FINANCIAL CRISIS, STATE OF CONFIDENCE AND ECONOMIC POLICIES IN A POST-KEYNESIAN STOCK-FLOW CONSISTENT MODEL

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FINANCIAL CRISIS, STATE OF CONFIDENCE AND ECONOMIC POLICIES IN A POST-KEYNESIAN STOCK-FLOW CONSISTENT MODEL.

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INTRODUCTION

While in 2007 it was only a financial crisis and particularly, a banking crisis, now economic growth and employment are deteriorating sharply. The aim of this chapter is to understand how the financial crisis was transformed in a global real economic crisis and how it passed through the banking behaviour. We are particularly interested in psychological variables such as the state of confidence, because these variables play a key role in the Post-Keynesian tradition through expectations. We develop a model of a 'financiarized' economy suffering a strong fall in the state of confidence of banks, firms and households. In order to do so, we analysed two policy mix. We contrast a rule on public expenditures with a rule on public deficits and a usual Taylor rule with a truncated Taylor rule. In the first case, the government implements a fiscal policy with automatic stabilizers and the central bank has a dual mandate: inflation and growth. There is a co-ordination between fiscal and monetary policies. The second policy mix implements an orthodox fiscal policy (balanced budget) and the independent central bank implements inflation targeting.

In the first part, we present the most important equations of a Post-Keynesian stock-flow consistent (SFC) model (Godley-Lavoie, 2007, Dos Santos-Zezza, 2004, Le Heron-Mouakil, 2008, Le Heron, 2009) with a private banks sector introducing more realistic features. We introduce the borrower's and the lender's risks from the Minskian approach. In the second part, we simulate the model to study the effects of a financial crisis on the banking behaviour within our two policy mix. The aim is to deal with the consequences of a fall in the state of confidence of banks, firms and households. We make a comparison for the two assumptions on the policy mix and we analyze the channel of transmission on the economic activity.

A POST KEYNESIAN STOCK-FLOW CONSISTENT GROWTH MODEL OF A 'FINANCIARIZED' ECONOMY

We resume only the most specific features of our model[1] with five sectors: government, firms, households, private banks and central bank. SFC modelling is based on two tables. You can find the transactions matrix (flows) in appendix 2 and the balance sheet matrix (stocks) in appendix 3. The complete model (Appendix 4) contains 61 equations.

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 a fall in the state of confidence of banks, firms and households 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). ΔF determines monetary creation in the period.

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.

TWO FISCAL POLICIES FOR THE GOVERNMENT

Government expenditures are only final sales of consumption goods. The government collects only taxes from households on wages. 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 (i_l). To analyze the consequences of the crisis, 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 rule on public expenditures

First, we assume that public expenditure (G) is always growing at the growth rate (gr_{y-1}) of the national income with a lag of one year. 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. The financial cost of the national debt varies with interest rate. 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 weak self-stabilizing tendency due to the fiscal policy, though the fiscal policy effect comes through the effects of interest rate on the budget deficit.

[1] For more explanations, you can read Le Heron and Mouakil (2008) and Le Heron (2009) for the Post Keynesian model and Le Heron (2008) for the Keynesian stock-flow consistent model.

(1-F1) $G = G_{-1}. (1 + gr_{y\,-1})$
(2-F1) $GD \equiv G + (i_{b-1} . B_{-1}) - T - P_{cb}$

Assumption 2 (F2): a rule on public deficits

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. 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 always balanced. As the interest rate does not act on fiscal policy, there is no co-ordination between the fiscal and the monetary policies.

(1-F2) $GD = r_{GD} . Y_{-1}$ With r_{GD}: constant
(2-F2) $G \equiv GD - (i_{b-1} \cdot B_{-1}) + T + P_{cb}$

FIRMS

The investment function is the most important one in a growth model. The stock of capital (K) 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). Firms issue equities (E), bonds with fixed rates of interest (OF) and commercial papers (CP), and borrow money from banks (variable rate) (L) to finance investments. Amortization concerns only the debt: loans, bonds and commercial papers.

(3) $I \equiv \varphi + IF$
(4) $IF = P^u - amort$
(5) $amort = (a_l \cdot L_{-1}) + (a_{of} \cdot of_{-1}) + (a_{cp} \cdot CP_{-1})$

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 14, 15, 17). A rationing in investment financing 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 level of endebtedness, 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 Minsky.

(6) $I_D = gr_{kD} . K\text{-}1$
(7) $\varphi^d = I^d - IF$
(8) $gr_{kD} = \gamma_0 + (\gamma_1 \cdot r_{cf-1}) + (\gamma_2 \cdot u_{-1}) - (\gamma_3 \cdot FCI_{-1})$ With γ_i: constant

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

(9) $r_{cf} = P^u / K_{-1}$
(10) $u = Y / Y_{fc}$

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

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

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

We measure the output gap in ratio, with Y_{fc} the output of full capacity and not of the capacity that corresponds to the potential output. Distributed dividends (P^d) are a fraction (25%) of profits realized in the previous period. This part can be higher in a 'financiarized' economy:

(13) $P^d = (1 - s_f) \, . \, P_{-1}$ With s_f: constant

HOUSEHOLDS

We assume that households determine their consumption expenditure on the basis of their expected disposable income and their wealth of the previous period that consist entirely of bank deposits. Following the Kaleckian tradition, wages are mostly consumed while financial income is largely devoted to saving. The consumption decision depends on the state of confidence of households and determines the amount that they will save out of their disposable income. The financial behaviour of households is simplified: they hold only banking deposit account.

PRIVATE BANKS

Banks don't make loans to households, but 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'. The state of confidence of banks is notably taking into account by an exogenous variable (γ_4). After the study of expected production and of demand of financing that integrates the firm's borrowing risk, bankers can refuse to finance. The state of confidence of banks summarizes these factors.

Banks know a lender's risk (LR) when underwriting finance and creating money. Lender's risk is the sum of three fundamental risks: risk of default, risk of liquidity and market risk. 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 (14, 17, 20, 21), 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 value of the securities lodged as collateral 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: $\Delta F = 0$. 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}).

(14) $\varphi = \varphi^d .(1 - LR)$ With $0 \leq LR \leq 1$
(15) $\Delta F = \varphi$ - amort + CG
(16) $CG = CG_e + CG_{of}$

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 variation in the value of the securities lodged as collateral (V_C) 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. The variation in the value of the securities lodged as collateral (V_C) is measured by the value of equities (E) on the value of equities of the last period. The financial value is the value of the equities on the market.

(17) $LR = -\gamma_4 + a_1 \cdot (lev_{-1} - lev_c) - (b_1 \cdot V_C) + (c_1 \cdot i_{cb})$ With γ_4, a_1, b_1, c_1 et lev_c: constant
(18) $lev = (CP + OF + L) / K$
(19) $V_C = E / E_{-1}$

We follow the methodology developed by Godley and Lavoie (2007) and inspired by Tobin (1958) to define the portfolio behaviour of banks. 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:

Monetary authorities determine endogenously the key rate on the money market (i_{cb}) following a Taylor rule. 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 and budget; expected inflation; the level of future short-term rates of interest; financial markets' evolution and capital assets' prices; foreign long-term rates. In the model, we use the same lender's risk as the one seen previously (equation 17), that is a mix of state of confidence, leverage ratio and variation in the value of the securities lodged as collateral. But with the different coefficients (γ_5), (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.

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

(21) $lr = - \gamma_5 + a_2 . (lev_{-1} - lev_c) – (b_2 . V_C)$

With γ_5, a_2, b_2, lev_c constant and c = convention on the 'normal' debt ratio

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

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

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

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

CENTRAL BANKING

The central bank has neither operating costs nor net worth and pays all its profits to the government. Following the theory of endogenous money, we assume that the central bank is fully accommodating. We use a Taylor rule for the modelling of its behaviour. 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 today, independent central banks prefer inflation targeting. A truncated rule (without the output gap) appeared as a theoretical answer (Batini and Haldane, 1999). From the Taylor rule, we can summarize monetary policy according to three dimensions: strategy, flexibility and intensity. Strategy represents the mandate and therefore the long-term policy. Flexibility measures the deviation in the short term of the policy from the strategy. Intensity is the weight put respectively on output gap and inflation gap. With the 'Taylor principle', coefficients must be superior to one to avoid that inflation expectations produce inflation.

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). Full capacity output is a Post-Keynesian approach. We refused the New Keynesian potential output that is founded on a NAIRU. Inflation gap is the difference between current inflation and the target of inflation (Π^*).

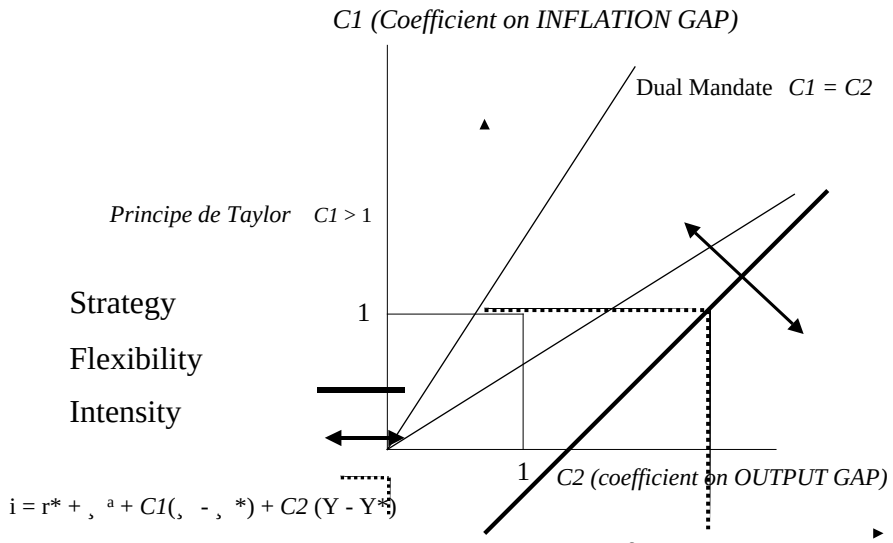


Figure 1 Monetary policy of central bank

As in standard Taylor rule, we add a neutral interest rate, exogenously fixed at 2 % as Keynes in the *General Theory*. 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 ($i_{cb} - \Pi^* = i^* = 2\%$). The monetary rule M1 is:

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

The second hypothesis (M2) is a truncated Taylor rule similar to inflation targeting, which only contains inflation gap. With inflation targeting, 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:

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

A special kind of Phillips Curve models inflation. 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 curve. But if the variations in output are too important (for instance, close to full capacity output), inflation reacts. Inflation reappears over OG_{Rmini} and disinflation or deflation 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:

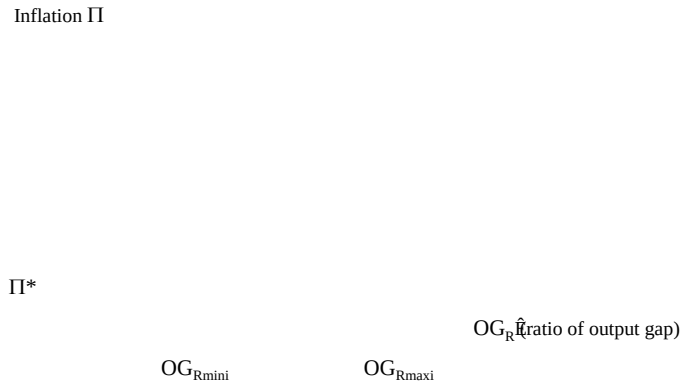


Figure 2 Inflation curve

To write the equation of inflation, we use the output gap and the inflation gap:

(61) $\Pi = \Pi^* + d_1 .(OG_{Rmini} + OG_R) + d_2 .(OG_{Rmaxi} + OG_R)$

EXPERIMENTS ABOUT FINANCIAL CRISIS AND CONFIDENCE WITH TWO POLICY MIX

We make simulations[2] by imposing exogenous shocks arising from the financial crisis during four years (5, 6, 7 and 8). Shocks are stronger in 6 and 7 than in 5 and 8. Numerous features in our standard model correspond to a 'financiarized' economy: an important financial market, four different financial assets, the lender's risk, the borrower's risk, a time structure of interest rate, etc.. We assume that financial crisis involves essentially a drop in the state of confidence of the economic agents and, in our model, especially that of banks. The aim is to deal with the channels of transmission of these psychological variables on the real sector. We want to show that psychological reactions (lower confidence) are sufficient to explain the spread of financial crisis to the real sector. We try also to understand the effects of the policy mix on it. Model and shocks are the same for both economies, even if the steady states are a little bit different because the policy mix is different. We develop four processes for the crisis.

A drop in the state of confidence of commercial banks: B

First, the state of confidence of banks decreases sharply and then th
e lender's risk increases. We change exogenously (γ_4) and (γ_5) in equations (17) and (21) of lender's risk. More the level of the conventional leverage ratio (quantity of firms indebtedness considered as normal (lev_C)) falls strongly in these equations. Last, the variation in the value of the securities lodged as collateral (V_C) is certainly negative at the beginning of the financial crisis. But this change is endogenous. Accordingly lender's risk and rationing of finance increase.

[2] We use the E-views 5.5 software.

A drop in the state of confidence of firms: F

Second, the state of confidence of firms (γ_0) falls with the development of the financial crisis. We change exogenously (γ_0) in the equation (8) of the desired rate of accumulation. Pessimistic expectations of firms depress effective demand. We could also increase the weight of the financial condition index in this equation (γ_3) to take into account the higher borrower's risk.

A drop in the state of confidence of households: H

Third, the state of confidence of households is going down and their propensity to consume is falling, involving a negative demand shock.

GENERALIZED CRISIS IN THE STATE OF CONFIDENCE (BANKS, FIRMS, HOUSEHOLDS): B+F+H

Fourth, we put the three processes together for a generalized fall of the state of confidence. In the experiments, the respective importance of the crisis in the different economic sectors is not relevant. To respect the stylized facts of the last crisis, we assume that the drop in the state of confidence of banks is higher than those of others sectors (firms and then households). Polls on expectations and confidence of various kinds of agents can be used. The liquidity preference increases for all the economic agents.

The consequences of the financial crisis are examined for two kinds of policy mix:

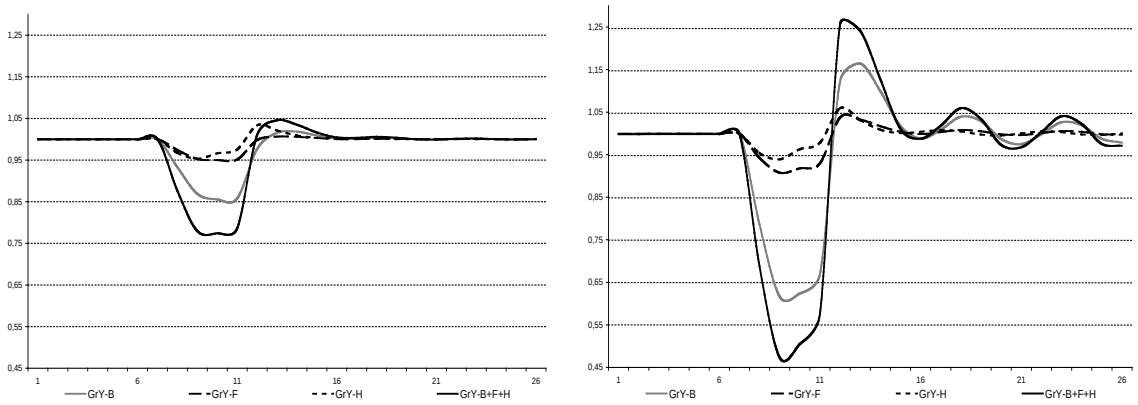
> For country (1), monetary policy is determined by a standard Taylor rule (M1) that corresponds to a dual mandate: output gap and inflation gap. The fiscal policy rule (F1) has a stabilizing effect. But this effect is insufficient to restore the economy to the previous steady state. There is a co-ordination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

The drop in the state of confidence of banks and firms involves a supply shock. In contrast the drop in the state of confidence of household involves a shock of demand. As risk is deflation, the equations of complete or truncated Taylor react similarly. In fact the output gap as the anticipation of lower prices requires lower interest rates.

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. To simplify, we introduced inflation only in our special Phillips curve 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.

In the short-term, the growth rate in the national income decreases strongly. Depressed effective demand that is the cause of higher unemployment can be explained by lost confidence of firms but

also of banks. In our approach, private banks are no longer neutral. Following the approaches of Minsky and Keynes, financial features and confidence explain the crisis. Figures (3A-B) show that country (1) resists much better than country (2) to a fall in the state of confidence.

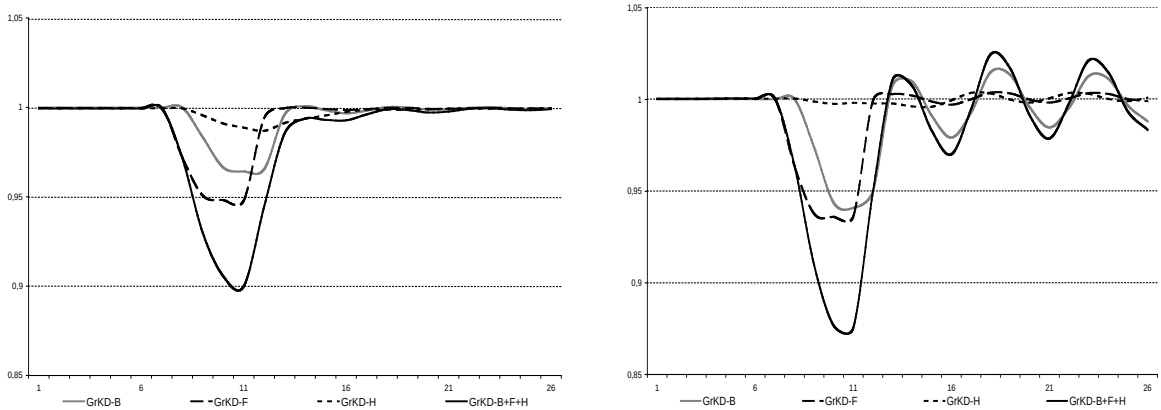


A (Policy mix 1) B (Policy mix 2)

Figure 3. Fall in the state of confidence during 4 years.
Effects on the growth rate of the economy[3]

The fall in the growth rate is much lower. In addition, the emergence of economic cycles is obvious in country (2). With the removal of the fiscal tool, the economic situation deteriorates deeply and becomes more strongly cyclical.

The drop in state of confidence of firms is the first explanation to the depressed effective demand, *i.e.* the desired growth rate of accumulation of capital (Figures 4A-B). But, particularly with the policy mix (2), banks have also an important responsibility, because financing conditions deteriorate. The rate of utilization of productive capacity falls more in the second country than in the first. The financial behaviour of firms explains widely these developments. With the depressed financial condition index and the lower cash flow ratio, the borrower's risk increases seriously.

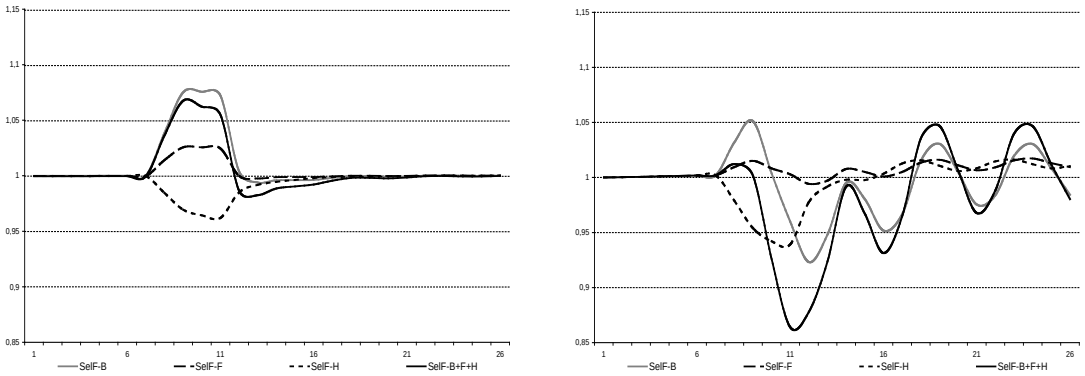


A (Policy mix 1) B (Policy mix 2)

Figure 4. Fall in the state of confidence during 4 years
Effects on the desired growth rate of accumulation of capital of Firms

[3] In all the figures (except the figures 9 and 10), all values on the vertical axis are homogenized to one for the steady state. The drops in the state of confidence are respectively: B for Banks, F for Firms, H for Households and B+F+H for all the private sectors.

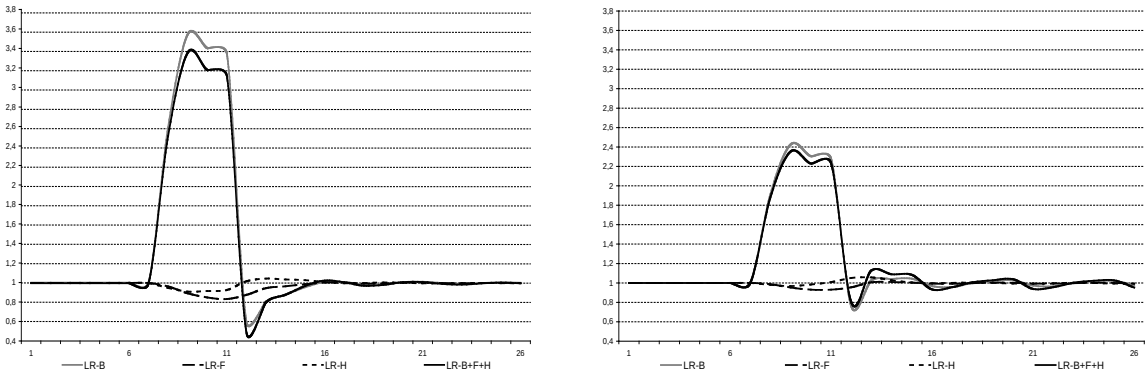
The effects on the self-financing of firms are very interesting (Figures 5A-B). With the higher borrower's and lender's risks, firms and banks reduce external financing: self-financing of firms increases. It corresponds to a supply shock and a credit crunch. On the contrary, the lost confidence of households involves a shock of demand and self-financing of firms decreases. With the policy mix (1), the higher government deficit allows an increase of the cash flow of firms. Their self-financing increases. Government indebtedness substitutes the one of firms. With the policy mix (2), the weight of banks and households behaviours is stronger and durably lowers self-financing of firms. We understand why the reding of the ratio of self-financing is difficult and why it does not show the good state of economy.



A (Policy mix 1) B (Policy mix 2)

Figure 5. Fall in the state of confidence during 4 years.
Effects on the ratio of self-financing of Firms

One key element of the experiments is the increase of the lender's risk (Figures 6A-B). The fall of collateral value, the supposed lowest solvency of firms and the new strict convention of firms endebtedness explain the rise of the lender's risk.

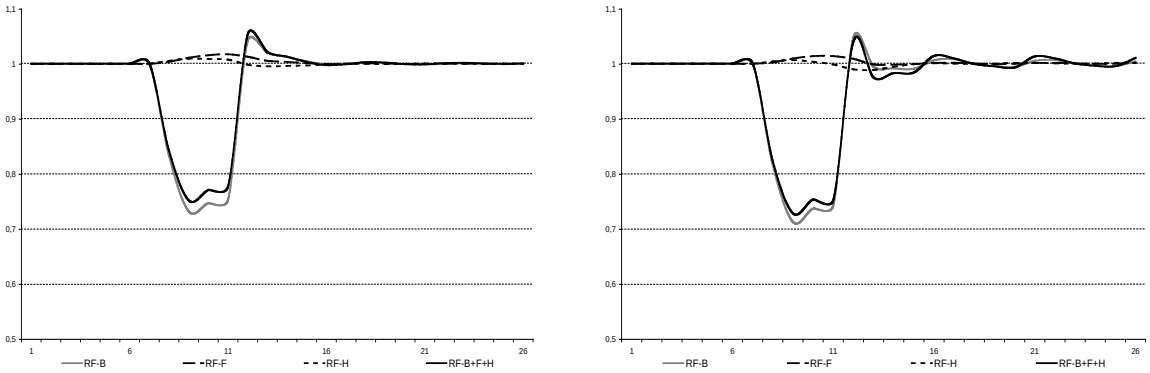


A (Policy mix 1) B (Policy mix 2)

Figure 6. Fall in the state of confidence during 4 years.
Effects on the lender's risk of commercial banks

The consequence is a financing rationing of the investment of firms by private banks: $\varphi < \varphi^d$ (Figures 7A-B). We can understand the credit crunch. The financing rationing of firms explains in part an increasing rate of unemployment. It exists a sharp volatility in the financial markets (stocks and bonds) and a significant fall in the profit of banks. During the crisis, private banks try reaching

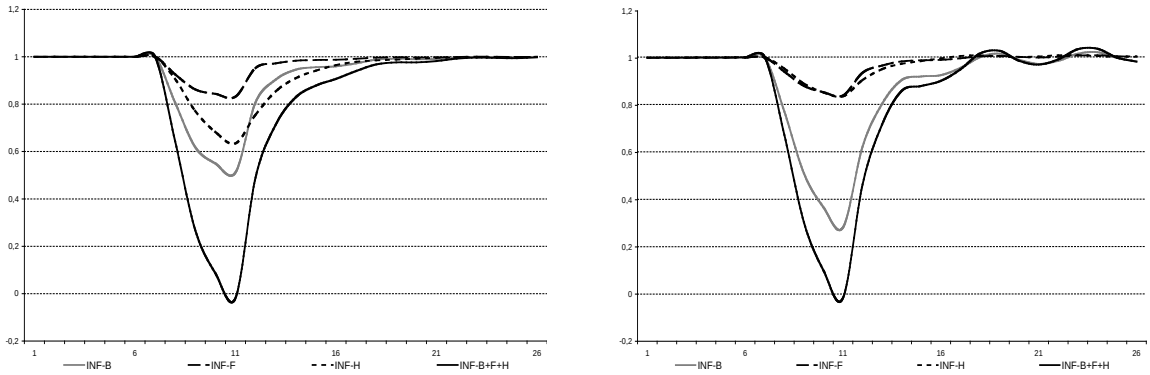
a new equilibrium in their asset allocation. The structure of their balance sheet changes clearly. These elements could explain the crossing of the financial crise to the real world.



A (Policy mix 1) B (Policy mix 2)

Figure 7. Fall in the state of confidence during 4 years.
Effects on the rationing of finance from banks

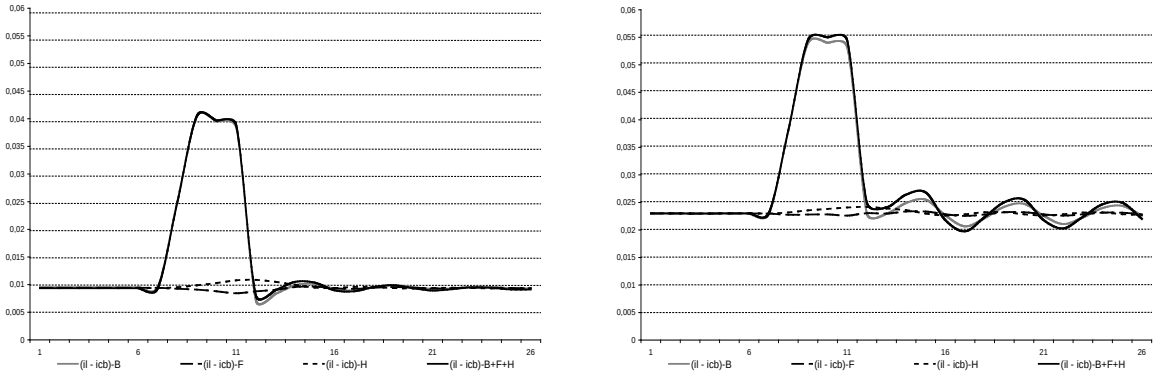
We see the beginning of the deflation (Figures 8A-B). With the deep crisis, monetary policy tries to avoid deflation, then the two kinds of Taylor rule work similarly : key interest rate goes down quickly to stop the fall of prices. The influence of output gap on the key interest rate is the same but is lower than that of inflation, even with the standard Taylor rule. With the desinflation, the truncated Taylor rule reacts more. If the fear is inflation, it is the opposite because output gap pushes in the other way.



A (Policy mix 1) B (Policy mix 2)

Figure 8. Fall in the state of confidence during 4 years.
Effects on the rate of inflation

Contrary to IS-LM, to New-Keynesians or to usual PK-SFC models, the curve of interest rates is not exogenous. The spread between the short-term and the long-term interest rate is not constant. The Figures (9A-B) show the same evolution as the stylized facts of the last crisis: a quick rise of this spread (almost 3%), which corresponds to higher lender's risk, at the time of the key rate decreasing by central bank.



A (Policy mix 1) B (Policy mix 2)

Figure 9. Fall in the state of confidence during 4 years.
Effects on the spread: Long-term interest rate (i_l) – Short-term interest rate (i_{cb})

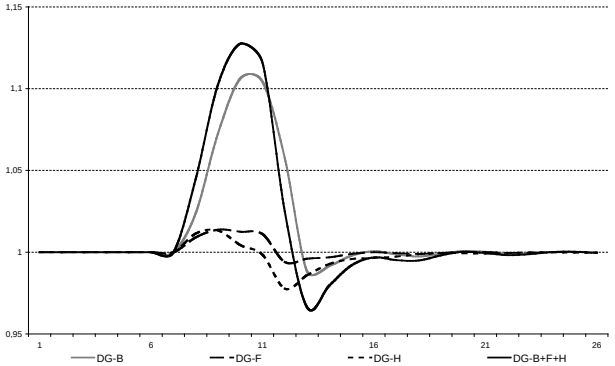


Figure 10. Fall in the state of confidence during 4 years.
Effects on the Fiscal Deficit with policy mix 1.

A fall of the state of confidence in the private sector involves that the government 'becomes' optimistic and supports the effective demand with an increasing fiscal deficit. It is the case of the country (1)(Figure 10). But, by hypothesis, there is a balanced budget in the country (2).

CONCLUSION

In this chapter, to better understand the last financial crisis and its generalization to the real world, we have tried to take into account the behaviour of private banks, the financial risks of firms and banks, and the psychological variables (state of confidence). In order to do so, Keynes and Minsky give an adequate framework. We have analyzed more deeply the problems of co-ordination between fiscal and monetary policy. We can argue that it is better to include a stabilizing fiscal policy. Indeed, simulations showed a high volatility in production with the policy mix (2) and financial instability may be also an unforeseen consequence. 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
γ_4, γ_5 State of confidence of banks
r_{of}^a Expected yield of bonds
r_e^a Expected return on equities
P^d Expected distributed profits
lev Leverage ratio
V_C Variation of the value of collateral

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)
γ_0 State of confidence of firms

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

APPENDIX 2. TRANSACTIONS MATRIX

Sector / Operation	Govt	Firms		Households	Private banks		Central Bank (CB)		Σ
		Current	Capital		Current	Capital	Current	Capital	
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						- ΔH		+ ΔH	0
Δ T Bills	+ ΔB					- ΔB			0
Δ equities			$+ \Delta e\ .\ p_e$			$- \Delta e\ .\ p_e$			0
Δ loans			+ ΔL			- ΔL			0
Δ commercial paper			+ Δ CP			- Δ CP			0
Δ bonds			$+ \Delta of \cdot p_{of}$			$- \Delta of \cdot p_{of}$			0
Δ bank deposits				- ΔD		+ ΔD			0
Δ CB advances						+ ΔREF		- ΔREF	0
Σ	0	0	0	0	0	0	0	0	0

APPENDIX 3. 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

APPENDIX 4. THE COMPLETE MODEL: 2 VERSIONS WITHIN 4 HYPOTHESIS

Policy mix (1) = F1-M1 *Policy mix (2) = F2-M2*

(1)	$Y = C + I + G$		National income
(2)	$gr_y = \Delta Y/Y_{-1}$		Growth rate (of national income)
(3)	$T = \tau \, . \, W_{-1}$	With τ: constant	Taxes
(4)	$B = B_{-1} + DG$		Treasury bills
(5)	$i_b = i_l$		Interest rate on treasury bills

F 1: Model 1 with a countercyclical fiscal policy

(F1-6)	$\mathbf{G = G_{-1} \, . \, (1 + gr_{y\,-1})}$		**Government expenditure**
(F1-7-i)	$\mathbf{DG \equiv G + i_{b-1} \cdot B_{-1} - T - P_{cb}}$		**Government deficit**

F 2: Model 2 with a neutral fiscal policy: DG/Y-1 constant

(F2-6-i)	$G \equiv DG - i_{b-1} \cdot B_{-1} + T + P_{cb}$		*Government expenditure*
(F2-7)	$DG = g_{dg} \, . \, Y$	*With g_{dg}: constant ratio*	*Government deficit*

(8)	$K = K_{-1} + I$		Stock of capital
(9-iii)	$I \equiv \varphi + IF$		Net investment
(10)	$IF = P^u - amort$		Autofinancement
(11)	$amort = a_l \cdot L_{-1} + a_{of} \cdot of_{-1} + a_{CP} \cdot CP_{-1}$		Internal Funds
(12)	$I_D = gr_{kD} \, . \, K\text{-}1$		Demande d'investissement
(13)	$\varphi^d = I^d - IF$		Desired gross investment
(14)	$gr_{kD} = \gamma_0 + \gamma_1 \, . \, r_{cf-1} + \gamma_2 \, . \, u_{-1} - \gamma_3 \cdot FCI_{-1}$	With γ_i: constant	Desired growth in the stock of capital
(15)	$r_{cf} = P^u / K_{-1}$		Borrower's risk (ratio of cash flow)
(16)	$u = Y/Y_{fc}$		Capacity utilization rate
(17)	$Y_{fc} = K_{-1} \, . \, \sigma$	With σ : constant	Output of full capacity
(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: constant	Financial Condition Index
(19)	$OG_R = Y_{fc} - Y \, / \, Y_{fc}$		Output gap ratio
(20)	$W = Y \, / \, (1 + \rho)$	With ρ: constant	Wages
(21-ii)	$P \equiv Y - W - i_{l-1} \, . \, L_{-1} - i_{CP-1} \, . \, CP_{-1} - i_{of} \, . \, of_{-1}$		Firms profits
(22)	$P^d = (1 - s_f) \, . \, P_{-1}$	With s_f: constant	Profits distribués
(23-ix)	$P^u \equiv P - P^d$		Distributed profits
(24)	$e = e_{-1} \, . \, (1 + gr_{y-1})$	With gr_e : constant	Number of equities

(25)	$C = \alpha_1 \, . \, Y_w^{\,a} + \alpha_2 \, . \, Y_v^{\,a} + \alpha_3 \cdot D_{-1}$	With α_i : constant	Consumption
(26)	$Y_w^{\,a} = Y_{w-1} + \theta_h \, . \, (Y_{w-1} - Y_w^{\,a}{}_{-1})$	With θ_h : constant	Expected disposable income of workers
(27)	$Y_v^{\,a} = Y_{v-1} + \theta_h \, . \, (Y_{v-1} - Y_v^{\,a}{}_{-1})$	With θ_h : constant	Revenu financier disponible anticipé

(28) $Y_w = W - T$ Expected disposable financial income

(29) $Y_v = i_{d-1} \cdot D_{-1}$ Revenu financier disponible

(30) $Y_h = Y_w + Y_v$ Disposable income of workers

(31-iv) $D \equiv D_{-1} + Y_h - C$ Bank deposits

(32) $\varphi = \varphi^d \cdot (1 - LR)$ Gross finance

(33) $\Delta F = \varphi - amort + CG$ Net finance

(34) $CG = CG_e + CG_{of}$ Capital gains of banks (Capital losses of firms)

(35) $LR = \gamma_4 + a_1 . (lev_{-1} - lev_c) - b_1 . V_C + c_1 \cdot i_{cb}$ With γ_4, a_1,b_1, lev_c and c_1 : constant Lender's risk

(36) $lev = (CP + OF + L) / K$ Leverage ratio

(37) $V_C = E / E_{-1}$ Value of the collateral

(38) $OF = (\lambda_{10} + \lambda_{11} . r_{of}^a - \lambda_{12} . r_e^a - \lambda_{13} . i_l - \lambda_{14} . i_{CP}) . F$ Bonds (Fixed rate)

(39) $E = (\lambda_{20} - \lambda_{21} . r_{of}^a + \lambda_{22} . r_e^a - \lambda_{23} . i_l - \lambda_{24} . i_{CP}) . F$ Equities

(40) $L = (\lambda_{30} - \lambda_{31} . r_{of}^a - \lambda_{32} . r_e^a + \lambda_{33} . i_l - \lambda_{34} . i_{CP}) . F$ Loans (variable long-term rate)

(41) $CP = F - OF - E - L$ Commercial paper

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

(43) $CG_{of}^a = CG_{of-1} + \theta_b . (CG_{of-1} - CG_{of\,-1}^a)$ Expected capital gains on bonds

(44) $CG_{of} = \Delta p_{of} \cdot of_{-1}$ Capital gains on bonds

(45) $of = OF / p_{of}$ Number of bonds

(46) $p_{of} = p_{of-1} (1 + i_{of}) / (1 + i_l)$ Prix des obligations à taux fixe

(47) $r_e^a = (P^{d\,a} + CG_e^a) / E_{-1}$ Expected return on equities

(48) $P^{d\,a} = P^d_{-1} + \theta_b . (P^d_{-1} - P^{d\,a}_{-1})$ Expected distributed profits

(49) $CG_e^a = CG_{e-1} + \theta_b . (CG_{e-1} - CG_{e\,-1}^a)$ Expected capital gains on equities

(50) $CGe = \Delta p_e \cdot e_{-1}$ Capital gains on equities

(51) $p_e = E / e$ Price of equities

(52) $i_l = i_{cb} + lr + \chi_1$ With χ_1: constant Interest rate on loans

(53) $lr = \gamma_5 + a_2 \cdot (lev_{-1} - lev_c) - b_2 \cdot V_C$ Lender's risk for long-term interest rate

With γ_5, a_2 and b_2, Lev_c constant = convention on leverage ratio

(54) $i_{CP} = i_{cb} + \chi_2$ With χ_2: constant $\chi_1 > \chi_2$ Interest rate on comm. paper

(55) $i_d = i_{cb} - \chi_3$ Interest rate on deposits

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

(57) $H = \eta \cdot D$ High powered money (bank reserves)

(58-vii) $P_{cb} \equiv i_{cb-1} \,.\, REF_{-1}$ Central bank profits

M1: Policy mix 1 with a Taylor rule (inflation gap and output gap) RM1

(M1-59) $i_{cb} = i^* + \Pi - \alpha_4 .OG + \alpha_5 (\Pi - \Pi^*)$ Central bank key interest rate (Taylor rule)

M2: Policy mix 2 with a truncated Taylor rule (only inflation gap) RM2

(M2-59) $i_{cb} = i^* + \alpha_5 (\Pi - \Pi^*)$ Central bank key interest rate (Truncated TR)

(60-vi) $REF \equiv REF_{-1} + \Delta H + \Delta B + \Delta F - CG - P_b - \Delta D$ Reserve requirements (CB refunds)

(61) $\Pi = \Pi^* + d_1 .(OG_{Rmini} - OG_R) + d_2 .(OG_{Rmaxi} - OG_R)$ Inflation (NKPC)

Missing equation : (62-viii) $REF = H$

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