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FISCAL AND MONETARY POLICIES IN A KEYNESIAN STOCK-FLOW CONSISTENT MODEL

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ABSTRACT

Following the New Classical Macroeconomics and the New Keynesian Macroeconomics, the independence of central banks significantly increased after 1990, which could preclude the coordination between the fiscal and the monetary policies. The purpose of this paper is to consider the stabilizing effects of fiscal policy within the framework of the new monetary policies implemented by independent central banks.

Firstly, we build a Post Keynesian stock-flow consistent (SFC) model with a private banks sector introducing more realistic features. New Keynesian Macroeconomics replaces the three equations of the Keynesian synthesis (IS-LM-Phillips Curve) by three new equations of the new consensus: an IS relation, a Taylor Rule and a New Keynesian Phillips Curve (IS-TR-NKPC). Our Post Keynesian SFC model replaces the IS relation.

Secondly, we make simulations by imposing supply shocks (cost push) corresponding to an inflationary shock. The consequences are examined for two kinds of policy mix, for two countries:

- For country (1), monetary policy is determined by a standard Taylor rule that corresponds to a dual mandate: output gap and inflation gap. Fiscal policy has a countercyclical effect. Broadly speaking, country (1) describes the United States.
- For country (2), monetary policy is determined by a 'truncated' Taylor rule that corresponds to a unique mandate: inflation gap only. Fiscal policy is neutralized, because we assume that the ratio of the current deficit of the Government (GD) on the GDP is constant and equal to zero, as imposed by the Maastricht Treaty. Broadly speaking, country (2) describes the European Union.

Keywords: Monetary policy, fiscal policy, stock- flow consistent model, post-keynesian macroeconomics

JEL Classification: C15, E12, E31, E4, E52, E61, E62, G11

FISCAL AND MONETARY POLICIES IN A KEYNESIAN STOCK-FLOW CONSISTENT MODEL

Edwin Le Heron

Following the New Classical Macroeconomics (NCM) and the New Keynesian Macroeconomics (NKM), the independence of central banks significantly increased after 1990, which could preclude the co-ordination between the fiscal and the monetary policies. The purpose of this chapter is to consider the stabilizing effects of fiscal policy within the framework of the new monetary policies implemented by independent central banks. We contrast a rule on public expenditures with a rule on public deficits. In order to do so, we develop a two-country model. In the first country, the government implements a fiscal policy with automatic stabilizers and a central bank has a dual mandate: inflation and growth. There is a co-ordination between fiscal and monetary policies. The second country implements an orthodox fiscal policy (balanced budget) and the central bank has a unique objective: inflation.

In the first part of the paper, we build a Post Keynesian stock-flow consistent (SFC) model (Lavoie and Godley, 2001, 2007, Dos Santos and Zezza, 2004, Mouakil, 2006) with a private banks sector introducing more realistic features. We introduce the borrower's and the lender's risks from the Minskian approach. New Keynesian Macroeconomics replaces the three equations of the Keynesian synthesis by three new equations of the new consensus: an IS relation, a Taylor Rule (TR) (Taylor, 1993) and a New Keynesian Phillips Curve (NKPC) (Taylor, 1979). IS-LM-Phillips Curve has been changed into IS-TR-NKPC. Our Post Keynesian SFC model (59 equations) replaces the IS relation. Then, we add two of the three equations of the new consensus in macroeconomics: a Taylor rule and a NKPC. IS-TR-NKPC is changed in SFC-TR-NKPC.

In the second part, we simulate the model to study the stabilizing effects of fiscal policy. The aim is to analyze the consequences of a supply shock within our two assumptions on the policy mix. If the society seeks after three aims: stability of prices, full employment and stability on the financial markets, we can measure the welfare performance of our policy mix by their welfare cost deduced from the loss function of the society. We make a comparison for the two countries.

A POST KEYNESIAN STOCK-FLOW CONSISTENT GROWTH MODEL WITH A FULL BANKING SECTOR, A TAYLOR RULE AND A NEW KEYNESIAN PHILLIPS CURVE

Building a stock-flow consistent model requires three steps: writing the matrices, counting the variables and the accounting identities issued from the matrices, and defining each unknown with an equation (accounting identity or behavioural equation).

Matrices

Five sectors form our economy: government, firms, households, private banks and central bank. All production must be financed. However, current production is financed by the working capital of entrepreneurs (retained earnings) and by contracted revolving funds granted by banks at the current rate of interest. These two factors constitute a shock absorber to possible monetary rationing by banks. We are essentially limiting our study to the effects that monetary policy might have on new financing for investment and growth of production.

Let us proceed to examine the gross supply (φ) and the net supply (ΔF) of finance by banks – that is to say, the new flow of money, as opposed to the existing stock of money (D). Also, there is a stock of money demand equal to transaction, precaution, finance and speculative motives, whereas the desired gross finance demand (φ^d) represents the new flow of financing required by firms (I^d) plus the redemption of the debt (amortization = amort) minus the undistributed profits (P^u). Thus the internal funds of firms (IF) represent the undistributed profits (P^u) minus the redemption of the debt (amort). Assuming a closed economy, demand for money can be satisfied by banks, either by the stock markets or by credit. At the end of the period, net financing demand (ΔF_D) can be constrained by net money supply from banks (ΔF) (granted financing - paid off financing - amortization). ΔF determines monetary creation in the period.

We discuss here a closed economy. Firms issue equities, bonds with fixed rates of interest and commercial papers, and borrow money from banks to finance investments but they neither hold money balance. They have excess capacity but no inventories.[1] Two factors are involved in producing goods (fixed capital and labour), but we deal with a vertically integrated sector and hence ignore all intermediate goods. Banks have no operating costs and they don't make loans to households. Contrary to Lavoie-Godley (2001), private banks own a net wealth and retain all their profits.

The central bank has neither operating costs nor net worth. The central bank pays all its profits to the government, which collects taxes from households and finances its deficit by issuing Treasury bills. Government expenditures are only final sales of consumption goods: there is neither operating costs (like wages for state employees) nor transfers between households. The financial behaviour of households is simplified: they hold only banking deposit account (current accounts and time deposits).

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1 Excess capacity exists because of expectations of future demand, entry barriers, cost minimization, time-taking production. For the role of inventories see Godley and Lavoie (2007: chapter 9).

SFC modelling is based on two tables: a balance sheet matrix (stocks) and a transactions matrix (flows). Table 8.1 gives the transactions matrix that describes monetary flows between the five sectors of the economy. Every row represents a monetary transaction, and every column corresponds to a sector, which is fragmented in a current and a capital account, except in basic cases such as the government and that of households. Sources of funds appear with plus signs and uses of funds with negative signs, so every row must sum to zero seeing that each transaction corresponds always simultaneously to a source and a use of funds. The sum of each column must also be zero since each account (or sub-account) is balanced.

Sector / Operation	Govt	Firms: Current	Firms: Capital	Households	Private banks: Current	Private banks: Capital	Central Bank (CB): Current	Central Bank (CB): Capital	Σ
Consumption		$+ C$		$- C$					0
Government expenditures	$- G$	$+ G$							0
Net investment		$+ I$	$- I$						0
Wages		$- W$		$+ W$					0
Taxes	$+ T$			$- T$					0
Interest on Treasury Bills	$- i_{b\,-1}.B_{-1}$				$+ i_{b\,-1}.\ B_{-1}$				0
Interest on loans		$- i_{l\,-1}\ .L_{-1}$			$+ i_{l\,-1}\ .L_{-1}$				0
Interest on comm. paper		$- i_{cp\,-1} \cdot CP_{-1}$			$+i_{cp\,-1} \cdot CP_{-1}$				0
Interest on bonds		$- i_{of} \cdot of_{-1}$			$+ i_{of} \cdot of_{-1}$				0
Interest on bank deposits				$+ i_{d\,-1}.D_{-1}$	$- i_{d-1}.D_{-1}$				0
Interest on CB advances					$- i_{cb\,-1}\ .REF_{-1}$		$+i_{cb\,-1}\ .REF_{-1}$		0
Profits of firms		$- P$	$+ P^u$		$+ P^d$				0
Profits of banks					$- P_b$	$+ P_b$			0
Profits of CB	$+ P_{cb}$						$- P_{cb}$		0
Δ HPM						$- \Delta H$		$+ \Delta H$	0
Δ T Bills	$+ \Delta B$					$- \Delta B$			0
Δ equities			$+ \Delta e\ .\ p_e$			$- \Delta e\ .\ p_e$			0
Δ loans			$+ \Delta L$			$- \Delta L$			0
Δ commercial paper			$+ \Delta\ CP$			$- \Delta\ CP$			0
Δ bonds			$+ \Delta of \cdot p_{of}$			$- \Delta of \cdot p_{of}$			0
Δ bank deposits				$- \Delta D$		$+ \Delta D$			0
Δ CB advances						$+ \Delta REF$		$- \Delta REF$	0
Σ	0	0	0	0	0	0	0	0	0

Table 8.1: Transactions matrix

Table 8.2 gives the balance sheet matrix of our economy. Symbols with plus describe assets and negative signs indicate liabilities. The sum of every row is again zero except in the case of accumulated capital in the industrial sector. The last row presents the net wealth of each sector.

Table 8.2: Balance sheet matrix

Sector / Assets	Government	Firms	Households	Private banks	Central Bank	Σ
Capital		+ K				+ K
HPM high powered money				+ H	- H	0
Treasury Bills	- B			+ B		0
Equities		$- e \cdot p_e$		$+ e \cdot p_e$		0
Loans		- L		+ L		0
Commercial paper		- CP		+ CP		0
Bonds (fixed-yield)		$- of \cdot p_{of}$		$+ of \cdot p_{of}$		0
Bank deposits			+ D	- D		0
CB advances				- REF	+ REF	0
Net wealth	- B	$+ V_f$	+ D	$+ V_b$	0	+ K

Variables and accounting identities

Building a model that describes the monetary economy of production discussed above in a consistent way requires that the transactions matrix should be properly translated into equations. First, the model must contain the 26 variables of the matrix. Each of these 26 variables can be associated with the behaviour of one of the five sectors of our economy.

Government: G, T, B, i_b
Firms: I, W, P, P^u, P^d, e
Households: C, D
Private banks: $i_l, L, i_{cp}, CP, i_{of}, p_{of}, of, p_e, i_d, P_b$
Central Bank: H, i_{cb}, REF, P_{cb}

Second, we must use the accounting identities resulting from each row and each column sum to zero. We have nine accounting identities corresponding to the eight columns of the transactions matrix and to the non-ordinary row[2]. To start we transcribe the identities (uses of funds on the left side, sources of funds on the right side) without being precise how we will use them in the model:

(i) $G + (i_{b-1} \cdot B_{-1}) \equiv T + P_{cb} + \Delta B$

(ii) $W + (i_{l-1} \cdot L_{-1}) + (i_{cp-1} \cdot CP_{-1}) + (i_{of} \cdot of_{-1}) + P \equiv C + I + G$

(iii) $I \equiv P^u + (\Delta e \cdot p_e) + \Delta L + \Delta CP + (\Delta of \cdot p_{of}) \equiv \varphi + P^u - amort$

(iv) $C + T + \Delta D \equiv W + (i_{d-1} \cdot D_{-1})$

(v) $(i_{d-1} \cdot D_{-1}) + (i_{cb-1} \cdot REF_{-1}) + P_b \equiv (i_{b-1} \cdot B_{-1}) + (i_{l-1} \cdot L_{-1}) + (i_{cp-1} \cdot CP_{-1}) + (i_{of} \cdot of_{-1}) + P^d$

(vi) $\Delta H + \Delta B + (\Delta e \cdot p_e) + \Delta L + \Delta CP + (\Delta of \cdot p_{of}) \equiv P_b + \Delta D + \Delta REF$

2 What we call non-ordinary row is the row concerning profits of banks that includes three different variables (see ix).

(vii) $P_{cb} \equiv i_{cb-1} \cdot REF_{-1}$
(viii) $\Delta REF \equiv \Delta H$
(ix) $P \equiv P^u + P^d$

A feature of SFC models is that if there are M columns and N non ordinary rows in the transactions matrix, then there are only (M + N – 1) independent accounting identities in the model. Because of this one equation must be dropped: we shall use exactly eight accounting identities in the model. Concerning the balance sheet matrix, it is simpler: we just make sure that initial values of stocks are consistent with the matrix. In the following periods, stocks will stay consistent since our eight identities will generate consistent flows. Now we must define every variable relative to the five sectors using an accounting identity[3] or a behavioural equation. When we introduce new unknowns in a behavioural equation we define them immediately so that our model should have the same number of equations as unknowns.

The national income (Y) adds the household consumption (C), investment of the firms (I) and the public expenditure (G). The rate of growth of the national income is gr_y:

(8.1) $Y = C + I + G$
(8.2) $gr_y = \Delta Y / Y_{-1}$

Two fiscal policies for the Government: G, T, B, i_b

The government collects only taxes from households (on wages):

(8.3) $T = \tau \cdot W_{-1}$ With τ: constant

The government finances any deficit issuing bills, so that the supply of treasury bills (B) in the economy is identical to the stock of government debt. In other words, it is given by the pre-existing stock of debt plus its current deficit (GD). The current deficit of the Government includes the redemption of the National debt. We assume that private banks give limitless credit to government at the long-term rate of interest:

(8.4) $B = B_{-1} + GD$
(8.5) $i_b = i_l$

To analyze the consequences of a supply shock, we assume two different assumptions for the fiscal policy. We contrast a rule on public expenditures (F1) with a rule on public deficits (F2).

Assumption 1 (F1): A stabilizing effect of the fiscal policy

First, we assume that public expenditure (G) is always growing at the same rate (gr_y) as the national income (Y). With F1, public expenditure is pro-cyclical, because G falls with the GDP. But the final effect of the fiscal policy is measured by the government deficit (GD). Tax revenue is proportional to income and hence varies in line with the public expenditure. But with a contractionary monetary policy and its higher interest rate, the financial costs of the national debt increase. The global impact is linked to the key interest rate and, then, to the monetary policy. It looks like a co-ordination between the monetary and the fiscal policies. With F1, the economy has a

3 When we use an accounting identity we often need to rewrite it so we will always recall its number (using Roman numeral), rendering it more easily recognizable by the reader.

self-stabilizing tendency due to the fiscal policy, though the fiscal policy effect comes through the effects of interest rate on the budget deficit.

(8.6-F1) $G = G_{-1} \cdot (1 + gr_{y\,-1})$

(8.7-i-F1) $GD = G + (i_{b-1} \cdot B_{-1}) - T - P_{cb}$

Assumption 2 (F2): a 'neutral' fiscal policy

Second, we assume that a 'neutral' fiscal policy corresponds to a constant ratio (r_{GD}) of government deficit-to-the last national income: DB/Y_{-1}. It is more or less the case of the Maastricht treaty of the European Union. The stability and growth pact of the Treaty decrees that 'Member States shall avoid excessive government deficits'. Then we use the first accounting identity to calculate the adequate public expenditure. In experiences, we shall take the ratio (r_{GD}) equal to zero as is required by the Maastricht treaty. Contrary to the previous assumption, the public debt is zero, since the budget is balanced. As the interest rate does not act on fiscal policy, there is no co-ordination between the fiscal and the monetary policies.

(8.6-F2) $GD = r_{GD} \cdot Y_{-1}$ With r_{GD}: constant

(8.7-i-F2) $G \equiv GD - (i_{b-1} \cdot B_{-1}) + T + P_{cb}$

With these assumptions, we should better understand the links between monetary policy and fiscal policy (Figure 8.1)[4]:

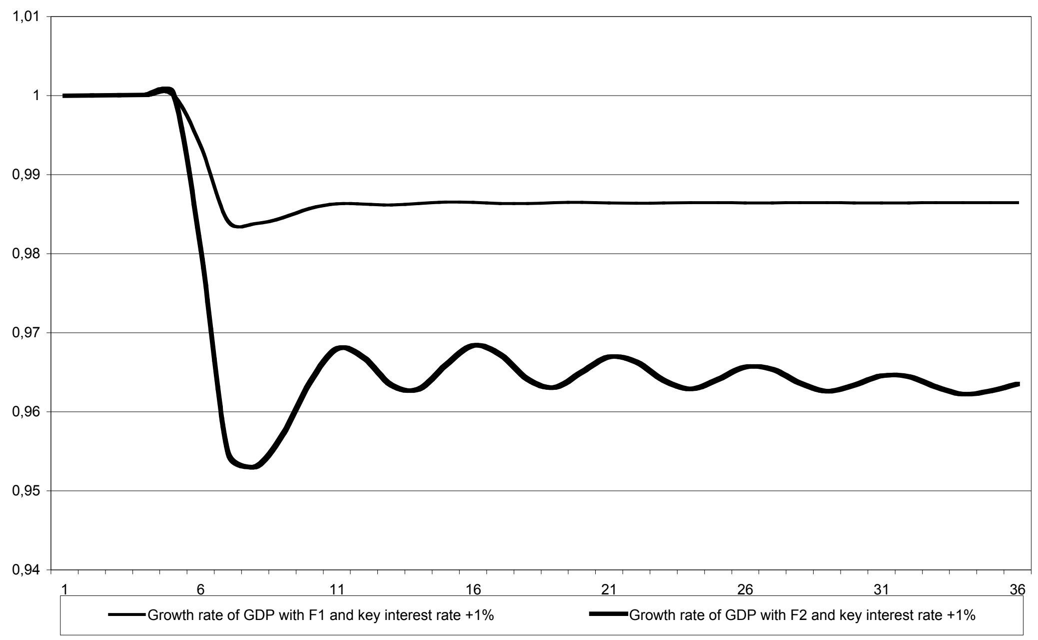


Figure 8.1 Higher key interest rate (from 2 to 3% after 2005): effects on the growth rate of the economy with F1 and F2

4 In all the figures (except the figure 8.4), all values on the vertical axis are homogenized to one for the steady state.

Firms: I, W, P, P^u, P^d, e, OG

The investment function is the most important one in a growth model. The stock of capital increases with the flow of net investment (I) that is financed by the total of external funds from commercial banks (gross finance = φ) and by the internal funds of firms. The self-financing of firms corresponds to the retained earnings (P^u) minus the redemption of the debts of firms (amort). Amortization concerns only the debt: loans (L), bonds (OF) and commercial papers (CP).

(8.8) $K = K_{-1} + I$

(8.9-iii) $I \equiv \varphi + IF$

(8.10) $IF = P^u - amort$

(8.11) $amort = (a_l \cdot L_{-1}) + (a_{of} \cdot of_{-1}) + (a_{cp} \cdot CP_{-1})$

In our model, we focus on the difference between actual investment (I) and the desired investment of firms (I_D). The banks accept to finance totally or in part the second one according their lender's risk (LR) (see equations 8.32, 8.33, 8.35). A monetary rationing on investment can exist ($\varphi<\varphi^d$ or $I<I_D$). The desired rate of accumulation (gr_{kD}) is function of an exogenous state of confidence (γ_0), the capacity utilization rate (u) and of the borrower's risk (BR), which is measured by the rate of cash flow (r_{cf}) and by the financial condition index (FCI). The rate of cash flow is the ratio of retained earnings to capital and the financial condition index captures the sensitivity of investment to the long-term interest rate, to the short-term interest rate and to the financial capitalization ratio. The lender's risk and the borrower's risk come from the analysis of H. Minsky.

(8.12) $I_D = gr_{kD} \cdot K\text{-}1$

(8.13) $\varphi^d = I^d - IF$

(8.14) $gr_{kD} = \gamma_0 + (\gamma_1 \cdot r_{cf\text{-}1}) + (\gamma_2 \cdot u_{-1}) - (\gamma_3 \cdot FCI_{-1})$ With γ_i: constant

where the rate of capacity utilization is defined as the ratio of output to full capacity output (Y_{fc}.):

(8.15) $r_{cf} = P^u / K_{-1}$

(8.16) $u = Y / Y_{fc}$

The capital-to-full capacity ratio (σ) is defined as a constant:

(8.17) $Y_{fc} = K_{-1} \cdot \sigma$ With σ: constant

(8.18) $FCI = (\mu_1 \cdot i_l \cdot L/K) + (\mu_2 \cdot i_{cb} \cdot CP/K) - (\mu_3 \cdot E/Y)$ With μ_i: constants

Concerning wages, they can be decomposed into a unit wage (w) times the level of employment (N):

(8.19a) $W = w \cdot N$

where employment is determined by sales given productivity (σ_2):

(8.19b) $N = Y / \sigma_2$ With σ_2: constant

The full employment (N_{fe}) is:

(8.19c) $N_{fe} = Y_{fc} / \sigma_2$ With σ_2: constant

The unemployment (Un) or the output gap (OG) are easily found:

(8.19d) $Un = N_{fe} - N$

(8.19e) $OG = Y - Y_{fc}$

The rate of unemployment r_{un} is:

(8.19f) $r_{un} = Un / N_{fc}$

For the model, we measure the output gap in ratio:

(8.19) $OG_R = (Y - Y_{fc}) / Y_{fc}$

We assume that the ratio 'wages on output' (W/Y) is exogenous and constant.

(8.20) $W = Y / \rho$ With ρ: constants

Total profits (P) of firms are the difference between their sales and their expenditures (wages and interest payments on loans, commercial papers and bonds):

(8.21-ii) $P \equiv Y - W - (i_{l-1} \cdot L_{-1}) - (i_{cp-1} \cdot CP_{-1}) - (i_{of} \cdot of_{-1})$

Distributed dividends (P^d) are a fraction of profits realized in the previous period:

(8.22) $P^d = (1 - s_f) \cdot P_{-1}$ With s_f: constant

Retained earnings (P^u) are determined as the residual:

(8.23-ix) $P^u \equiv P - P^d$

Equations concerning issues of equities by firms are usually oversimplified in SFC models. We simply assume that the stock of shares grows at the rate of the GDP with a lag of one year (gr_{y-1}): $\Delta e / e_{-1} = gr_{y-1}$. The more the economy grows, the more firms issue equities. There are two explanations. First it is easier to sell new equities when the economy and thus the profits grow. Second, firms need new finance to follow the growth of the GDP.

(8.24) $e = e_{-1} \cdot (1+gr_{y-1})$

Households: C, D

We assume that households determine their consumption expenditure (C) on the basis of their expected disposable income and their wealth of the previous period (that consist entirely of bank deposits: current accounts and time deposits):

(8.25) $C = (\alpha_1 \cdot Y_w^a) + (\alpha_2 \cdot Y_v^a) + (\alpha_3 \cdot D_{-1})$ With α_i: constant $1>\alpha_1>\alpha_2>\alpha_3>0$

(8.26) $Y_w^a = Y_{w-1} + \theta_h \cdot (Y_{w-1} - Y_{w\,-1}^a)$ With θ_h: constant

(8.27) $Y_v^a = Y_{v-1} + \theta_h \cdot (Y_{v-1} - Y_{v\,-1}^a)$

(8.28) $Y_w = W - T$

(8.29) $Y_v = i_{d-1} \cdot D_{-1}$

(8.30) $Y_h = Y_w + Y_v$

Whereas (Y_w^a) is the expected disposable income of workers, (Y_v^a) the expected disposable financial income and each (α_i) is a propensity to consume. There are adaptive expectations[5].

Following the Kaleckian tradition, we assume that wages are mostly consumed while financial income is largely devoted to saving ($1>\alpha_1>\alpha_2>0$). This class-based saving behaviour is of importance in a SFC model where interest payments play a great role. With the same high propensity to consume ($\alpha_1=\alpha_2$), an increase of the interest rates can move the economy to a higher growth path in the long run. The consumption decision determines the amount that households will save out of their disposable income Y_h:

(8.31-iv) $D \equiv D_{-1} + Y_h - C$

5 The expected value of any variable for current period (represented with the superscript *a*) depends on its value of the previous period plus an error correction mechanism where (θ) represents the speed of adjustment in expectations.

Private banks: i_l, L, i_{cp}, CP, i_{of}, p_{of}, of, i_d, p_e, P_b

Firms' financing is fundamental in a monetary economy of production. Firms begin by being self-financed then turn to external finance (ΔF_D). Banks only finance projects they consider profitable, but confidence in their judgment is variable and can justify various strategies. Banks examine firms' productive and financial expectations and also their financial structure. This investigation is made according to their confidence in the state of long-term expectations of yields on capital assets, influencing what Keynes referred to as 'animal spirits'. After the study of expected production and of demand of financing that integrates the firm's borrowing risk (r_b), bankers can refuse to finance. The state of confidence of banks summarizes these factors.

Banks know a lender's risk (LR) when underwriting finance[6] and creating money. Lender's risk is the sum of three fundamental risks:

- First, risk of default corresponds to the bank's perception regarding the borrower's likelihood failure to repay the claim.
- Second, risk of liquidity. Liquidity entails the ability to reverse a decision at any moment at the smallest possible cost.
- Third, market risk corresponds to unanticipated changes on the various financial markets. Market risk can be split into other risks. Fluctuations in capital asset prices modify their value and explain capital risk - which is very high for equities and fixed-yield bonds. For the fixed-yield bonds, capital risk is inversely proportional to interest rates. The risk of income mainly concerns the highly uncertain dividends of equities and the variable yield of loans. Finaly, monetary policy involves a money market risk when fluctuations in the money interest rates occur.

In equations (8.32, 8.35, 8.52, 8.53), the risks of default and of liquidity are take account by the gap of the leverage ratio with a conventional leverage ratio. We also introduce the Tobin's q ratio and the cost of indebtedness for the risk of default. The market risk is taken into account by the expected capital gains on equities (CG_e^a) and on fixed-yield bonds (CG_{of}^a), but also with the central bank interest rate.

When the lender's risk is at a maximum (LR = 1), commercial banks refuse to finance the net investment of firms: ΔF = 0. Desired investment (I_D) faces a serious finance rationing. The flow of net investment is only financed by self-funding, that is the retained earnings (P^u), minus the amortization of the debt, minus the capital losses of firms (CG). Thus the money supply (in stock) can be reduced with the redemption of the debt. If the lender's risk is null (LR = 0), desired investment is fully financed: $\Delta F = \Delta F_D$ or $\varphi = \varphi^d$. It is the horizontalist case. The capital losses of firms are also the capital gains of banks, measured by the capital losses on equities (CG_e) and on fixed rate bonds (CG_{of}) (équations 44 and 50).

(8.32) $\varphi = \varphi^d .(1 - LR)$ With $0 \leq LR \leq 1$

(8.33) $\Delta F = \varphi - amort + CG$

(8.34) $CG = CG_e + CG_{of}$

6 We will take into account the loans (L) (long-term), the short-term securities as treasury bills (B) and commercial papers (CP), bonds (fixed-rate (OF)) and equities (E).

In the model, the lender's risk (LR) is measured by the difference between the current leverage ratio and the conventional leverage ratio (quantity of indebtedness), by the Tobin's q ratio and by the cost of indebtedness (i_{cb}). The higher current indebtedness of firms ((CP + OF + L)/K) is over the accepted indebtedness, the more the lender's risk is. The accepted indebtedness is conventional, but this conventional indebtedness can increase during a boom and decrease during a crisis. Tobin's q ratio is measured by the financial value of the firms on the capital (K). The financial value is the value of the equities on the market.

(8.35) $LR = a_1 \cdot (lev_{-1} - lev_c) - (b_1 \cdot q_{-1}) + (c_1 \cdot i_{cb})$ With a_1, b_1, c_1 et lev_c: constant

(8.36) $lev = (CP + OF + L) / K$

(8.37) $q = (e \cdot p_e) / K$

We come to the equations defining the portfolio behaviour of banks. We follow the methodology developed by Godley and Lavoie (2007) and inspired by Tobin (1958). Banks can hold four different assets: bonds (with fixed rate of interest) $OF = of \,.\, p_{of}$, equities $E = e \,.\, p_e$, loans at variable long-term interest rate (L) and commercial paper (CP) at short-term interest rate. The λ_{ij} parameters follow the vertical, horizontal and symmetry constraints (Godley and Lavoie, 2007). Banks are assumed to make a certain proportion λ_{i0} of their financing in the form of asset *i* but this proportion is modified by the rates of return on these assets. Banks are concerned about (i_l) and (i_{cp}), the rates of interest on loans and on commercial paper to be determined at the end of the current period, but which will generate the interest payments in the following period. We have further assumed that it is the expected rates of return on equities (r_e^a) and on bonds (r_{of}^a) that enter into the determination of portfolio choice. The four assets demand function described with the matrix algebra are thus:

(8.38) $OF = (\lambda_{10} + \lambda_{11} \cdot r_{of}^a - \lambda_{12} \cdot r_e^a - \lambda_{13} \cdot i_l - \lambda_{14} \cdot i_{cp}) \cdot F$

(8.39) $E = (\lambda_{20} - \lambda_{21} \cdot r_{of}^a + \lambda_{22} \cdot r_e^a - \lambda_{23} \cdot i_l - \lambda_{24} \cdot i_{cp}) \cdot F$

(8.40) $L = (\lambda_{30} - \lambda_{31} \cdot r_{of}^a - \lambda_{32} \cdot r_e^a + \lambda_{33} \cdot i_l - \lambda_{34} \cdot i_{cp}) \cdot F$

(8.41a) $CP = (\lambda_{40} - \lambda_{41} \cdot r_{of}^a - \lambda_{42} \cdot r_e^a - \lambda_{43} \cdot i_l - \lambda_{44} \cdot i_{cp}) \cdot F$

As it is the case with every matrix, we cannot keep all these equations in the model because each one of them is a logical implication of the others. We model commercial paper as the residual equation:

(8.41) $CP = F - OF - E - L$

For the bonds, the expected rate of yield (r_{of}^a) is the fixed interest rate plus the expected capital gains on the market value of the previous period of these bonds (OF_{-1}). The market value of the bonds is the number of bonds (of) times their prices (p_{of}). The interest rate (i_{of}) is always the long-term interest rate of the first period applied to the initial price (in t_0, $p_{of} = 1$). But after the first period, the prices of the old and of the new fixed-yield bonds (p_{of}) is inversely proportional to the changes in the long-term interest rates (i_l).

The expected value of capital gains on bonds (CG_{of}^a) and on equities (CG_e^a) for current period depends on its value of the previous period plus an error correction mechanism where (θ) represents the speed of adjustment in expectations. The capital gains (CG_{of} and CG_e) correspond to the variations in the price times the quantity of the previous period.

(8.42) $r_{of}^{a} = i_{of} + CG_{of}^{a}/OF_{-1}$ With i_{of} : constant

(8.43) $CG_{of}^{a} = CG_{of-1} + \theta_b . (CG_{of-1} - CG_{of}^{a}{}_{-1})$

(8.44) $CG_{of} = \Delta p_{of} \cdot of_{-1}$

(8.45) $of = OF/p_{of}$

(8.46) $p_{of} = p_{of-1} \cdot (1+ i_{of})/(1 + i_l)$

For the equities, the expected rate of yield (r_e^a) is the sum of the expected distributed profits (P^{da}) and the expected capital gains (CG_e^a), on the market value of the previous period of these equities (E_{-1}). As usual, the expected distributed profits (P^{da}) for current period depends on its value of the previous period plus an error correction mechanism where (θ) represents the speed of adjustment in expectations. The only price clearing mechanism of this model occurs in the equity market. The price of equities (p_e) will allow the equilibrium between the *number* of equities (e; see equation 8.22) that has been issued by firms (the supply) and the *amount* of equities (E) that private banks want to hold (the demand).

(8.47) $r_e^{a} = (P^{d\,a} + CG_e^{a}) / E_{-1}$

(8.48) $P^{d\,a} = P^{d}_{-1} + \theta_b . (P^{d}_{-1} - P^{d\,a}{}_{-1})$

(8.49) $CG_e^{a} = CG_{e-1} + \theta_b . (CG_{e-1} - CG_e^{a}{}_{-1})$

(8.50) $CGe = \Delta p_e \cdot e_{-1}$

(8.51) $p_e = E / e$

Monetary authorities determine exogenously the key rate on the money market (i_{cb}). In 1936, Keynes asserts that this rate is widely conventional. While central banks fix the short-term rates, private banks' liquidity preference determines banking rates (short, medium and long-term interest rates). Significant rates for growth and financing (loan) are the long-term interest rates (i_l). The link between short-term and long-term interest rates is complex. Macroeconomic banking interest rates (i_l) are the production costs of money plus a risk premium. The first element corresponds to functioning costs (wages, investment, immobilization); payment costs for monetary liabilities (subjected to the firms competition for households savings) and the cost of high powered money determined by the central bank; and to a rate of margin (χ) corresponding to standard profits of banks. The production costs of money are equal to (i_{cb}) plus a relatively constant mark up (χ).

Risk premiums are not constant because they are the fruits of the banks' liquidity preference. Risk premiums cover lender's risk (lr). Five expectations strongly influence risk premiums: anticipations about the productivity, economic evolution (growth, employment) and budget; expected inflation; the level of future short-term rates of interest; financial markets' evolution and capital assets' prices; foreign long-term rates present. In the model, we use the same lender's risk as the one seen previously (equation 8.35), that is a mix of leverage ratio and Tobin's q ratio. But with the different coefficients (a_2) and (b_2), (lr) can be negative and reduces the mark up. Therefore the long-term interest rate becomes endogenous and the spread between (i_{cb}) and (i_l) is not constant. Contrary to the horizontalist' view, we introduce an endogenous curve of the interest rates. To explain the short-term interest rates (i_b or i_{cp}), i_{cb} and χ are sufficient. On the contrary, lr is the primary variable in order to explain long-term interest rates (i_l, i_{of},). Banks apply a spread (χ_3) between the key rate and the rate on deposits in order to realize profits.

(8.52) $i_l = i_{cb} + lr + \chi_1$ With χ_1: constant $\chi_1 > \chi_2$

(8.53) $lr = a_2 \cdot (lev_{-1} - lev_c) - b_2 \cdot q_{-1}$

With a_2, b_2, lev_c constant and c = convention on the ‘normal’ debt ratio

(8.54) $i_{cp} = i_{cb} + \chi_2$ With χ_2: constant $\chi_1 > \chi_2$

(8.55) $i_d = i_{cb} - \chi_3$

The initial structure of interest rates is as following: $i_l > i_{of} > i_{cp} > i_b = i_{cb} > i_d$

Banks try to maximize their net income. To make a profit, they finance the economy and agree to become less liquid. By making the almost irreversible decisions of financing, they are subjected to the lender’s risk. They can hope for big profits only by lowering their LP_B. Economic activity also depends on the animal spirits of banks. Finance scarcity can only be the consequence of a deliberate choice. ‘Desired scarcity’ of financing is the sign of banks’ liquidity preference. From an optimal structure of their balance sheet, we can measure the profits of commercial banks (P_b) obtained by monetary financing:

(8.56-v) $P_b \equiv i_{b-1} . B_{-1} + i_{l-1} . L_{-1} + i_{cp-1} . CP_{-1} + i_{of} . of_{-1} + P^d - i_{d-1} . D_{-1} - i_{cb-1} . REF_{-1}$

Central Bank : H, i_{cb}, REF, i_b, P_{cb}, , Π, LF

It is assumed that banks are obliged by the government to hold reserve requirements (H) in high powered money that do not generate interest payments and that must always be a fixed share (the compulsory ratio η) of deposits:

(8.57) $H = \eta \cdot D$

Since the central bank is collecting interest payments advances while paying out no interest on the notes, it is also making profits P_{cb}:

(8.58-vii) $P_{cb} \equiv i_{cb-1} . REF_{-1}$

It is assumed, in line with current practice, that any profits realized by the central bank revert to the government. Following the theory of endogenous money, we assume that the central bank is fully accommodating. First the central bank fixes the key rate of interest (i_{cb}) using a Taylor rule and second it provides whatever advances (REF) demanded by banks at this rate.

Taylor propounded his first rule in 1993, modelling the dual mandate of the Fed. It was founded on the output gap and on the inflation gap. But the output gap generates a theoretical problem to the RBC models (Goodfriend-King or Rotenberg-Woodford) and creates an implementation problem for inflation targeting. Inflation targeting is more a hierarchical mandate than a dual mandate. A truncated rule (without the output gap) appeared as a theoretical answer (Batini and Haldane, 1999), but this solution does not characterize well the practice of central banking. The development of the DGSE models and of the New Macroeconomic Consensus (NCM) around three equations (IS, TR and NKPC) explains the numerous papers on the status of the output gap.

In our model, we use two of three equations from the NCM: a Taylor rule and a New Keynesian Phillips Curve. But we replace the IS equation by our post keynesian SFC model. We take two sorts of Taylor rule: a standard one and a truncated one.

The first hypothesis (M1) is that central bank uses a standard Taylor rule, modelling the dual mandate of the Fed. The key interest rate (i_{cb}) is a negative function of the output gap and a positive function of the inflation gap. Output gap is the difference between the full capacity output (Y_{fc}) and the current output (Y). Output gap in ratio (see equation 8.19 for OG_R) is output over the output gap. Inflation gap is the difference between current inflation and the target of inflation (Π^*). As in standard Taylor rule, we add a neutral interest rate, exogenously fixed at 2 %. The inflation target is 1 %. At the steady state, the key interest rate is equal to 3 %, so the real key interest rate is equal to the neutral interest rate ($i_{cb} - \Pi^* = i^* = 2\%$). In this case, the three gaps (output, inflation and interest rate) are equal to zero. The monetary rule M1 is:

(8.59-M1) $i_{cb} = i^* + \Pi + \alpha_4 .OG_R + \alpha_6 (\Pi - \Pi^*)$

The second hypothesis (M2) is a truncated Taylor rule similar to the unique mandate of ECB. A truncated Taylor rule only contains the inflation gap. When the central bank has a unique mandate, the fear of inflation is higher. We should have: $\alpha_5 > \alpha_6$. We put $\alpha_6 = 0,5$ and $\alpha_5 > 1$. The monetary rule (M2) is:

(8.59-M2) $i_{cb} = i^* + \alpha_5 (\Pi - \Pi^*)$

(8.60-vi) $REF \equiv REF_{-1} + \Delta H + \Delta B + \Delta F - CG - P_b - \Delta D$

A kind of New Keynesian Phillips Curve models inflation (Taylor, 1979). When inflation is low and close to its target, we consider that the anticipations of inflation are anchored on the target. In this case, inflation does not react to the variations of output gap (OG_R). Inflation depends only on the anticipated inflation (Π^a) that is anchored on the target: $\Pi^a = \Pi^*$. This leads to a horizontal NKPC. But if the variations in output are too important (for instance, close to full capacity output) or, if an exogenous supply shock occurs (for instance, a shock in the productivity or in the oil price), inflation reacts. Inflation reappears over OG_{Rmini} and disinflation under OG_{Rmaxi}. The idea that for small disturbances the inflation rate is stable while for large disturbances it is unstable was coined by Leijonhufvud (1981:112n) in the notion of a 'corridor'. The economy has stability inside the corridor, while it will lose stability outside. Such a 'corridor of stability' can provide another way of looking at Keynes's insight that the economy is not violently unstable.The shape of the curve is as follows:

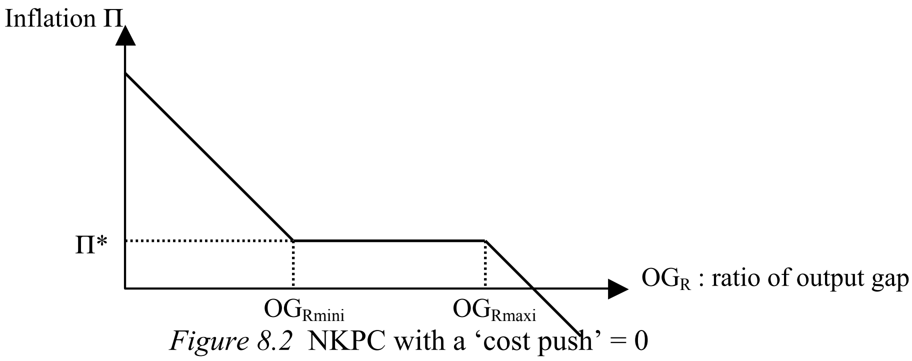


Figure 8.2 NKPC with a 'cost push' = 0

We can write the equation of inflation as a sort of NKPC:

$$(8.61)\quad \Pi \;=\; \Pi^{*} + d_1 .(OG_{Rmini} + OG_R) + d_2 .(OG_{Rmaxi} + OG_R) + \text{Cost push}$$

We can model the loss function of the society as a linear-quadratic function. It supposes that the society has a symmetric target. It is an *ad hoc* loss function because it does not have any micro-foundations. It is not a utility-based loss function based on the utility function of the representative agent (Woodford, 2003). It is connected with the final objective of the society. The society seeks to reach three objectives: price stability, full employment and financial-market stability. The price of equities is not part of governments' or central banks' policies. Society as a whole does not share the same concerns that the government or the central bank. Their reaction functions are not derived from the loss function. Asset prices in the steady state correspond to (p_e*). We measure the volatility of the asset prices by (p_e – p_e*). We can represent the welfare performance of such policies by their welfare cost. In our model, we have: $\beta_1 = \beta_2 = \beta_3 = 1{,}33$

$$(8.62)\quad LF = \beta_1 (\Pi - \Pi^*)^2 + \beta_2\, OG_R^{\,2} + \beta_3 (p_e - p_e^*)^2$$

Our model is now closed. We have defined the 26 variables of the transactions matrix introducing 37 new variables[7] and we now have the same number of equations (62) and unknowns. Furthermore, we have managed to use the M + N – 1 = 8 accounting identities issued from the transcription of the transactions matrix. The missing identity concerns the capital account of the central bank:

$$(8.63viii)\quad REF = H$$

This identity reflects the fact that high-powered money is supplied through advances to private banks. Of course, this accounting identity must invariably hold. When we solve numerically our model, identity (viii) H ≡ REF perfectly holds.

---

7 These 37 new variables are the following:

Government: DG

Firms: gr_y, gr_{KD} Y, Y_{fc}, K, I_D, r_{cf}, u, ICF, φ, $φ^d$, IF, amort, OG_R

Private Banks: CG, CG_{of}, CG_{of}^{a} CG_e, CG_e^{a}, RP, lev, q, OF, E, r_{of}^{a}, r_e^{a}, P^{da}, rp

Households: Y_w^{a}, Y_v^{a}, Y_w, Y_v, Y_h

Central Bank : i_{cb}, Π, LF

EXPERIMENTS ABOUT A SUPPLY SHOCK WITH TWO POLICY MIX

We make simulations[8] by imposing exogenous supply shocks corresponding to an inflationary shock of 1% during three years (5, 6 and 7); e.g. an increase in oil price. This cost-push increase in inflation is first reflected in the NKPC and then, the key interest rate given by the Taylor rule. The key interest rate of the central bank is endogenous. In turn, changes in the short term rate of interest modify the long term interest rate and the growth rate through the different channels of transmission developed by the model. Then fiscal policy acts upon the economy.

The consequences of the supply shock are examined for two kinds of policy mix[9]:

- For country (1), monetary policy is determined by a standard Taylor rule (M1) that corresponds to a dual mandate: output gap and inflation gap. The fiscal policy rule (F1) has a stabilizing effect (see Figure 8.1). But this effect is insufficient to restore the economy to the previous steady state. There is a co-ordination between the monetary and the fiscal policies. Country (1) could describe as a policy followed by the United States.
- For country (2), monetary policy is determined by a 'truncated' Taylor rule (M2) that corresponds to a unique mandate: inflation gap only. Fiscal policy (F2) is neutralized, because we assume the fiscal rule that the ratio of the current deficit of the Government (GD) on the GDP is constant and equal to zero, as imposed by the Maastricht treaty. Country (2) could describe an idealized European policy.

In our economy, the steady state is not the full-employment equilibrium. The output gap is positive, with a significant rate of unemployment. Potential output corresponds to the full capacity output. Figure 8.3 shows that country (1) resists much better than country (2) to a supply shock. The fall in the growth rate and in the desired growth rate of accumulation of capital is much lower. In addition, the emergence of economic cycles is obvious in the country (2). Without output gap in the Taylor rule and with the removal of the fiscal tool, the economic situation deteriorates and becomes more strongly cyclical.

8 We use the E-views 5.5 software.

9 For a more precise analysis of the institutional design (European Union, United States, Japan), see Creel and Capoen (2007) and Le Heron (2007b).

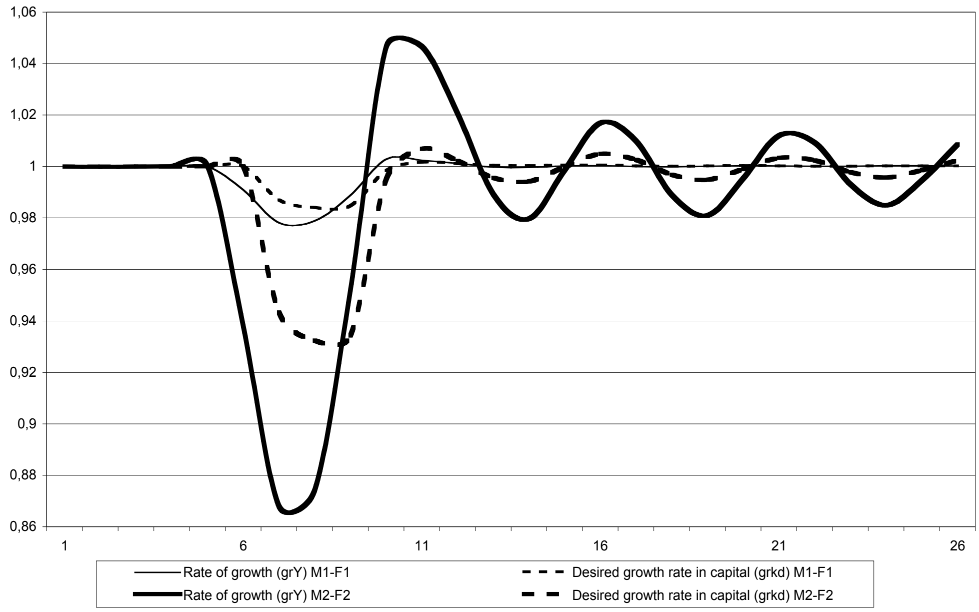


Figure 8.3 Inflationary shock of 1 % during 3 years (M1-F1, M2-F2): effects on the growth rate of the economy and on the desired rate of accumulation

The rate of utilization of productive capacity falls more in the second country than in the first (Figure 8.4). The financial behaviour of firms explains widely these developments. The borrower's risk measured by the rate of cash flow (r_{cf}) and the financial condition index (FCI) rises substantially. With higher costs of financing, the rate of cash flows ($r_{cf} = P^u / K_{-1}$) drops in the short term. Interest payments on loans and commercial papers increase, and this reduces retained profits. But then, firms reduce the issue of equities to preserve the part of undistributed profits (P^u) and the rate of cash flow rises but under its first position. The drop in the Tobin's ratio is an additional negative effect (Figure 8.5). The financial condition index increases vigorously with the fall in the financial capitalization (E/Y). With the depressed FCI and the lower cash flow ratio, the borrower's risk increases seriously.

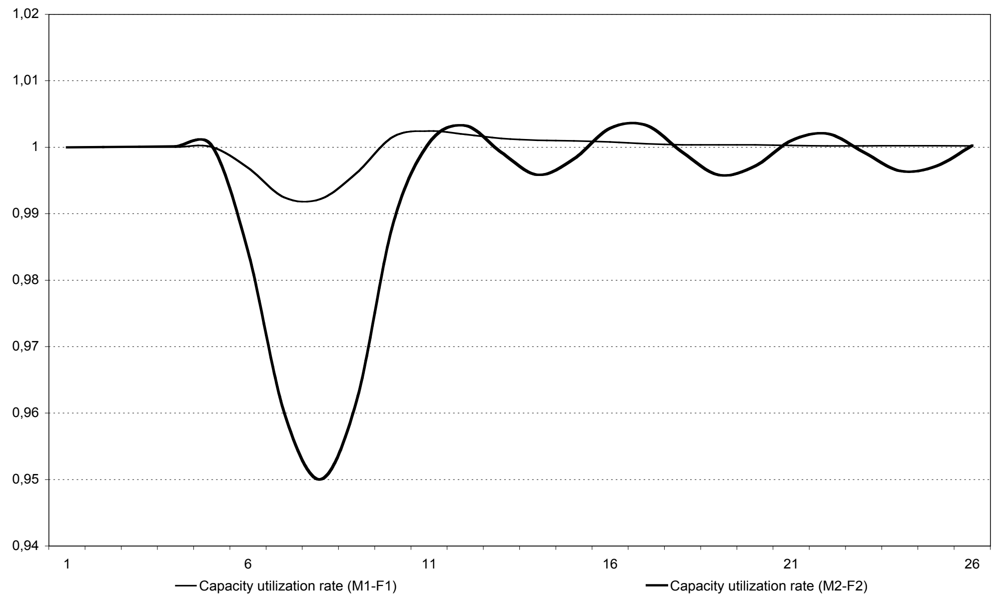


Figure 8.4 Inflationary shock of 1 % during 3 years (M1-F1, M2-F2): effects on the rate of utilization capacity

To simplify, we introduced inflation only in the NKPC and we do not take into account the difference between real and monetary variables in the rest of the model. Inflation could be integrated into the determinants of lender's risk and borrower's risk and into the portfolio matrix, in order to better integrate the wealth effects. Monetary policy tries to neutralize expectations of inflation, but it had little impact on the shock of inflation, which is exogenous.

Since the fear of inflation is higher in country (2), central bank rate of interest reacts more vigorously (Figure 8.6). This rise enlarges the output gap more in country (2) than in country (1). Business cycles appear (Figure 8.7). With a lower inflation rate and a higher interest rate, the real interest rate of country (2) far exceeds that of country (1), which restricts more investment and growth.

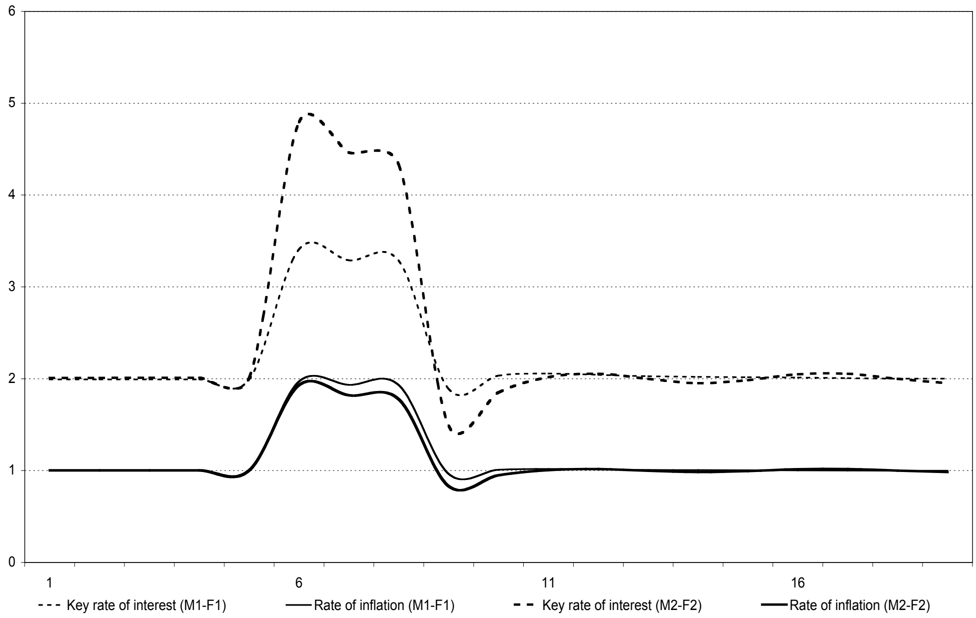


Figure 8.6 Inflationary shock of 1 % during 3 years (M1-F1, M2-F2): effects on the rate of interest and on the rate of inflation

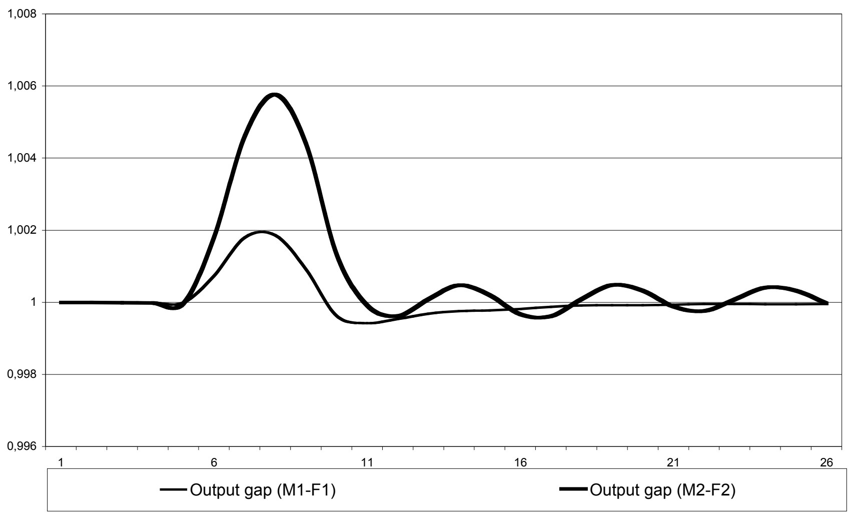
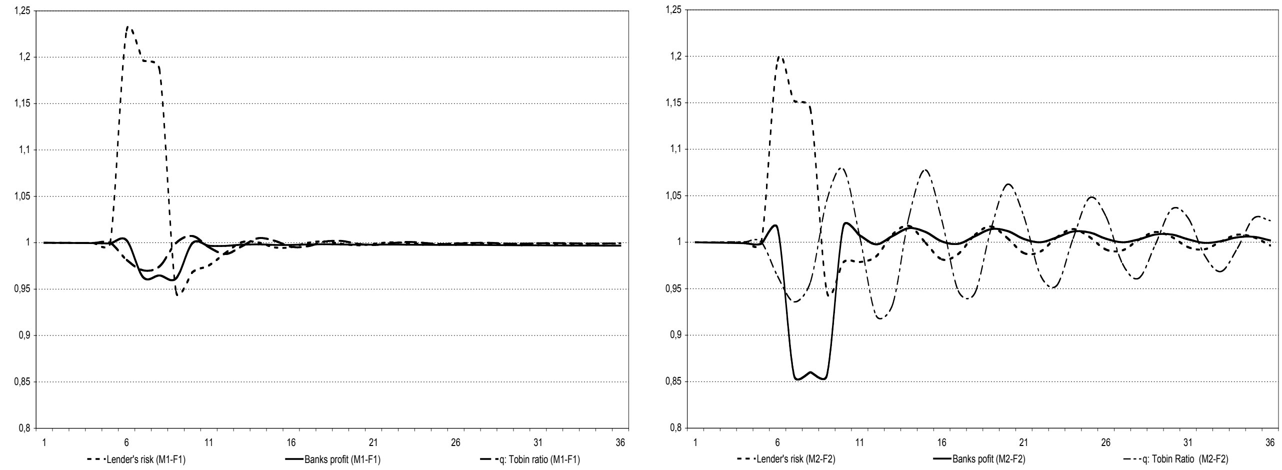


Figure 8.7 Inflationary shock of 1 % during 3 years (M1-F1, M2-F2): effects on the output gap

The influence of output gap on the key interest rate is lower than that of inflation, even with the standard Taylor rule. With the sharp rise in interest rates, investment, which reacts swiftly to the interest rate, will be more affected than other components of demand. On the one hand, the fall in investment will be larger than the expansion resulting from stabilizing policy of the country (1). On the other hand, the fiscal policy F2, which has no stabilizing effect, explains the strong negative effect on the growth of the country (2). Finally, the rise in interest rates improves the financial income of households and so consumption. But, with our Kaleckian consumption function, the benefits on consumption are very weak. This effect is insufficient to offset the others.

One key element of the experiments is the increase of the lender's risk. The fall of the Tobin's q ratio plus the lowest solvency of firms following the rise of the interest rates explain the rise of the lender's risk and the decreasing leverage ratio (Figure 8.5). Our virtual economies experience a transitory business depression, characterized by a lower rate of utilization capacity, a lower Tobin's ratio and leverage, and higher lender's and borrower's risks. The consequence is a credit rationing of the investment of firms by private banks (Figure 8.8). The credit rationing of firms explains an increasing rate of unemployment. The situation is worse in the second country.



(a) *Figure 8.5* Inflationary shock of 1 % during 3 years: (a) M1-F1, (b) M2-F2: effects on Lender's risk, on banks profit (6%), and on Tobin's q ratio (b)

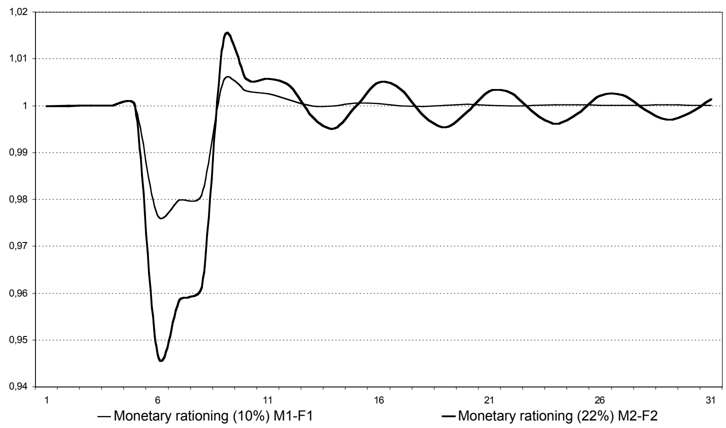
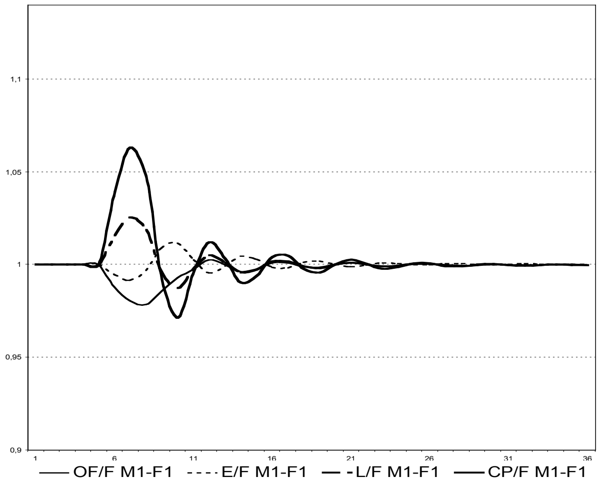


Figure 8.8 Inflationary shock of 1 % during 3 years (M1-F1, M2-F2): effects on credit rationing

Let us examine the bank-balance-sheet channel. Four channels ar5 usually taken into account by literature: wealth effect (Davis et Palumbo, 2001), Tobin's *q* (Tobin, 1969), the financial accelerator

(Bernanke and al., 1999) and the capital of banks (Van den Heuvel, 2002). We have these four channels in the model (Le Heron, 2007a).



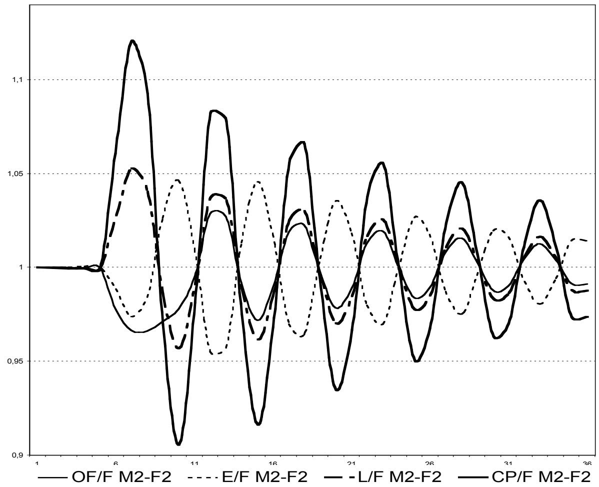


Figure 8.9 Inflationary shock of 1 % during 3 years (M1-F1, M2-F2):
effects on finance structure (E = 50 %; OF = 23 %; L = 19 %; CP =: 8 %)

With the country 2, we see a sharp volatility in the financial markets (stocks and bonds) and a significant fall in the profit of banks (Figures 8.5 and 8.9). These elements could explain the coming out of financial crises.

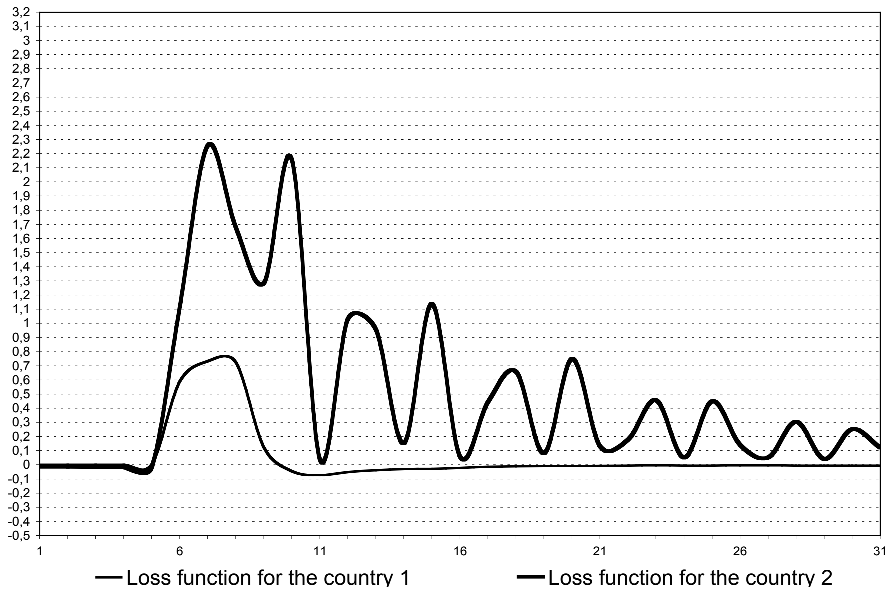


Figure 8.10 Welfare performance of the society:
loss function with three equal objectives: Inflation, Output gap and Stability of asset prices

We can argue from these experiments that it is preferable to include the output gap in Taylor rule and that the use of stabilizing fiscal policy is beneficial. Indeed, simulations showed a high volatility in production with the truncated rule, but also price volatility on the financial markets. Financial instability may be an unforeseen consequence. Since money is not neutral, it is difficult to consider inflation only for the monetary policy. We note that the absence of output gap accentuates the decline in the growth and increases the volatility of the economy. In case of supply shock, co-ordination with a stabilizing fiscal policy always generates better results and does not cause any business cycles. Co-ordination between policies, as we see in United States, is more efficient than the total separation between fiscal and monetary policies, which is required by the Maastricht treaty.

We have modelled two kinds of institutions. We can use a welfare function of the society seeking to maximize the following three objectives with the same weight for each of them: price stability, growth and stability in financial markets. Clearly, the institutional design of the United States is far better than in European Union (Figure 8.10).

In this chapter, we have tried to make the New Keynesian consensus in macroeconomics compatible with the Post Keynesian theories in a stock-flow consistent approach. By taking into account the behaviour of private banks, a more realistic creation of money, the stocks and the financial risks of firms and banks, we can analyze more deeply the problems of co-ordination between fiscal policy and monetary policy. Indeed, the intensity of these problems has increased with the full independence given to some central banks. This stock-flow consistent model is a first step into this research agenda.

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Appendix 1. Glossary of variables

Y	National income
Y_{fc}	Output of full capacity
gr_y	Growth rate in the national income
Π	Inflation
Π^*	Inflation target
N	Employment
N_{fe}	Full employment
OG	Output gap
OG_R	Ratio of output gap
Un	Unemployment
r_{un}	Rate of unemployment
L	Loans (variable long-term rate)
CP	Commercial paper
B	Treasury bills
E	Equities
e	Number of equities
p_e	Price of equities
OF	Bonds (Fixed rate)
of	Number of bonds
p_{of}	Price of fixed rate bonds
LF	Loss function of the society
	Central Bank
P_{cb}	Central bank profits
REF	Reserve requirements (CB refunds)
H	High-powered money
i_{cb}	Central bank key interest rate
i^*	Neutral interest rate
	Commercial Banks
P_b	Banks profits
V_b	Net wealth of banks
CG	Capital gains of banks (Capital losses of firms)
CGe	Capital gains on equities
CG_e^a	Expected capital gains on equities
CG_{of}	Capital gains on bonds
CG_{of}^a	Expected capital gains on bonds
i_{cp}	Interest rate on commercial paper
i_d	Interest rate on deposits
i_l	Interest rate on loans
i_b	Interest rate on treasury bills
FCI	Financial Condition Index
LR	Lender's risk
lr	Lender's risk for long-term interest rate
r_{of}^a	Expected yield of bonds
r_e^a	Expected return on equities
P^d	Expected distributed profits
lev	Leverage ratio
q	Tobin's q ratio
	Firms
I	Net investment
I_D	Investment demand
W	Wages
K	Stock of capital
V_f	Net wealth of firms
u	Capacity utilization rate
gr_k	Growth rate in the stock of capital
gr_{kD}	Desired growth rate in the stock of capital
ΔF	Net finance
φ	Gross finance
φ^d	Desired gross investment
IF	Internal Funds
$amort$	Amortization (debt redemption)
P	Firms profits
P^d	Distributed profits
P^u	Undistributed profits
r_{cf}	Borrower's risk (ratio of cash flow)
	Government
G	Government expenditure
DG	Government deficit
g_{dg}	Constant ratio of government deficit
P_{cb}	Central bank profits
T	Taxes
	Households
C	Consumption
D	Bank deposits
Y_w^a	Expected disposable income of workers
Y_v^a	Expected disposable financial income
Y_w	Disposable income of workers
Y_v	Disposable financial income
Y_h	Disposable income of household

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