The Term Structure of Interest Rate and Income Distribution in an SFC Post-Keynesian Growth Model with Inflation Targeting and Zero Money Financing of Government Deficit*

*Julio Fernando Costa Santos****

*José Luis Oreiro***

Resumo: O objetivo desse artigo é construir um modelo de crescimento pós-keynesiano em abordagem *Stock-flow consistent* para uma economia fechada com atividade governamental que incorpore o arranjo fiscal e monetário que há em alguns países ao redor do mundo. Mais precisamente, o modelo faz uso do regime de metas de inflação e assume a proibição de financiamento do tesouro via Banco Central. O modelo calibrado foi capaz de apresentar os seguintes resultados: (a) após a parametrização, o modelo pode apresentar regimes tanto *wage-led* quanto *profit-led*; (b) Há a possibilidade do efeito *crowding-out* em choques de aumento do componente autônomo do gasto público; (c) Há possibilidade de gerar endogenamente a estrutura a termo da taxa de juros e essa pode ter inclinação positiva ou negativa no decorrer dos choques.

Palavras-chave: Modelo SFC; Conflito Distributivo; Financeirização; Regra de Taylor; Estrutura a Termo da Taxa de Juros.

Abstract: The aim of this paper is to build a post-Keynesian growth model in a stock-flow consistent approach to a closed economy with government activity that incorporates the fiscal and monetary arrangement that exists in some countries around the world. More precisely, the model makes use of the inflation targeting regime and assumes the prohibition of treasury financing by Central Bank. The calibrated model was able to present the following results: (a) after parameterization, the model can show both wage-led and profit-led regimes; (b) There is the possibility of the crowding-out effect on shocks to increase the autonomous component of public spending; (c) It is possible to endogenously generate the term structure of the interest rate and this may have a positive or negative slope in the course of the shocks.

Keywords: SFC Model; Conflict Claims; Financialization; Taylor Rule, Term Structure of Interest Rates.

JEL Code: E12, E37, P10

Área 6 - Crescimento, Desenvolvimento Econômico e Instituições

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*** Adjunct professor at Instituto de Economia e Relações Internacionais, Universidade Federal de Uberlândia (UFU), Brazil. E-mail: julio.costa@ufu.br.

** Associate Professor of Economics at Departamento de Economia, Universidade de Brasília (UnB), Brazil and Level IB Researcher at CNPq. E-mail: joreiro@unb.br.

1. Introduction

Two major theoretical postulates of Keynesian economics are that the level of interest rate is a strict monetary phenomenon, being determined by the interaction between liquidity preference of households, firms and commercial banks and the monetary policy conducted by Central Bank (Carvalho, 2015, pp.21-25); and that an increase in government (or other element of the so-called autonomous) expenditures will always increase the level of output and employment and hence aggregate savings, avoiding a crowding out of private investment by government expenditures due to a "lack of savings" (Amadeo, 1989, pp.113-117), at least if the economy is operating in a situation of underemployment equilibrium[1]. The first postulate is the *Liquidity Preference Theory*, the second is the *Principle of Effective Demand*.

These postulates are generally presented in a very simplified model about the workings of the economic system, where there is just *one interest rate* and the stock-flow implications of financing of government deficits are ignored. Many years ago, the dependence of these postulates on simplified assumptions regarding the structure of economic system were questioned by Tom Asimakopoulos, an unsuspected Keynesian economist. In his 1991 book, Asimakopoulos said that "Keynes´s theory of interest is dependent on the long-term expectations that determine the position and shape of liquidity preference function. He did not recognize that these long-term expectations could be affected by comparison of projected rates on investment and projected savings (based on economy´s propensity to save) in future periods. If it appears that investment would be greater than normal savings, concerns over future interest rates could bring about immediate increases in long-term rates that act as a damper to investment plans. Thus, the independence of investment from saving – a key element in Keynes´s theory – does not hold in all circumstances" (Asimakopoulos, 1991, p.116).

The development of the so-called stock-flow consistent models by Godley (1999), Lavoie and Godley (2001), Zezza and Dos Santos (2006), Godley and Lavoie (2007a, 2007b) and Dos Santos and Zezza (2008) allowed the construction of a series of macroeconomic models that could track the stock-flow implications of financing of government deficit over the whole term structure of interest rates. One of such models is the one presented in chapter five of Godley and Lavoie (2007b). These authors considered a closed economy with four economic sectors: households, firms, government and central bank. Households´ wealth is stored in three types of assets, that are imperfect substitutes one to the other: money, bills and bonds. Bills are the short-term debt issued by the central bank in order to regulate the balance sheet liquidity of the private sector. Since bills are short-term debt, they are not exposed to the risk of capital losses. Bonds are the long-term debt issued by the government in order to finance its fiscal deficit. Long-term bonds are constituted by perpetuities, whose market price is an inverse function of the long-term interest rate (Godley and Lavoie, 2007b, p.132). These means that capital gains or losses must be taken explicit in consideration in the Transaction Flow Matrix of the model (Ibid, p. 138). Long term bonds are sold in capital markets, but central bank act as a buyer of last resort, buying all bonds that are not bought by households (Ibid, p. 166). This means that monetary financing of government deficits is allowed by the Institutional Arrangement of fiscal and monetary policy.

Their model presented some counter-intuitive results. For example, the yield curve will assume a negative slope as a result of once and for all increase in the short-term interest rate (p.156). Also, in the *LP3 closure of the model*, where government expenditures are made endogenous by means of the introduction of a reaction function for government expenditures that is dependent on the ratio of public sector borrowing requirement to GDP (p.161); a sharp decrease in the propensity to consume out of disposable income will produce a permanent reduction on the level of GDP. This result occurs to the fact that a reduction in private consumption expenditure triggers also a reduction of government expenditures, due to effect of the fall in economic activity over the tax receipts and hence over the ratio of public sector borrowing requirement to GDP, generating a strange "crowding-in" effect. Besides this monetary policy is completely exogenous,

[1] The idea that output is demand determined is also valid in the long-run is due to Kaldor (1988).

since short-term interest rate is set at a level that is not related to any of the traditional goals of monetary policy, like to achieve some target inflation or to eliminate the output gap.

The great shortcoming of the Godley and Lavoie (2007b) model, however, is the lack of correspondence between Institutional Arrangement of fiscal and monetary policy assumed by the model and the one that prevails in the real world. In many developed and developing economies monetary policy is operated under the framework of Inflation Targeting Regimes, which reduces enormously the scope for monetary authorities to set "freely" the level of short-term interest rates. Moreover, in many countries money financing of government deficits is explicitly forbidden by law. This is, for instance, the case of Brazil, where *loans of central bank to the treasury are explicitly forbidden by the article 164 of the Federal Constitution* [2]. Moreover, perpetuities are not the main type of bonds issued by government in order to finance its fiscal deficit. Taking again Brazil as an example, more or less 40% of government debt is constituted by the so-called *Financial Treasury Bills* (*Letras Financeiras do Tesouro)* which is an interest rate-indexed bond that had a *special feature of having zero duration in Mackaulay sense*[3], which means that the price of these bonds has no sensitivity to changes in interest rates[4], being free of the risk of capital losses, whatever their maturity (Holanda Barbosa, 2006).

The aim of the present article is precisely to build an SFC growth model that incorporates the Institutional Arrangement of fiscal and monetary policy that exists in the real world. More precisely in our model monetary policy will be conducted under the framework of Inflation Targeting Regime, money financing of government deficit will be -forbidden by law and government issued interest rate-indexed bonds in order to finance its fiscal deficit. We are not saying that these institutional arrangements should be considered the ideal one for the conduction of fiscal and monetary policy; but we only want to analyze its effect over the dynamics of our model economy since these arrangements are the ones that prevails in many countries in the real world[5].

In the model to be presented in this article we will consider a closed economy with government activities. Firms produces a homogeneous output, which served both for consumption and investment; and operate in a market structure characterized by monopolistic competition. Prices are set by means of a variable mark-up rate over unit labor costs. Labor is the only variable input used in production, but production also requires the utilization of physical capital. Regarding pricing decisions, we will consider that the weighted average cost of capital as one of the main determinants of mark-up rate. This assumption expresses the idea that our model economy works in in accordance to the logic of the actual stage of the capitalist evolution, which is the *finance-dominated capitalism* (Hein, 2012). On this stage of capitalist evolution the financial variables had a growing influence over the production, pricing and investment decisions of productive firms[6].

Government takes no production activities and buys goods from firms in order to carry on its (unproductive) activities. Government consumption is financed by income taxes and by selling interest rate-indexed bonds to the rentiers. All investment is made by private firms and is financed by retained profits and loans from commercial banks. Workers are organized in labor unions in order to strength their position in the wage bargains. Labor unions define targets for the wage share in income, based on which they set the rate of wage inflation.

Central Bank operates monetary policy in an *Inflation Targeting Regime*, setting the short-term interest rate in order to achieve a numerical target for inflation rate in the long-term. *Central bank is forbidden by law to buy government bills,* so there is no fiscal dominance and

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[2] See https://www.senado.leg.br/atividade/const/con1988/con1988_14.12.2017/art_164_.asp.
[3] About duration in Mackaulay sense see Fabozzi (1999)
[4] One important implication of this kind of bond for the construction of SFC models is that there are no capital gains or losses on long-term bonds to be included in the Transaction Flow Matrix of the Model.
[5] Regarding the possible compatibility of Inflation Targeting and Post Keynesian Economics see Setterfield (2006) and Lima and Setterfield (2008).
[6] For s formal treatment of "financialization" in SFC models see Trreck (2009).

government had to finance 100% of fiscal deficit by selling interest rate-indexed bonds on capital markets. This means that long term interest rate is thus determined by capital markets, being the price that coordinates the portfolio decisions of households from one hand, and the composition of financial wealth from the other side. Government bills are assumed to be free of interest risk since coupon payments are indexed by the long-term rate. Households are composed by workers and rentiers. Workers are supposed to “spend all they get” in consumption goods; and rentiers save all their current income – originated from distributed profits and interest on bonds - and store it in financial assets. All financial wealth belongs to rentiers.

Once the accounting structure and the behavior equations of the model are presented and explained, then we will use an algorithm developed by Costa Santos (2017)[7] in order to find the parameters for the model that generate steady-state values for the endogenous variables. In the baseline model dynamics, the economy will converge to a steady-state position where (i) long-term interest rate is higher than short term interest rate, defining a yield curve with positive inclination; (ii) both demand and accumulation regimes are wage-led; (iii) inflation rate converges to the target; and (iv) government to GDP ratio stabilized at a considerably low level.

Hence the model is used to analyze the effects of a once-and-for all change in the level of government expenditures over the time path of investment to GDP ratio, profit share, capacity utilization, the spread between long-term and short-term interest rates and inflation. The results of the simulation show that a permanent increase in the level of government expenditures is followed by a permanent decrease in the investment to GDP ratio, a permanent increase in the spread between long and short-term interest rate, a permanent decrease in the level of capacity utilization and a permanent increase in the profit share, but with no lasting effects over inflation dynamics.

These results show that in an SFC growth model with inflation targeting and zero money financing of fiscal deficit, a permanent increase in the level of government expenditures produces a crowding-out effect over investment expenditures and a redistribution of income from households to firms and rentiers. This is a novel and surprising result for the SFC model literature.

2. Accounting Structure and Assumptions of the Model

As we had told in the introduction, the model at hand aims to understand the dynamics of public financing and its interrelations with the other macroeconomic variables in a closed economy adopting as hypothesis the non-financing of long-term public debt securities through the Central Bank (an unusual hypothesis in the SFC literature, but it is a good representation of the relation of monetary and fiscal authorities in countries like Brazil). As a starting point, we will describe the basic structural features of this economy.

First, we will consider an economy with unlimited labor supply during simulated periods, so that the availability of labor is never a constraint to the expansion of output (Lewis, 1954). The existence of labor unions, however, makes it possible for wages of employed workers to be set above the subsistence level due to the insider-outsider effect in wage bargaining (Blanchard and Fischer, 1989, pp. 448-449). In other words, only employed workers participate in the wage bargaining. There is also no technical progress which guarantees a constant level of labor productivity.

The model assumes the existence of five institutional sectors: households (workers and rentiers), firms, banks, central bank and government. Aligned to the most common hypothesis in SFC models, this is a one-good economy, where output can be both invested and consumed. Table 1 and table 2 summarize the accounting structure of this economy, representing the assets and liabilities of the institutional sectors and the matrix of transactions and flow of funds, respectively.

[7] In that work, Costa Santos (2017) shows that there are similar results between studying the stability criterion by the traditional analytical method and the algorithm developed for model simulation.

Regarding households, we will adopt the traditional Post-Keynesian hypothesis of class segmentation between workers and rentiers (Harcourt, 2006, pp. 6-11). The first group receives wages from their labor supply and spends them paying taxes over their income and consuming everything else. In this way, since there are no leftovers (no savings) and there is no wealth inherited by this class. Their equity is zero and workers do not accumulate wealth over time.

The second class is formed by the rentiers. This class do not supply labor services and their income comes from distributed profits from firms and banks and interests over financial wealth. Rentiers´ financial wealth is allocated between bank deposits and interest rate-indexed government bonds. These two assets generate as gross income interest on deposits and interest on bonds. In net terms there is the discount of a tax rate on this income. Since we are considering interest rate-indexed government bonds, there is no capital gains or losses to be computed as part of the disposable income of rentiers.

The firms, in turn, shows in their balance sheet the physical capital responsible for production of goods supplied in this economy. On the liability side, there are loans taken from commercial banks.

Government had only interest rate-indexed bonds as its´ liabilities. Therefore, it is also assumed that government do not undertake any production activities. Government net worth is also negative. The Central Bank (CB), which has a link with the Government, is not allowed by law to buy bonds, so there is a clear institutional separation between fiscal (Treasury) and monetary (Central Bank) authorities. CB's liability is made up of the reserves of the Banking Sector, since there is no paper money in the system; and the asset side is constituted by the advances provided to the banking system to guarantee its liquidity. The only relation that arises in this economy between the CB and the Government is that the profit obtained by the receipt of interest from the banks in relation to the advances is passed on to the Treasury.

Lastly, we have commercial banks that have as assets the loans granted to firms and reserves within CB. On the liability side, loans taken via advances with CB and the deposits of the rentiers. The commercial bank profit comes from the spread between the interest rate of funding and the interest rate of the loans provided to the firms.

Table 1 - Balance Sheet of the SFC Model

	Workers	Firms	Government	Banks	Central Bank	Rentiers	$\sum$
Loans		$-L$		$+L$			0
Bank Deposits				$-D$		$+D$	0
Bank Reserves				$+R$	$-R$		0
CB Advances				$-A$	$+A$		0
Bonds			$-B$			$+B$	0
Fixed Capital		$+p.K$					$+p.K$
Balance (Net Worth)	0	$-V_f$	$-V_a$	$-V_b$	$-V_{cb}$	$-V_r$	$+p.K$
$\sum$	0	0	0	0	0	0	0

Note: Positive sign (+) preceding a variable represents an asset for that agent and negative sign (-) represents a liability.

Table 2 - Transactions-Flow Matrix of the SFC Model.

		Firms						
	Workers	Current	Capital	Government	Central Bank	Banks	Rentiers	$\sum$
Consumption	$-C_W$	$+C$					$-C_R$	0
Investment		$+I$	$-I$					0
Government Expenditures		$+G$		$-G$				0
Wages	$+W_b$	$-W_b$						0
Tax	$-T_w$	$-T_f$		$+T$		$-T_b$	$-T_r$	0
Retained Profits (Firms)		$-Fu$	$+Fu$					0
Unretained Profits (Firms)		$-Fd$					$+Fd$	0
CB and Bank Profits				$+F_{cb}$	$-F_{cb}$	$-Fb$	$+Fb$	0
Interest in Bonds				$-ib_{-1}.B_{-1}$			$+ib_{-1}.B_{-1}$	0
Interest in Advances					$+ia_{-1}.A_{-1}$	$-ia_{-1}.A_{-1}$		0
Interest in Loans		$-il_{-1}.L_{-1}$				$+il_{-1}.L_{-1}$		0
$\sum$	0	0	$+Fu-I$	$+Sav_g$	0	0	$+Sav_r$	0
Δ Deposits						$+\Delta D$	$-\Delta D$	0
Δ Bonds				$+\Delta B$			$-\Delta B$	0
Δ Advances					$-\Delta A$	$+\Delta A$		0
Δ Loans			$+\Delta L$			$-\Delta L$		0
$\sum$	0	0	0	0	0	0	0	0

Note: Positive sign (+) preceding a variable represents a resource destination and negative sign (-) represents a source.

3. The Model Structure and Behavior Equations

In this section we will present the structure and the behavior equations of the economy at hand.

3.1. Price, Inflation and Income Distribution

Regarding the behavior equations of the model we will consider a closed economy where firms operate in a market structure with monopolistic competition. In this setting prices are formed by means of a mark-up over unit labor costs as expressed in Equation (1). We are assuming that labor is the only variable input used in production and its productivity (q) is assumed constant over time; i.e. there is no technical progress. The mark-up rate (m) is not constant; but changes due to changes in the weighted average cost of capital, i_{wacc}, and on the level of capacity utilization of production inherited from the previous period, u_{-1} [8], as we can see in equation (2). The dependence of the mark-up rate to the weighted average cost of capital (WACC, hereafter) is a simple way to formalize the idea that the economy at hand is financialized in the sense that price decision – and hence income distribution - are directly linked with financial variables[9]. Regarding the negative influence of capacity utilization on the rate of mark-up, we are simply adopting the new Keynesian perspective about counter-cyclical mark-up.

The profit share in income, h, is determined in equation (3), being dependent on the rate of mark-up. On the other hand, wage share can be obtained through the residual form by the subtraction of profit in the income, as it appears in (4).

Equation (5) shows the target value for the wage share that is demanded by labor unions, which is based in Rowthorn (1977). This target has an autonomous component, ω_0, plus a component that captures the influence of the level of activity – represented by the level of capacity utilization, u – over income claims by unions. Equation (6), in turn, presents the wage inflation dynamics. Unions demand nominal wage increases in order to compensate the erosion of real wages by the inflation occurred in the previous period plus a component that captures the distributive conflict, given by the difference between the desired wage share by labor unions and the actual share, $\alpha_1.(\omega^d - \omega)$.

$$p = [1 + m(\cdot)].\frac{W_b}{q} \quad (1)$$

$$m = m_0 + m_1.i_{wacc_{-1}} - m_2.u_{-1} \quad (2)$$

$$h = \frac{\Pi}{Y} = \frac{m(\cdot)}{1+m(\cdot)} = \frac{m_0+m_1.i_{wacc_{-1}}-m_2.u_{-1}}{1+m_0+m_1.i_{wacc_{-1}}-m_2.u_{-1}} \quad (3)$$

$$\omega = 1 - h(\cdot) = \frac{1}{1+m_0+m_1.i_{wacc_{-1}}-m_2.u_{-1}} \quad (4)$$

$$\omega^d = \omega_1 + \omega_2.u \quad (5)$$

$$\hat{w}_b = (1-\alpha_1).\hat{p}_{-1} + \alpha_1.\left(\omega^d - \omega\right) \quad (6)$$

$$\hat{p} = \frac{m_1.\Delta i_{wacc_{-1}} - m_2.\Delta u_{-1}}{1+m_0+m_1.i_{wacc_{-1}}-m_2.u_{-1}} + (1-\alpha_1).\hat{p}_{-1} + \alpha_1.(\omega_1 + \omega_2.u - \omega) \quad (7)$$

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[8] We assume the premise commonly adopted in New Keynesian models of using a counter-cyclical mark-up. Examples in: CALVO (1983), CARLIN and SOSKICE, D. (2006). CHRISTOPHER and RAMEY (2013).

[9] A similar approach is adopted by Hein (2012, chapter 3), where the mark-up rate depends on rentiers´ return on equity and bonds, instead of the WACC.

$r_k = \frac{\Pi}{p.K_{-1}} = h(\cdot).u(\cdot)$ (8)

Equation (7) summarizes the dynamics of inflation in the economy at hand. It is given by three parts. The first one is related to the mark-up dynamics, given by $(m_1.\Delta i_{wacc_{-1}} - m_2.\Delta u_{-1})/(1 + m_0 + m_1.i_{wacc_{-1}} - m_2.u_{-1})$. The second part is the inertial component resulting from the *backward looking* of the unions regarding inflation expectations and the third part captures the distributive conflict.

Equation (8) shows the rate of return over productive capital in this economy. It is obtained by dividing total profits by the capital stock inherited from the previous period. Another way to calculate is by multiplying $h(\cdot).u(\cdot)$.[10]

3.2. Households

3.2.1. Consumption and Households Saving

As previously shown, households are composed by workers and rentiers. Workers consume all their disposable income and consequently do not save or accumulate wealth. Thus, equation (9) shows that worker's consumption is the residue of wages, W_b, after the incidence of income tax, θ.

Rentiers, in turn, will save all their available disposable income and will only consume a portion of the wealth inherited from the previous period. This is explicit in equation (10), considering that the propensity to spend of the inherited wealth is given by the interval $0 < a \ll 1$.

By aggregating the consumption of the two classes, we have the aggregate consumption function that is presented in equation (11). This means that consumption is explained by the current level of disposable income and the inherited wealth of the previous period.

$C_w = (1 - \theta).W_b$ (9)

$C_r = a.V_{r_{-1}}$ (10)

$C = C_w + C_r = (1 - \theta).W_b + a.V_{r_{-1}}$ (11)

Where C_w is the workers consumption, C_r is the rentiers consumption, θ is a tax rate of income, a is the wealth propensity for consumption, C is the aggregate consumption, Vh_{-1} is a inherited rentiers wealth.

Nevertheless, we can use (11) in order to normalize consumption by the capital stock. Defining $\omega = W_b/Y$ and $u = Y/K_{-1}$, we get:

$c = (1 - \theta).\omega.u + v_{r_{-1}}$ (11b)

Where c is the normalized consumption by the stock of inherited capital, C/K_{-1}; ω is the share of wages in income and vr_{-1} is the inherited capital divided by the stock of inherited capital.

3.2.2. The Dynamics of Households Wealth

The wealth of households is the sum of the wealth of the rentiers and the wealth of the workers. Since workers do not have wealth, then we have that $V_h = V_r$, that is, the wealth of households is the wealth of the rentiers. Then, we have that originally, the dynamics of wealth is given by:

$V_r = V_{r_{-1}} + S_r$ (12)

However, as part of the inherited wealth is consumed and all the current income of the rentiers after taxation is saved, we get:

$V_r = (1 - a).V_{r_{-1}} + (1 - \theta)\left(i_{b_{-1}}.B_{-1} + F_b + F_d\right)$ (12b)

[10] Assuming for simplicity and without loss of generality that capital-output ratio is equal to one.

Where V_r is the wealth of the rentiers, i_b is the interest rate of the public bills, F_b are the dividends received from the banks, F_d are the dividends received from the firms.

3.2.3. Portfolio of Rentiers[11]

The rentiers allocate their wealth between only two financial assets: Deposits and Government Bonds. Rentiers endogenously modify their portfolio allocation according to changes in the spread between bond (long-term) interest and the advances (short-term) interest rate; and also due to changes in the level of economic activity, represented by disposable income. This is displayed in equations (13) and (14) below:

$$B^d = [\lambda_0 + \lambda_1.(i_b - i_a)].V_{r_{-1}} - \lambda_2.(1-\theta).Y \qquad (13)$$

$$D^d = [(1-\lambda_0) - \lambda_1.(i_b - i_a)].V_{r_{-1}} + \lambda_2.(1-\theta).Y \qquad (14)$$

Where B^d is the demand for bonds in current period, λ_0 is the autonomous component of the portfolio to allocate in bonds, λ_1 is the sensitivity parameter of the bonds demand to the spread between long term and short term interest rates, i_b is the bond interest rate, i_a is the advances interest rate, D^d is the bank deposits demanded by rentiers.

Following Tobin's logic for portfolio construction[12], we have some restrictions on parameter values. The first is that all wealth must be allocated between bank deposits and bonds. The second constrain is that if there is a percentage increase in one asset, the other must be decreased by the same percentage.

3.3. Government and Central Bank

The Government is presented by equations (15) to (21). Equation (15) shows the government's tax revenue, which is obtained endogenously as a rate, θ, over the level of economic activity. Note that this focuses on wages, profits in its broad conception that encompasses the real activity and financial activity of that economy. In order for there to be no double taxation, we define that dividend taxation occurs in the payment of the households.

Equation (16) shows that fiscal policy is designed for the government consumption to grow at the same rate of capital stock. Equation (17) shows the *public sector borrowing requirement* before the payment of interest on the debt[13]. Equation (18) shows the dynamics of public debt. The stock of bonds in the current period is given by the inherited bonds from previous period plus the payment of interest of inherited bonds plus the public sector borrowing requirement (PBR). Finally, in equation (19), we have that the profit of the Central Bank is given by the receipt of interest on the rediscount operations used by Commercial Banks.

$$T = \theta.d.\Pi + \theta.(1-d).\Pi + \theta.W_b = \theta.Y \qquad (15)$$

$$G = g_0.K_{-1} \qquad (16)$$

$$PBR = \Delta B = G - (T + F_{cb}) \qquad (17)$$

$$B^s = \left(1 + i_{b_{-1}}\right)B^s_{-1} + PBR \qquad (18)$$

$$F_{cb} = i_{a_{-1}}.A_{-1} \qquad (19)$$

Where G is public expenditure, g_0 is desired ratio between government consumption expenditures and capital stock PBR is the public sector borrowing requirement before interest

[11] This approach is Based on Tobin (1980, 1982).

[12] It is usual in the SFC literature to make use of the portfolio decision equations referring to the way that James Tobin did as well. Further details can be found in Chapter 3 of Godley, W. and Lavoie, M. (2007b).

[13] Actually it is the primary deficit of public sector.

payments over public debt, B^s is the stock of government bonds issued and F_{cb} is the profit of the central bank.

3.4. The Term Structure of the Interest Rate

The developed model makes use of two distinct interest rates. The first is equivalent to a short-term rate. It is used by the Central Bank as the one that pays the advance loans. It is fixed by the means of a Taylor rule[14] with the aim of being an instrument for the achievement of some numerical target for the inflation rate ($\hat{p}^T$) in the long term. This means that monetary policy in the economy at hand is conducted under the Institutional Arrangement of the Inflation Targeting Regime[15]. This is presented in equation (20) and its behavior is explained by an inertial component (due to the so-called interest rate smoothing) and a component that captures the deviations of inflation from the inflation target.

The second, presented in equation (21), is the long-term interest rate[16], that is, the interest rate on public debt securities, which is determined by the interaction between the supply of government securities, determined by the composition of financial wealth and public sector borrowing requirement, and the demand for then, given by the portfolio behavior of rentiers.

$$i_a = i_{a_{-1}} + \phi_2.(\hat{p}_{-1} - \hat{p}^T) \quad (20)$$

$$i_b = -\frac{\lambda_0}{\lambda_1} + i_a + \frac{(1-\tau)}{\lambda_1}.i_{a_{-1}} + \frac{(1+i_{b_{-1}})B^S_{-1} + g_0.K_{-1} - i_{a_{-1}}.(L_{-1} + (1-\tau).B_{-1}) + [\lambda_2.(1-\theta) - \theta].Y}{\lambda_1.V_{r_{-1}}} \quad (21)$$

Where ϕ_2 is the component that captures the current interest rate response to the deviation of past inflation from the target, $\hat{p}^T$.

3.5. Comercial Banks

The activity of the banking sector is described through equations (22) to (26). We suppose that interest rate on the bank loans is determined by applying a mark-up on the advances rate, according to equation (22).

Equation (23) indicates that a share of the bank deposits is maintained in the form of bank reserves in the central bank. Equation (24), in turn, shows that bank profits are calculated as the difference between the income received from interest on loans and the interest paid on advances. Its taxation occurs in the payment to the shareholders, since all banking profits are distributed to the households.

Equation (25) shows that loans in the current period are given by the sum of the loans inherited from previous period plus the difference between the desired investment by firms and the profits retained to finance it.

Equation (26) presents central bank loans to commercial banks. The loans demanded by the firms are fully supplied by the banks, so credit supply is fully endogenous. The liquidity for banks is provided by the rediscount operations conducted by central bank. In this way, we have the guarantee that there is unrestricted credit in the system.

$$i_l = (1 + \phi_1).i_a \quad (22)$$
$$R \equiv \tau.D \quad (23)$$
$$Fb = i_{l_{-1}}.L_{-1} - i_a.A_{-1} \quad (24)$$
$$L = L_{-1} + I - Fu \quad (25)$$
$$A \equiv L - (1-\tau).D \quad (26)$$

[14] See Taylor (1993).
[15] For the different types of Institutional Arrangements of Inflation Targeting Regime see Oreiro and Rocha (2011).
[16] Details on the derivation of the equation that determines the interest rate of government securities are presented in the appendix.

Where i_l is the interest rate of loans, ϕ_1 is the mark-up of bank loans, τ is the share of deposits held as reserve within central bank, R are the reserves, D deposits, F_b is the profit from banking activity, L are the loans.

3.6. Firms

The equations that define the behavior of firms are given by (27) to (32). The weighted average capital cost or WACC is given by equation (27). It represents a weighted average of the cost of equity and the cost of third-party capital (loans).

Equation (28), in turn, presents the investment rate. It is given by an autonomous component, γ_0 and a component, γ_1, which captures the difference between the return on economic activity and the average cost weighted by capital. This specification of the investment function is based on Robinson (1956).

Equation (29) presents the calculation of profit before taxes. In order to avoid double taxation, the model assumes that dividends are taxed only after they are distributed, that is, households are responsible for their payment and firms pay for the share that is retained. Profit is calculated directly through the profit share times the national income minus the interest payment over loans.

Equation (30) shows that dividends are a percentage share, d, of total profit after payment of interest on loans. The equation (31) complements the idea showing that the retained profits are equal to total profits times the retention coefficient (*1-d*) times one minus the tax rate. Finally, (32) reveals the dynamics of capital that is given by accumulated capital until previous period plus gross investment. For simplicity, we consider that there is no depreciation of productive capital.

$$i_{wacc} = x_1 . i_a + (1 - x_1) . i_l, \quad 0 \leq x_1 \leq 1 \tag{27}$$

$$in = \frac{\Delta K}{K_{-1}} = \gamma_0 + \gamma_1 . (r_k - i_{wacc}) \tag{28}$$

$$F = h . Y - i_{l_{-1}} . L_{-1} \tag{29}$$

$$Fd = d . F, \quad 0 < d < 1 \tag{30}$$

$$Fu = (1 - \theta) . (1 - d) . F \tag{31}$$

$$K = K_{-1} + I \tag{32}$$

4. Reduced Model Version

In this section we will present the reduced version of the model. Although it is not usual in the SFC literature to use this type of approach, we chose to simplify the model by replacing and manipulating algebraically until it was possible to take the complete system of 32 equations and transform it into one of only 9 difference equations.

To that end, the variables that grow at the level, such as Y, C, I, B, V_r, among others, were normalized by dividing by the stock of capital, which also grows in level. The advantage in doing this is that in the end we have a system that can converge to a steady state rather than just providing a balanced growth path.

In addition, we can through the reduced system, perform the calculation of the partial derivatives and infer the short-term links and whether these assume positive or negative values (when is possible to define without numerical calculus).

Thus, we present the first equation that represents inflation. It has three terms that need to be analyzed. The first one is called mark-up inflation, described by $(m_1 . z_1 \Delta . i_{a_{-1}} - m_2 . \Delta u_{-1})/(1 + m_0 + m_1 . z_1 \Delta . i_{a_{-1}} - m_2 . u_{-1})$. This term represents the price mark-up change of firms over time and in the steady state it converges to zero. The second term is the inertial component of inflation, given by $(1-\alpha_1).\hat{p}_{-1}$ and the third captures the conflict claim, given by $\alpha_1.[\omega_1+\omega_2.u-(1-h)]$.

$$\hat{p}=\frac{m_1.z_1\Delta.i_{a_{-1}}-m_2.\Delta u_{-1}}{1+m_0+m_1.z_1\Delta.i_{a_{-1}}-m_2.u_{-1}}+(1-\alpha_1).\hat{p}_{-1}+\alpha_1.[\omega_1+\omega_2.u-(1-h)] \qquad (33)$$

Next, we have the u curve (or IS curve) of the economy created in equation (34). In it we have the term which is the *well-known Keynesian multiplier*, given by $1/(\theta+\gamma_2+a_3.h)$, where $a_3=[(1-\theta)-\gamma_1]$. As can be noted, the multiplier rises as wage share increases (and profit-share decreases). The autonomous components in period t are $A_1+a.v_{r_{-1}}$, where $A_1=\gamma_0+g_0$. As the curve also shows, the higher the interest rate, the lower will be the level of capacity utilization.

$$u=\frac{1}{\theta+\gamma_2+a_3.h}(A_1+a.v_{r_{-1}}-\gamma_1.z_1.i_a) \qquad (34)$$

Equations (35) and (36) have been presented previously. The first is the equation that provides the Taylor rule that defines the dynamics of the short-term interest rate while the second defines the interest rate of the public bonds necessary to clear capital markets.

$$i_a=i_{a_{-1}}+\phi_2.(\hat{p}_{-1}-\hat{p}^T) \qquad (35)$$

$$i_b=-\frac{\lambda_0}{\lambda_1}+i_a+\frac{(1-\tau)}{\lambda_1}.i_{a_{-1}}+\frac{g_0+[1+i_{b_{-1}}-(1-\tau).i_{a_{-1}}].b_{-1}-i_{a_{-1}}.l_{-1}+[\lambda_2.(1-\theta)-\theta].u}{\lambda_1.v_{r_{-1}}} \qquad (36)$$

Equations (37) and (38) present the dynamics of profit-share and investment. The profit-share has already been exposed in the complete model, while the investment equation has been simplified here to make the channels clear. It has an autonomous parameter representing the "animal spirits", a parameter of sensitivity to changes in capacity utilization and profit-share and another parameter of sensitivity to the interest rate.

$$h=\frac{m_0+m_1.z_1.i_{a_{-1}}-m_2.u_{-1}}{1+m_0+m_1.z_1.i_{a_{-1}}-m_2.u_{-1}} \qquad (37)$$

$$in=\gamma_0+\gamma_1.h.u-\gamma_1.z_1.i_a \qquad (38)$$

Equations (39), (40) and (41) present the dynamics of the public debt normalized by the stock of capital, loans normalized by the stock of capital, and the wealth of rentiers normalized by the stock of capital.

$$b=\frac{[1+i_{b_{-1}}-(1-\tau).i_{a_{-1}}].b_{-1}+\gamma_0-\theta.u-i_{a_{-1}}.[l_{-1}-(1-\tau)]}{1+in} \qquad (39)$$

$$l=\frac{[1+(1+\phi_1).i_{a_{-1}}].l_{-1}+in-(1-\theta).(1-d).h.u}{1+in} \qquad (40)$$

$$v_r=\frac{[1-a+(1-\tau).i_{a_{-1}}].v_{r_{-1}}+(1-\theta)\{[i_{b_{-1}}-(1-\tau).i_{a_{-1}}].b_{-1}+[(1-d)(1+\phi_1)-1].i_{a_{-1}}.l_{-1}+d.h.u\}}{1+in} \qquad (41)$$

4.1. Short-run link among the variables

As mentioned earlier, from the reduced system, we have an easier work to establish the short-term connections between the current and lagged variables of the system. We have 55 partial derivatives of 116 possible combinations between variables. We will comment on some of them in the sequence and these are presented in table 3 below.

First, let's talk about inflation. This variable increases with the increase in the use of current capacity utilization, falls with the increase of the short-term interest rate, rises with the increase of inertial inflation (lagged) and may have a positive or negative relation with the inherited capacity utilization and the rate of lagged short-term interest, depending on the values of the parameters used.

Table 3 – Short-run link among the variables of SFC Model

	Short-run link among variables															
	Actual Variables									*Lagged Variables*						
	$\hat{p}$	u	i_a	i_b	h	in	b	l	v_r	$\hat{p}_{-1}$	u_{-1}	i_{a-1}	i_{b-1}	b_{-1}	l_{-1}	v_{r-1}
$\hat{p}$	-	>0	<0	-	>0	-	-	-	-	>0	?	?	-	-	-	-
u	-	-	<0	-	<0	-	-	-	-	<0	-	<0	-	-	-	>0
i_a	-	-	-	-	-	-	-	-	-	>0	-	>0	-	-	-	-
i_b	-	>0	>0	-	-	-	-	-	-	>0	-	>0	>0	>0	<0	<0
h	-	-	-	-	-	-	-	-	-	-	<0	>0	-	-	-	-
in	-	>0	<0	-	>0	-	-	-	-	<0	?	?	-	-	-	>0
b	-	?	?	-	-	<0	-	<0	-	-	-	?	>0	>0	<0	-
l	-	?	-	-	?	?	-	-	-	?	-	?	-	-	>0	-
v_r	-	?	?	-	?	<0	-	-	-	?	?	?	>0	?	>0	>0

Following, we have the u curve that undergoes negative variations when: the short-term interest rate rises, the profit-share rises, the inflationary inertia rises and the inherited interest rate rises. It undergoes positive variations when the normalized inherited wealth rises.

With respect to the short-term interest rate, this rises when: inertial inflation increases or when the lagged short-term interest rate increases. The interest rate on government bonds rises when: it increases the capacity utilization, increases the short-term interest rate, increases inertial inflation, increases the lagged short-term interest rate, increases the interest rate of inherited bonds, increases the inherited stock of bonds normalized by the capital stock. The rate undergoes negative variations when: it increases the stock of inherited loans normalized by the stock of capital and when inherited wealth increases normalized by the stock of capital.

Following this, we analyze the profit share that increases with positive changes in the lagged WACC and falls with the increase in the lagged capacity utilization. The investment rate increases due to increased capacity utilization, increased profit share and increased inherited wealth. It is negatively related to the interest rate and to inflationary inertia.

The last three variables are the normalized stocks of bonds, loans, and rentier wealth. The first one has positive variations when there is: increase of the interest rate of inherited bonds, increase of the stock of normalized bonds inherited. There are negative variations when: there is an increase in the investment rate, there is an increase in the normalized stock of current and lagged loans. The relationship can be positive or negative depending on the parameters for the following variables: capacity utilization, current and inherited short-term interest rates.

The second stock, the normalized loans, shows increases when we have an increase in lagged normalized loans. The partial derivative signs can be positive or negative for: capacity utilization, profit-share, investment rate, inherited inflation, and inherited interest rate.

Finally, the third stock, presented in (41) by the equation that gives the normalized wealth dynamics of the rentiers, indicates the following relations: positive increases when the interest rate increases inherited from government bills, bank loans and rentier wealth both lagged.

4.2. Long-run stability and growth regimes

4.2.1. The Steady State

In this section we will define the fixed points that must be found in the steady state of the model. It will not be possible to isolate the variables only in function of the parameters. However, even if this is not possible, it is important to separate the points to investigate possible indeterminations or overdeterminations of the system. Thus, we have the following steady state values:

(a) Inflation:

As the monetary authority will raise short term interest rate up to the level that is required for inflation does not deviate from the target[17], in the steady state we will have:

$$\hat{p}^* = p^T \qquad (42)$$

(b) Capacity Utilization:

Since capacity utilization is the adjustment variable of distributive conflict, in the steady state that level had to be compatible with the value that can bring inflation to the target. Therefore, we have from (33) that:

$$u^* = \frac{1}{\omega_2}(\hat{p}^T + \omega^* - \omega_1) \qquad (43)$$

(c) Interest Rate on Advances:

As equation (33) determines the level of u^*, the equation (34) allows us to determine the level of the short-term interest rate in the steady state. In this way, we have:

$$i_a^* = \frac{1}{A_2}.\left[(A_1 + a.v_r^*) - \frac{1}{\psi_1.\omega_2}.(\hat{p}^T + \omega^* - \omega_1)\right] \qquad (44)$$

Where $A_1 = \gamma_0 + g_0$; $\psi_1 = 1/\{1 - (1-\theta) + \gamma_2 + [(1-\theta) - \gamma_1].h^*\}$; $A_2 = \gamma_1.z_1$.

(d) Interest Rate on Government Bonds:

Using the same previous criteria, from equation (36), we have the following equation (45). As can be noted, the interest rate value depends on the parameter values to be positive and higher than the short-term interest rate. For this reason, during our simulations, we need to restrict the parameter values so that the model result makes economic sense.

$$i_b^* = -\frac{\lambda_0.v_r^*}{\lambda_1.v_r^* - b^*} + \frac{[\lambda_1 + (1-\tau)].i_a^*.v_r^*}{\lambda_1.v_r^* - b^*} + \frac{b^* + g_0 - i_a^*.[l^* + (1-\tau).b^*] + [\lambda_2.(1-\theta) - \theta].u^*}{\lambda_1.v_r^* - b^*} \qquad (45)$$

(e) Profit-share:

Regarding the profit-share, the direct result of the steady state is expressed by the following equation (46). The result dispenses other comments. Mathematically it is clear that we must have $m_0 + m_1.z_1.i_a^* > m_2.u^*$ to model makes economic sense.

$$h^* = \frac{m_0 + m_1.z_1.i_a^* - m_2.u^*}{1 + m_0 + m_1.z_1.i_a^* - m_2.u^*} \qquad (46)$$

(f) Investment Rate:

Again, regarding the investment rate, the direct result of the steady state is:

$$in^* = \gamma_0 + \gamma_1.h.u^* - \gamma_1.z_1.i_a^* \qquad (47)$$

(g) Bonds-Capital Ratio:

The level of indebtedness in the steady state depends positively on the autonomous expenditure of the economic activity and negatively on the profit received by the CB. For the value to be positive, we must have $\gamma_0 > \theta.u^* + i_a^*.(l^* - v_r^*)$ and $in^* > (i_b^* + i_a^*)/(1 - i_a^*)$.

$$b^* = \frac{\gamma_0 - \theta.u^* - i_a^*.(l^* - v_r^*)}{(1 - i_a^*).in^* - i_b^* - i_a^*} \qquad (48)$$

(h) Loans-Capital Ratio

$$l^* = \frac{\gamma_0 - \gamma_1.z_1.i_a^* + [\gamma_1 - (1-\theta).(1-d)].h^*.u^*}{\gamma_0 + \gamma_1.h^*.u^* - (1 + \phi_1 + \gamma_1.z_1).i_a^*} \qquad (49)$$

[17] This condition will be fulfilled if $\phi_2 > 1$.

(i) Rentier´s Wealth-Capital Ratio.

$$v_r^* = \frac{(1-\theta)\{[i_b^*-(1-\tau).i_a^*].b^*-[1-(1-d)(1+\phi_1)].i_a^*.l^*+d.h^*.u^*\}}{\gamma_0+a+\gamma_1.h.u^*-(1-\tau+\gamma_1.z_1).i_a^*} \qquad (50)$$

4.2.2. Growth Regimes (Wage or Profit Led?)[18]

In this work we used an algorithm developed by Costa Santos (2017) to find the parameters for the model that generate steady state. Briefly, the algorithm is developed in the following steps:

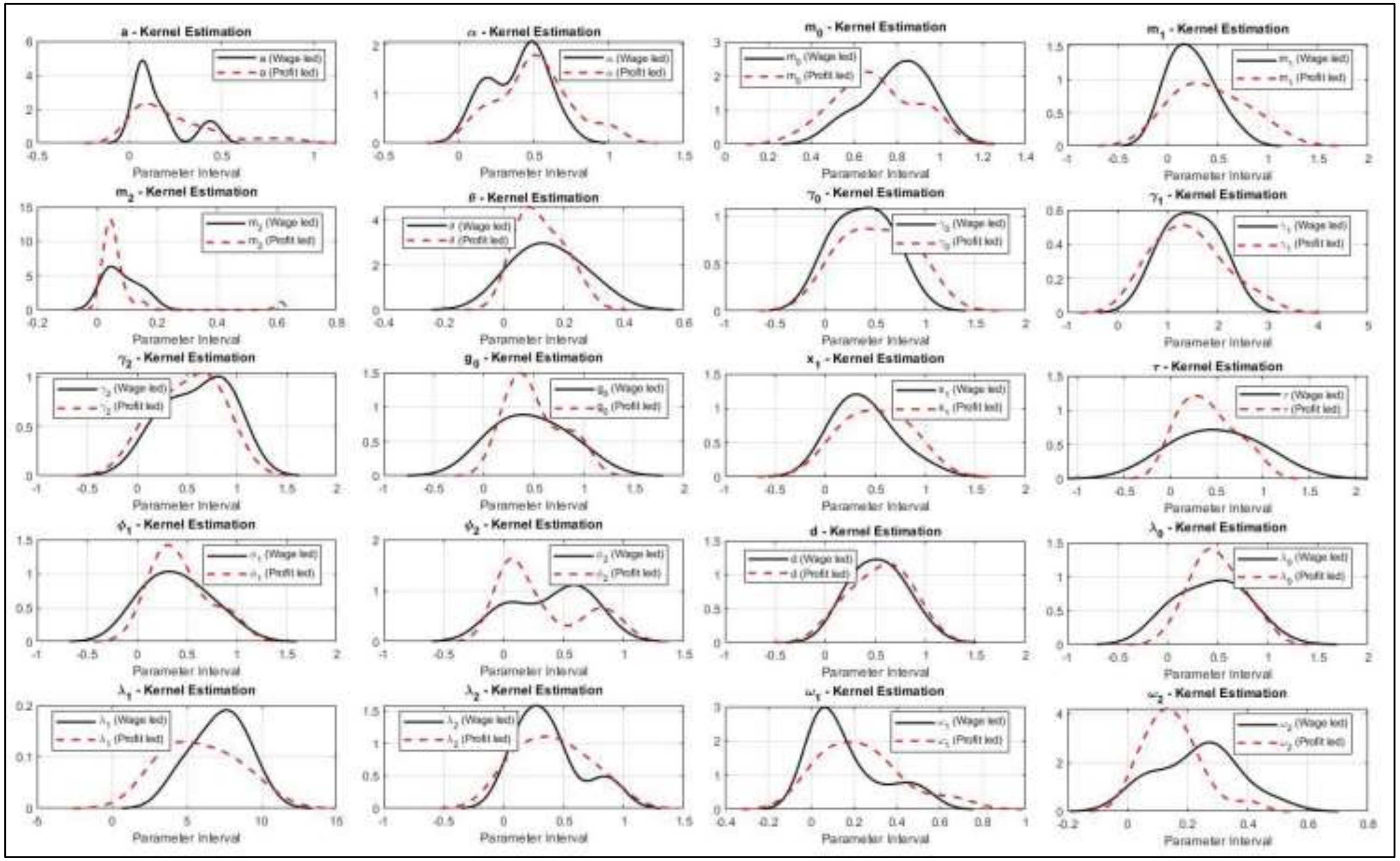
1. Generation of random parameters through a plausible economic interval.
2. Model resolution via Gauss-Seidel using these random parameters as input.
3. Storage of reduced model variables when $t = 1000$.
4. Separate $\Delta\hat{p}, \Delta u, \Delta h, \Delta in, \Delta i_a, \Delta i_b, \Delta b, \Delta l, \Delta v_r < 10^{-6}$ (tolerance).
5. From the filtered data, it is calculated for $t = 1000$ the values of $\Delta u/\Delta h$ and $\Delta in/\Delta h$.
6. If $\Delta u/\Delta h > 0$ and $\Delta in/\Delta h > 0$, Profit-led demand and accumulation regimes. Wage-led, otherwise.

Having explained the steps of the above algorithm, we present figure 1, in the sequence, with the results obtained for 10^9 simulations, which finally could be separated the wage led and profit led regimes and estimated in a non-parametric way the density probability via Kernel.

The use of this type of methodology allows us to separate parameters to later carry out simulations with this calibration and to investigate the general properties of the model for each of the two possibilities of growth regime.

[18] Regarding different demand and accumulation regimes see Rowthorn (1981) and Marglin and Bhaduri (1990).

Figure 1 – Kernel Density for Parameters and Growth Regimes



5. **Calibration, Simulation and Results**[19]

5.1. Baseline Scenario and Steady State

The complete model was simulated based on the parameters and exogenous variables described in table 4 below. The first result to be reported is the baseline scenario which describes the convergence of the model to steady state.

Table 4 – Parameters Used in Baseline Simulation

Parameter	Value	Parameter	Value
a	0,04	m_0	0,5
α	1	m_1	0,2
α_1	0,15	m_2	0,2
d	0,25	ω_1	0,4
g_0	0,07	ω_2	1
γ_0	0	ϕ_1	0,5
γ_1	0,5	ϕ_2	0,25
γ_2	-0,05	τ	0,1
λ_0	0,3	θ	0,2
λ_1	100	x_1	0,6
λ_2	0,5	$\hat{p}^T$	0,04

Figure 2 below shows in the first quadrant the left the paths of the components shares of GDP from the perspective of demand. As it is a closed economy, we have $C/Y + G/Y + I/Y = 1$. In this way, we have that C/Y converges to values close to 60% while the other variables converge to 20% each.

In the second upper quadrant to the right, we have the path of public and private debt in this economy, these both variables over the GDP. In the baseline scenario, we then have the convergence of public debt to values around 20% of GDP and private debt to approximately 40% of GDP.

In the third quadrant, which is in the second row of the first column, we have the profit share and the wage share of this economy converging to the steady state. The wage share converges to a value around 70% while the profit share to close to 30%, obviously both having to add up to 100%.

In the fourth quadrant, which is in the second row and second column of figure 2, we have the dynamics of inflation in this economy. We have that for the values used in the simulation, the monetary policy is efficient in being able to take the path of the inflation towards the established goal. Thus, in the steady state, $\hat{p} = p^T$.

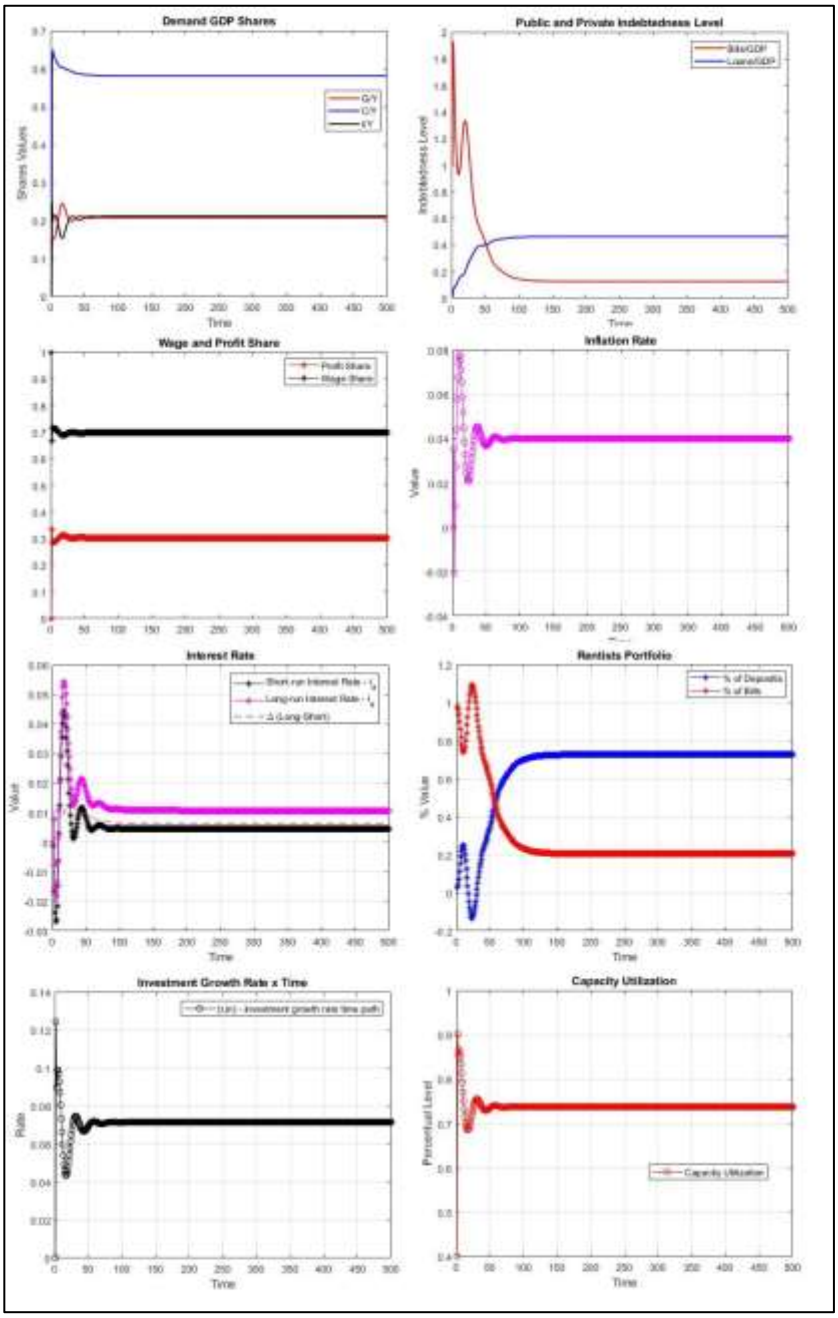
In the fifth quadrant of the same figure, third row and first column, we have the dynamics of short-term and long-term interest rates. In this baseline scenario we can see that the short is lower than the long, which at first can be affected depending on the shocks that reach that economy.

In the sixth quadrant, we have the portfolio behavior of the rentiers. There we find that in the steady state the wealth is subdivided between 20% in bonds and 80% in deposits. The last two quadrants present the dynamics of the investment rate, which converges to values between 6 and

[19] Regarding calibration and simulation of SFC models see O´Shea and Kinsella (2016) and Kinsella and O´Shea (2017).

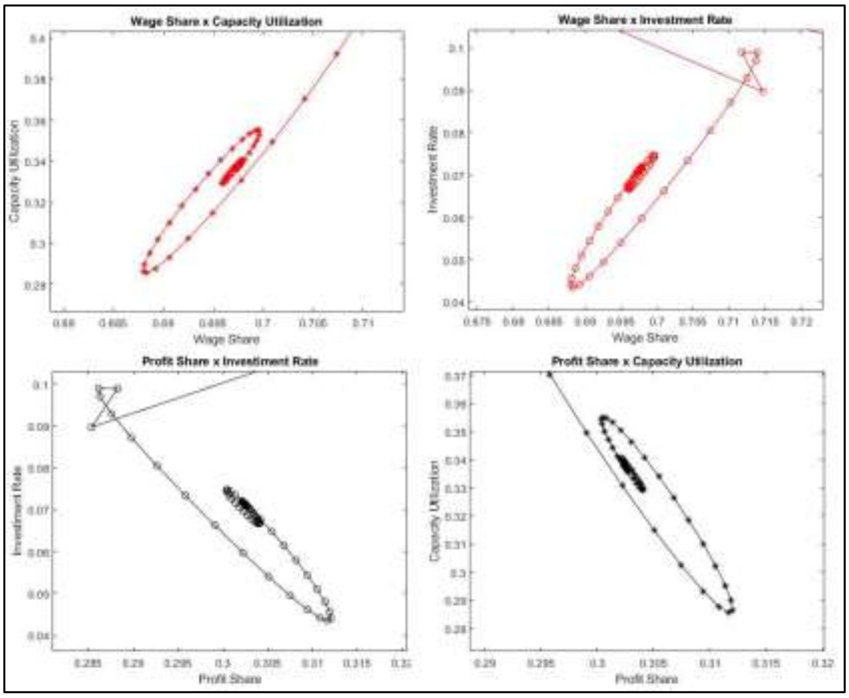
8% and, in the sequence, we have the use of the productive capacity that converges to values between 70% and 80%, so that the observed trajectories of this simulated economy are similar to the capitalist experience observed so far.

Figure 2 – Baseline Model Dynamics



Still on the model in base scenario, we present figure 2 that brings the results of the growth regime of the model. There are four quadrants with the following paths: Wage Share × Capacity Utilization; Wage Share × Investment Rate; Profit Share × Capacity Utilization; Profit Share × Investment Rate. The convergence to the steady state between the variables makes it clear that the growth regime is wage-led, since there is a positive relation between the investment rate and the capacity utilization with the wage share.

Figure 3 – Growth Regime in Baseline Simulation



5.2. Shocks – Increase of Desired ratio of Government Consumption to Capital Stock

After analyzing the time path of the model for the base scenario, we will present the results after an exogenous shock was applied to a parameter of the model. More precisely, we applied a shock of 14% increase in the desired ratio of government consumption to capital stock, g_0, representing an increase in the level of government expenditure at a point in time.

The results of the shock are presented in figure 4 and 5. In figure 4, we have an important result of the model. The increase in the level of government expenditures produces a crowding-out effect over private investment, in a sense that the increase in the ratio of government consumption over GDP resulted in a one to one reduction in the ratio of investment to GDP. Since the ratio of investment to GDP is one of the main determinants of the growth rate of capital stock, then an increase in the level of government expenditures will produce a reduction of the pace of capital accumulation in the long term. We will explain the mechanism behind these effects in sequence.

The crowding-out mechanism of the model basically occurs through the following channels: by raising an exogenous component of demand; there will occur immediately an increase in the level of capacity utilization. This effect increases the level of conflict over income distribution since target wage share increases, which in turn accelerates inflation. In the next turn, the monetary authority perceiving the deviation of inflation to the target; starts to raise the short-term interest rate to decrease aggregate demand and capacity utilization. In doing so, there will be an increase in the equilibrium level of short-term interest rate that will also raise the long-term interest rate and the cost of capital; affecting investment decisions in a negative way.

This crowding-out effect is unusual in SFC models, due to the demand-led nature of output and employment decisions in those type of models. However, as we introduce real world institutional arrangements of monetary and fiscal policy in the model, then new and surprising results can appear.

Any increasing in public spending needs to be financed by an increase in taxation or issuance of new bonds, when money financing of government deficits is forbidden by law. As expected, the initial effect over capacity utilization of an increase in government expenditure is expansionary, according to the fourth quadrant of figure 5. This increase in capacity utilization is not enough, however, to increase tax receipts to such a level capable to balance the public budget; in order words; there are no such a thing as a perpetuum mobile device that allowed increase in government expenditures to be self-financed. Thus, the initial shock unbalances the government's primary budget, according to quadrant 3 of Figure 4. Throughout the transitional dynamics, the budget converges to approximately -1% of deficit and to a stable debt-to-GDP ratio.

Regarding the effects of increasing government expenditures over income distribution, we can see that the effect on profit-share is initially to decrease and then to converge to a higher level. As the level of capacity utilization falls slightly, the net effect on the actual return on assets is virtually neutral. The same cannot be said about the cost of capital. As the CB raises the interest rate to overthrow economic activity and reduce inflation to the target level, there will be an increase in the WACC and a net fall in the spread of profit rate over WACC, according to the sixth quadrant of figure 4, which also contributes to the reduction of the pace of capital accumulation.

Finally, we also have a new set of values for the balanced growth path. As we can see easily in figure 5, steady-state growth rates of investment, consumption and government expenditures are lower after the shock over fiscal policy.

Figure 4 – Increase of Desired Ratio of Government Consumption to Capital Stock, g_0 – Part 1.

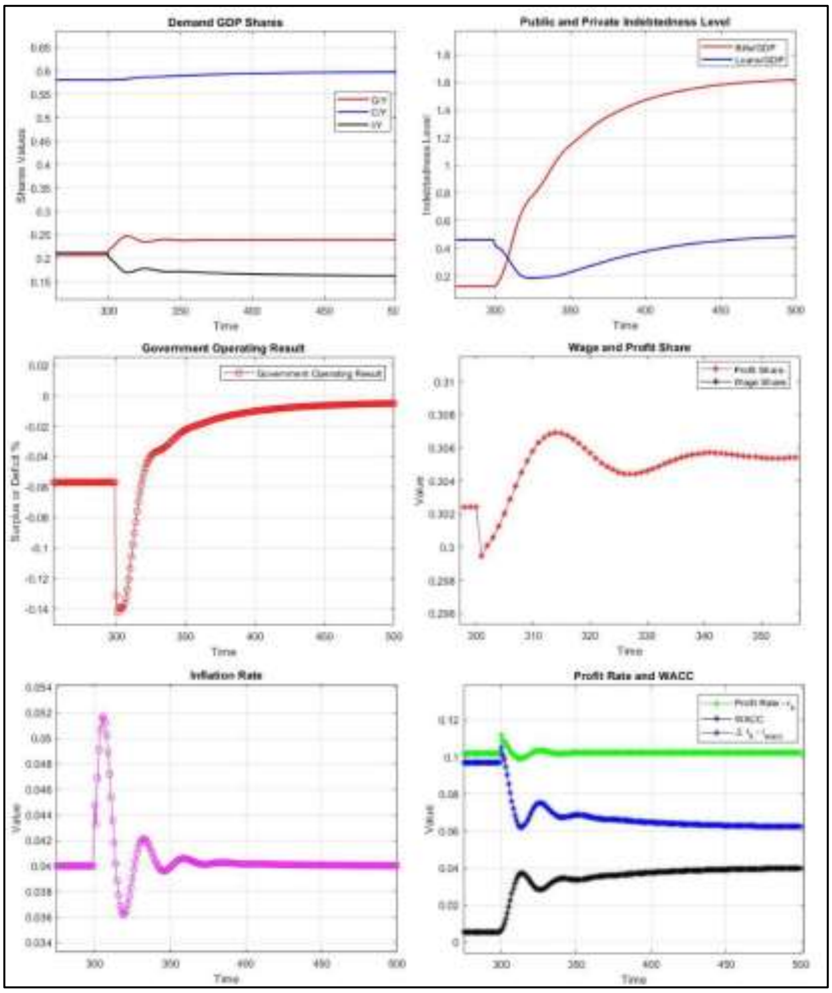
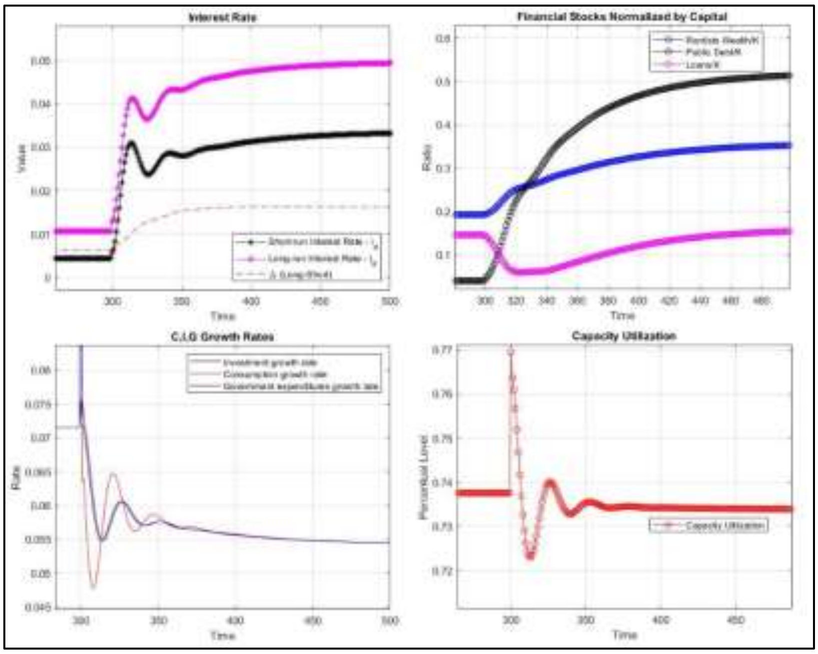


Figure 5 – Increase of Desired Ratio of Government Consumption to Capital Stock, g_0 – Part 2.



6. Final Remarks.

Throughout this article we developed a SFC growth model that aims to understand the dynamics of public financing and its interrelations with the other macroeconomic variables in a closed economy with government activities, in which moneatary policy is conducted under an Inflation Targeting Regime, there is no money financing of government debt and government issues an interest rate-indexed bond in order to finance its fiscal deficit. As general features of the model, we have (i) a Taylor rule to define the short-term interest rate; (ii) a long-rate determined by the balance between the composition of financial wealth between government bonds, bills and money, in one hand, and the portfolio decisions of households, on the other hand; and (iii) the dynamics of inflation being given by a inertial component and distributive conflict.

The complete model is characterized as a system of thirty-two differential equations, twenty-one parameters, two exogenous variables, and four initial stocks.

The results of the parameter mapping algorithm show that through the specification of the investment function of the model it is possible to obtain both led and profit led schemes according to Blecker (2002). When broadly mapped[20], the most likely regime is wage led, with about 70% of the stable cases found.

Thus, in the presentation of the model, some simulations were carried out for a specific set of parameters that generated a wage led regime. The results of the simulation show that in an SFC growth model with inflation targeting and zero money financing of fiscal deficit, a permanent increase in the level of government expenditures produces a crowding-out effect over investment expenditures and a redistribution of income from households to firms and rentiers. This is a novel and surprising result for the SFC model literature. Future research will investigate if these results could be also obtained in models with alternative Institutional Arrangements for fiscal and monetary policy.

[20] 10^9 numerical simulations.

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