Financialized Growth Regime: Lessons from Stock-Flow Consistent Models

Luis Reyes*    Jacques Mazier†

January 30, 2017

Published in Revue de la Régulation in 2014.

Abstract. The financialized growth regime which settled in most developed economies in the nineties is characterized by the quest of a higher profitability for shareholders, an increased financial accumulation at the expense of productive accumulation and the use of leverage effects. Stock-Flow Coherent models à la Godley and Lavoie are well suited to account for this growth regime. We retain two types of closures for non financial companies, either an indebtedness norm or an own funds norm. The paper studies the dynamics of these two models with the aid of simulations and supply or demand shocks, or stemming from the financial sector. Their fitness to take into account financial cycles and over indebtedness typical of financialized growth may be thus analyzed. The model with the indebtedness norm generates short-term financial cycles which appear as the regulation mode of this growth regime with an asset price serving as an adjustment variable. The model with the own funds norm generates a financial bubble with growing indebtedness without a self-stabilizing mechanism.

Résumé. Le régime de croissance financiarisée qui s’est installé dans la plupart des économies développées à partir des années 1990 se caractérise par la recherche d’une rentabilité élevée pour les actionnaires, une accumulation financière accrue au détriment de l’accumulation productive et le recours à l’effet levier. Les modèles Stock-Flux Cohérents (SFC) à la Godley et Lavoie sont bien adaptés pour rendre compte de ce régime de croissance. Deux types de fermeture de ces modèles sont distingués en retenant au niveau des entreprises non financières, soit une norme d’endettement, soit une norme de fonds propres. Ce papier étudie la dynamique de ces deux types de modèles à l’aide de simulations et de chocs d’offre ou de demande ou au niveau de la sphère financière. Leur aptitude à rendre compte des cycles financiers et de surendettement caractéristiques de la croissance financiarisée peut ainsi être analysée. Le modèle avec norme d’endettement génère des cycles financiers de courte

*Centre d’Économie Paris Nord, Paris 13: luisantonio.reyesortiz@univ-paris13.fr
†Centre d’Économie Paris Nord, Paris 13: mazier@univ-paris13.fr
1 Introduction

Since the 1980s liberal reforms (particularly on the labor and financial markets) have set up a financialized growth regime in most developed countries ([4], [5]). This financialized growth regime is characterized by the quest of a high return on own funds, large leverage effects and an increasing financial accumulation, even at the expense of long term growth. These transformations have generated more macroeconomic instability and, in many cases, weak growth despite the restoration of profits to a high level. In this paper we try to describe the mechanisms which produce the macroeconomic instability of these growth regimes. This instability seems to be caused by wealth and leverage effects. This is the main reason why we focus on the financing mode and the financial structure of non financial companies (NFCs henceforth).

The Stock Flow Consistent (SFC) models, inspired by the methodology of Godley and Lavoie ([3]), are well suited to represent a financialized growth regime because the wealth and leverage effects are integrated in coherent social accounting matrices where the price of equities is endogenized. In this framework we know where all incomes (flows) come from and where they go to, in consumption or savings (stock). In order to characterize financialization, two alternative closures of the SFC model are considered with alternative ways in which NFCs finance investment: the first with an indebtedness norm, where equities appear as a residual; the second with an own-funds norm where, on the contrary, loans are determined as a residual. The results of simulations in these two configurations describe financial cycles due to leverage and revaluation effects, but with contrasted mechanisms. Our main objective is to compare the nature of these two regimes by carrying out demand or supply shocks as well as shocks on the financial side. The paper is organized as follows. We present the framework of the SFC model in the first section and the simulations of the two regimes in a second section. A last section concludes.
2 A Simplified Stock-Flow Consistent Framework

2.1 Literature Review

To our knowledge, one of the first serious attempts to empirically deal with financial phenomena on a macroeconomic perspective, combining stocks and flows rather than dealing with one at the time, was that of Brainard and Tobin ([6]), then extended by Tobin ([13]) and others from the Yale school. This approach did not make its way into mainstream economics because it lacked micro foundations which explained the mechanism by which agents allocated their financial resources. When asked about the abandonment of SFC models, Tobin’s reply was "Well, people would rather do the other thing [computable, numerical or applied general equilibrium models] because it’s easier" ([9], p. 19).

Some years later, a group of researchers from the Post Keynesian school took over SFC models and, thanks to the ease of access to large-scale reliable computational techniques rapidly evolving, gave them further solidity and more realism. Instead of a general equilibrium taste, these authors gave it a Keynesian/Minskyan flavor that aimed at explaining endogenously created disequilibrium without optimizing behavior from economic agents which, under this approach, is rather redundant and difficult to deal with in a realistic way. Lavoie and Godley ([11]) and Godley and Lavoie ([3]) account for the most influential works on this type of analyses.

SFC models consist of systems of simultaneous equations which combine stocks (of debt, capital or deposits) with flows (of production, income or liquid assets) using experimental (simulated) data under a realistic accounting framework. Considering the fact that all form of wealth\(^1\) in an economy comes from somewhere and goes somewhere, these models have an advantage above other techniques: they are capable of describing the mechanism underlying a shock, either coming from the financial or the real side of the economy, and its effect on macroeconomic aggregates. They are especially well suited to study a finance-led growth regime.

In Minsky’s ([1]) model, the surge in investment in bull phase of the business cycle is allowed by an increase in external financing (debt only in the present model) which explains the endogenous fragility of firms, i.e. the increase in default risk. In the ascending phase of a cycle, the reduction of investors’ liquidity preference on financial markets, that is to say the decrease of the risk perceived by the investors, allows the increase of the debt share in firms’ balance sheets. Firms thus take advantage of this situation to increase their financial

---

\(^1\)This includes capital gains and valuation effects.
leverage. But this process ends because of an endogenous reversal of the liquidity preference which corresponds to a reversal of collective opinion in financial markets. As a consequence, credit risk is revised upward, which generates the fall in investment. When investors in financial markets begin to have doubts about the value of collateral (the sum of retained earnings here) liquidity preference starts rising and this generates a fall of the prices on financial markets. These doubts generate a revaluation of credit risk. Investors run towards liquidity, which thus leads firms to run strong insolvency risks since the refinancing of debt becomes extremely difficult.

The Stock Flow Consistent (SFC) approach is well suited to analyze these questions. Thanks to a complete description of the balance sheets of each agent and of the associated flows of funds, the main components of Post-Keynesian macroeconomic models can be incorporated in a consistent way: relations between capital accumulation and income distribution, wealth effects (especially for rentiers), valuation effects (due to capital gains or losses), and a debt-led growth regime with a Minskyan perspective.

Lavoie and Godley ([11]), Godley and Lavoie ([3]), Taylor ([2], [12]), Dos Santos and Zezza ([10]) have proposed SFC models including most of these factors. Although close, these models differ in some points. Godley and Lavoie ([3]) use computer simulations to study the nature of growth regimes while Taylor ([2], [12]) and Dos Santos and Zezza ([10]) study analytically the dynamics of their models. Beyond this methodological divergence, the models differ in the way they deal with debt and equity issuing. These are actually two alternative closures of the model; to represent how firms finance capital accumulation, which we consider in our simulations.

Godley and Lavoie, Dos Santos and Zezza, as well as Taylor in some of his models, retain an equation describing equities issued. Consequently, credit demand by firms is simply determined as a residual of the firms’ financing account. In Taylor ([12]) asset prices display positive feedback but must eventually be reversed by other forces. The growth rate of asset prices depends positively on the return to equity and the valuation ratio\(^2\), and negatively on the dividends-capital stock ratio. The growth rate of the amount of equities depends positively on the accumulation rate and the share of newly issued equities on the capital stock, and negatively on the valuation ratio. Growth of the capital stock can stabilize the valuation ratio which negatively affects equities, but positively their price. Alternatively, Taylor ([2]), in two other

\(^2\)Value of equities divided by the capital stock.
versions of his models, retains an explicit firms’ credit demand equation with no issued equities or with equities determined as a residual of the firms’ budget constraint. These questions are not discussed in detail in the SFC literature and may not be central for the models’ properties. However, this trade-off between debt, equity and retained profits is important in the growth regime which prevailed since the 1990s. Under this perspective, a simplified SFC framework will be outlined with two versions of the model corresponding to the main closures previously discussed, one with an indebtedness norm (or loan demand), the other with an own funds norm (or equities issued).

### 2.2 The Model

We assume there are five sectors in the economy: households, non financial firms, the government, private banks and a Central Bank. The price level is assumed to be constant across all periods. The price of equities plays a market-clearing role. Table 1 shows the matrix of stocks. The first column describes the stocks of wealth held by households ($V_h$), which is made up of cash ($H_h$), bank deposits ($BD$), bonds ($pbB$, where $pb$ is their price) and equities ($peE_h$, with $pe$ the price of equities). In the same vein, firms contract debts ($L$), hold equities ($peE_e$) and issue equities ($peE$) in order to finance capital ($K$), and they hold an outstanding amount of wealth ($V_e$). The government issues the bonds households retain and Treasury bills held by banks ($BT$). Total government debt ($V_g$) is the sum of the last two terms with a minus sign. Private banks hold a total amount of wealth ($V_b$) which comes from holding reserves ($H_b$), receiving deposits from households, making loans to firms, lending to the government and getting refinanced by the Central Bank, which in turn issues money ($H$) and holds no wealth.

The first equation of the model is the national income identity and, as we assume a closed

\[
\begin{array}{cccccc}
\text{Households} & \text{Firms} & \text{Government} & \text{Banks} & \text{Central Bank} \\

H_h & Hb & -H \\
BD & -BD & \\
-L & L & \\
-pbB & -pbB & \\
peE_h & peE_e & -peE & \\
-BT & BT & \\
-V_h & -V_e & -V_g & -V_b & RF & RF
\end{array}
\]

**Table 1: Matrix of Stocks**
economy, the equation says that national income is equal to the sum of consumption, investment and government spending:\(^3\):

\[ Y = C + I + G \]  

(1)

*Households’ behavior.* Equations (2)-(11) describe households’ decisions. Disposable income (\(YDh\)) is the sum of wages (\(W\)), interests on bank deposits and on bonds one period before, and dividends (\(DIVh\)) net of taxes (\(T\)). The Haig-Simmons definition of income is the sum of disposable income and capital gains of households (\(CGh\)). Taxes are a proportion (\(\theta\)) of gross disposable income. The standard Keynesian consumption function depends on the Haig-Simmons definition of income, where \(a_0\) is autonomous consumption and \(a_1\) is the marginal propensity to consume, and on a (lagged) ‘wealth effect’ described by \(a_2\).

\[ YDh = W + idBD_{-1} + B_{-1} + DIVh - T \]  

(2)

\[ YHSh = YDh + CGh \]  

(3)

\[ T = \theta(W + idBD_{-1} + B_{-1} + DIVh) \]  

(4)

\[ C = a_0 + a_1YHSh + a_2Vh_{-1} \]  

(5)

Following Godley and Lavoie’s ([3]) approach, bonds as a proportion of households’ wealth is a linear function of the interest rate on bills (\(rb\)), the interest rate on deposits (\(id\)) and the rate of return on issued equities (\(re\)), with the last two affecting it negatively. The proportion of the value of equities held by households (\(peEh\)) out of their total wealth is negatively influenced by the interest rates and has positive own feedback through its rate of return. The cash held by households are a proportion (\(\lambda_0\)) of consumption. The change (\(\Delta\)) in bank deposits is calculated as a residual of other forms of incoming wealth. Capital gains of households are defined by the change in the prices of the bonds and equities they hold multiplied by their corresponding amounts lagged one period. Total households’ wealth was defined above.

\(^3\)Government spending is assumed to grow at a constant rate.
\[
\frac{pbB}{Vh} = v_0 + v_1rb - b_2id - v_3re \\
\frac{peEh}{Vh} = w_0 - w_1rb - w_2id + w_3re
\] (6) (7)

\[Hh = \lambda_0 C\] (8)

\[\Delta BD = YDh - C - pb\Delta B - pe\Delta Eh - \Delta Hh\] (9)

\[CGh = \Delta pbB_{-1} + \Delta peEh_{-1}\] (10)

\[Vh = BD + pbB + peEh + Hh\] (11)

*Firms’ behavior.* Firms’ decisions are described in equations (12)-(28). Following a Kaleckian framework, the investment function (equations 12-14) is assumed to depend positively on the lagged profit rate \((UP/K_{-1})\) and the growth rate of the economy \((\Delta Y/Y_{-1})\) with \(k_2\) being the accelerator effect. It depends negatively on the debt ratio \((L_{-1}/K_{-1})\), according to an increasing risk effect, and on the interest rate on loans. Last, the financial rate of return on equities held \((ree)\) has also a negative impact, reflecting an arbitrage between real and financial accumulation. \(\delta\) is the depreciation rate of capital.

\[g = k_0 + k_1 \frac{UP_{-1}}{K_{-2}} + k_2 \frac{\Delta Y}{Y_{-1}} - k_3 \frac{L_{-1}}{K_{-1}} - k_4 rl - k_5 ree\] (12)

\[I = gK_{-1}\] (13)

\[\Delta K = I - \delta K_{-1}\] (14)

Financial accumulation is described through the share of the value of equities held by firms out of their total capital (equation 15). It is a linear function of the rate of return on equities held \((ree)\) and the profit rate. An alternative specification will focus directly on the rate of financial
accumulation \((pe\Delta E_e/(peE_e)_{-1}, \text{equation 16})\) explained by the same variables (financial rate of return and profit rate), but also by the debt ratio, with a positive influence as a leverage effect favors financial accumulation, in contrast with the negative impact of the increasing risk on real investment.

\[
\frac{peE_e}{K + peE_e} = f_0 + f_1ree + f_2 \frac{UP}{K_{-1}}
\]

\[
\frac{pe\Delta E_e}{pe_{-1}E_{e-1}} = f_0 + f_1ree + f_2 \frac{UP}{K_{-1}} + f_3 \frac{L_{-1}}{K_{-1}}
\]

Two alternative closures. Equations (17) and (18) are, respectively, the debt ratio and the own funds norm equations, which are used alternatively in each model. Thus, Model 1 uses (17), and the amount of equities issued \((E)\) is deducted from (19), solving for \(\Delta E\). Similarly, Model 2 uses (18), and debt is deducted from (19), solving for \(\Delta L\). We proceed in this fashion to analyze Minsky-type cycles when firms finance investment by external funds (debt) and by internal funds (undistributed profit or issuing equities). The left-hand side of (19) is the spending decision of firms (between investing and holding equities), whereas the right-hand side represents their income (from profits, from issuing equities and from contracting loans).

\[
\frac{L}{K} = g_0 + g_1 \frac{UP}{K_{-1}} + g_2 \text{ree} - g_3 \text{rl}
\]

\[
\frac{peE}{K + peE_e} = z_0 + z_1 \text{rl} + z_2 \frac{L_{-1}}{K_{-1}} - z_3 \text{ree}
\]

\[
I + pe\Delta E_e = UP + pe\Delta E + \Delta L
\]

The debt ratio, interpreted as an indebtedness norm (equation 17), depends positively on the rate of profit (as higher profitability makes it easier to borrow from banks), on the rate of return on equities (as a higher cost of issued equities makes credit more attractive) and last, as usual, on the rate of interest.

Conversely, the own funds ratio, measured as a percentage of the total real and financial assets (equation 18), depends positively on the interest rate (as a higher credit cost makes equities issuing more attractive), on the debt ratio (as an increase of the indebtedness pushes firms to use more internal funds), and negatively on the rate of return of equities (as a higher
cost of issuing equities discourages their creation).

Undistributed profits ($UP$) are deducted from total income minus costs, which in this case account for wages, interests and households’ dividends. Wages are a constant ($r_0$) share of income. The rate of return of equities issued is equal to the share of the capital gains (or losses) augmented of distributed dividends, in percent of the total equities issued, which is equivalent to the growth rate of the price of equities plus the share of distributed dividends ($DIV$) out of total equities issued. Dividends, in turn, are calculated (as in Lavoie and Godley, 2001) as a proportion ($1 - sf$) of profits realized the previous period. Dividends paid to firms ($DIVe$) are here defined as the share of equities held by firms out of total equities issued in the previous period ($Ee_{-1}/E_{-1}$). Dividends paid to households, as well as their equities, are calculated as a residual. Firms’ capital gains ($CGe$) come from changes in the price of equities multiplied by the amount held by them. The outstanding amount of wealth held by firms was defined through the matrix of stocks.

$$UP = Y - W - rlL_{-1} - DIVh$$

$$W = r_0Y$$

$$re = \frac{\Delta pe}{pe_{-1}} + \frac{DIV}{pe_{-1}E_{-1}}$$

$$DIV = (1 - sf)(Y_{-1} - W_{-1} - rl_{-1}L_{-2})$$

$$DIVe = DIV \frac{Ee_{-1}}{E_{-1}}$$

$$DIVh = DIV - DIVe$$

$$Eh = E - Ee$$

$$CGe = \Delta peEe_{-1}$$
\[ Ve = K + peEe - L - peE \]  

\[ (28) \]

**Government.** Equation (29) describes the government’s issuing of Treasury bills (\( \Delta BT \)), which is calculated as a residual of its expenditures on current spending, interests on treasury bills and bonds and its revenues from taxes on personal income, taxes on banks (\( TB \)) and taxes on the Central Bank (\( TCB \)) and from new issued bonds (\( pb \Delta B \)). The price of bonds is assumed to vary inversely with respect to the interest rate paid, which is assumed to be equal to interest rate on bills (short-run). Total wealth held by the government is equal to its debt.

\[ \Delta BT = G + rBT_{-1} + B_{-1} - T - TB - TCB - pb\Delta B \]  

\[ (29) \]

\[ pb = \frac{1}{rb} \]  

\[ (30) \]

\[ Vg = -D = -BT - pbB \]  

\[ (31) \]

**Banking sector.** Private banks make profits (\( BP \)) and pay taxes (\( TB \)) out of their income, which is made up of interests on loans to non financial firms and to the government minus interests paid on deposits and refinancing from the Central Bank. \( \theta_b \) is the tax rate they pay. Their refinancing (\( RF \)) comes from their expenditures, mandatory reserves (\( Hb \)) at the Central Bank, loans and Treasury bills, minus their retained profits and deposits they receive. This refinancing is granted without restriction by the Central Bank. Mandatory reserves are a proportion (\( \lambda \)) of bank deposits. The change in wealth held by them (\( \Delta Vb \)) is their profits.

\[ BP = (1 - \theta_b)(rL_{-1} + rBT_{-1} - idBD_{-1} - ibRF_{-1}) \]  

\[ (32) \]

\[ TB = \theta_b(rL_{-1} + rBT_{-1} - idBD_{-1} - ibRF_{-1}) \]  

\[ (33) \]

\[ \Delta RF = \Delta Hb + \Delta L + \Delta BT - BP - \Delta BD \]  

\[ (34) \]

\[ Hb = \lambda BD \]  

\[ (35) \]
ΔVb = BP \hspace{1cm} (36)

The Central Bank receives interests from private banks out of previous refinancing and transfers them as taxes to the government (TCB). As a consequence, the Central Bank makes no profits and its net wealth remains constant, equal to zero. Total high power money (H) is the sum of cash held by households and reserves made by commercial banks. The interest rate on loans (rl) is assumed higher than the short term interest rate controlled by the Central Bank (ib) and supposed exogenous, where m1b (m2b) is the spread. Inversely, interest rate of deposits (id) is supposed smaller, which is at the origin of banks’ profit. Interest rate on Treasury bills (r) is assumed to be equal to interest rate on loans (rl), which is in turn equal to the yield on long-term bonds (rb).

\begin{align*}
TCB &= ibRF_{-1} \hspace{1cm} (37) \\
H &= Hh + Hb \hspace{1cm} (38) \\
rl &= ib + m_{1b} \hspace{1cm} (39) \\
id &= ib - m_{2b} \hspace{1cm} (40) \\
r &= rl \hspace{1cm} (41) \\
rb &= r \hspace{1cm} (42)
\end{align*}

In order to ensure that in our model all flows come from somewhere and go somewhere, we make sure that in both models \( H = RF \) (the Central Bank’s equilibrium, the unwritten equation). The final condition for the model to be coherent is that the capital stock be equal to the sum of all wealth held by all the economic agents in the model; \( Vh + Ve + Vg + Vb = K \).
### Table 2: Main financial determinants of firms’ behavior

<table>
<thead>
<tr>
<th></th>
<th>Fixed Capital Acc.</th>
<th>Fin. Acc.</th>
<th>Equity Issuing</th>
<th>Debt Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profit Rate</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Real Interest Rate</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Debt Ratio</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Financial Rate of Return</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
</tbody>
</table>

Table 2: Main financial determinants of firms’ behavior. Signs of partial derivative of explained variables regarding each explaining variable according to each equation.

### 2.3 The Working of the Model

Table 2 summarizes in a simplified way the main determinants of fixed and financial accumulation on the one hand, and of equity issuing and indebtedness on the other, as they result from the outlined SFC model. These relations characterize some of the main features of the finance-led growth regime regarding firms. They allow us to describe financial cycles under a Minskyan approach, as it is illustrated in Figure 1.

Starting with a rising financial rate of return, financial accumulation is stimulated while equity issuing is reduced. This leads to an increase in equities’ price as a clearing market result, which accentuates the initial rise of the financial rate of return. On the other hand, higher financial profitability induces firms to borrow more and increase their indebtedness, which, through the leverage effect, sustains financial accumulation. In this environment fixed capital accumulation is slowed down through negative impacts of the rise of both the financial rate of return and the debt ratio reflecting an increasing risk. The contrast between booming financial accumulation and limited recovery of fixed capital accumulation has been a figure of the nineties and 2000s in many industrialized countries. In this ascending phase of the financial cycle, there is no stabilizing mechanism, except the positive effect of rising indebtedness which leads firms to issue more equities, contributing to limit the increase of equities’ price. In that sense the model does not describe how the process can end in an endogenous reversal, which can reflect the instability of this growth regime. Simulations in the next section will help to clarify this question.

Three points can be added. First, a restrictive monetary policy can contribute to stabilize the system. A rise in interest rates slows down financial accumulation while it favors equity issuing, which helps lowering equities’ price and financial profitability. On the other hand, indebtedness is reduced which also limits financial accumulation. But the overall effect on fixed capital accumulation is slowed down through negative impacts of the rise of both the financial rate of return and the debt ratio reflecting an increasing risk.

---

4 The two closures of the model are presented simultaneously in Figure 2 for sake of simplification, although equities issuing or debt is alternatively determined as a residual through an accounting equation.
investment and growth is, most of the time, negative due to the rising cost of credit.

Second, the economic environment and the demand side can be taken into account using our model. A rise in the price of equities induces capital gains and increases households’ wealth, which in turn sustains their consumption and, indirectly, the demand and fixed investment. A higher rate of profit stimulates both fixed investment and financial accumulation and authorizes more recourse to indebtedness, which indirectly favors equities issuing and contributes to stabilize the system.

Third, this model only focuses on relations between firms and finance, which is an important component of a finance-led growth regime. But it gives a simplified representation of households, as it ignores their indebtedness and their capital accumulation in housing, which has played a crucial role at the origin of the current financial crisis. Households’ portfolio behavior would also have to be adapted with two kinds of households, according to the level of their wealth and income. Lastly, banks’ behavior is also highly simplified and does not reflect their active
role, neither in financial accumulation nor in financialization.

However, some new and improved econometric results will be given regarding the relations between firms’ capital accumulation and finance. A first set of preliminary simulations of the SFC model will be proposed in the last section and will give a better understanding of the working of the model.

3 Simulations

A first set of simulations of the SFC model is proposed to give a better understanding of the working of the model. Calibration has been made using French national accounts in flows and stocks for 2009. For firms’ equations (real and financial investment, debt and equity) the corresponding parameters stem from Clévenot, Guy and Mazier ([7], [8]) and some new estimates.

Two models will be examined, Model 1 with an indebtedness norm and Model 2 with an own-funds norm. In order to study the mechanisms of these two models, shocks on the demand and supply sides and on the financial side will be carried out. Before proceeding with the description of these shocks, it seems useful to show the baseline GDP growth rate reference for each model. As shown in the top panel of Figure 2, Model 1 with the indebtedness norm exhibits 5-period cycles (from peak to peak) which vanish over time. On the other hand, Model 2 with an own-funds norm also shows cycles, but over a much longer period (from peak to trough there is more than 50 periods), as shown in the bottom panel of the Figure. The nature of these contrasted cyclical behaviors will be better understood below thanks to the shocks and the adjustment mechanisms which will be analyzed in more detail.

We now carry out our simulation experiments, which consist in shocking five variables out of our system: the consumption function, the wage share, the investment function, the demand for equities from firms, and the demand for equities from households. Shocks 1, 2 and 3 are on the demand side and Shocks 4 and 5 on the financial side. The effects of these shocks are analyzed graphically for Model 1 (indebtedness norm) and Model 2 (own funds norm) on the following variables: output ($Y$), personal consumption ($C$), the price of equities ($pe$), capital accumulation ($I/K$), the profit rate ($UP/K$), the share of equities held by firms out of their total assets\(^5\) ($peE/(K + peEe)$), the debt ratio ($L/K$), the wealth effect ($Vh/YDh$) and the

\(^5\)Or own funds.
Figure 2: Baseline growth rate in Model 1 (Top) and Model 2 (Bottom)
financial rate of return \( (re) \). We assume a once-and-for-all change in period 45, and each shock will be compared to the corresponding baseline solution (see Figure 2). Although shocks run from \( t = 45 \) to the end of the sample, the reader must bear in mind that what we analyze here are once-and-for-all shocks on single variables, which in turn imply no other change in economic policy or other exogenous factors. The possibility of policy responses (i.e. a 'Taylor' rule) is also left for further research.

### 3.1 Increase in Households’ Consumption

*Model 1 with indebtedness norm.* We begin by describing a shock on the demand side. We assume that autonomous consumption increases 2.5% out of total personal consumption\(^6\). That is, \( a_0 = 0.566 \) increases to 2.066, or \( \Delta a_0 = 1.5 \). Figure 3 illustrates what happens in Model 1 with the indebtedness norm. The top panel shows income, consumption and equities’ price given Shock 1, that is \( Y_1, C_1 \) and \( pe_1 \) divided by the corresponding baseline scenario values; \( Y_0, C_0 \) and \( pe_0 \). The second panel shows the effect of the shock on physical capital accumulation and the profit rate. The third panel shows the post-shock evolution of financial profitability and the wealth effect. The bottom panel of the Figure shows the relative evolution of own funds and the debt ratio.

As can be seen from the Figure, an increase in personal consumption has the expected positive effect on output which, although less than proportional, takes place immediately and extends to the longer-run, following a traditional Keynesian recovery. This brings about an increase in the price of equities, as firms issue less equities thanks to the economic recovery and the improvement of undistributed profits. Two periods later the rather strong positive effects of this shock take place, the first economic downturn occurs (top panel), which is then followed by a milder three period trough. The price of equities reaches its peaks one period after output does. This downturn of the price of equities is the consequence of the fall in output and profit which induces firms to issue new equities facing the indebtedness norm. With the slowdown investment declines and firms reduce their issuing of equities. This allows a new upturn of their price. Consequently a financial cycle can be observed but business cycles become progressively milder.

The other variables provide further information. The accumulation rate \( (I/K) \) decreases slightly in the first period after the increase in autonomous consumption, due to the improve-

\(^6\)Personal consumption’s starting value was set to 60, more details in Appendix.
ment in the financial rate of return which has a negative effect. But it then increases significantly along with the recovery, for up to four more periods until profits fall enough for firms to begin issuing equities, which again makes output fall. These differences then become less and less important. For the same reasons just described, the rate of return on equities held and the rate of financial accumulation evolve cyclically. With the indebtedness norm, fluctuations of the debt ratio remain limited.

On the whole, financial cycles can be observed in the market for equities, with acceleration and slowdown of growth in equities’ price and in the financial rate of return. This is mainly explained by the variation of equities issued facing the constraint of financing with the indebtedness norm and by the role played by equities’ price to clear the market.

*Model 2 with own funds norm.* The same shock is carried out in Model 2, with an own funds norm. The top panel of Figure 4 also shows, in the short term, a positive effect of an increase in personal consumption on output, although of more limited amplitude than in Model 1. The price of equities, the profit rate, the equities held by firms and the rate of return on equities also increase. In the short term the debt ratio decreases slightly when compared to the baseline solution, contrary to what was observed in Model 1. The reader must bear in mind that in Model 2 loans to firms are determined as a residual. In the short-term firms need less credit thanks to the improvement of profit with the recovery and to the preservation of equities issued with the own funds norm.

But in the medium term the evolution is quite different. There is a financial bubble with higher financial rate of return, increasing financial accumulation and a permanent decline of the real rate of accumulation. Firms’ indebtedness increases without limit which stimulates financial accumulation and the growth of equities’ price but reinforces the slowdown in investment and production.

Indeed, the two versions of the model show contrasted mechanisms. In Model 1 with the indebtedness norm, there are short-term financial cycles with equities issued determined as a residual and the price of equities clearing the market. In Model 2 with the own funds norm there is on the contrary a financial bubble with increasing financial accumulation and equities’ price. There is no stabilizing mechanism in the latter. Loans are determined as a residual and the debt ratio increases without limit.
Figure 3: Shock 1; Model 1; Consumption
Figure 4: Shock 1; Model 2; Consumption
3.2 Increase in the Wage Share

Shock 2 on the demand side is assumed, in which the wage share is 2% higher. Figures 5 and 6 show the results for Models 1 and 2, respectively.

Model 1 with indebtedness norm. With the indebtedness norm the increase in the wage share implies lower output because investment is sensitive to the fall of the profit rate and consumption does not increase sufficiently in order to offset the fall in output. The profit fall and the constraint of the indebtedness norm push firms to issue more equities which are here determined as a residual. This induces a decline of the price of equities to clear the market and a drastic decline in financial profitability. Indeed consumption falls despite the increase in the wage share, because household’s capital gains fall. The slowdown of the activity and of the rate of accumulation then reduces equities issuing, which contributes to stabilize their price and, as a consequence, the financial rate of return. Consequently, a financial cycle can be once again observed with a debt ratio moderately fluctuating with the constraint of the indebtedness norm. On the whole, under the current calibration, the economy appears profit-led with financial fluctuations.

Model 2 with own funds norm. On the contrary, Model 2 with the own-funds norm appears wage-led in the short to medium term (Figure 6). It shows that the switch from capitalists’ income to workers’ income implies a short- to medium-run increase in output more in line with the Post-Keynesian wage led tradition. In order to offset the declining rate of profit, firms now get more indebted. Loans are here determined as a residual, which contributes to limit the fall in investment. It also sustains financial accumulation with an increasing price of equities. In the longer-run the decrease in investment weighs on output growth, which, in the absence of any appropriate policy response, falls.

On the whole, the contrast between the two models is confirmed, Model 1 with the indebtedness norm is more financial-cycles driven with the price of equities clearing the market, whereas Model 2 with the own funds norm financial accumulation with increasing price of equities are at work.

7The wage share increase has a negative effect on consumption under this specification, but the reader must be aware that this is due to the important amount of equities held by households out of their wealth. This should be further improved.
Figure 5: Shock 2; Model 1; Wage Share
Figure 6: Shock 2; Model 2; Wage Share
3.3 Increase in Investment

Figures 7 and 8 show what happens to the economy under a shock which implies a 1% increase in the rate of capital accumulation ($\Delta k_0 = 0.01$).

**Model 1 with indebtedness norm.** Starting with Model 1 (indebtedness norm), this demand shock implies a permanent increase in output driven by investment and a permanent decrease in the price of equities. The consequent decrease in financial profitability keeps investment from falling, which in turn makes the capital stock grow proportionally more than undistributed profits, thus gradually reducing the profit rate. This is explained by the fact that firms are constrained by their indebtedness norm and issue more equities which, following an insufficiently increasing demand for equities, makes their price fall. In the medium-run, financial accumulation by firms is reduced due to the worsening of the rate of return on equities issued. Demand is sustained by consumption and investment at the expense of capitalists’ income coming from both the real and financial sides. In this shock the financial cyclical behavior remains with the clearing market role played by the price of equities but is partly offset by the general growth trend.

**Model 2 with own funds norm.** In Model 2 (own funds norm) the shock on investment has a longer-lasting effect in the economy (Figure 8). The price of equities rises due to the own funds norm which limits their supply. This in turn implies an increase in the financial rate of return which sustains financial accumulation and the financial bubble. Firms’ indebtedness grows so as to finance supplementary real and financial investment. The debt ratio grows without limit as loans are determined as a residual and can be obtained without restriction. The increase in the price of equities brings about capital gains capable of holding demand at high levels in spite of a decreasing rate of accumulation in the long run. This fall is due to the sensitiveness of the investment function to the negative effect of financial profitability and of the debt ratio, as seen in equation 12. The profit rate remains higher than in the corresponding baseline solution but accumulation eventually falls in the medium-run, both as a consequence of the financial boom and the growing indebtedness. Growth in the long run is sustained by households’ consumption, which benefit of wealth effects. This shock illustrates a combination of a finance-led growth with increasing indebtedness.

This shock on the accumulation rate gives another illustration of the opposition between

---

8Here again this wealth effect could be revised in other calibration reducing the amount of equities held by households.
the two models. In Model 1 with indebtedness norm growth is mainly driven by investment with limited financial accumulation and declining financial rate of return. The financial cyclical behavior remains under constraint thanks to the general growth trend. In Model 2 with the own funds norm growth is more finance-led with a financial bubble and increasing indebtedness which limits investment in the long run but supports growth thanks to wealth effects.

3.4 Increase in Firms’ Financial Accumulation

Figures 9 and 10 are for Models 1 and 2. They assume a 1% increase of the financial rate of accumulation in equation (15) with $\Delta f_0 = 0.01$.

Model 1 with indebtedness norm. In Model 1 with the indebtedness norm the financial shock on firms’ demand for equities implies a cyclical increase in output of limited amplitude, thanks to a stock market boom seen through the increases of equities’ prices and of the financial rate of return. Capital gains stimulate households’ demand. However, it is followed by a downturn of financial profitability due to the new equities issued by firms, which are a consequence of their indebtedness constraint. Troughs are not as deep so as to erase the initial gains and variations in the profit rate remain above the variations of the accumulation rate. A financial cycle is observed later on, as in the previous shocks, with equities’ prices clearing the market.

Model 2 with own funds norm. Model 2 with the own funds norm presents a paradoxical result, also found for the next shock (see below), originating in the financial side. The paradox here is that both real investment and financial investment become less attractive (as seen in their corresponding profitability rates) but there is an increasing growth rate for the economy. There is, however, an initial decline in output due to the drastic decrease of the price of equities (linked to the increase in accumulation by firms and to the own funds norm). It is followed by a recovery of output growth due to the lowering of the financial rate of return, which in turn makes real investment more attractive in the medium- to long-run. Thus the initial decline in the profit rate is followed by a further recovery. Although accumulation increases significantly in the short term, it tends to fall in the medium- to long-term because of the increasing debt ratio.

3.5 Increase in Households’ Demand for Equities

Figures 11 and 12 describe, for Models 1 and 2 respectively, a shock assuming an exogenous increase in the demand for equities from households (as a proportion of their wealth) of 1%
Figure 7: Shock 3; Model 1; Investment
Figure 8: Shock 3; Model 2; Investment
Figure 9: Shock 4; Model 1; Firms’ Financial Accumulation
Figure 10: Shock 4; Model 2; Firms’ Financial Accumulation
\( \Delta w_0 = 0.01 \).

**Model 1 with indebtedness norm.** This financial shock on households’ demand of equities generates large financial cycles with a succession of financial crises. Initially equities’ prices are boosted by the stronger demand which increases the financial rate of return. Capital gains improve households’ income and demand while firms’ investment is reduced to the benefit of financial accumulation. However, a reversal appears a few periods later. Facing the indebtedness norm, equities’ issue increases, which depress the financial market and induce a decline of the price of equities and of the financial rate of return. This in turn has a negative impact on households’ income and demand and, more broadly, on growth. Financial cycles follow as in preceding cases, but more in-tensely than in the previous shocks. In the longer-run, the increase in the price of equities is unsustainable and thus tends to fall despite the peaks which occur every 5 periods. This happens because non financial firms must issue more equities to finance investment, due to the indebtedness constraint they face. Broadly speaking, what we see is a succession of financial cycles with similar effects on the real side of the economy without any gain in terms of output growth in the medium- to long-run.

**Model 2 with own funds norm.** For Model 2 with the own funds norm (Figure 12) the supplementary demand for equities from households gives results close to those observed in case of increasing financial accumulation by firms (see above). It induces a short-term decrease in output and a decrease of the price of equities. Consumption falls more drastically than output, deposits are reduced significantly, but dividends for households double every 6 periods, due to the drastic decline in firms’ demand for equities, which firms issue almost exclusively for households. Output closely follows the evolution of the share of equities held by firms on their own funds. The rate of accumulation grows mainly due to the decline of the financial rate of return which induces firms to invest more in real capital. Losses are absorbed mostly by capitalists who see their profit rate reduced. This increase in disposable income, through households’ dividends (which grow drastically), appears hardly sustainable in reality.

### 4 Conclusion

We have studied a 'finance-led' growth regime, using a Stock-Flow Consistent model with two alternative closures, one with an indebtedness norm where issued equities are determined as a residual, and another with an own funds norm where loans to firms are in turn determined as
Figure 11: Shock 5; Model 1; Households' Financial Accumulation
Figure 12: Shock 5; Model 2; Households' Financial Accumulation
a residual. Simulations with shocks on the demand side or on the financial side have helped to give a better understanding of the working of the model.

Indeed, the two versions of the model have shown contrasted mechanisms. In Model 1 with indebtedness norm, there are short-term financial cycles with equities issued determined as a residual for the need of real and financial investment. The price of equities clears the market. Consequently, financial fluctuations with ups and downs more or less pronounced according to the cases are the normal mode of regulation of this financial regime. On the contrary, in Model 2 with the own funds norm there is a financial bubble with increasing financial accumulation and a rising price of equities or a permanent financial deflation according to the cases. There is no stabilizing mechanism. Loans are determined as a residual and the debt ratio increases or decreases without limit. This financial regime appears structurally unstable.

These results have appeared clearly, both in the shocks on households’ demand and on the wage share. The shock on investment has given another illustration of the opposition between the two models. In Model 1 with the indebtedness norm, growth is mainly driven by investment with limited financial accumulation and declining financial rate of return. The financial cyclical behavior remains under constraint thanks to the general growth trend. In Model 2 with the own funds norm, growth is more finance-led with a financial bubble and increasing indebtedness which limits investment in the long run but supports growth thanks to wealth effects.

Shocks on the financial sector, on firms’ financial accumulation or households’ equities demand, have confirmed the previous observations in the case of Model 1 with the indebtedness norm. Financial cycles with a succession of financial crises are observed in both cases. On the contrary Model 2 with own founds norm has appeared more paradoxical.

These results must be regarded as preliminary. It would be useful to check the robustness of these conclusions according to the specifications used to characterize the two types of indebtedness norm or own funds norm. The importance of the wealth effect in households’ behavior is another factor to examine. Last, the hypothesis of a closed economy would have to be revised by introducing a foreign sector.

References


### A Parameters Setting and Starting Values

**Parameters; Consumption Function**

\[ a_0 = 0.5658628, \ a_1 = 0.83, \ a_2 = 0.04 \]
Parameters; Accumulation Function
\[ k_0 = 0.1086334242..., \quad k_1 = 0.35, \quad k_2 = 0.025, \quad k_3 = 0.1, \quad k_4 = 0.5, \quad k_5 = 0.1 \]

Parameters; Households’ Bonds Function
\[ v_0 = 0.22382378, \quad v_1 = 0.2, \quad v_2 = 0.2, \quad v_3 = 0.1 \]

Parameters; Households’ Financial Wealth Function
\[ w_0 = 0.389734150, \quad w_1 = 0.01, \quad w_2 = 0.02 \quad w_3 = 0.02 \]

Parameters; Firms’ Financial Wealth Function
\[ f_0 = 0.09826265506, \quad f_1 = 0.2, \quad f_2 = 0.6 \]

Parameters; Firms’ Debt Ratio Function
\[ g_0 = 0.2352693030..., \quad g_1 = 0.3, \quad g_2 = 0.04, \quad g_3 = 0 \]

Parameters; Firms’ Own Funds Function
\[ z_0 = 0.3, \quad z_1 = 0.5, \quad z_2 = 0.45, \quad z_3 = 0.033333... \]

Other Parameters
\[ \theta = 0.1, \quad \lambda = 0.050005, \quad \lambda_0 = 0.159143, \quad \delta = 0.0625, \quad \theta_b = 0.2862767, \quad r_0 = 0.67652, \quad s_f = 0.34097798866 \]

Interest Rates
\[ ib = 0.015, \quad rb = 0.02, \quad m_{1b} = 0.005, \quad m_{2b} = 0.005 \]

Initial Values of Endogenous Variables
\[ Y = 100, \quad C = 60, \quad I = 25, \quad G = 15, \quad BD = 45, \quad B = 0, \quad BP = 0.979955, \quad BT = 0, \quad DIV = 20, \]
\[ DIVe = 13.33..., \quad DIVh = 6.66..., \quad Vg = 0, \quad E = 3, \quad Ec = 2, \quad Eh = 1, \quad g = 0.0625, \quad Hh = 9.54858, \]
\[ Hb = 2.250225, \quad K = 400, \quad L = 100, \quad pe = 35, \quad rl = 0.02, \quad r = 0.02, \quad TB = 0.393063, \quad TCB = 0.176982075, \]
\[ T = 7.47687, \quad UP = 23.6813, \quad Vh = 89.54858, \quad YHSh = 67.2918, \quad YDh = 67.2918, \]
\[ W = 67.652, \quad H = RF = 11.798805, \quad pb = 50 \]

B Other Baseline Solution Graphs
Figure 13: Baseline Solutions of Debt Ratio and Own Funds
Figure 14: Baseline Growth Rates of Asset Price
Figure 15: Baseline Capital Accumulation Rates
Figure 16: Baseline Profit Rates