demand. As such, fiscal policy can be used to stabilize the economy on a higher growth trend, without necessarily endangering government fiscal solvency or firms' profitability.

Based on this perspective, we examine a closed economy driven by autonomous public expenditure, whose growth rate is adjusted continually to maintain a steady growth of the economy at an exogenous rate. This rate is a policy target, motivated by full employment and stability goals, in accordance with the policy implications of the *General Theory* and the ideas of Abba Lerner and Michał Kalecki.

The study contributes to the literature on the newer post-Keynesian and Sraffian models of growth and distribution, where the pace of growth is dictated by autonomous components of demand, while investment and consumption (for its greatest part) are entirely induced (see Lavoie [2014, ch. 6] for a recent survey).

The proposed one-good growth model builds on a concise stock-flow consistency framework (Godley and Lavoie, 2007a), maintains Kaleckian features, and simulates a change from an initial steady state to a final long-run equilibrium position emphasized by the *supermultiplier* approach. During this traverse from one growth path to another, capacity utilization converges towards a 'normal' level (or towards a band of normal levels) if the growth of government demand is maintained for a sufficiently long time (Serrano, 1995; Bortis, 1997; Cesaratto, Serrano, and Stirati, 2003; De Juan, 2005; Freitas and Serrano, 2015; Cesaratto, 2015). Here, we use simulations to investigate which cause, constraint, or consequence of an institutional or economic shape can undermine the ability of governments to transition the economy to a higher

[1] The patterns of macroeconomic performance in these two historical episodes are investigated thoroughly in Cornwall and Cornwall (2001), among others.

steady state, following an increase in the target growth rate.
The model deals with public debt dynamics, inflation, income distribution changes, and firms' financial and profitability constraints. In addition, it takes into account the portfolio choices of rentiers' households and the evolution of financial assets.
The analysis employed is that of comparative dynamics and the simulations are based on parameter values that exclude instability. Nonetheless, we will show which of the parameters is most responsible for instability and that, under certain assumptions on the parameters of the distributive process, instability may arise from overambitious target growth rates.
In particular, our analysis combines he following different approaches:

(1) We follow the well-established post-Keynesian tradition claiming that the labour force growth rate cannot be taken as exogenous and, thus, is not a binding constraint on growth.[2]
(2) The canonical short-run Kaleckian investment function is extended to the long run. This is done by adding a simple Harrodian-type adjustment mechanism, where firms, by revising their expected output growth, are able to restore the normal long-run rate of capacity utilization, once changes in aggregate demand have been perceived as permanent. This is in line with the 'fully adjusted positions' of the Sraffian approach (Vianello, 1985). The transition to the long-run equilibrium is realized by two adjustment processes that work together. One is relative to quantities, while the other, linked to profit margins, is an adjustment in the wage share (i.e. in costing margins). The latter is derived from endogenous changes in the wage and price setting, where firms practise mark-up pricing and workers bargain over the real wage.
(3) A classical consumption function is adopted along Kaleckian lines, where only rentiers' households save.
(4) The financial behaviour of firms, banks, the central bank, the government and rentiers' households is modelled using an over-simplified form of stock-flow accounting, which links the real and the financial sides of the economy. The accounting framework is drawn from the models of Godley and Lavoie (2007a), although limited to its smallest possible structure, that of an 'overdraft economy', as required by the goals of the study.
Commercial banks accept deposits from rentiers and fully accomodate loans demanded by (supposedly credit-worthy) firms, according to the so-called *horizontalist* view. The central bank supplies cash to rentiers and advances

[2] Setterfield (2002) describes demand-led growth theories, and Dutt (2010) discusses the many aspects of the economy through which aggregate demand influences long-term growth. The assumption that the labour force growth rate is a binding constraint on capitalistic development has been criticized by, among others, Kaldor (1989), Marglin (1984), Garegnani (1990) and Vianello (2013).

to banks. Moreover, it fixes a key nominal rate of interest by endogenously purchasing all bonds that rentiers are not willing to hold at that rate.[3] Thus, the core aspect of monetary sovereignty, according to which government finance is not subject to market interest rates, is adopted.

Contrary to the mainstream views, a major finding of this study is that the long-term sustainability of public finance is not jeopardized by a moderate expansion of public expenditure that is designed to permanently increase the growth rate of the economy. This is made possible by the presence of a central bank that removes the market control of the interest rate by setting it exogenously. Lastly, under the hypothesis that growth increases workers' bargaining power, rentiers' income and wealth and firms' profitability may be reduced. However, the extent of these reductions depends on how strongly the distributive conflict is developing. In order to control for potential inflationary pressure and the threat of instability, active income policies are needed.

2. Literature review

Our analysis organizes elements taken from three lines of research. The first is the canonical Kaleckian model, which combines accumulation and wage-price dynamics (see Lavoie (2014, chs. 6 and 8), and the references therein, for a detailed discussion of the model).[4] The second is the Sraffian supermultiplier approach (see the authors cited in the previous section), which emphasizes autonomous demand dynamics. The third is the stock-flow approach of Godley and Lavoie (2007a), which considers the interdependence between real and financial aspects. Therefore, our study is related to many works, but to the best of our knowledge, is the first to combine these analytical devices within a single model.
Given this background, in this section, we focus on works that share our goal, that is, the long-run role of fiscal policy.[5]

[3] This is in line with the 'parking-it' view of Rochon and Setterfield (2008).
[4] See also Lavoie (2010).
[5] Studies similar to ours in terms of their methodologies, but that target different goals, are those of Dallery and van Treeck (2011) and Le Heron (2008). The former develops a model similar to ours that combines a Kaleckian accumulation process with conflict inflation and stock-flow relationships. However, its main aim is to critically discuss the equality of actual and normal utilization rates in a long-run equilibrium, and does not consider fiscal policy. The latter develops a stock-flow consistent model to analyse the consequences of monetary policy shocks under different fiscal policies. This model also includes a detailed banking sector, but differs in scope to our study. In addition, in the latter model, the accumulation function does not provide a mechanism for capacity adjustment, the distribution is exogenous, and government finance is disregarded.

The studies closest to ours can be divided into two groups: those that adopt a stock-flow consistent approach, and those that examine the long-run convergence to a normal rate of capacity utilization, driven by autonomous demand. The first group includes the works of Godley and Lavoie (2007a), Accoce and Mouakil (2007), and Ryoo and Skott (2013). The second includes the works of Allain (2015), and Lavoie (2016).

The model of Godley and Lavoie (2007a) is far more comprehensive than ours in its design of financial relationships. As in our model, it considers that the government can spur economic growth by increasing its real pure expenditure. In addition, they depict inflation as a conflicting-claim phenomenon. A key difference between the two models is that theirs is not a steady-state model, because it allows output to grow forever at a lower rate than capital. This outcome is plausible only if we accept that firms refrain from reacting to an ever-expanding excess capacity. This is due to the investment function they use, which excludes adjustments towards a normal capacity utilization rate, resulting in, among other things, a steady increase in the debt-to-GDP ratio. This result is contrary to our finding, as we show below.

Accoce and Mouakil (2007) also build a stock-flow consistent model, based on the work of Lavoie and Godley (2002), applying the monetary circuit approach. In one of their experiments, they find that the economy is pushed to a higher steady growth path and to a higher utilization rate when government expenditure increases permanently. However, no mention is made of the evolution of the debt-to-output ratio, a decisive element in assessing the impact of fiscal policy. In addition, the authors adopt an investment function that excludes any convergence to a normal utilization rate, and do not consider inflation or an endogenous distribution.

Ryoo and Skott (2013) include equity issued by firms, but they focus on a full-employment trajectory, fixed by a given labour force growth rate. A constant utilization rate is assumed, and investments are determined by full-employment savings. Moreover, they do not include the income distribution in their model.

With regard to the second group, Allain (2015) and Lavoie (2016) both extend the canonical short-run Kaleckian function to the long term, as we do, where firms revise their expected trend in sales to restore a normal rate of utilization. However, whereas Lavoie considers autonomous consumer expenditures as a growth driver, Allain chooses government expenditure.[6] Neither of these theoretical studies build a full dynamic model showing the adjustment processes towards final equilibria, nor do they take advantage of a stock-flow consistent framework. Allain's model, which is closest in purpose to ours, assumes a public balanced budget and, thus, does not

[6] In a recent paper, Nah and Lavoie (2017) adopt the same long-run convergence mechanism, taking foreign demand as the autonomous growth driver.

analyse a deficit or debt dynamics. In addition, the model does not consider distributive issues or inflation.
Other studies that investigate the role of public debt and fiscal policy in a growing economy are those of You and Dutt (1996), Dutt (2013) and Schlicth (2006).
You and Dutt (1996) make interesting observations on how the dynamics of government debt influence distribution. Dutt (2013) introduces government investment and postulates financial crowding-out effects of government debt. Finally, Schlicth (2006) examines the role of public debt in an economy growing at a given natural rate, where profits are equal to interests payments.
However, none of these last three contributions deal with the convergence to normal capacity utilization, endogenous changes in wages and prices, or financial stock-flow relationships.
Interestingly, all of them, based on a Keynesian perspective, find evidence supporting a positive relationship between public debt and the growth path of the economy.

3. The accounting background of the model

The stock-flow consistent methodology (Godley and Lavoie, 2007a) provides a framework within which we can formulate our behavioural hypotheses. The appeal of this approach lies in its consistency check mechanism and its integration of financial, monetary, and production circulation among sectors, the balance sheets of which are interdependent.
We assume that the economy is composed of the following: worker households (workers), who sell their labour power to firms; rentier-capitalist households (rentiers), who receive capital income (interest and distributed profits) from their capital assets; firms (producing a single good at a price P); a banking sector; a central bank; and a government sector.
The balance sheet position of each sector is shown in Table 1. Workers are not shown because we assume that they do not save. All variables in Tables 1 and 2 are given in nominal terms, except for fixed capital K, which is multiplied by P, the price of the single good produced. All stocks and flows in these tables have straightforward real counterparts, calculated as their nominal value divided by P.
Assets are preceded by a plus sign, while liabilities have a minus sign. Rentiers keep their wealth in the form of cash (Z), bank deposits (M), and government bonds (B_r). Firms finance their investments using bank loans (L) and retained profits (F_u). We ignore financing through equity issuance in order to simplify the model. Banks receive households' deposits, lend credit to firms, and take advances (A) from the central bank to balance their capital account. We assume that banks do not demand treasury bonds. Therefore, the portfolio choice is restricted to rentiers.

Table 1 Sectoral balance sheet

	Rentiers	Firms	Banks	Central Bank	Government	Σ
Cash	$+Z$			$-Z$		0
C.B. Advances			$-A$	$+A$		0
Deposits	$+M$		$-M$			0
Loans		$-L$	$+L$			0
Gov. bonds	$+B_r$			$+B_{cb}$	$-B$	0
Fixed capital		$+PK$				PK
Net worth	V_r	V_f	0	0	V_g	PK

The central bank supplies cash to the economy in the amount demanded by households (Z) and banks (A) and, moreover, is a residual purchaser of government bonds (B_{cb}). We assume that the government finances any deficit by issuing bonds, so that B is identical to the stock of government debt. The last row shows the net wealth of each sector. Here, we consider the conventional case in which both firms and government are in debt.

As in most current stock-flow consistent macroeconomic models, we ignore the banks' and the government's investments in fixed capital, as well as their intermediate consumption and operating costs. The associated transaction-flow matrix is shown in Table 2, where sources of funds take a plus sign, and the uses of funds take a minus sign.
The columns show the sources and uses of income by sector. Workers use their entire wages (W) to buy consumer goods (C_w) and pay taxes (T_w). Rentiers receive dividends from firms (F_d) and banks (F_b), as well as interests on deposits ($i_M\, M$) and on bonds ($i_B\, B_r$); they buy consumer goods (C_r) and pay taxes (T_r). Their savings (S_r) are used to increase cash, deposits, and government bond holdings. Firms use sales receipts to pay wages, taxes (T_f) and interest on loans ($i_L\, L$), and realize profits (F) as a residual. They buy capital goods from themselves, and borrow the funds (ΔL) from banks that they need, in excess of retained profits (F_u), to finance investment ($P\, I$). Thus, by extending loans to firms, banks expand their balance sheet. In this latter case (which is the usual one), firms' savings (S_f) are negative.
Column 5 shows that banks receive interest payments on their loans to firms ($i_L\, L$) and pay interest to rentiers ($i_l\, M$) for deposits and to the central bank ($i_A\, A$) for advances. Their profits (F_b) are transferred to rentiers. Column 6 shows that the central bank's profit (F_{cb}), generated from interest revenue, is delivered to the government. Finally, column 7 shows the government balance, where G is public expenditure, T

denotes taxes, and $i_B B$ denotes the interests on the stock of public debt, where i_B is the rate of interest.
Given that these are all identities, each row and column sums to zero, in accordance with the accounting method of Godley (1999). Note that, as emphasized by Godley (1999), since the '*banks',* [and the central bank's] *remaining transactions must be passive responses to the transactions of other sectors*', the columns describing the banking sector's asset transactions (column 5 and 6 of the flow matrix) must sum to zero as well.

Table 2 Transactions-flow matrix

	Workers	Rentiers	Firms		Banks	Central Bank	Gov	Σ
			Curr.	Cap.				
1. Consumption	$-C_w$	$-C_r$	$+C$					0
2. Pub. Expendit.			$+G$				$-G$	0
3. Investment			$+PI$	$-PI$				0
4. $X = C_w + C_r + PI + G = W + F = Y$								
5. Wages	$+W$		$-W$					0
6. Taxes	$-T_w$	$-T_r$	$-T_f$				$+T$	0
7. Int. on loans			$-i_l L$		$+i_l L$			0
8. Int. on deposits		$+i_M M$			$-i_M M$			0
9. Int. on bonds		$+i_B B_r$				$+i_B B_{cb}$	$-i_B B$	0
10. Int. on anticip.					$-i_A A$	$+i_A A$		0
11. Dividends		$+F_d + F_b$	$-F$	$+F_u$	$-F_b$	$-F_{cb}$	$+F_{cb}$	0
12. Savings	0	S_r	0	S_f	0	0	S_g	0
13. ΔZ		$-\Delta Z$				$+\Delta Z$		0
14. ΔA					$+\Delta A$	$-\Delta A$		0
15. ΔM		$-\Delta M$			$+\Delta M$			0
16. ΔL				$-\Delta L$	$-\Delta L$			0
16. ΔB		$-\Delta B_r$				$-\Delta B_{cb}$	$+\Delta B$	0
17. Col. totals	0	0	0	0	0	0	0	0

Significantly, this approach, which integrates the contributions of Wicksell and Keynes, leads Godley to conclude that the '*supply of money is a redundant concept*', in accordance with the views of the 'endogenous money' school.[7]

[7] Godley (1999), p. 397.

4. Aggregate demand

4.1. **Capital accumulation and the transition to the long run.** Among the many factors that influence investment decisions endogenously, the need to adjust capacity to demand and profitability are two of the most relevant. In our model, the first requirement has a primary role, while the latter appears only as a prerequisite, although is still important. Technological innovation, a third important, but at least partially exogenous factor, is not considered here.[8]

Ignoring the depreciation of capital, the canonical Kaleckian investment function is defined, in the short run, as follows:

$$g = g^e + g_u(u - u_n) \qquad g_u > 0 \tag{1}$$

where g is the rate of accumulation decided by firms (as a ratio of capital stock, that is I/K), g^e is the firms' expected long-run rate of output growth, u is the output-capital ratio, X/K, taken as a proxy for capacity utilization, g_u is the speed at which the rate of accumulation adjusts to changes in the gap $(u - u_n)$, and u_n is the normal rate of capacity utilization, derived from cost minimization or from the entry-deterrence strategy of firms. Here, we assume a one-commodity model, where the same commodity is used as a capital good, not subject to depreciation, and as a consumption good. The lag measured by $1/g_u$ reflects the time lag required to adjust the stock of capital to a change in demand, which is higher than that needed to adjust current output, as prescribed by the short-and-long-period method of analysis.

As is usual in these types of models, it is convenient to express all variables (for flows and for stocks, such as production, income, government expenditure, deficit and debt, demand components, financial stocks, etc.) as ratios to capital stock, using the corresponding lower-case symbols.

Equations of type (1), as well as other variants of the canonical Kaleckian model, are discussed extensively in Lavoie (2014, ch. 6). The two parameters g^e and u_n in the investment function (1) represent crucial entrepreneurs' behaviour that characterizes the short run. Here, the long-term expectations underlying the trend of economic growth are given, and increases in output are produced mainly using capacity above

[8] Technical change has been the main motive for adding an autonomous component in investment functions. A persuasive argument not to use the concept of autonomous investment is put forward by Cesaratto, Serrano and Stirati (2003), who refer to Kaldor and Duesenberry. Their point is that, given the expected trend of aggregate demand, a reduction of non-innovating investment tends to compensate for the expansionary capacity effects of autonomous investment. As a result, in a long-term context, it is ultimately the expected trend of aggregate demand what induces total investment. Then, the expected trend of aggregate demand eventually converges to that of autonomous expenditures.

the normal level. Differences with respect to the actual parameters, once perceived as permanent, provide the motive for adjusting equipment to the production of a definitely different level of output, thus triggering the correction that brings about the long-run equilibrium.
For ease of comprehension, the diagram in Figure 1 shows the sequence of events.

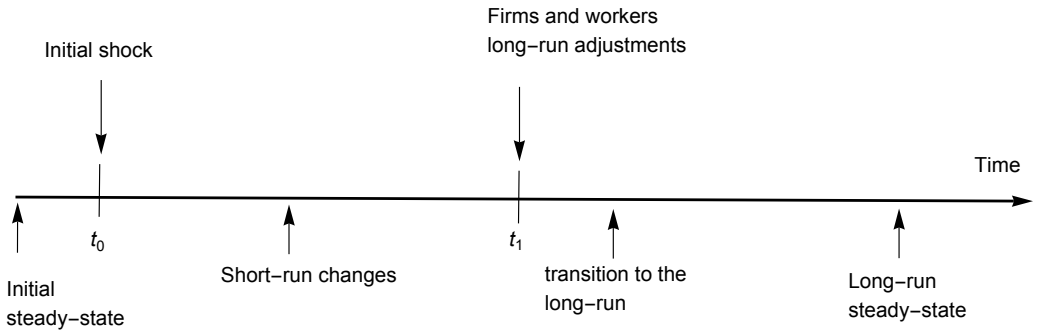

Figure 1

As a first adjustment, we assume that g^e is accommodated to the output rate of growth (g_x) that takes place after short-run changes have settled down. This is in line with the view of Garegnani (2015, p. 3), according to whom, '*over a sufficient long period of time ... current investment will be configured on scales and in sectors determined by what entrepreneurs have discovered through experience about the demand for goods*'. Then, supposing that an initial steady-state equilibrium is perturbed at time $t = t_0$, this mechanism is described by the following system:

$$\dot{g}^e = \begin{cases} 0 & \text{if } t < t_1 \\ \beta(g_x - g^e) & \text{if } t \geq t_1 \end{cases} \qquad \beta > 0 \tag{2}$$

where the dot on one variable denotes differentiation with respect to time ($\dot{g^e} = dg^e/dt$) and β represents the coefficient of the speed of adjustment. System (2) assumes that firms begin to adjust their expectations to the changed rate of growth of output starting from an arbitrary time $t = t_1$.[9] In this way, t_1 separates the new short-run equilibrium, which settles down during the period from t_0 to t_1, from the transition to the long-run steady state. This constitutes sufficient time for firms to realize that changes are permanent, and investments must be accelerated in order

[9] This process is similar to that proposed by Shaikh (2004). However, in our formulation, this does not require perfect foresight by the firms, because it only implies an adaptive adjustment to past values of the rate of output growth.

to fully adjust their productive capacity. Therefore, the period from t_0 to t_1 is that in which an over-utilization of capacity is increasing to meet an increase in demand. Then, the adjustment process towards the new steady state unfolds after t_1.
This endogenous process of the revision of g^e has been suggested by Lavoie (1996, p. 139; and 2016) and Allain (2015), and corresponds to the *capacity supermultiplier* described by Cesaratto, Serrano, and Stirati (2003), although our formulation differs from all of these, somewhat. The first two authors use the capital growth rate, g, instead of that of output, g_x. Moreover, system (2) enables us to trace a path for all the variables from the short-run (after the perturbation) to the long-run equilibrium.

With regard to the second adjustment mechanism, we now hypothesize how u and u_n converge to a single value in the long term. Here, we run into the long-debated and controversial question of the exogeneity versus the endogeneity of the normal capacity rate, and of its unicity. We take the view that firms consider normal capacity utilization as a range of utilization rates, rather than as a single rate (Hicks, 1974; Dutt, 1990, ch. 3; Palumbo and Trezzini, 2003; Dallery and Van Treeck, 2011).[10] Therefore, we assume that in the transition to the long run, firms adapt their notion of normal capacity to the new value that emerges from the short-run changes, but under the condition that it remains within an acceptable range. We denote this range as $\bar{u}_n$ to $\bar{\bar{u}}_n$, which refer to the inferior and superior limits, respectively. This behaviour is described by system (3) as follows:

$$\dot{u_n} = \begin{cases} 0 & \text{if } t < t_1 \\ \phi(u - un) & \text{if } t \geq t_1 \text{ and } u_n \in [\bar{u}_n, \bar{\bar{u}}_n] \ ; \ \phi > 0 \end{cases} \tag{3}$$

where ϕ is an adjustment coefficient.
If stability prevails, systems (2) and (3), taken together, imply that $g = g_x = g^e$ and that $u = u_n$, as required by both the Harrodian 'warranted path' conditions and the 'fully adjusted position' of the Sraffian approach.
Note that the case of a single and constant value of normal capacity is included in formulation (3) when $\bar{u}_n{=}\bar{\bar{u}}_n{=}u_n$.
However, in the following simulations, the baseline model solution is obtained under the assumption of a unique normal rate of capacity, for ease of comparison with the neo-Sraffian contributions, which apply a unique normal rate only. Model experiments based on an interval of normal capacity values are left to future research. The preliminary tests do not suggest any important qualitative differences between the

[10] A thorough survey is available in Lavoie (2014), ch. 6, who refers to many models that endogenize the utilization rate. We agree with the author that the interpretation of normal capacity as a conventional, and somewhat flexible norm makes the fully adjusted long-run positions coincide with the provisional, or medium-run equilibria, as formulated by Chick and Caserta (1997).

two cases.

In the above formulations, the inducement to invest comes only from the requirement to adjust productive capacity to expected demand, while expected profitability is absent. Sraffian authors, such as Garegnani (2015), Cesaratto (2015), and Petri (2013), take the position that changes in the profit rate have no immediate impact on investment. They claim that a *minimum* rate of profit corresponding to a normal degree of utilization is in itself a background condition, because investment in physical capital is an alternative to employing wealth in financial assets. This minimum rate of profit is given by the real rate of return of the alternative financial investment, plus a risk factor contingent on specific market conditions. To achieve a rate of profit on the time horizon relevant for investment that is above this minimum value, on average, is then a second long-run requirement for firms. Of course, a policy that decreases the profit rate under this minimum, a sort of reservation profit, decreases the *state of confidence*, disappoints entrepreneurs, and may give rise to strong pressure to have it overturned via a threat of an 'investment strike'. Therefore, from this view, it follows that the impact of policy changes on long-run profitability have to be assessed in our simulation exercises.[11]
Now that the primary adjustments have been established, the characterization of the behaviour of firms will be completed with the inclusion of the financial limits on investment expenditures, discussed in section 5.2.

4.2. **Fiscal reaction function and budget constraint.** Public expenditure dynamics lie at the core of this exercise, although we only consider the non-capacity creating public demand. The inclusion of public investment on infrastructure, which creates capacity directly, is left to future research. We assume that the government, wanting to provide welfare provisions and to maintain a high employment rate, unrelentingly adjusts its real expenditure to a given trend growth rate n, according to the following adjustment mechanism:

$$\dot{h} = \gamma(n - g_x) \qquad \gamma > 0 \tag{4}$$

Here, h represents pure real government expenditure, expressed as a ratio to capital stock, and γ is a velocity adjustment parameter, such that $1/\gamma$ measures the implementation lag with which the government reacts to discrepancies between n and the observed output growth rate. Recognition and implementation lags for fiscal policy actions, which includes necessary spending plans, need to be tailored carefully, using institutional changes to ensure that they are neither too short nor too long in order

[11] See Bonifati (2011) for a discussion on this topic.

to prevent destabilizing effects. Recall that monetary policy has a shorter inside lag, but has effects that can be totally ineffective. In contrast, fiscal policy acts directly on aggregate demand with a null outside lag, which makes it particularly effective. The line of thinking adopted here is not so much that the government responds to a *temporary* aggregate demand disturbance, but rather that it keeps the economy steadily anchored on a desired path, thus tackling the *permanent* weakness of aggregate demand.[12]
Thus, public expenditure drives the economy towards the target growth rate n, a pure policy parameter that the government can change in a discretionary way. This is not to be confused with the 'natural' rate of growth of the labour-force. Of course, for the relevance and stability of the present model, n must have a sufficient degree of persistence, as emphasized by the *supermultiplier* theorists (e.g. Cesaratto, 2015). We now need to ascertain how the growth rate g will converge to n in an economically meaningful steady state, that is, one in which the investment and public expenditure shares of output both tend to non-zero values.

Government tax revenue t consists of labour income tax, rentiers' income tax, and firms' income tax, as follows:

$$t = \tau_w \, \omega \, u + \tau_r \, y_r + \tau_f \, f \tag{5}$$

where τ_w, τ_r, and τ_f are the respective tax rates on wage income $\omega \, u$ (where ω is the wage share in real output), on rentiers' income y_r, and on firms' profit f, net of interest payments, given as follows:

$$f = (1 - \omega)u - i_L \, l \tag{6}$$

where $(1 - \omega) \, u$ is firms' gross profit, i_L is the rate of interest on loans, and l is the amount of loans. Moreover, y_r in equation (5) is given by

$$y_r = (1 - s_f)(f - t_f) + i_B \, b_r + i_M \, m + f_b \tag{7}$$

where s_f is the firms' retention ratio out of profits (net of interest and tax payments),

[12] The term *fiscal reaction function* is taken from Godley and Lavoie (2007b, p. 91). However, their function has a rather different purpose, because it is used to determine a given target inflation rate, rather than to examine how fiscal policy influences the output growth rate, which they assume to be exogenous.

i_B is the rate of interest on government bonds owned by households b_r, i_M the rate of interest on households' money deposits m, and f_b denotes the banks' profits, which we assume are entirely distributed to rentiers, a common simplifying assumption (Dos Santos and Zezza , 2008; Godley and Lavoie, 2007a, ch. 11).
As stated earlier, all financial variables are ratios to the value of capital stock $P\,K$, where P is the price level. Therefore, they are all ratios in real terms, such that, for instance, $m = M/(P\,K)$.
The government budget constraint is given as:

$$\dot{b} = d + (i_B - g - \pi)b \tag{8}$$

where b is the stock of government debt, which is identical to the stock of government bonds because, by assumption, any deficit is financed by a bond issuance. In addition, $d = h - (t + f_{cb})$ is the primary government deficit, and $f_{cb} = i_B(a + b_{cb})$ denotes the central bank's profit that is transferred to the government.

4.3. **Consumption and rentiers' disposable income.** We assume that workers do not save because wages after taxes are spent entirely. Rentiers' consumption decisions are based on their current disposable income and accumulated wealth, as in Godley-type models. Formally, total consumption c (as a ratio to capital stock) is given by:

$$c = (1 - \tau_w)\,\omega\,u + c_1\,(1 - \tau_r)\,y_r + c_2\,v_r \tag{9}$$

The parameters c_1 and c_2 denote the rentiers' propensities to consume out of disposable income and wealth, respectively ; $c_w = (1 - \tau_w)\,\omega\,u$ is workers' consumption; $c_r = c_1\,(1 - \tau_r)\,y_r + c_2\,v_r$ is rentiers' consumption; and v_r is rentiers' wealth, which is defined as:

$$v_r = z + m + b_r \tag{10}$$

where z is money, m is bank deposits, and b_r is government bonds owned by rentiers.

4.4. **Effective demand and short-run dynamics of output in the goods market.** For the short run, we assume a Keynesian quantity reaction to the gap between demand and production, which translates into changes in the utilization rate (with a Lundbergian lag), as follows:

$$\dot{u} = \alpha(c + g + h - u) \qquad \alpha > 0 \tag{11}$$

where α is the speed of adjustment in the goods market, and $c+g+h$ is the effective demand (per capital stock).
This completes the real part of the model.

5. Financial behaviour and budget constraints

5.1. **Financial behaviour of rentiers and portfolio assumptions.** Rentiers consume and make portfolio choices between cash, bank deposits, and government bonds. The portfolio behaviour of rentiers is based on the methodology developed by Godley and Lavoie (2007a), and inspired by Tobin (1969). We present it here in matrix form, for better readability:

$$\begin{bmatrix} z \\ m \\ b_r \end{bmatrix} = \begin{bmatrix} \kappa_1 \\ \kappa_2 \\ \kappa_3 \end{bmatrix} v_r + \begin{bmatrix} \lambda_{11} & \lambda_{12} & \lambda_{13} \\ \lambda_{21} & \lambda_{22} & \lambda_{23} \\ \lambda_{31} & \lambda_{32} & \lambda_{33} \end{bmatrix} \begin{bmatrix} -\pi \\ i_m - \pi \\ i_b - \pi \end{bmatrix} v_r + \begin{bmatrix} \mu_1 \\ \mu_2 \\ \mu_3 \end{bmatrix} y_{rd} \tag{12}$$

where $y_{rd} = (1 - \tau_r)y_r$ is rentiers' disposable income, and $-\pi$, $i_m - \pi$, and $i_b - \pi$ are the real rates of return on money, bank deposits, and government bonds, respectively, according to Fisher's formula in continuous time.
This is a typical formulation in stock-flow consistent models, where the parameters κ, λ and μ are subject to the standard symmetry constraints for asset demand functions:

$$\sum_i \kappa_i = 1; \quad \sum_j \lambda_{ij} = 0 \quad \forall\, i, \text{ and } \quad \lambda_{ij} = \lambda_{ji}\,; \quad \sum_i \mu_i = 0$$

Given the importance of inflation in this model, it seems appropriate to express portfolio choices in terms of real rates of return. Though the expected rate of inflation should be used, we assume, for simplification purposes, that the expected rate of inflation is equal to the current rate. Full details of this approach could be found in Godley and Lavoie (2007a, ch. 5). Then, the rentiers budget constraint is given by:

$$\dot{v} = s_r - (g + \pi)v \tag{13}$$

where π is the inflation rate, and s_r, is rentiers' savings out of their disposable income (as a ratio to PK), given by the identity:

$$s_r \equiv (1-\tau_r)(1-c_1)y_r - c_2\, v_r \tag{14}$$

Identity (14) corresponds to column 2 of Table 2.

5.2. **Financial behaviour of firms and the limits on investment finance.** Firms finance investment through retained profits and by borrowing from banks. As said above, we assume that firms retain their profits, net of taxes and interest paid on loans, according to a fixed proportion s_f. Thus, undistributed profits, f_u, are given as a residual: $f_u = s_f(f - t_f)$. For simplification purposes, we ignore equity issuance, and therefore, investment can only be financed by bank loans and retained profits f_u, yielding the following budget constraint:

$$\dot{l} = g - f_u - (g+\pi)l \tag{15}$$

where l is, as usual, equal to $L/(P\,K)$, the debt-to-capital ratio. Therefore, the firms' net worth may be written as $v_f = 1 - l$.

We are now in a position to consider the financial constraints of firms. Though capital markets in our model are absent and firms can only access finance through banks, it is nonetheless possible to examine whether firms' limits on investment finance are likely to be exceeded in the final steady-states in the simulations. These limits are given by a stock condition, which is the requirement of sufficient own entrepreneurial capital, and by a flow condition, which is adequate retained earnings with respect to funds that can be borrowed (Kalecki, 1971, ch. 9). The former can be monitored using the debt-to-capital ratio l, which is an index of the collateral firms may offer, while the latter can be checked using the trend of the g/f_u ratio, which indicates that higher investments require higher retained earnings according to the *principle of increasing risk*. In other words, the firms' aggregate *finance frontier* implies that g/f_u should not exceed a given θ, where $\theta > 1$ is a conventional parameter determined by both the lender's risk, as perceived by banks, and the borrower's risk, as perceived by firms.[13]

Recall that in the case of the minimum profitability constraint, every policy that reduces the net profit rate f significantly is regarded as leading firms to unsustainable growth paths. Similarly, every policy that increases l or that increases the ratio g/f_u will be assessed as unsuitable, leading firms to an unsustainable financial position.

[13] See Lavoie (2014, ch. 3), and the references therein.

5.3. **Commercial banks and the central bank.** As in the *horizontalist* view (Davidson, 1972; Minsky, 1975; Godley and Lavoie, 2007a; and the Circuitist school), commercial banks are assumed to provide loans passively, as demanded by firms (i.e. money is endogenous). The banks accept deposits from rentiers, but do not buy government bonds. However unrealistic, this latter assumption restricts the portfolio decisions to those of rentiers, and makes the model simpler and more suitable for our purposes. Thus, the central bank acquires any bonds not absorbed by rentiers' savings. Advances from the central bank to commercial banks, a, are provided on demand, such that:

$$a = l - m \tag{16}$$

where l denotes loans and m is rentiers' deposits. It follows that a is a residual item in banks' balance sheet (Table 1, column 3). When this is negative (deposits exceed loans), the excess reserves are transferred to the central bank at a corresponding remuneration. For simplification purposes, the rate on interest on advances is assumed to take the same value as the interest rate of government bonds i_B (Godley and Lavoie, 2007a, ch.10). Banks fully accommodate all demands for loans made by creditworthy firms by charging a nominal rate of interest on loans i_L, by applying a markup μ_L on the central bank rate of interest i_B. Similarly, they compensate rentiers with a rate of interest on deposits i_M, by applying a mark-down μ_M on i_B. Formally:

$$i_L = i_B(1 + \mu_L) \tag{17}$$

$$i_M = i_B(1 - \mu_M) \tag{18}$$

To allow the banks to have positive profits on loans, we assume that they fix exogenous spreads, such that $i_M < i_B < i_L$. In addition, by assumption, banks transfer all profits or losses, $f_b = i_L\, l - i_M\, m - i_B\, a$, to rentiers.
Cash is supplied to the economy by the central bank through purchases of government bonds and advances to banks (Table 1, col. 4) . That is,

$$z = a + b_{cb} \tag{19}$$

where purchases of government bonds from the central bank clear the bond market (Table 1, raw 5):

$$b_{cb} = b - b_r \tag{20}$$

The central bank is thus a residual purchaser at the rate of interest i_B, set exogenously by the monetary authorities.

6. Money-wage dynamics, inflation, and income distribution

Thus far, the process towards the long-run equilibrium has concerned only firms' capital adjustments. In this subsection, to complete our model, we introduce a second important adjustment, namely that which occurs in income distribution. Of course, this is a different kind of adjustment because it depends on firms' market power and on conflicting claims between firms and workers. As is well known, the Post-Keynesian literature offers two possible adjustments in income distribution when the economy accelerates its rate of growth: the Cambridge price adjustment, which predicts a downward variation in the real wage, and the 'Radical' price adjustment, which predicts an upward variation in the real wage. The first is the forced-saving macroeconomic adjustment, which operates near full employment, as found in the Kaldor-Robinson growth models. The second is the Marx-Kalecki-Goodwin profit-squeeze behaviour, where rising employment provides a bargaining advantage to workers.[14] In other words, the distributive shares of workers and firms change according to how wage and price inflation chase each other in economic upturns and downturns. We choose to unify these two adjustments by modelling the reaction of the money wage and price to changes in aggregate demand during the transition to the long-run steady-state as follows:

$$\hat{w} = \hat{a} + \pi^e + \epsilon(u - u_n) \tag{21}$$

$$\pi = \pi^e + \delta(u - u_n) \tag{22}$$

where the 'overhat' denotes time rates of growth. This is a compact representation of a cost-induced process of inflation that best fits our model, where inflation originates from inconsistent income claims of firms and workers, as follows. According to equation (21) workers set the nominal wage growth rate $\hat{w}$ to maintain, and possibly increase the real wage according to their relative bargaining power. Here, they take into account the trend in labour productivity growth $\hat{a}$, which we assume is anticipated correctly, and the expected price inflation π^e. However, workers' success depends on their bargaining position, expressed by the third addend $\epsilon(u-u_n)$, where $\epsilon > 0$ is a parameter denoting the speed of adjustment. With excess (shortage) demand, represented by $u - u_n$ in our model, firms must raise (reduce) capacity and employment, which yields a stronger (weaker) bargain position for workers. Thus, by

[14] The term 'Radical' is taken from Lavoie (2014, ch. 6).

driving employment, aggregate demand drives the wage rate of growth. We assume that workers are aware of the trend in labour productivity growth, and that this influences their bargaining strength in a direct manner. In our model, $\hat{a}$ is assumed as given.[15]

With regards to the price change (equation (22)), we assume that firms that face an increase (decrease) in economic activity, that is, rates of utilization above (below) the normal rate, increase (decrease) price inflation above the expected rate. Here, $\delta > 0$ is the parameter for the speed of adjustment . Equations (20), (21), and (22) make ω and π path-dependent variables, affected by their initial values and past changes, so that different levels of the wage share and the inflation rate may be consistent with the equilibrium condition $u = u_n$.

In summary, after considering that the rate of change of the wage share (ω) is given by $\dot{\omega}/\omega = \hat{w} - \pi - \hat{a}$, and after substitutions from (20) and (21), we have the following adjustment mechanism:

$$\dot{\omega} = \begin{cases} 0 & \text{if } t < t_1 \\ (\epsilon - \delta)(u - u_n)\,\omega & \text{if } t \geq t_1 \quad \text{and subject to } \omega \in [\bar{\omega}, \bar{\bar{\omega}}] \end{cases} \tag{23}$$

where, as in the previous adjustments, t_1 is the time that marks the beginning of the transition path to the long-run steady-state. Thus, system (23) considers both the Cambridge price mechanism, when $\epsilon < \delta$ (real wages grow more slowly than does labour productivity in demand upswings), and the profit-squeeze behaviour or Radical price mechanism in the opposite case, when $\epsilon > \delta$. Movements in the wage share must be restricted realistically within a given range, in which our simulations take place. In light of its greater realism, we apply only the Radical adjustment, leaving the Cambridge adjustment as future work.

Finally, it is necessary to hypothesize how expectations of inflation are formed. Here, we adopt a simple adaptive expectations hypothesis that relates inflation changes to the gap between current and expected inflation, as follows:

$$\dot{\pi^e} = \begin{cases} 0 & \text{if } t < t_1 \\ \rho(\epsilon)(\pi - \pi^e) & \text{if } t \geq t_1 \qquad \rho > 0 \end{cases} \tag{24}$$

where $\rho(\epsilon)$ denotes an adjustment parameter that depends directly on the wage reactivity parameter ϵ. The rationale is that the higher the wage reactivity to changes in demand, the faster firms will revise their inflation expectations. Making parsimonious use of parameters, without loss of generality, we assume in our simulations

[15] The thesis of the procyclicality of the bargaining position of workers, inflation and the output growth rate has been put forward by Kalecki (1971), Marglin (1984), Screpanti (2000), Godley and Lavoie (2007a , ch. 11), Lavoie (2014, ch. 8) and Dallery and Van Treeck, (2011).

that $\rho(\epsilon) = \epsilon$.
Systems (2), (3), (23), and (24) describe the time evolution of our economy towards the long-run steady state.
Our model is now closed. When solving it numerically, we must drop one of the equations of the behavioural portfolio system (12), which, owing to the consistency of the accounts, is redundant. Therefore, among the 34 equations describing the model, we exclude the equation representing the first row of system (12).

7. Model simulations

Owing to its complexity, the model is not suitable for finding analytical solutions. However, its properties can be analysed by performing numerical simulations. We proceed in the usual way, starting from a reasonable configuration of key parameters to obtain a base steady-state solution, where the utilization of capacity is assumed to be at its normal level, and the flow and stock variables all grow at 2.5 per cent. Inflation is assumed to run at 1 per cent, and the nominal interest rate i_B is set at 2 per cent. Then, we conduct experiments by modifying one parameter or exogenous variable at a time, according to the methodology of Godley and Lavoie (2007a). Accordingly, special attention will be given to the difference between the initial effects of some change (short period), the paths of variables, and the terminal effects in the final steady state. As expected, the evolution of the debt-to-capital ratios of the government and firms is sensitive to their initial values. Therefore, only realistic initial steady-state solutions are chosen (including not unreasonably low b and l). The main experiment is that of an increase in the target rate of growth n, from 2.5 percent to 3 percent. Almost all variables under examination show an evolution pattern characterized by a change in trend just after the long-run adjustments are triggered. Therefore, these adjustments play a decisive role in our final conclusions.

The first problem to deal with is that of instability. As noted above, we only consider a range of possible and plausible values for the key parameters that generate an initial a steady state. However, changes that lead to instability may guide us in assessing the importance of fundamental parameters or in reconsidering the underlying model assumptions.

The following sections are organized as follows. Sections 7.1 to 7.6 discuss our findings, Section 8 briefly discusses the stability issues, and Section 9 concludes the paper.

7.1. **Effects on growth rates and capacity utilization.**

The effects of a permanent increase in n on the rates of growth of capital and of output are shown in Figure 2A. The shock happens at $t = 2.5$ (an arbitrary choice; these periods could be years, 2.5 years, corresponding to ten quarters), whereas the long-run adjustments begin

at $t_1 = 12.5$ (fifty quarters). In the short run, as public expenditure expands, the growth rate of output increases faster than the growth rate of capital, causing an increase in capacity utilization. Instead, in the transition stage to the long run, this pattern reverses.

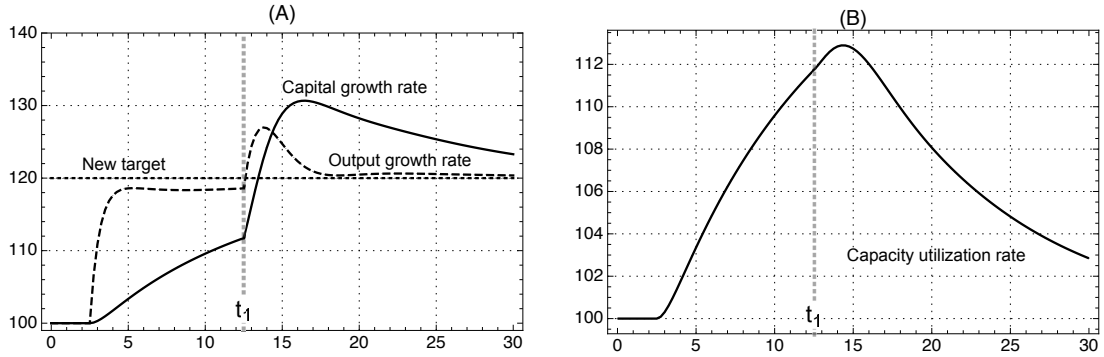

Figure 2. Evolution of growth rates of capital and output and of capacity utilization following a one-step permanent increase in the public expenditure growth rate.

In this last phase, the faster growth rate of capital, induced by the adjustment of g^e to g_x, causes utilization to fall back to u_n (see Figure 2B). Nonetheless, the fiscal expansion retains its Keynesian effects: higher growth rates and higher capacity utilization, on average, over the entire transition period. The transient increase in the utilization rate is the key mechanism that permits the higher growth path, consistent with the changed level and structure of final demand (as shown in Figure 4).[16]

7.2. **Effects on public finance, distribution, inflation, and the demand structure.** As shown in Figure 3A, which displays the evolution of the financial ratios of the public sector, a permanent increase in the public expenditure growth target turns out not to be detrimental to the sustainability of public finances.
After a slight increase in the short run, owing to the initial rise in public expenditure, the debt-to-output ratio declines considerably, reaching a level in the long run far below its initial steady state. In contrast, the deficit-to-output ratio stabilizes, after fluctuations, at a higher level.[17] It should come as no surprise that higher deficits can

[16] De-Juan (2005) emphasizes this point, arguing that the *supermultiplier* mechanism is stable when demand has an 'autonomous' component.
[17] These ratios are given by d/u and b/u, respectively, in terms of our variables. We conform here to the common use where variables refer to GDP, rather than to capital stock. However, d and b show an identical evolution.

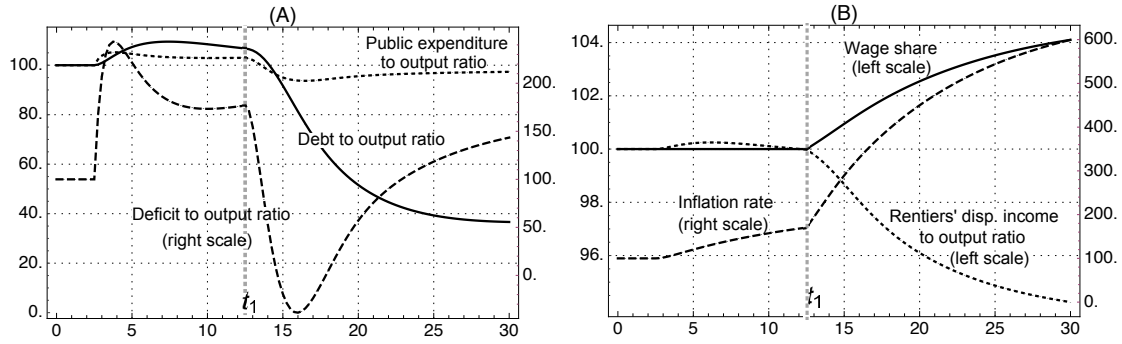

Figure 3. Evolution of the deficit- and debt-to-output ratios, and of inflation, the wage share, and rentiers' disposable income ratio following a one-step permanent increase in the public expenditure growth rate.

lead to a smaller debt-to-output ratio if fiscal expansion is accompanied by *constant* and *low* nominal interest rates, a 'convention' followed by central banks in the 1950s and 1960s, before the radical change in the late 1970s (Pasinetti, 1997). The explanation is simple (as well as recurring in Keynesian literature): total public deficit (primary plus interest payments) increases are more than offset by higher output growth rates originating from the *super*-multiplier process.
Thus, after expansionary fiscal policy, the deficit and debt ratios show sustainable development, with debt-servicing expenditure kept in check, indicating that a critical issue lies in the central bank's control of the interest rate.

The impact on the wage share, inflation rate, and rentiers' income ratio (to output) is shown in Figure 3B. Given the Radical price mechanism assumption ($\epsilon > \delta$), the increase in n induces an increase in wage inflation at a faster pace than that of price inflation. Thus, the wage share reaches a persistently higher level in the long run. Owing to this (as well as to the decreases in rentiers' wealth and interest, as shown below), the rentiers' disposable income ratio to output undergoes a long-run decline, after a temporary increase in the short run.
Note that the model's solutions are quite sensitive to variations in parameters ϵ and δ, as well as to variations in their difference, given the linearity of our distributive relationship. Of course, the introduction of behavioural nonlinearities or of institutional floors and ceilings, though difficult to formalize, would improve the model's realism.

Figure 4 shows the impact on the components' shares of real output, relative to their baseline values. The components that exhibit an increase in the long run are investment, because of the higher capital growth rate, and workers' consumption,

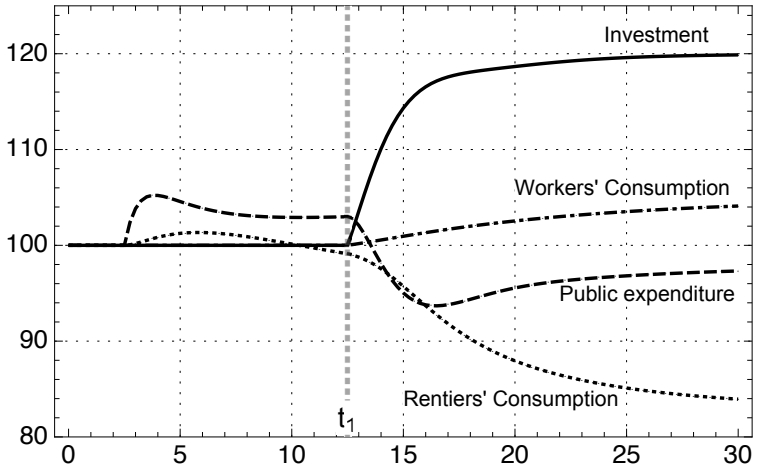

Figure 4. Evolution of demand components following a one-step permanent increase in the public expenditure growth rate: shares of total output.

because of the increased wage share. The rentiers' consumption share shows a neat final decline, after an increase in the short run. Lastly, public expenditure has a lower share, relative to the baseline solution (recall, however, that these shares relate to increasing absolute values of output).

7.3. **Effects on firms' financial sustainability and profitability.** Our purpose now is to observe whether there may arise a long-run destabilizing tendency from the evolution of firms' profitability or financial indicators.
Figure 5A shows that the permanent increase in government expenditure leads to an increase in the rate of profit, net of taxes and interest, up to time t_1. Then it converges back, in the transition to the long run, following the same pattern of capacity utilization. Eventually, it reaches a level lower than that of the baseline solution, because of the increase in real wages. Understandably, the measure of this final reduction depends fundamentally on the intensity of the bargaining struggle between workers and employers (i.e. on the magnitude of parameters ϵ and δ), as well as on their difference.

The two financial sustainability indicators (see Figure 5B) tend to move in a direction opposite to that of the profit rate. In the face of an increasing rate of profit, the g/f_u ratio and l decline slightly until time t_1. Then, they both increase as soon as the rate of profit falls back. This last increase is also explained by the acceleration required by the capital growth rate, with respect to that of output,

for the adjustment towards normal capacity, thus calling for an increase in external financing.

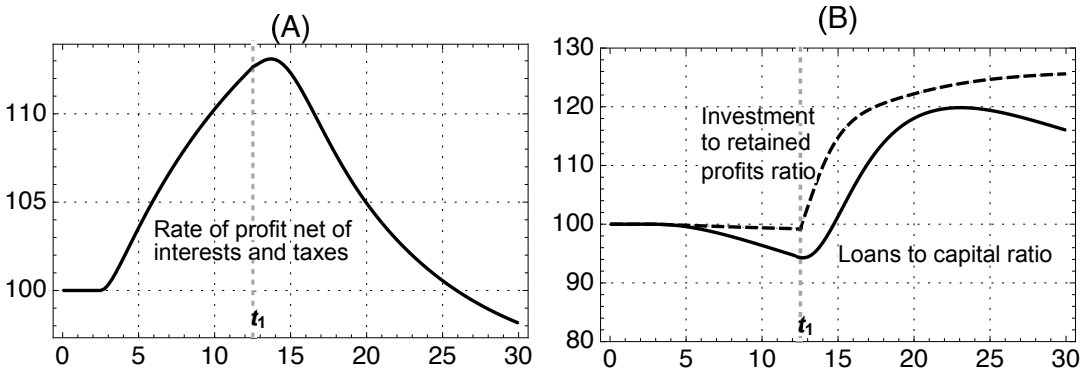

Figure 5. Evolution of the rate of profit, loans-to-capital ratio and investment-to-retained profit ratio of firms, following a one-step permanent increase in the public expenditure growth rate.

7.4. **Effects on rentiers' wealth, income, and savings.** Figure 6 shows the effects of the fiscal expansion on rentiers' wealth and savings.

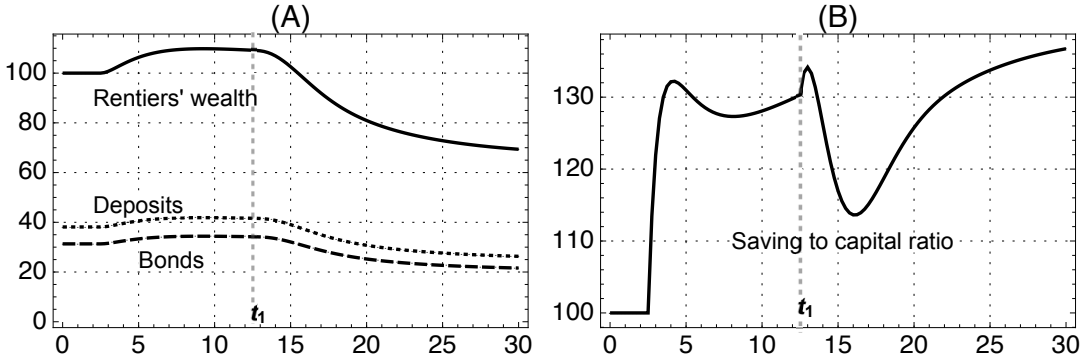

Figure 6. Evolution of rentiers' wealth- and savings-to-capital ratios, following a one-step permanent increase in the public expenditure growth rate: ratios to capital stock.

Following a short-term increase, the larger government expenditure determines the long-term drop in rentiers' wealth, consistent with the pattern already seen in rentiers' income and consumption. Rentiers' savings-to-capital ratio (part B), shows a fluctuating, but increasing trend because of the adverse wealth effect (captured by

parameter c_2 in equation (9)), which makes rentiers' consumption fall by more than their income does. Therefore, rentiers' income and wealth are adversely affected by increases in the wage share and in the inflation rate. The more the latter increases, the sharper the decreases will be. However, it is worth recalling that, since we are dealing with ratios, these decreases are only relative, because they occur within a general context where the absolute values of the variables are all growing at a higher rate.

7.5. **The role of the banking system and the central bank.** Following the Post-Keynesian tradition, in our model, the central bank finances government outlays and private banks, and provides the cash money demanded by rentiers. The central bank maintains a fixed rate of interest, which means that the rate is not determined by the market. The central bank can do this by acting as a residual buyer of bonds issued by the government (i.e., by purchasing bonds that rentiers are not willing to hold at that rate). This has a support function for fiscal policy, enabling the financing of the entire economic system, where money performs more as a social construction, in conformity with its proper nature, than as a fictitious commodity.

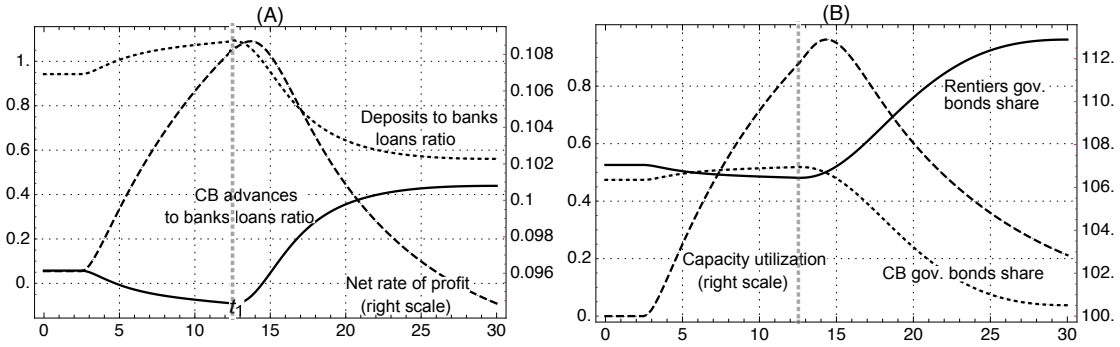

Figure 7. Evolution of central bank advances- and deposits-to-bank loans ratios (part A); government bonds' shares by buyer (part B), following a one-step permanent increase in the public expenditure growth rate.

Figure 7A shows that during the after-shock short run, banks draw their funds for investment financing more from deposits than they do from central bank advances, given that output, profits, and rentiers' dividends (and, thus, savings) grow faster than firms' capital requirements do. This pattern reverses when firms adjust to restore normal capacity. Here, central bank advances are mostly required, given that rentiers' income and deposits decline (recall that autonomous credit creation is excluded from the current configuration of the model).

With regards to government financing, in the short run (see Figure 7B), the increasing deficit (relative to capital) is supported more by purchases by the central bank than it is by those of rentiers, notwithstanding the increase in their disposable income. Again, this movement reverses in the transition phase to the long run, from t_1 onwards, where the share of central bank bond purchases decreases sharply, in contrast to that of rentiers. This is due to the steep fall in the debt-to-output ratio (Figure 3), which makes central bank intervention less necessary.

7.6. **The effect of growth and inflation on the public debt-to-capital ratio: Financial repression or redistribution towards non-savers?** A final remark is due concerning the relative contribution of growth and inflation to the long-term decline of the debt-to-output (or debt-to-capital) ratio. This contribution, as shown in equation (8), is given by gb, a growth effect, and by πb, an inflation effect. These two effects, which follow the increase in public spending and are responsible for the fall in the debt-to-capital ratio, are shown in Figure 8. Both effects are always positive, but gb declines strongly during the transition to the long run.

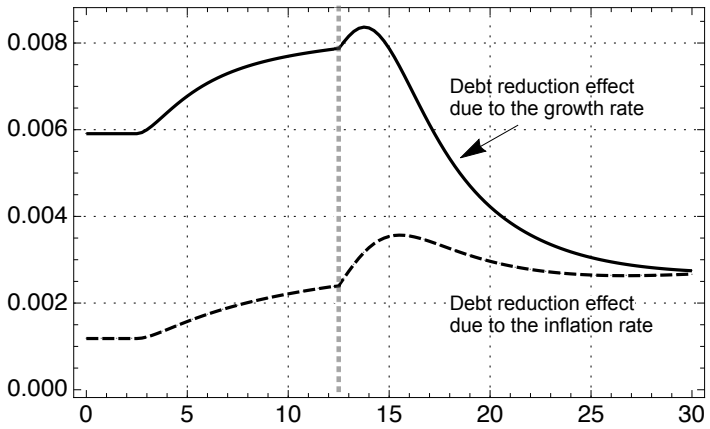

Figure 8. Evolution of the reduction effects on the debt-to-output ratio following a one-step permanent increase in the public expenditure growth rate.

Advocates of laissez-faire economics may argue that these developments entail a form of *financial repression*, since maintaining a low nominal interest rate may lead to a negative real interest rate, that is, to a subtle 'tax' on bond holders and to a hidden source of revenue for the government.[18] However, this policy is the

[18] In economic history this was the reality in the regulated financial markets of the Bretton Woods era (Reinhart and Sbrancia, 2015).

monetary rule that best fits the conflicting, rather than monetary, nature of the inflation process incorporated in the model. The central bank function adopted here is the provision of liquidity to reliable borrowers, as cheaply as possible, as well as the stability of the financial system. Furthermore, controlling the wage-price spiral requires implementing structural and permanent income policies, and can hardly be managed through activist interest-rate approaches.[19] Therefore, the *financial repression* argument does not apply to the institutional characteristics adopted in this model, where inflation is cost-determined and the rate of interest is not a market-clearing price. After all, non-savers, who are affected by the limitations that financial markets can impose on fiscal expansion, have no opportunity to exert any influence on these same markets.

8. Crucial parameters and stability issues

An important role is played by the retention ratio s_f. For instance, an increase in s_f has an impact on the real and financial variables. From the real side, it lowers rentiers' disposable income and consumption, causing a temporary fall in capacity utilization. As a result, given the government reaction function, public expenditure and the public deficit and debt increase. From the financial side, on the one hand, firms' debt ratios decline, while on the other, given the fall in rentiers' savings, the central bank is forced to increase its purchases of government bonds. Thus, an improvement in firms' self-financing leads to a higher public debt if the economy's growth rate is to be maintained.

As we noted in the previous section, parameters ϵ and δ, describing the intensity of the conflict on income distribution, also have an effect, especially with respect to their inflationary and distributive consequences. In general, the higher their values, the higher the inflation dynamics are, and the stronger is the decline in rentiers' income and financial wealth. Whether this will cause a fall in total consumption depends on by how much ϵ is greater than δ. When their difference is low, total consumption falls, because the increase in workers' consumption does not compensate for the drop in rentiers' consumption. When it is high, the reverse happens. In this case, the fiscal expansion exerts its most powerful multiplicative effect, leading to a long-run decline in the share of public expenditure in total output.

Parameter γ, which summarizes the recognition and the decision and action lags of fiscal policy, does not destabilize the economy unless it assumes very low values. For instance, with $\alpha = 1$, so that the lag between spending and production is assumed

[19] See Davidson (2006), Wray (2007), Rochon and Setterfield (2008), and Tymoigne (2009) for a discussion in support of this viewpoint. Whether the nominal or real interest rate should be the appropriate target for monetary policy is a matter of debate in the Post-Keynesian community; a review of the various positions can be found in Lavoie (2014, ch. 4.5) and in Rochon and Setterfield (2008).

to be one unit of time (which should, empirically, be between one month and one quarter), a destabilization takes place, in our simulations, only with a lag value that is 10 times greater (i.e. $\gamma < 0.1$).[20]
Harrodian instability is also possible. This is due to an overreaction of investment to utilization changes, making demand grow faster than capacity creation. Intuitively, and as tested in the simulations, parameters g_u and β (or more accurately, their product), must not exceed a given threshold if stability is to be retained.
Finally, as a consequence of the Radical price mechanism, the model exhibits instability when the postulated change in the target growth rate n takes on high values. Given a strong enough push in public expenditure, and the consequent increase in the wage share (and, therefore, in total consumption), the fall in the overall saving propensity that occurs may be such that the Keynesian stability condition $s(\underline{\omega}) > g_u$ is violated in the adjustment process to the long run. This happens even more with a stronger increase in ω, that is, when the difference in $(\epsilon - \delta)$ is bigger.[21] This kind of instability, of course, stems from the simplifying assumption that the parameters ϵ and δ are constant.

9. Conclusion

The proposed model seeks to reconcile different strands of heterodox macroeconomics by depicting a highly simplified institutional setup. Firms adjust capacity to demand and defend their profits from workers' claims. No autonomous investment activity is predicted, and nor are changes in the labour productivity growth rate. Banks accept deposits from rentiers and provide finance to firms on request, and have no influence on policy.
There are no true markets for money or financial assets, in which prices would respond to demand and supply forces, leading to 'equilibrium' rates and open speculation on assets' price volatility. The interest rate is fixed and kept constant by the central bank, which plays a role of 'lender of last resort', supplying all liquidity required by banks, the government, and households. Thus, monetary power is strictly connected to the financing of public expenditure.
This pre-globalization framework mimics an overdraft economy, where all actors depend on stable growth decided by a *Lernerian* government. Within the framework, the constraints on the expansion of output and employment through fiscal policy

[20] Table 3 in Appendix shows the stability range of parameters g_u, β, α and γ.
[21] Table 4 in appendix shows a numerical example of the maximum level n can take in correspondence to two different $(\epsilon - \delta)$ before leading to instability. The instability of a Keynesian growth model that does not incorporate an automatic mechanism to stabilize the distribution of income is not new (see, among others, Shaikh (2004).

come potentially from the distributive side of the economy and its correlated danger of high inflation. They do not come from a shortage of monetary saving, unsustainable public finance, or, within certain limits, from financial or profitability problems of firms. Inflation and real wage increases may harm rentiers, because their real income and wealth, even if growing in absolute terms, decline relative to total income. Therefore, these effects help to explain the opposition of wealth holders to expansionary fiscal policies. The high and volatile interest rates that usually result from monetary or inflation-targeting strategies, recommended by the mainstream perspective and adopted by current rulers, are certainly more beneficial to them.
The implementation of effective incomes policies, where workers accept welfare benefits in exchange for wage moderation, though difficult to realize, may be the correct policy response to control inflation and to maintain real interest rates at a low, but not a negative level.[22] However, a major obstacle is represented by political barriers erected around the rules preventing the use of *functional finance* instruments, which allowed the 'capture' of central banks by rentier interests in the period 1979 to 1982.[23] These barriers, insurmountable as they seem in the current climate, may not be for future political majorities in favour of changing them.

[22] Proposals to reconcile the commitment to full employment with stable inflation have been advanced by a number of authors under the term *employer of last resource* (Wray, 1998) or *job guarantee* (Mitchell, 1998). Their implementation, in our opinion, would imply changes in the institutional and political environment as demanding as those necessary to promote incomes policies.
[23] See Smithin, 1996.

Appendix A

Table 1. List of parameter values

$\kappa_1 = 0.3$	$\mu_1 = 0.06$	$c_1 = 0.5$
$\kappa_2 = 0.4$	$\mu_2 = -0.03$	$c_2 = 0.05$
$\kappa_3 = 0.3$	$\mu_3 = -0.03$	$n = 0.03$
$\lambda_{11} = 0.6$	$i_B = 0.02$	$u_n = 0.25$
$\lambda_{21} = -0.5$	$i_L = 0.04$	$g_u = 0.1$
$\lambda_{31} = -0.1$	$i_M = 0.04$	$\alpha = 1$
$\lambda_{12} = -0.5$	$\mu_L = 1$	$\gamma = 0.4$
$\lambda_{22} = 1.5$	$\mu_M = 0.8$	$\beta = 0.1$
$\lambda_{32} = -1$	$\tau_w = 0.1$	$\epsilon = 0.3$
$\lambda_{13} = -0.1$	$\tau_r = 0.25$	$\delta = 0.2$
$\lambda_{23} = -1$	$\tau_f = 0.22$	
$\lambda_{33} = 1.1$	$s_f = 0.25$	

Table 2. List of steady-state values

	Initial s-s values	Final s-s values		Initial s-s values	Final s-s values
a	0.05262	0.05017	l	0.17469	0.12659
b	0.14605	0.07551	m	0.12207	0.07642
b_{cb}	0.04579	0.01283	n	0.03	0.032
b_r	0.10026	0.06278	s_r	0.01283	0.01636
b_x	0.58421	0.30203	t_c	0.01924	0.01764
c_r	0.04490	0.03657	t_f	0.02596	0.02454
c_t	0.15740	0.15662	t_w	0.0125	0.01334
d	0.00292	0.00460	u	0.25	0.25
f	0.11801	0.11155	v_r	0.32074	0.20210
f_b	0.00545	0.00375	v_f	0.82531	0.87341
f_{cb}	0.00197	0.00126	y_r	0.07698	0.07057
f_u	0.02301	0.02175	y_{cd}	0.05773	0.05293
g	0.03	0.032	y_w	0.125	1.33349
g_e	0.03	0.032	z	0.09840	0.06300
g_x	0.03	0.032	π	0.01	0.04895
h	0.06260	0.06139	π_e	0.01	0.04895
i_L	0.04	0.04	ω	0.5	0.53335
i_M	0.004	0.04			

Table 3. Stability range for demand reaction parameters

Parameters	Base value	Stability range –%	Stability range +%
g_u	0.1	- 25%	+45%
β	0.1	- 50%	+400%
α	1.0	-80%	+300%
γ	0.4	-75%	>+500%

Note: Stability range is obtained by varying every single parameter at each run, while holding all others constant.

Table 4. Sability sensitiveness to $(\epsilon - \delta)$.

		Instability begins when n increases from 3% to more than
ϵ	0.30	9%
δ	0.29	
ϵ	0.30	4.70%
δ	0.20	

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