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It is not *la vie en rose*

New insights from Graziani's theory of monetary circuit

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Abstract

The aim of this paper is twofold. First, it shows how a standard stock-flow consistent model (SFCM) can be modified to embed some fundamental insights from Graziani's theory of monetary circuit (TMC). Second, it aims at addressing some common misconceptions about the TMC. More precisely, it is argued that: *a*) a market-clearing price mechanism does not necessarily imply a neoclassical-like closure of the model; *b*) the ways in which SFCMs and the TMC define bank loans are mutually consistent, although they are based on different accounting periods; *c*) consumer credit is final finance, not initial finance; *d*) the paradox of profit is not a logical conundrum, but an abstract counterfactual that allows shedding light on a neglected role of government spending; *e*) overall, the TMC can be regarded as a "Marxian" rendition of Keynes's method of aggregates.

Keywords: Theory of Monetary Circuit, Stock-Flow Consistent Models, Macroeconomics, Monetary Economics

JEL Classification: E11, E12, E16, E17

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We can ask an analytical model to be logically coherent, or confirmed by the empirical evidence; not to be depicting *la vie en rose*.

A. Graziani, 1995

1 Introduction

The goal of this paper is twofold.[1] First, it aims at showing how a standard stock-flow consistent model (SFCM) can be amended to incorporate some fundamental insights (particularly, about initial finance, interest payments and alternative model closures) from the theory of monetary circuit (TMC). Model BMW developed by Godley/Lavoie (2007, chapter 7) is used as the credit-money SFCM canon, whereas the equations developed by Graziani (2003, chapter 5) are taken as the benchmark TMC scheme.

Second, the paper aims at addressing some common misconceptions about the TMC. More precisely, it is argued that: *a*) a market-clearing price mechanism does not necessarily imply a neoclassical-like closure of the model; *b*) the ways in which SFCMs and the TMC define bank loans are mutually consistent, although they are based on different accounting periods; *c*) consumer credit is final finance, not initial finance; *d*) the paradox of profit is not a logical conundrum, but an abstract counterfactual that allows shedding light on the role of external sources of money, including government spending; *e*) overall, the TMC can be regarded as a "Marxian" rendition of Keynes's method of aggregates.

The rest of the paper is organized as follows. Section 2 defines the method used to present and discuss the key features of the TMC. A simple but stock-flow consistent dynamic macroeconomic model for a closed economy with no government intervention is developed. Unlike other SFCMs, the model is explicitly inspired by the TMC literature. The system of difference equations is solved numerically to obtain a baseline, which is then compared with alternative scenarios characterized by different model closures. Section 3 relies on model findings to address a number of common misconceptions about the TMC. This allows shedding light on less known aspects of Graziani's approach, while identifying new insights. Final remarks are made in Section 4.

2 Method (the model)

It has been argued that a SFCM is the dynamic counterpart of the TMC scheme (Graziani 2003; Godley 2004; Lavoie 2004, 2021; Godley/Lavoie 2007; Zezza 2012; Veronese Passarella 2014, 2017; Sawyer/Veronese Passarella 2017). The latter provides the basic monetary-accounting structure that the former is built upon. Clearly, there are some differences between the two approaches:

i) Graziani and other TMC authors usually rely on single-period static analyses, whereas SFCMs are typically multi-period dynamic models;

ii) SFCMs are based on an *ex-post* accounting, which records each net entry *at the end* of every period, whereas the TMC explicitly focuses on the whole sequence of economic acts that take place *within* each period, including *ex-ante* gross flows (see Veronese Passarella 2017);

iii) in principle, TMC schemes are stock-flow consistent, but they are highly simplified (e.g. consumption is only a function of disposable income) and usually stock-flow incomplete (e.g. capital accumulation and saving/portfolio relations are not fully modeled).

[1] The inspirational quote is taken from Graziani (1995: 188). Translation from Italian.

Differences above are mainly due to the different level of abstraction of TMC schemes compared with SFCMs. This, in turn, is due to the different research questions that they aim at addressing. While SFCMs, like other macroeconometric models, are usually employed to create, simulate, and compare, alternative economic and policy scenarios, the TMC *only* aims to show how credit-money is endogenously created, circulated, and destroyed in a capitalist economy during "normal times", and how does this affect real income distribution between and within different social classes. However, the two approaches are coherent.[2]

In this section, the benchmark TMC scheme is re-framed as a simple but complete macroeconomic dynamic model for a closed economy. This can also be regarded as an advanced version of the *bank-money world* (BMW) model developed by Godley and Lavoie in chapter 7 of *Monetary Economics* (Godley/Lavoie, 2007), in which credit money is created by private banks that grant loans to production firms. However, there are differences. Most of them are about model closure and the way loans and interest payments are calculated, and are discussed in the next sub-sections. Besides, class divide is explicitly factored in. Four macro-sectors are considered:

i) The lower class or working-class households, who sell labour power to firms in exchange for a money wage, consume a share of their income, and hold the remaining share in the form of bank deposits and/or corporate securities;

ii) The upper class or capitalists or rentiers, who own all the firms and banks and are the final recipients of distributed profits (which the capitalists, like the workers, either spend for consumption or save in the form of deposits and/or securities);

iii) Production firms, which use bank loans to purchase labour power from working-class households, and set the price and/or the level and composition of real output;

iv) Commercial banks, which grant loans to firms and supply deposits to households on demand.

Following a long-standing practice in the TMC literature, the government sector is not included in the benchmark model, while the central bank is only implicitly considered by assuming that the policy rate is exogenously set.[3] The rationale is that the laws of motion of a capitalist economy should be first brought to light regardless of the impact of economic policies and country-related institutions. This allows focusing on the *pure* triangular relation between firms, workers, and banks, which underpins the capitalist circulation of money in modern economies.

2.1 Households (workers and capitalists)

As mentioned, the household sector is split into two sub-sectors: workers and capitalists. The former are marked with the subscript "w"; the latter are marked with the subscript "z". Subscript "h" marks the household sector as a whole.

The first equation of the model defines workers' nominal disposable income:

$$YD_w = WB + PAYM_w^m + PAYM_w^b \tag{1}$$

where WB is total wages, $PAYM_w^m$ is the (received) amount of nominal interest payments on bank deposits, and $PAYM_w^b$ is the (received) amount of nominal interest payments on corporate securities.

[2] It seems no coincidence that several leading SFCM theorists were close to Graziani and/or still admire his work (think of Marc Lavoie, Steve Keen, and Gennaro Zezza, among others). For a further discussion of this point, see Section 3.2.

[3] Obviously, the model can be easily amended to include taxes, government spending, government bills, monetary base, and other policy-related variables.

Similarly, capitalists' disposable income is:

$$YD_z = F_f + F_b + PAYM_z^m + PAYM_z^b \tag{2}$$

where F_f is corporate profit and F_b is bank profit, which are both paid to the capitalists (even though, for the sake of simplicity, there is no asset corresponding to this ownership in the model).

Total household disposable income is:

$$YD_h = YD_w + YD_z$$

As usual, the stock of wealth in each sub-sector is defined as:

$$V_w = V_{w,-1} + YD_w - C_w \tag{3}$$

$$V_z = V_{z,-1} + YD_z - C_z \tag{4}$$

$$V_h = V_w + V_z$$

where $C_{w,z}$ is nominal consumption of workers and capitalists, respectively.

In the simplest TMC scheme, portfolio decisions do not depend on relative rates of return of financial assets. Both workers and capitalists hold a share ($\lambda_{w,z}$) of their wealth in the form of bank deposits ($M_{w,z}$) and hold the remaining share in the form of securities issued by production firms ($B_{w,z}$):

$$M_w = \lambda_w \cdot V_w \tag{5}$$

$$M_z = \lambda_z \cdot V_z \tag{6}$$

$$M_h = M_w + M_z \tag{7}$$

$$B_w = (1 - \lambda_w) \cdot V_w \tag{8}$$

$$B_z = (1 - \lambda_z) \cdot V_z \tag{9}$$

$$B_h = B_w + B_z \tag{10}$$

In line with the SFCM literature, real consumption is defined as a linear function of expected (real) disposable income and real wealth:

$$c_w = \alpha_w^0 + \alpha_w^1 \cdot E\left(\frac{YD_w}{p}\right) + \alpha_w^2 \cdot \frac{V_{w,-1}}{p_{-1}} \tag{11}$$

$$c_z = \alpha_z^0 + \alpha_z^1 \cdot E\left(\frac{YD_z}{p}\right) + \alpha_z^2 \cdot \frac{V_{z,-1}}{p_{-1}} \tag{12}$$

$$c = c_w + c_z \tag{13}$$

where $\alpha_{w,z}^0$ captures changes in consumption that do not depend on income and wealth, $\alpha_{w,z}^1$ is the marginal propensity to consume out of disposable income, $\alpha_{w,z}^2$ is the propensity to consume out of wealth, p is the price level, and $E(\cdot)$ denotes expected values.[4]

[4] Notice that the definition of real disposable income used in equations (11) and (12), $YD_{w,z}/p$, is not fully accurate, as it does not consider the impact of the so-called "inflation tax" on the real value of the stock of wealth, which in turn affect household consumption decisions. A more accurate definition would be: $(YD_{w,z}/p) - (\Delta p/p) \cdot (V_{w,z,-1}/p_{-1})$ – see Godley/Lavoie (2007), sections 9.2.4 and 9.3.1. However, this complication is ignored hereafter. In other words, the model implicitly assumes that households suffer from money illusion.

Nominal consumption is therefore:

$$C_w = p \cdot c_w \tag{14}$$

$$C_z = p \cdot c_z \tag{15}$$

$$C = C_w + C_z \tag{16}$$

Household parameter values used for model simulations are shown by Table 1. They have been identified in such a way to reproduce the baseline values for model BMW. Based on empirical evidence, workers' propensity to consume out of income is greater than capitalists'. The other coefficients are homogenous across the two groups (except for autonomous consumption levels). Initial values of endogenous variables are set at their steady-state levels.

Table 1: Values of coefficients in the baseline scenario: households

Description	Values
Workers' share of bank deposits to total wealth	$\lambda_w = 0.50$
Capitalists' share of bank deposits to total wealth	$\lambda_z = 0.50$
Autonomous consumption of workers	$\alpha_w^0 = 23$
Autonomous consumption of capitalists	$\alpha_z^0 = 2.5$
Workers' propensity to consume out of disposable income	$\alpha_w^1 = 0.76$
Capitalists' propensity to consume out of disposable income	$\alpha_z^1 = 0.69$
Workers' propensity to consume out of wealth	$\alpha_w^2 = 0.10$
Capitalists' propensity to consume out of wealth	$\alpha_z^2 = 0.10$

2.2 Production firms

Turning to production firms, nominal output (calculated using the demand or expenditure approach) is:

$$Y = C + I \tag{17}$$

whereas real output is:

$$y = \frac{Y}{p} \tag{18}$$

The standard SFCM real investment function (i) is defined by the two following equations:

$$k_T = \kappa \cdot y_{-1} \tag{19}$$

$$i = \gamma_k \cdot (k_T - k_{-1}) + da \tag{20}$$

where k_T is the target stock of real capital, k is the actual real stock, κ is target capital to output ratio, γ_k is the speed of adjustment of actual capital to the target stock, and da are capital depreciation allowances in real terms.

However, following Graziani (2003), gross real investment can also be simply defined as a share of total production:

$$i_T = \beta \cdot y_{-1} \tag{19B}$$

$$i = i_{-1} + \gamma_i \cdot (i_T - i_{-1}) \tag{20B}$$

where i_T is the real investment planned by production firms, β is the target share of investment goods to total production, and γ_i is the speed of adjustment of actual investment to

target level. Since $0 < \gamma_i < 1$, it takes time for current real investment (i) to match target investment (i^T) when firms change their production plans.[5]

It can be shown that the two formulations imply the same qualitative behaviour for i.[6] Whatever the real investment function, nominal investment and current real capital stock are defined, respectively, as:

$$I = p \cdot i \tag{21}$$

$$k = k_{-1} + i - da \tag{22}$$

The latter depreciates according to a fixed rate, δ:

$$da = \delta \cdot k_{-1} \tag{23}$$

Amortization funds (AF) equal real capital depreciation allowances times the price level:

$$AF = p \cdot da \tag{24}$$

Firms' profit is here defined as the residual income, which is fully appropriated by the capitalist class:

$$F_f = Y - PAYM_l - PYM_w^b - PYM_z^b - AF - WB \tag{25}$$

where $PAYM_l$ are interest payments on bank loans obtained by production firms.

Production firms issue securities to fund (partially) their investment plans. For the sake of simplicity, it is assumed that the supply of new corporate securities (ΔB_s) fully adjusts to demand:

$$B_s = B_{s,-1} + \Delta B_h \tag{26}$$

Besides, any risk premium is assumed away. These assumptions insure that the interest rate (r_b) accruing on corporate securities remains constant at the policy rate set by the central bank:

$$r_b = r^* \tag{27}$$

Firms' parameter values used for model simulations are shown by Table 2. The target capital to output ratio (when a standard SFCM investment function is used) is borrowed from model BMW, like the other coefficients. The only exception is the target investment share (when a circuit-like investment function is used), which is set in such a way to obtain the same steady-state value for real investment.

Table 2: Values of coefficients in the baseline scenario: production firms

Description	Values
Initial value for unit price of output	$p = 1.00$
Target investment share to total output	$\beta = 0.10$
Target capital to output ratio	$\kappa = 1.00$
Speed of adjustment of actual investment to target one	$\gamma_i = 0.15$
Rate of capital depreciation	$\delta = 0.10$
Policy rate	$r^* = 0.04$

[5] While this assumption would not make sense in a single-period circuit scheme, it seems coherent with a dynamic rendition of the TMC.

[6] Simulations in figures 2-7 are made using the circuit investment function, but the model code allows switching to the SFCM formulation.

2.3 Commercial banks

As is well known, commercial banks play a pivotal role in the TMC. They provide the *initial finance* (FIN_i) that firms need to buy labour force and start the production process. At the highest level of abstraction, firms can be regarded as fully integrated into a single agent. One can even imagine that they "do not put on sale the fraction of total product that they plan to use in their own production" (Graziani 2003: 99). Therefore, new bank loans only cover wage costs:[7]

$$FIN_i = WB \tag{28}$$

Households can spend their money income on consumption goods or financial assets (corporate securities). The liquidity collected by firms through sales is denominated *final finance*. Its role is to make it possible for "firms to repay their bank debt [and] it makes no difference whether final finance is collected from the commodity market or from the financial market" (Graziani 2003: 69-70). Since firms distribute their profits and must provide interest payments on their liabilities, the net flow of final finance (FIN_f) they can use to repay their bank debt at the end of each period t is:

$$FIN_f = C + \Delta B_s - (PAYM_l + PAYM_w^b + PAYM_z^b + F_f) \tag{29}$$

Therefore, the change in the stock of loans, as recorded at the end of each period t, is:

$$\begin{aligned} L_d &= L_{d,-1} + FIN_i - FIN_f = \\ &= L_{d,-1} + WB - [C + \Delta B_s - (PAYM_l + PAYM_w^b + PAYM_z^b + F_f)] \end{aligned}$$

which, using equation (25), and after a few manipulations, becomes:

$$L_d = L_{d,-1} + I - \Delta B_s - AF \tag{30}$$

The end-of-period stock of demanded bank loans is a residual variable.[8] It rises as the initial finance demanded by production firms increases, and reduces as the final finance collected by them rises. The former is determined by the scale and costs of production. The latter depends on firms' commercial and/or financial success. As a result, the change in the stock of loans at the end of each period matches the amount of investment that has not been funded through security issues and/or internal funds.

In line with the horizontalist approach to endogenous money, supplied loans (L_s) adjust to the demanded stock:

$$L_s = L_{s,-1} + \Delta L_d \tag{31}$$

Money is fully endogenous: \$1 of deposits is created every time banks grant \$1 of new loans. In formal terms:

$$M_s = M_{s,-1} + \Delta L_s \tag{32}$$

Like the interest rate on corporate securities, both the interest rate on bank deposits (r_m) and the interest rate on bank loans (r_l) equal the policy rate set by the central bank:

$$r_m = r^* \tag{33}$$

[7] If firms were not taken as an aggregate sector, it would be "advisable to ... revert to the more realistic image of a multiplicity of firms ... exchanging finished products among themselves. ... In order to buy finished goods, firms need finance as much as they need finance for paying the wage bill in the labour market" (Graziani 2003: 99). Individual firms must "cover the whole cost of producing both consumer goods and investment goods" (Graziani 2003: 151). As a result, the initial finance they need at the beginning of each period t amounts to "the quantity of finished goods to be purchased multiplied by the price prevailing on the market"(Graziani 2003: 99). However, since the corporate sector is fully consolidated in this model, $i \cdot p$ has not been included in the initial finance.

[8] Notice that the choice not to include $i \cdot p$ in equation (28) does not affect equation (30), as the purchase of investment goods is an internal transaction for the corporate sector. As a result, the higher flow of initial finance would be exactly matched by a higher flow of final finance in equation (29). Notice also that the latter implicitly accounts for amortization funds, as F_f is calculated net of AF in equation (25).

$$r_l = r^* \tag{34}$$

Bank profits equal (received) interest payments on loans minus (paid) interest payments on deposits:

$$F_b = PAYM_l - PAYM_w^m - PAYM_z^m \tag{35}$$

Notice that $M_s = L_s$ always holds in this simplified model, because all money is bank money (deposits). As a result, if $r_m = r_l$, then there are no bank profits ($F_b = 0$).

2.4 Labour market

The model implicitly assumes that the labour force is always greater than (or equal to) labour demand. There is a reserve army of unemployed workers. The total wage bill and total employment can be simply defined, respectively, as:

$$WB = w \cdot N \tag{36}$$

$$N = \frac{y}{pr} \tag{37}$$

where w is the wage rate (money wage per unit of labour), and pr is labour productivity (real output per unit of labour), both taken as exogenous variables.

As usual, parameter values used for model simulations are shown by Table 3.[9]

Table 3: Values of coefficients in the baseline scenario: labour market

Description	Values
Money wage rate	$w = 0.72$
Product per unit of labour	$pr = 1.00$

2.5 Interest payments

The model is almost complete. The next step is to factor in interest payments, the price level, and the functional form of expectations, respectively.

In SFCMs, interest payments are usually defined as:

$$PAYM_x = r_{x,-1} \cdot X_{-1}$$

where X_{-1} is the stock of the financial asset/liability (where $X = M, L, B$) at the end of the previous period and r_x is the related interest rate. While this is an acceptable way to treat corporate securities (which are issued after the production process), it only calculates interest payments on the stock of net loans (and deposits) *at the end of the period*. This is at odds with the TMC scheme, in which firms pay interests on gross loans obtained at the beginning of the period, not only on the net or residual part of them at the end of the circuit. In other words, interest payments must be calculated also on the share of loans that firms pay back (thanks to final-finance inflows) *within* each period. If we assume that (*i*) firms *evenly* repay their loans over each period (as they sell their products on the market), (*ii*) the narrowly-defined production process is instantaneous, and (*iii*) the interest rate does not change within periods (but only across periods), then interest payments on loans can be simply redefined as:

$$PAYM_l = r_{l,-1} \cdot L_{d,-1} + r_{l,-1} \cdot \frac{FIN_{f,-1}}{2} \tag{38}$$

[9] The unit price of output can be defined using a simple cost-plus pricing rule: $p = (1 + \mu) \cdot (w/pr)$, where w/pr is the unit labour cost and μ is the percentage costing margin. Since the steady-state value of p is 1, the implicit costing margin is: $\mu = (pr/w) - 1 = (1/0.72) - 1 = 0.38 = 38\%$.

Turning to bank deposits, money wages are paid at the beginning of each period. A corresponding amount of deposits is transferred from the firms' account to the workers' account as soon as firms obtain loans from banks. By contrast, entrepreneurial incomes are usually paid at the end of the period, once the products have been sold on the market. As a result, interest payments on deposits are:

$$PAYM_w^m = r_{m,-1} \cdot M_{w,-1} + r_{m,-1} \cdot \frac{FIN_{f,-1}}{2} \cdot \frac{M_{w,-1}}{M_{h,-1}} \tag{39}$$

$$PAYM_z^m = r_{m,-1} \cdot M_{z,-1} \tag{40}$$

where M_w/M_h is the share of bank deposits held by working-class households (and M_z/M_h is the share of deposits held by the capitalists).

As mentioned, there is no *theoretical* reason to change interest payments on securities issued by production firms:

$$PAYM_w^b = r_{b,-1} \cdot B_{w,-1} \tag{41}$$

$$PAYM_z^b = r_{b,-1} \cdot B_{z,-1} \tag{42}$$

One can assume that, unlike bank loans (and deposits), corporate securities are purchased at the end of the circuit.

2.6 Prices and expectations

Turning to the price level, if inventories are assumed away, two extreme options remain in terms of how firms react following changes in aggregate demand. One can assume that firms set a monopoly price (on the basis of a cost-plus pricing rule) and fully adjust real supply to demanded quantity. At the other extreme of the behavioral spectrum, real supply is fixed and firms adjust the price in such a way to clear the market. The former is the most common choice in simple SFCMs that do not factor in inventories. Surprising though it may sound, the latter is the assumption upon which Graziani's TMC behavioral equations are built upon (e.g. Graziani 2003, section 5.3).

Arguably, while using a market-clearing price can work for some financial assets and a few commodities, it is not a realistic assumption for most industries of advanced capitalist economies. However, a market-clearing price does not necessarily imply a "neoclassical" closure of the model, as it is sometimes argued (e.g. Seccareccia 2015). On the contrary, it is used by Graziani and other *circuitisti* to show that both the composition (structure) and the level of real output eventually depend on firms' autonomous production and investment decisions. Real supply may well adjust to demand as long as this is the most profitable option for the firms. However, there is no such thing as a "consumer sovereignty": decisions about the level and composition of output are eventually made by the corporate sector, not by the consumers. A noteworthy corollary is that fiscal policy is always effective in redistributing income *within* social classes, but distribution *between* classes is inevitably *mediated* by firms' production plans.

In order to consider and assess both options, real supply is here defined as:

$$y_s = \sigma \cdot y + (1 - \sigma) \cdot y_n \tag{43}$$

where $0 \leq \sigma \leq 1$, and y_n is real potential output.

In principle, potential output can be fully determined on the supply side. In a single-period model, this is tantamount to assuming that firms choose the investment share of output by

conveniently setting the price of their products.[10] However, empirical evidence shows that potential output tends to adjust to the actual level of output over time, due to hysteresis (Lavoie 2006). As a result, potential output should be better defined as:

$$y_n = y_{n,-1} + \gamma_y \cdot (y_{-1} - y_{n,-1}) \tag{44}$$

where $0 \leq \gamma_y \leq 1$, is the speed of adjustment of potential output to the current level. More precisely, if $\gamma_y = 0$, then potential output is completely exogenous. If $\gamma_y = 1$, then potential output equals actual output (in the steady-state). Finally, if γ_y is positive but not unity, potential output converges to actual output over time.

In line with Graziani (2003), the unit price of output is defined in such a way to clear the market:[11]

$$p = \frac{c \cdot E(p)}{c_{res}} \tag{45}$$

where c is calculated based on equation (13), whereas:

$$\begin{aligned} c_{res} &= c_z + (y - c_z - i) = \\ &= y - i \end{aligned} \tag{46}$$

The numerator of equation (46) is households' planned consumption. The denominator is calculated by adding capitalists' planned consumption with workers' *forced* consumption. The latter is a residual variable, meaning what is left of real output once capitalists have fulfilled their consumption plans and firms have taken a share of output as fixed investment.

Looking at equation (43), there are three cases:

i) If $\sigma = 1$, then y_s fully adjusts to y, p is exogenously set, and so is the implicit markup on labour costs. This is the standard assumption in SFCM models that do not factor in inventories.

ii) If $\sigma = 0$, then y adjusts to $y_s = y_n$ through changes in p that force real saving of workers to adjust to firms' investment plans (and capitalists' consumption). This is the assumption made in Graziani's TMC scheme.

iii) If $0 < \sigma < 1$, then the adjustment process involves both prices and supplied quantities.

Whatever the social group they belong to, consumers are marked by adaptive expectations. It is also assumed that $E(\cdot)$ is *associative*, that is: $E(YD_{w,z}/p) = E(YD_{w,z})/E(p)$. The expected unit price is:

$$E(p) = p_{-1} + \psi_0 + \psi_1 \cdot \big[p_{-1} - E(p_{-1})\big] \tag{47}$$

where ψ_0 is a parameter and ψ_1 sets the size of correction of price expectations based on past errors.

Expected disposable incomes of workers and capitalists, $E(YD_w)$ and $E(YD_z)$, are defined in the same way.

[10] Incidentally, a supply-determined potential output is also the standard assumption of simultaneous general equilibrium models (such as DSGE models), in which potential output acts as an exogenous attractor for current output. However, the rationale is completely different. In general equilibrium models, the long-run equilibrium position is defined by consumer preferences (in addition to initial endowments and technology). By contrast, single-period TMC schemes use the demand-supply mismatch precisely to demonstrate that there can be no consumer sovereignty in a system in which production decisions are eventually made by private firms, neither in the short nor in the long run!

[11] Therefore, the costing margin is defined endogenously – see footnote 9. Notice that Graziani (2003) determines the unit price of output as the ratio of nominal aggregate demand to real supply. However, demand components are here defined in real terms based on expected prices, while real investment plans are fulfilled by definition. As a result, the market-clearing price can be worked out as the ratio of the desired nominal demand for consumption and the available quantity of consumer goods.

There are two points worth mentioning here. First, it could be argued that workers and capitalists should be forming their expectations in different ways, as capitalists are more likely to know what the price set by firms will be. However, the way in which price expectations are defined (e.g. adaptive, rational, or regressive) does not affect the qualitative results of the model. In fact, it can only affect the speed of convergence to the new steady state following a shock. Consequently, differences in expectation formation mechanisms are ignored in the baseline scenario. Second, workers' expectations are *necessarily unfulfilled* when aggregate supply does not fully adjust to aggregate demand, as (unpredicted) price changes are the way in which firms force working-class households to modify their consumption and saving plans.

As usual, parameter values used for model simulations are shown by Table 4.

Table 4: Values of coefficients in the baseline scenario: prices and expectations

Description	Values
Weight of demand in real supply equation	$\sigma = 1.00$
Initial value of potential output	$y_n = 200.00$
Speed of adjustment of potential output to current one	$\gamma_y = 0.15$
Fixed coefficient in price expectation function	$\psi_0 = 0.00$
Coefficient defining size of correction of price expectations	$\psi_1 = 0.10$

Table 5: Balance sheet (nominal values at the end of the period)

	Workers	Capitalists	Production firms	Commercial banks	$\sum$
Deposits	$+M_w$	$+M_z$		$-M_s$	0
Loans			$-L_d$	$+L_s$	0
Fixed capital			$+K$		$+K$
Securities	$+B_w$	$+B_z$	$-B_s$		0
Balance (net worth)	$-V_w$	$-V_z$	0	0	$-V_h$
$\sum$	0	0	0	0	0

Notes: A '+' before a magnitude denotes an asset, whereas '–' denotes a liability (except for Balance's entries, where signs are reversed); for the sake of simplicity, there is no asset corresponding to capitalists' ownership of firms and banks.

Table 6: Transactions-flow matrix (nominal values at the end of the period)

			Production firms			
	Workers	Capitalists	Current	Capital	Commercial banks	$\sum$
Consumption	$-C_w$	$-C_z$	$+C$			0
Investment			$+I$	$-I$		0
Memo: Production			$[Y]$			
Wages	$+WB$		$-WB$			0
Depreciation / Amortisation			$-AF$	$+AF$		0
Firms' profit		$+F_f$	$-F_f$			0
Banks' profit		$+F_b$			$-F_b$	0
Interest on loans			$-PAYM_l$		$+PAYM_l$	0
Interest on deposits	$+PAYM_w^m$	$+PAYM_z^m$			$-PAYM_m$	0
Interest on securities	$+PAYM_w^b$	$+PAYM_z^b$	$-PAYM_b$			0
Change in loans				$+\Delta L_d$	$-\Delta L_s$	0
Change in deposits	$-\Delta M_w$	$-\Delta M_z$			$+\Delta M_s$	0
Change in securities	$-\Delta B_w$	$-\Delta B_z$		$+\Delta B_s$		0
$\sum$	0	0	0	0	0	0

Notes: A '+' before a magnitude denotes a receipt or a source of funds, whereas '–' denotes a payment or a use of funds.

2.7 Walras's law

The redundant equation of the model is the one defining the equilibrium condition of demand and supply of bank deposits: $M_h = M_s$. The former is defined by households' portfolio decisions (equations 5-7), whereas the latter is determined by the amount of bank loans

created by the banking sector (equation 32) to meet firms' demand for credit (equations 30-31). If the model is consistent, the supply of deposits exactly matches the demand for them.

3 Findings

The model is now complete. The related balance sheet and the transactions-flow matrix are displayed by Table 5 and Table 6, respectively. A snapshot of cross-sector transactions and financial flows is provided by Figure 1, which also shows that the model is watertight. Simplified though it is, the model cannot be easily solved algebraically. Therefore, numerical simulations have been used to find steady-state values.[12] A time span of 100 periods has been considered. Coefficient values are shown by tables 1 to 4. Exogenous variables and parameters have been identified in such a way to reproduce the baseline values for model BMW. Simultaneous solutions for endogenous variables have been found by running 200 iterations per period. Steady-state values of endogenous variables (under the baseline) have been used as starting values when running alternative scenarios.

Figure 2 shows selected variables under the baseline scenario. Quadrant (a) displays real output, consumption, and investment, first under the initial baseline, and then following an increase in autonomous consumption (in period 10). They all achieve their new steady-state values after approximately 60 periods. Quadrant (b) displays key variables of the monetary circuit. Initial finance slightly outgrows final finance in the early periods after the shock, because households choose to hold a share of their wealth in the form of bank deposits ($\lambda_{w,z} = 0.5$, Table 1). This leakage in the corporate circuit of money fosters firms' debt to banks.

Eventually the flow of final finance adjusts to initial finance, because households no longer save in the (new) steady state. As a result, firms' stock of debt stabilizes. Quadrant (c) shows that the price level is stable over the whole period. This is no surprise, as it is assumed that real supply fully adjusts to demand under the baseline scenario ($\sigma = 1$, Table 4). The last quadrant, quadrant (d), shows that the increase in the real consumption of workers matches their expectations.

Table 7: Values of coefficients under alternative scenarios

Description	Symbol	Baseline	Scenario 1	Scenario 2	Scenario 3
Autonomous consumption of workers	α_w^0	$[23 \rightarrow 24]$	23	23	23
Autonomous consumption of capitalists	α_z^0	$[2.5 \rightarrow 3.5]$	2.5	2.5	2.5
Weight of demand in real supply equation	σ	1	1	$1 \rightarrow 0$	$1 \rightarrow 0$
Target level of real investment	i	20	$20 \rightarrow 25$	$20 \rightarrow 25$	$20 \rightarrow 25$
Speed of adjustment of potential output	γ_y	0.15	0.15	0.15	$0.15 \rightarrow 0$

The model can now be used to address a number of research questions about the TMC and its relation with the SFCM literature. For this purpose, three additional experiments have been run:

i) an increase in the real value of investment undertaken by the firms, assuming that real supply fully and instantaneously adjusts to demand;

ii) an increase in the real value of investment undertaken by the firms, assuming that real supply *does not* fully and instantaneously adjusts to demand;

iii) an increase in the real value of investment undertaken by the firms, assuming that real supply is exogenously given.

Table 7 shows parameter values under each scenario.

[12] An *R* code and a *Python* code reproducing both the model baseline and the experiments are available at: https://github.com/marcoverpas/.

3.1 Model closure

Figure 3 (a) shows demand components under scenario (1), that is, following an increase in real investment of firms in a monopoly-price world.[13]Unsurprisingly, workers' real consumption increases too. Its new steady-state value is higher than the pre-shock one. Unlike workers' consumption, capitalists' consumption peaks after a few periods and then falls. Its new steady-state value is slightly below the initial value. This is mostly due to the fall in firms' profits, which keep increasing as demand increases, but reduce as the interest burden takes over.[14] Eventually, the stock of loans stops growing – quadrant (b) – and capitalists' income stabilizes. Consumption plans of both workers and capitalists are fully met – quadrant (d).

What happens if real supply does not fully and instantaneously adjust to the higher demand generated by a higher investment? The unit price of output grows, thus reducing workers' real consumption below their desired or target level. In the short run, workers' consumption reduces, because of the higher price of products. By contrast, capitalists' consumption increases, fostered by the higher investment. The well known Kaleckian reformulation of Keynes' "widow's cruse" principle (the higher firms' aggregate investment, the higher will be aggregate profit) is confirmed.

If potential output adjusts to current output over time (scenario (2)), then the new steady-state value of workers' consumption can be above the initial level, whereas capitalists' consumption reduces as firms' profits scale down. This is the case portrayed by Figure 4 (a,c), in which there is a mixed adjustment involving both quantities and prices. By contrast, if potential output is exogenously set (scenario (3)), then the new steady-state value of workers' consumption is lower than the initial value. Capitalists' consumption is permanently higher instead. This is the case portrayed by Figure 5 (a,c), in which real output is fixed and the unit price adjusts in such a way to clear the market. While workers' planned consumption is only temporarily lower than the planned one under scenario (2), workers never fulfill their plans under scenario (3) – compare Figure 4 (d) with Figure 5 (d).

These results resemble Joan Robinson's "inflation barrier": faster growth is funded not by the saving of the capitalists, but rather by the austerity imposed on workers through a lower real wage.

Figure 6 shows that, if supply is exogenously given and workers' voluntary saving is not enough to fund firms' investment plans, workers are *forced to save* by paying a higher price for consumption goods. By contrast, capitalists' consumption is not affected.[15]

Needless to say that Graziani and other TMC authors are fully aware that, in the real world, individual firms usually behave like price- not quantity-makers. Yet the assumption of a full "market-clearing price" mechanism allows them to show that both the level and the composition of real output are eventually decided by the firms. The purchasing power of wages is only defined at the end of the monetary circuit, when firms set the price in such a way to fund their investment (and their owner's consumption) plans.

In a single-good model, output destination can be logically assumed to be defined at the end of the production process, as firms set the unit price. However, when multiple productions are factored in, the composition of output is predetermined before the production process takes place. At the macroeconomic level, *ex-post* price decisions only validate *ex-ante* production decisions. A rise in the price of products (inflation) is relevant precisely because it redistributes purchasing power from the workers to the dominant class.[16]

[13] As mentioned, the labour force is assumed to be plentiful.

[14] Notice that the fall in firms' profits cannot be offset by an increase in banks' profits, because it is assumed that $r_l = r_m$, which implies $F_b = 0$ in this simplified model.

[15] There is here a clear resemblance with the approach of Keynes's *Treatise on Money* (1930).

[16] Significantly, the article in which Graziani first describes the TMC sequence deals with the nature of inflation as a change in relative prices and its effects on income distribution (Graziani 1977).

If price expectations are wrong, *actual* real consumption will be different from *expected* consumption. Figure 4 (*d*) and Figure 5 (*d*) show that actual consumption of workers can also differ from their *planned* consumption, meaning from the quantity of goods that they would have consumed if supply fully adjusted to demand (and the unit price was fixed). This is the way class divide enters the scene. Not only can workers purchase only a share of output, but their consumption plans can be downsized at any time because of firms' and capitalists' purchasing plans.[17]

An interesting implication is that, while the individual worker can consume more by reducing her portfolio of corporate securities (thus downsizing her stock of wealth), this requires someone else to be willing to save more. Real income for the working class as a whole is only defined by their actual consumption, whereas the stock of wealth is purely "notional". Firms' debt to them (that is, the existing stock of securities) is purely notional too. If the workers do not wish to increase their deposit holdings, they can only exchange their securities for products or other securities. As a result, there is no monetary loss for the firms. If the workers do increase their deposit holdings, firms' debt ceases to be notional. However, this happens precisely because it is no longer a debt to the workers, and has turned into a debt to the banks.[18]

3.2 Initial finance of production vs investment funding

As is well known, initial finance is defined – by TMC theorists – as the flow of new credit supplied by the banks to firms at the beginning of the period, thus enabling them to start the production process. If firms are considered as one integrated and consolidated sector, initial finance must only cover the wage bill. "All the other exchanges can be neglected, being internal to the firms sector" (Graziani 2003: 27). At a lower level of abstraction, however, individual firms must "cover not only the wage bill but other current costs, including possible purchases of durable goods, such as machinery and other forms of investment" (*Ibidem*).

Moving to the end of the production process, final finance is defined as the flow of money that firms are able to collect by selling products and/or securities. If firms obtain additional loans to fund the purchase of capital goods, that liquidity also flows back to the firms, which use it to repay (partially) their debt to the banks.

Is this narrative consistent with the standard SFCM accounting, in which new loans equal the amount of investment that has not been funded through security issues and internal funds? The answer is yes, it is. Although based on different accounting timings, the TMC and SFCMs share the same theoretical presuppositions (Godley/Lavoie 2007; Zezza 2012; Veronese Passarella 2017; Nikiforos and Zezza 2022).

This has been shown in practice in Section 2.3. The initial amount of credit demanded by the firms (FIN_i) allows them to cover the costs of production. Firms then use their revenues from sales and security issues, net of interest payments and distributed profits, to pay back a portion of their new debt to banks (FIN_f). Therefore, the change in the stock of debt at the end of the period equals the amount of private saving that has not been turned into corporate securities and/or internal funds. This, in turn, necessarily matches the amount of firms' investment that has not been funded by other sources (see also Lavoie/Zezza 2020 on this point).

At the macroeconomic level, investment is never *financed* by bank credit. Rather, firms' production plans are financed by bank credit, whereas investment is always *ex-post funded* by saving (be it voluntary or forced). Although each individual firm may well need credit to purchase capital goods, there is no *logical* reason to assume that investment-related loans are demanded *at the beginning of the period*. These loans are only necessary to lubricate firms' internal exchanges, which can only take place once capital goods have been produced. This

[17] It is implicitly assumed that banks are always fully accomodative – see Figure 4 (*b*) and Figure 5 (*b*).
[18] The same considerations hold for the flow of interest payments between workers, firms and banks.

shows the *auxiliary* nature of investment-related loans (when firms are considered as one aggregated sector). Money acts as capital as long as firms undertake the only fundamental external purchase of capitalism: that of labour force.

3.3 The role of consumer credit

A similar reasoning applies to consumer credit. Several authors have suggested that, in the real world, consumer credit would be another source of initial finance, in addition to production-related bank loans (e.g. Botta et al. 2015). This claim seems to arise from a theoretical misunderstanding with the TMC. The adjective "initial" does not merely mean "new". Nor does it refer to a mere historical-time sequence. It refers to a *logical priority* that, in turn, reflects existing *class relations* under capitalism.

Bank loans that firms obtain to purchase labour force are of *different (class) nature* compared with loans obtained by the consumers (or other economic agents). The former are logically necessary for capitalism to be there. They allow the capitalist class to command over the production process. Hence their priority position in the monetary circuit sequence. On the other hand, the function of consumer credit is to support consumption, thus making it easier for the firms to repay their debt. Important though they are in most modern-day economies, consumer credit, household mortgages and other final sources of money embody no necessary class relation.[19]

It is only money used to hire workers that acts as (initial) capital, thus giving rise to a class domination. By contrast, money used to buy products allows the firms to realize the produced value. This is the reason consumer credit must be put at the end (not at the beginning) of the monetary circuit. Macroeconomically, it is an indirect subsidy to private firms, that is, an additional flow of final finance that shifts the debt burden from firms to households. The TMC is an abstract representation of the *necessary* dominant social relations within a capitalist economy, not a rough sketch of a pre-financialization manufacturing economy![20]

3.4 The paradox of profit (and interest payment)

The so-called "paradox of profit" is the impossibility for the firms to obtain from the market more money than they obtained from banks in each period. The point is that "in a credit economy, in a single period, the revenues of firms can at most equal the initial finance received for production costs and they do not cover interest payment" (Caverzasi/Godin 2015: 13). This paradox only arises if it is assumed that the initial finance demanded by firms only covers the wage bill. When this happens, firms can only make profits in real terms, unless there are external sources of money (notably, State money and/or foreign currencies).

Clearly, the paradox is due to the high level of abstraction of the model. Once investment-related loans to firms are factored in, the paradox fades away. Far from signaling an unresolved problem in the circuit, the paradox of profit sheds light on a neglected role of government spending (and net export). Not only the latter supports aggregate demand. It also allows private firms to *monetize* their real profits, given the velocity of circulation of money – as Luxemburg and Kalecki were fully aware of (e.g. Bellofiore/Veronese Passarella 2009; Bellofiore 2019).

One might wonder how can firms pay the interest accruing on bank loans if the latter are just enough to cover the wage bill and investment. The answer is that there is no reason to assume the "financial period" (starting when bank loans are created, and ending when loans are paid back) to match the "production period" (during which firms pay the interests to

[19] By contrast, no good can be consumed, no saving can be made, no asset/liability can be issued, and no loan can be granted, if private firms do not purchase labour power in exchange for a money wage first.

[20] On this point, see also Veronese Passarella (2014).

banks using their revenues from sales, thus enabling the bank owners to receive and spend their incomes). If the former is longer than the latter – as it seems reasonable to admit – then, in principle, production firms can pay back both the initial capital and the interest accrued on it (Zezza 2012). This is the assumption that pure bank-money SFCMs, like model BMW, are implicitly based upon.[21]

3.5 Keynes or Marx?

Graziani's TMC looks both Keynesian and Marxian. The reason is twofold. First, although Graziani's TMC bears a clear resemblance with Keynes's works, it is no secret that a strong preference is assigned to the *Treatise on Money* (1930) and 1937-39 essays after the *General Theory* (1936).

More precisely, Graziani's approach is grounded in the *hidden* line of research including the Second Volume of Marx's *Capital* of 1885, Wicksell's *Interest and Prices* of 1898, Schumpeter's *The Theory of Economic Development* of 1911, Keynes' *Treatise on Money* of 1930, and Kalecki's writings. The thin thread that connects all those works is the understanding of capitalism as a circular sequence of production and distribution relations between different social classes, activated by an initial inflow of money. By contrast, the way money is theorized in the *General Theory* (that is, as a stock of liquidity) is not regarded as fully satisfactory.

It is no coincidence that one of Graziani's seminal works on the TMC was entitled *Moneta senza crisi* ("Money without crisis").[22] The point is that one must explain how money is created, used, and destroyed, abstracting from a temporary rise in liquidity preference. When economic agents use money as store of value, money does not act as capital. It acts as gold, be it commodity money or credit money.[23]

Graziani's TMC resembles here more Marx's objective theory of the capitalist circulation of money – the well-known sequence $M - C - M'$ (Marx 1885), which Keynes himself praised (Keynes 1933) – than the subjective analysis of precautionary and speculative motives for holding cash provided by the *General Theory*. The point is that the chief function of money under capitalism is to act as *capital*. However, money only acts as capital when it is used to start the production process, that is, when it is spent to buy labour force.

Second, it has been argued that there is no room for consumer sovereignty in Graziani's TMC. Without a direct intervention of the State in the economy (that is, a direct provision of goods and services to divert resources from the dominant class to the workers), sovereignty remains firmly in the hands of private firms. This also explains why, unlike most post-Keynesian authors, Graziani explicitly advocates a macro-monetary interpretation of Marx's labour theory of value (Bellofiore/Veronese Passarella 2016).

The point is that capital valorization, for the firms taken as one integrated and consolidated sector, can only arise from exchanges that firms make *outside* their sector. Yet, the only possible "external exchange" for the firms is the purchase of labour power from the workers. At the macroeconomic level, firms can only make a monetary profit if the total direct labour time spent in the production process exceeds the quantity of labour time that the workers *recover* by spending their income on the goods market (Graziani 1997a, 1997b).[24]

If employment N is expressed in labour-time units (e.g. working hours), then the surplus

[21] On this point, see also Lavoie (2021).

[22] The article was published twice. An early version of it was published as a book chapter in 1982. A revised version was published as a journal article by *Studi Economici* in 1984 (Graziani 1984).

[23] As is well known, for Keynes, the Indian rupee was "virtually a note printed on silver" (Keynes 1913: 26). The point is that, under capitalism, money is of credit nature even when it is backed by silver, gold, or other precious metals. This relation can be somewhat reversed by noticing that credit money still acts as a commodity money when it is used as a store of value.

[24] Incidentally, this approach is coherent with the so-called "Price of Net Product-Unallocated Purchasing Power" interpretation of Marx's theory of value advocated by Duménil/Foley (2016).

labour time can be simply defined as:

$$SLT = \frac{c_z + i}{pr} \tag{48}$$

Similarly, the necessary labour time is:

$$NLT = \frac{c_w}{pr} \tag{49}$$

The former is the quantity of labour time spent on producing goods for the capitalist class. The latter is the residual amount of time, that is, the labour time that workers *recover* – so to speak – by purchasing products on the market. Therefore, the surplus or exploitation rate is:

$$\varepsilon = \frac{SLT}{NLT} \tag{50}$$

Figure 7 (*a*,*b*) shows the surplus labour time and the exploitation rate of the workers under alternative scenarios. Both the amount of surplus-labour and the exploitation rate are magnified by a higher autonomous spending, independently of its source. This happens because a larger demand is associated with a higher quantity of direct labour spent in the production process (hence a longer time in which the workers produce goods that are appropriated by other sectors and social groups).

However, the increase in the exploitation rate is only temporary if production eventually adjusts to demand (scenarios 2 to 4), for the longer working day is eventually matched by a proportional increase in the necessary labour time. By contrast, the exploitation rate remains permanently higher (compared with its baseline value) if real supply is fixed. In fact, the actual or *ex-post* exploitation rate of workers can differ from the expected one, because of firms' autonomous decisions concerning the level and composition of output (be those decisions made either directly, by setting output structure, or indirectly, by setting the costing margin).

Workers have no sovereignty in the circulation sphere (consumption) because they have no sovereignty in the production sphere.[25] This is one of the key messages of the TMC.

4 Final remarks

The aim of the paper was twofold. First, it showed how a standard stock-flow consistent model (SFCM) could be amended to incorporate some fundamental insights (about initial finance, interest payments, and alternative model closures) from the theory of monetary circuit (TMC). Second, it addressed some common misconceptions about the TMC. More precisely, it has been argued that: *a*) a market-clearing price mechanism does not necessarily imply a neoclassical-like closure of the model; *b*) the ways in which SFCMs and the TMC define bank loans are mutually consistent, although they are based on different accounting periods; *c*) consumer credit is final finance, not initial finance; *d*) the paradox of profit is not a logical conundrum, but an abstract counterfactual that allows shedding light on the role of external sources of liquidity; *e*) overall, the TMC can be regarded as a "Marxian" rendition of Keynes's method of aggregates. One of the most radical implications is that workers are not sovereign in the consumption market because they lack control in the production process. This, in turn, is a product of the monetary nature of capitalist relations. For money is neither a mere lubricant of the exchanges, nor simply a store of value during periods of uncertainty. Money is, above all, an instrument of class domination.

[25] In principle, workers could react to the extra-exploitation by reducing their work intensity (here labour productivity). If this happens, firms might be forced to revise their production plans (e.g. Bellofiore et al. 2000). However, this aspect is not developed further in this paper.

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A Charts

Figure 1: Sankey diagram of the model

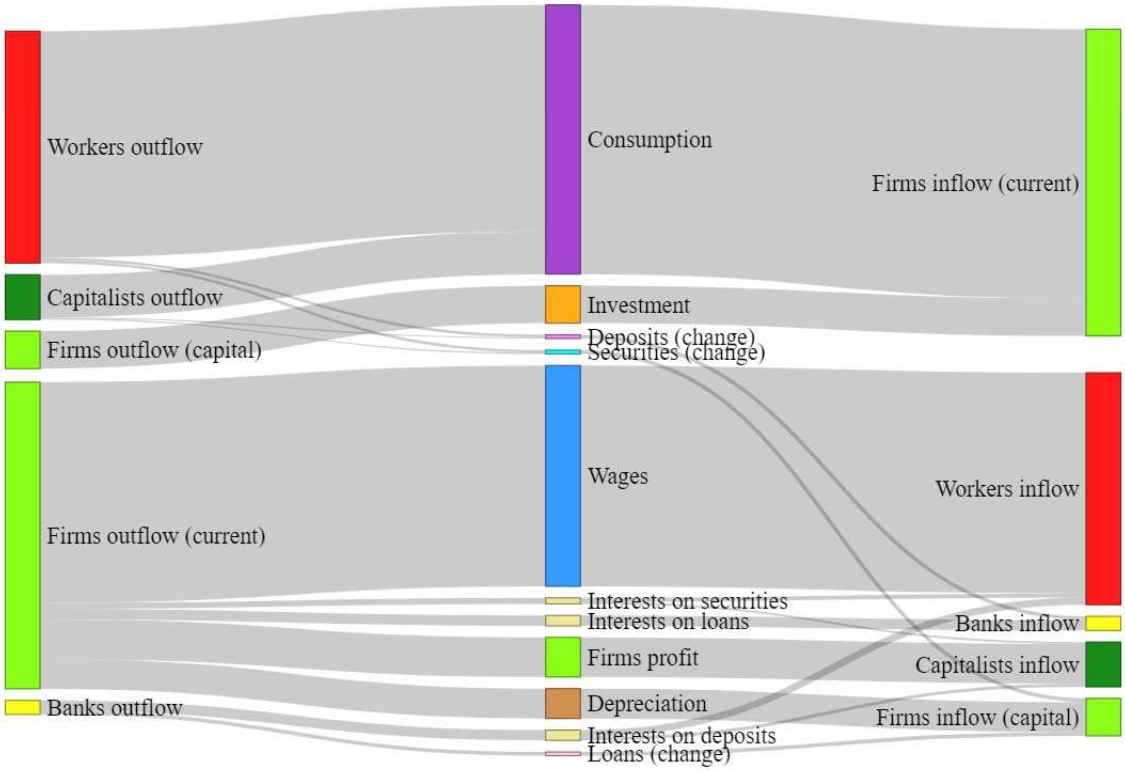


Figure 2: Baseline values and model dynamics following a rise in autonomous consumption

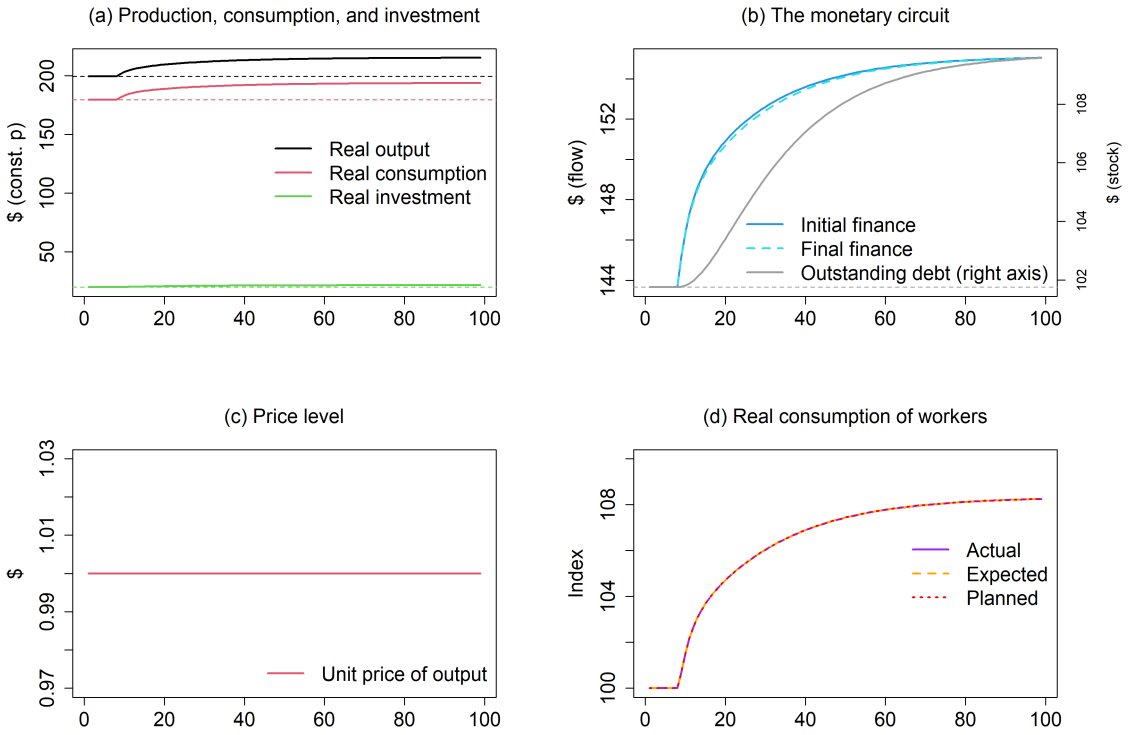


Figure 3: Higher investment with quantity adjustment

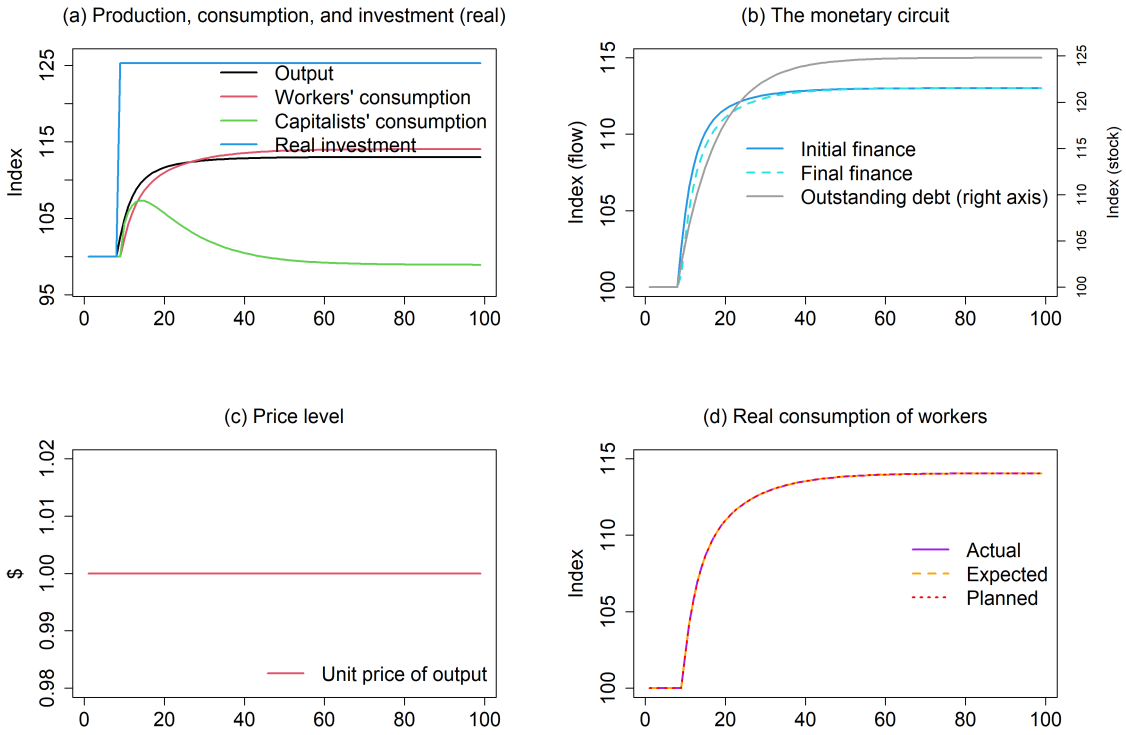


Figure 4: Higher investment with mixed adjustment ($\sigma = 0$)

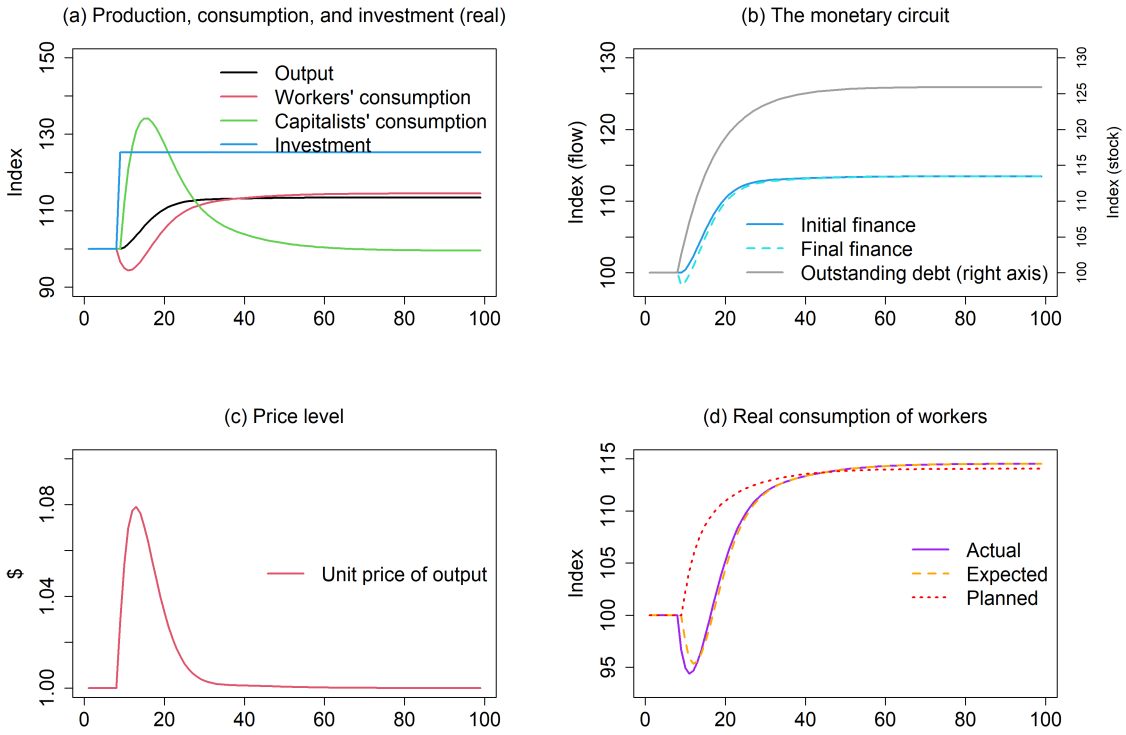


Figure 5: Higher investment with price adjustment ($\sigma = 0$, $\gamma_y = 0$)

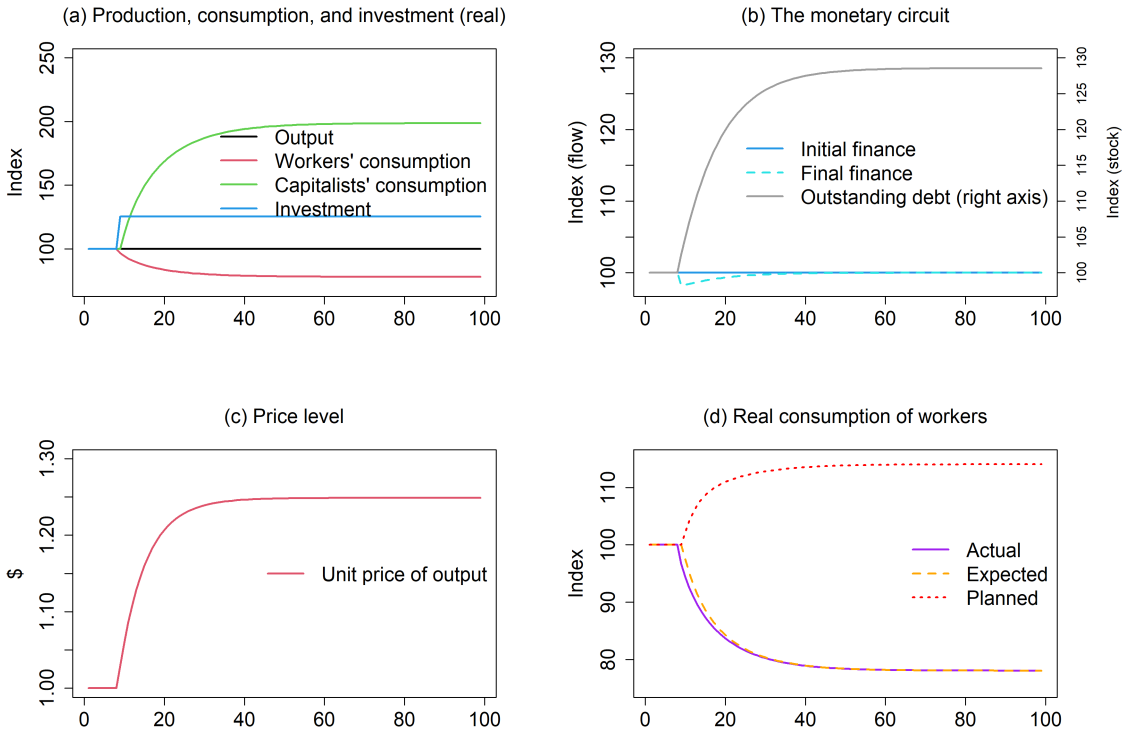


Figure 6: Consumption and saving following a rise in investment with price adjustment

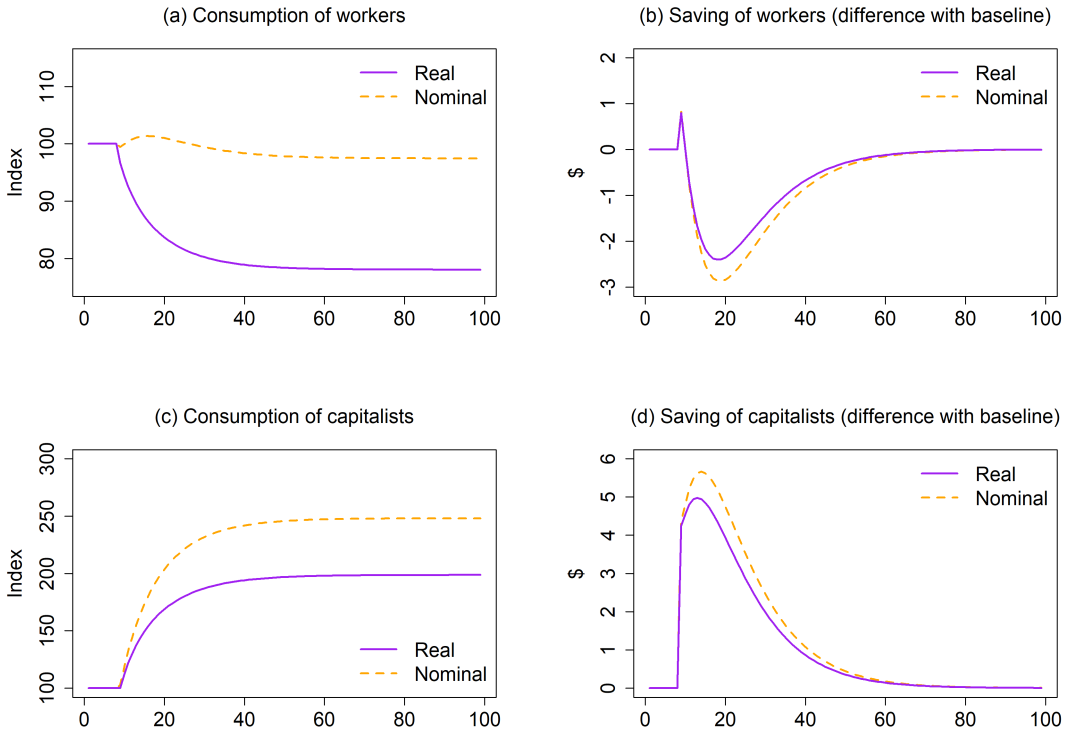
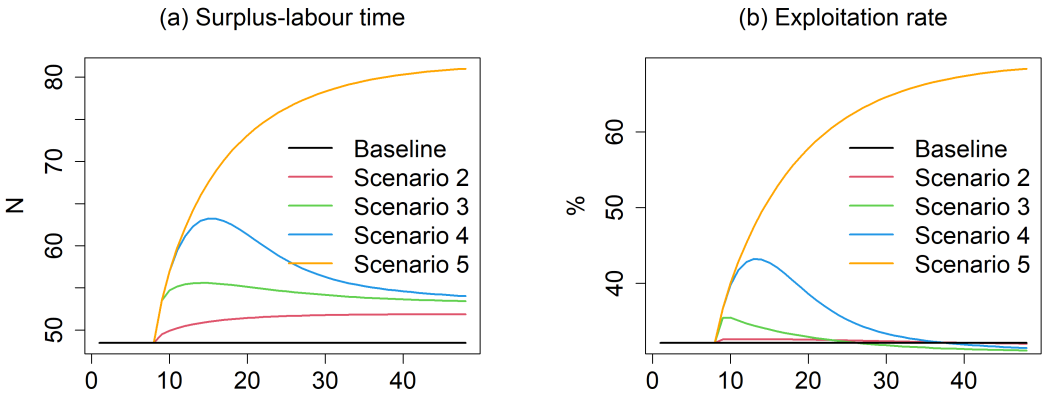


Figure 7: Surplus labour under alternative scenarios



Notes: Scenario 2 = higher autonomous consumption; Scenario 3 = higher investment with quantity adjustment; Scenario 4 = higher investment with mixed adjustment; Scenario 5 = higher investment with price adjustment