Document de travail

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Links between financial markets and economy, monetary policy and welfare

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Abstract

In several countries, the United States, the United Kingdom and Spain for instance, the economic equilibrium depends to a significant extent on developments in financial markets (valuation of assets, interest rates, etc.) via many channels: wealth effects linked to the value of assets, availability of loans backed by the value of property owned by the borrower, mortgages extended at variable rates or easy to refinance… Other countries (Germany for instance) are in an opposite situation, with very few links between financial markets and the economy. The optimal monetary policies pursued in these two groups of countries are very different. We build a dynamic theoretical model determining the value of assets, production, interest rates and inflation to characterise these differences between monetary policies in the two groups of countries and to assess the corresponding differences in welfare levels. This analysis makes it possible first to analyse the favourable or negative effects of the introduction of strong links between the economy and financial or property markets; also to examine the possibility of a conflict between the usual target of stabilizing inflation, production and smoothing interest rates, and the additional target of controlling asset prices, depending on the financial structure of the country.

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INTRODUCTION

We look at the **effects of the nature of the links between financial markets (or property prices) and economies and the nature of financing on monetary policy and well-being.**

1 – Two types of country

For the sake of simplicity, we distinguish **two groups of countries. In the first group of countries** (United States, United Kingdom and Spain, for example), the economic equilibrium depends to a significant extent on trends in asset prices (stock market prices, property prices), and, furthermore, monetary policy has a significant and rapid effect on economic activity because of the nature of credits: loans are extended at floating rates (United Kingdom and Spain), or are easy to renegotiate when interest rates decline (United States).

In the **second group of countries** (Germany, Italy and France to a lesser extent), the economic equilibrium hardly depends on trends in asset prices, and, moreover, the effects of monetary policy are weakened and lagged over time, notably by the fact that loans are primarily extended at a fixed rate.

A debate about **which of the two models is preferable** is raging. In the first model, monetary policy is probably more efficient, but the variability of the economy can be increased, since it is linked to the variability of financial markets; in the second model, the economy does not react to financial hazards, but monetary policy may lack efficiency in the near term.

Let us first show that **both groups of countries are indeed found in practice.**

The more or less strong link between financial markets and economic equilibrium depends on the intensity of several mechanisms:

(1) **Wealth effects on the household front,** as a rise in their assets leads to a fall in their savings rate, especially if there are (as in the United States and the United Kingdom) loans backed by the borrower’s wealth. We examine the case of four countries: the United States, the United Kingdom, Germany and France.

Far more pronounced wealth effects on the household savings rate can be seen in the United States and the United Kingdom.

In the **United States,** the household savings rate declined sharply from 1998 to 2000, as stock market prices soared, and levelled off subsequently despite the slump in the stock market, due to the rise in property assets **(Chart 1A)** and the related robust growth in home equity loans (loans backed by the value of houses) **(Chart 1B)**.

Chart 1A
United States: Household wealth, savings, and debt load

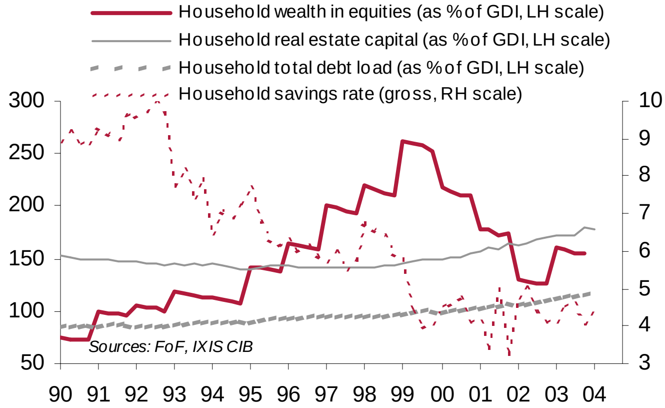
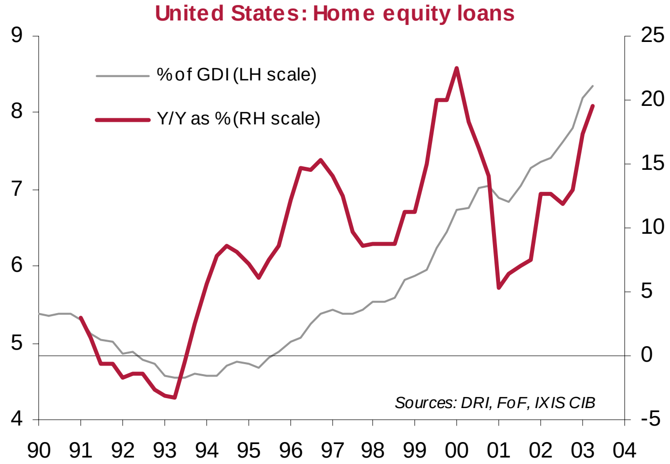


Chart 1B
United States: Home equity loans



In the **United Kingdom,** the household savings rate dropped noticeably from 1997 to 1999, and again from late 2000 to the end of 2002 **(Chart 2A),** and at each occasion this was associated with a rise in the value of property assets **(Chart 2B)** and the increase in mortgage equity withdrawals (cash extracted from mortgages when house prices rise) **(Chart 2C)**. In **Germany,** the household savings rate trended downwards from 1993 to 2000 **(Chart 3A)** before rising afterwards — perhaps in relation with moves in stock market prices **(Chart 3B)**. In France, the household savings rate was more or less stable from 1995 to 2002, despite trends in stock market prices **(Chart 4)**.

Chart 2A
United Kingdom: Household wealth, debt and savings

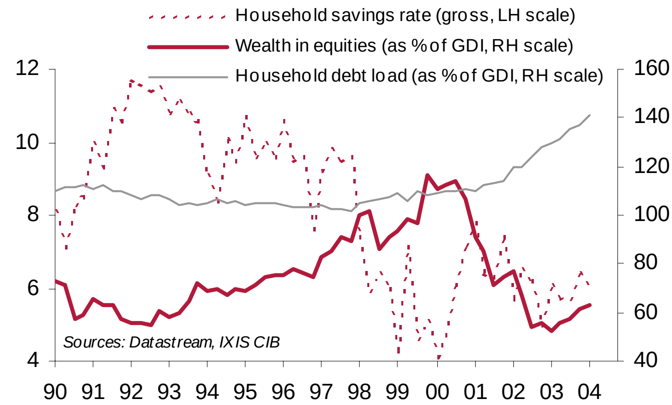


Chart 2B
United Kingdom: Household real estate capital (as % of GDI, annualised)

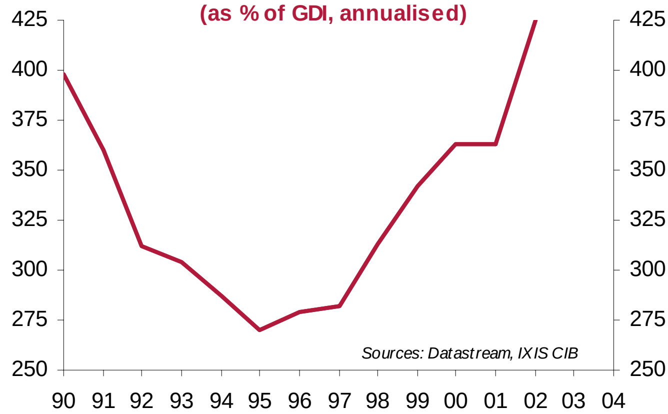


Chart 2C
United Kingdom: Mortgage equity withdrawals
(as % of GDI)

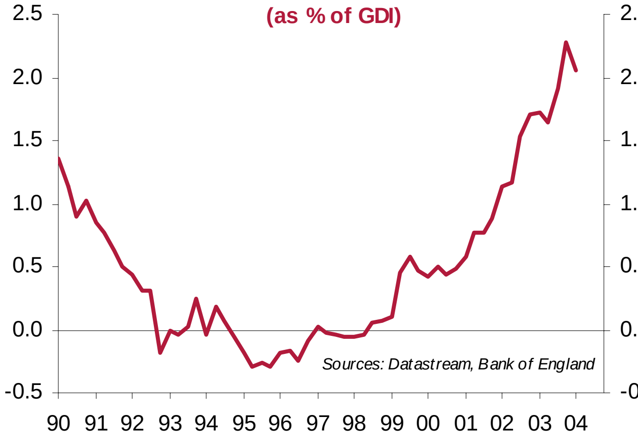


Chart 3A
Germany: Household debt and savings

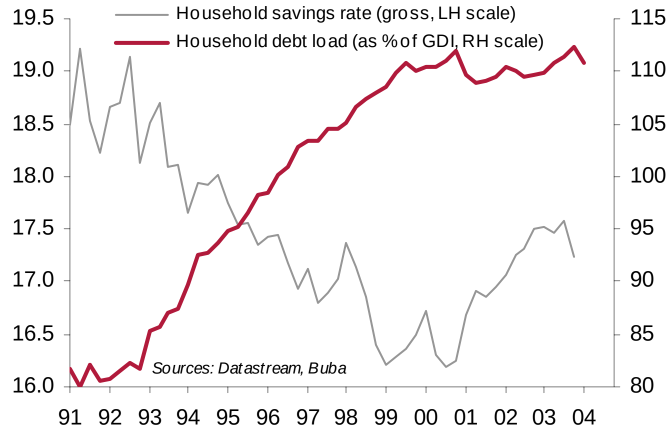


Chart 3B
Germany: Household wealth in equities
(as % of GDI)

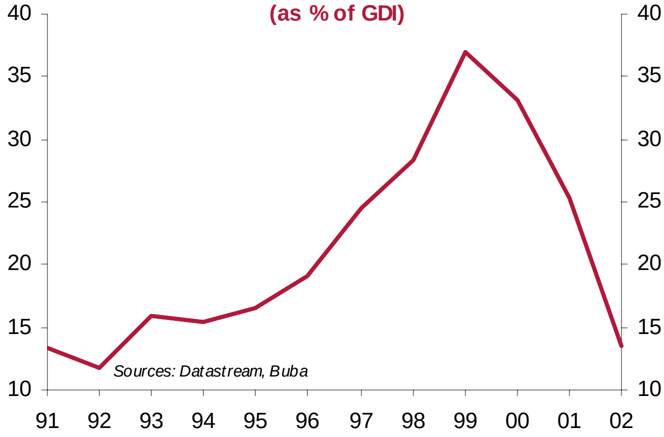
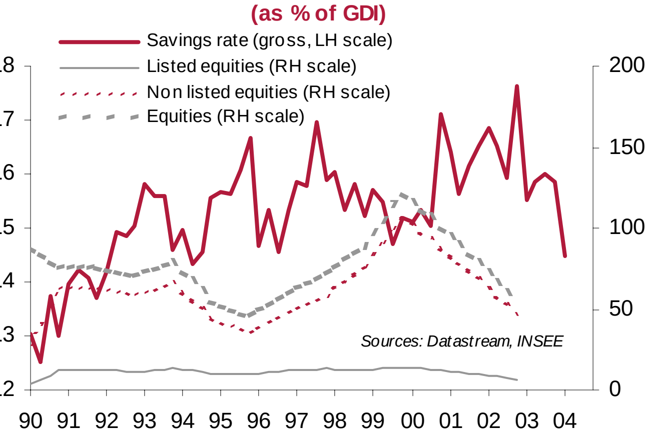


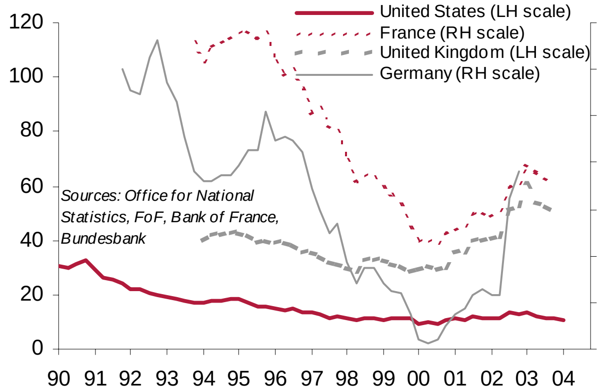
Chart 4
France: Household wealth and savings rate
(as % of GDI)



(2) **The effects of the financing mode of companies.** When companies are financed in the markets (equities, bonds, etc.), moves in the market affect business leaders' spending decisions to a greater extent than if they are financed by bank loans. A slide in the stock market, for example, makes it more difficult to finance investments. A high degree of disintermediation thus results in a stronger link between moves in financial markets and demand for goods.

The degree of corporate disintermediation is high in the United States and the United Kingdom, while it is low in France and Germany (Chart 5).

Chart 5
Bank loans to companies / stock market capitalisation + outstanding bonds (ratio as %)



This should lead to a more significant link between market trends and corporate decisions in the United States and the United Kingdom.

(3) **The effects of the structure of income between earned income and unearned income. If the share of unearned income in total household income increases, then naturally trends in financial markets affect household demand to a greater extent.**

Unearned income currently represents 17% of household disposable income in the United States **(Chart 6A)**, 10% in the United Kingdom **(Chart 6B)**, 15% in Germany **(Chart 7C)**, but with a different definition, and 8% in France **(Chart 7D)**. Unearned income plays an important role above all in the United States.

Chart 6A
United States: Payroll received by households and household unearned income (as % of GDI)

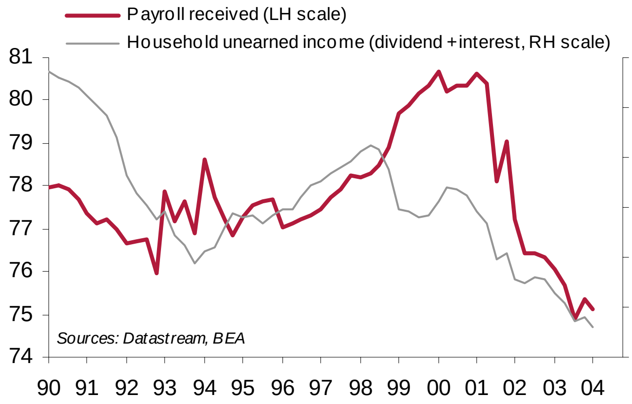


Chart 6B
United Kingdom: Payroll received by households and household unearned income (as % of GDI)

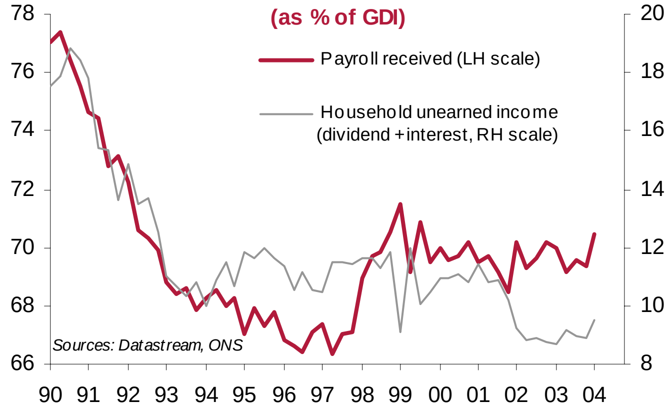


Chart 6C
Germany: Payroll received by households and household unearned income (as % of GDI)

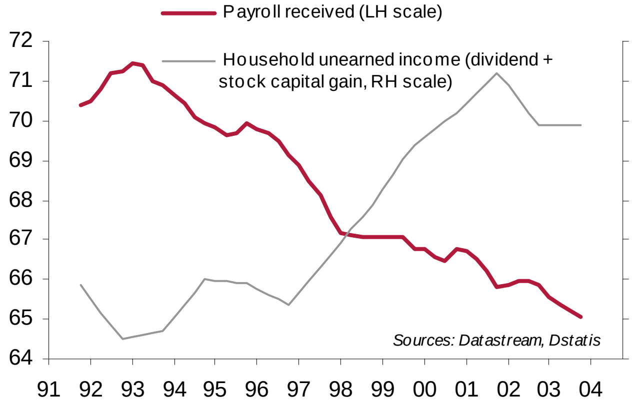
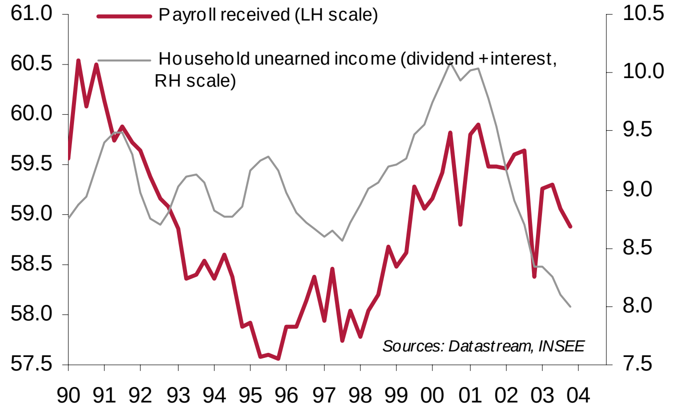


Chart 6D
France: Payroll received by households and household unearned income (as % of GDI)



It is therefore clear that these mechanisms create a **stronger link between trends in financial markets and the economy in the United States and the United Kingdom than in Germany or France.**

Let us now look at **the link between interest rates (monetary policy) and real activity.** In our opinion, this link is strong in the near term when the technology used to extend loans to households generates this type of link:

- because there are loans backed by the borrower's wealth (as seen above, home equity loans in the United States, mortgage equity withdrawals in the United Kingdom);
- because **floating interest rates, i.e. renegotiable interest rates** are used, e.g. in the United States, and not fixed rates (as in Germany) for mortgage loans and also due to the **ease in obtaining and low cost of** mortgage loan renegotiations when interest rates decline.

The household **mortgage debt load** is far larger, in relation to income or property wealth, in the **United States**, the **United Kingdom and Spain** than in Germany, France and Italy **(Charts 7A, B** and **C),** the same point holds for household consumer loans **(Charts 8A** and **B).** The countries where the household debt load is substantial are also those where residential property prices have increased the most rapidly **(Charts 9A** and **B).**

Chart 7A
Household mortgage loans (as % of GDI)

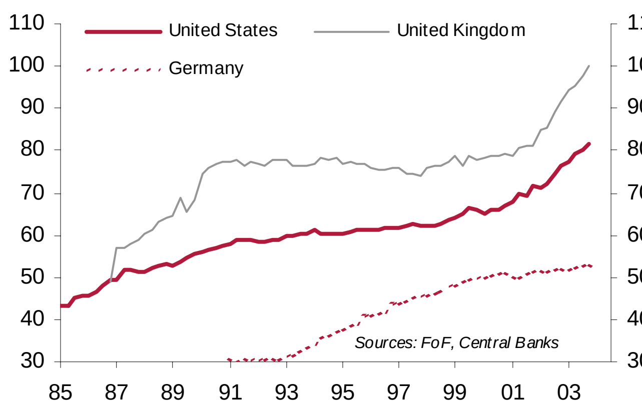


Chart 7B
Household mortgage loans (as % of GDI)

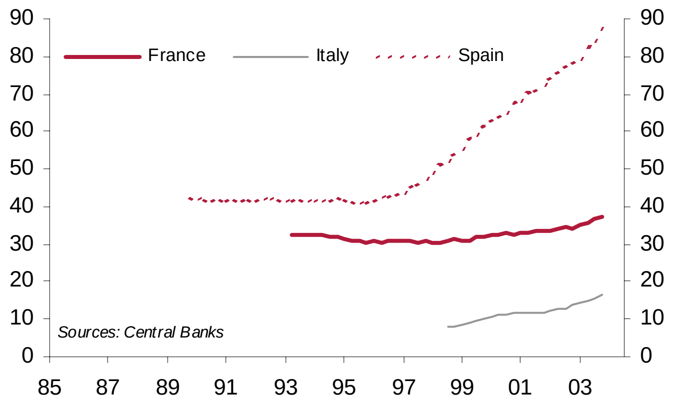


Chart 7C
Household mortgage loans / real estate wealth
(ratio as %)

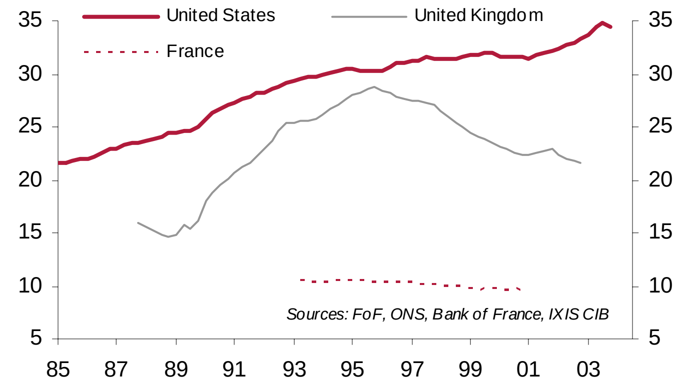


Chart 8A
Household consumer loans
(total ex mortgage loans, as % of GDI)

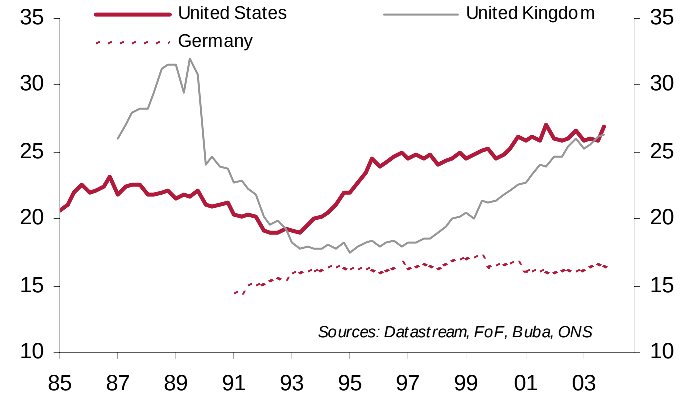


Chart 8B
Household consumer loans
(total ex mortgage loans, as % of GDI)

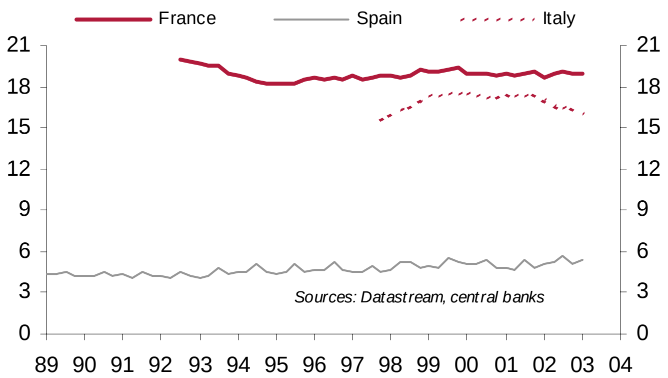


Chart 9A
House prices (Y/Y as %)

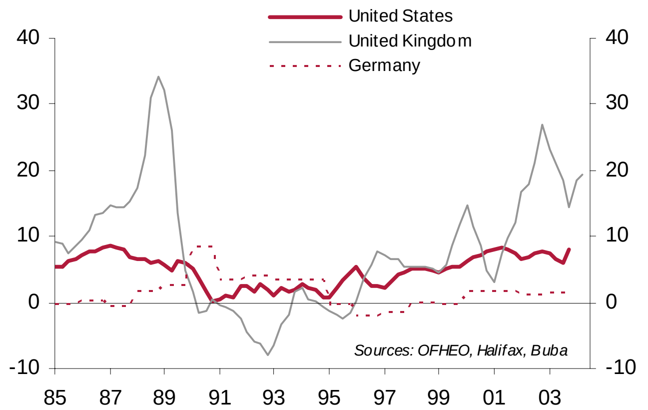
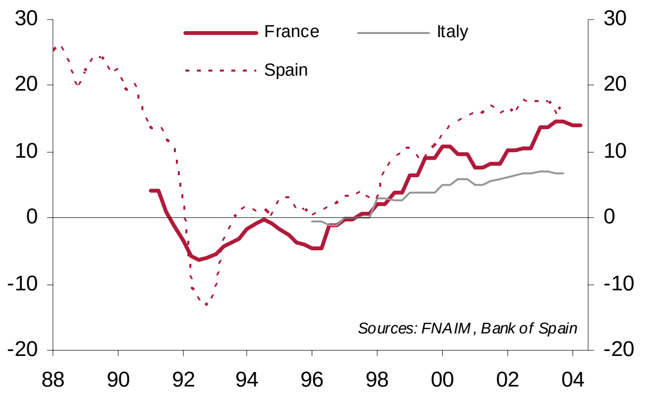


Chart 9B
House prices (Y/Y as %)



As is well known, in the **United States,** many types of credits (home equity loans and credit margins) are linked to the asset values held by households (property and equities) and increase sharply when the prices of these assets rise **(Chart 10A).** It is also well established that in the United Kingdom, households can extract cash from their mortgages when house prices rise **(Chart 10B.** Lastly, it is well known that in **Spain** and the **United Kingdom (Table 1)** mortgages are extended at a **floating rate** and demand for credit accordingly reacts significantly to rate cuts.

Table 1
Principal characteristics of property loans

	Variable rate	Fixed rate
United States	17	83
Spain	80	20
Germany	30	70
Italy	40	60
France	25	75
United Kingdom	71	29

Source: national central banks

Chart 10A
United States: Home equity loans and margin credit (as % of GDI)

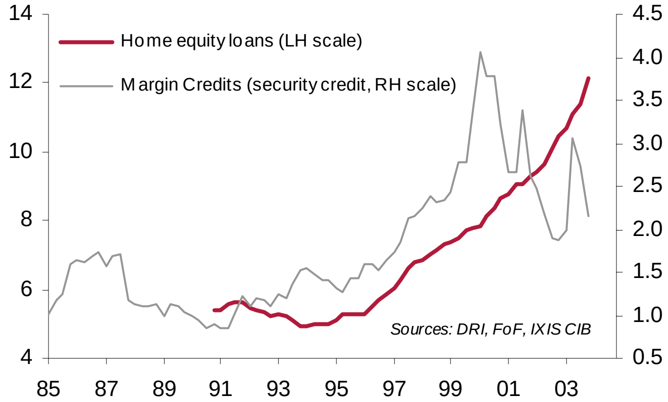
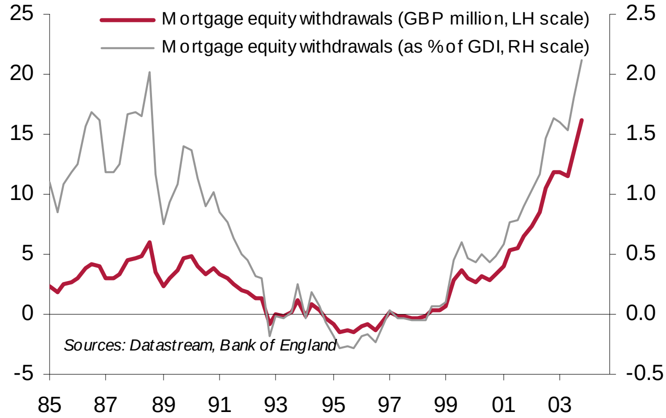
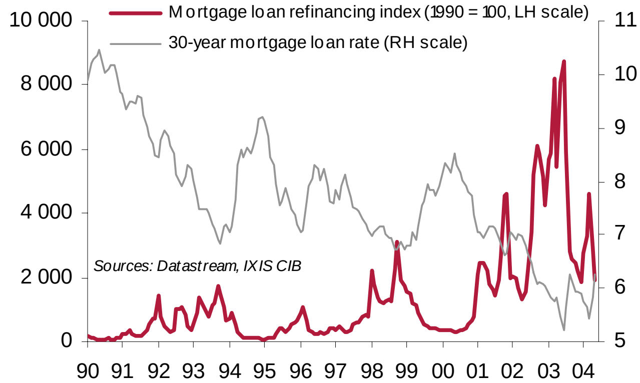


Chart 10B
United Kingdom: Mortgage equity withdrawal



Finally, it is well known that in the **United States,** declines in mortgage rates allow borrowers to refinance their loans **(Chart 11).**

Chart 11
United States: Mortgage rate and mortgage refinancing



It is therefore not surprising to see that **rate cuts stimulate household demand for credit and housing investment in the United States (Chart 12A), in the United Kingdom (Chart 12B), and Spain (Chart 12C), but markedly less in France and Italy (Charts 12D** and **E) and not at all in Germany (Chart 12F).**

Chart 12A
United States: Mortgage rate, mortgage loans and household investment

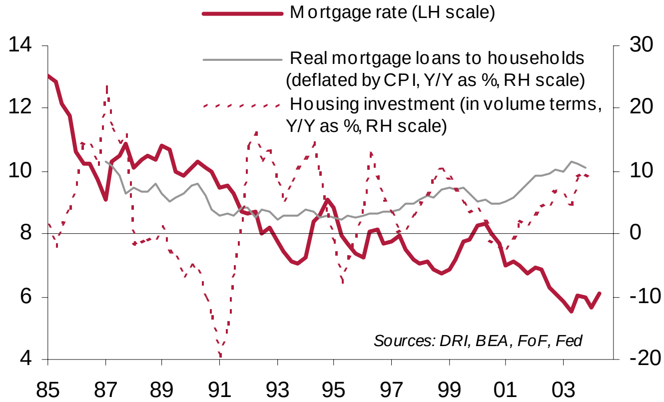


Chart 12B
United Kingdom: Mortgage rate, mortgage loans and household investment

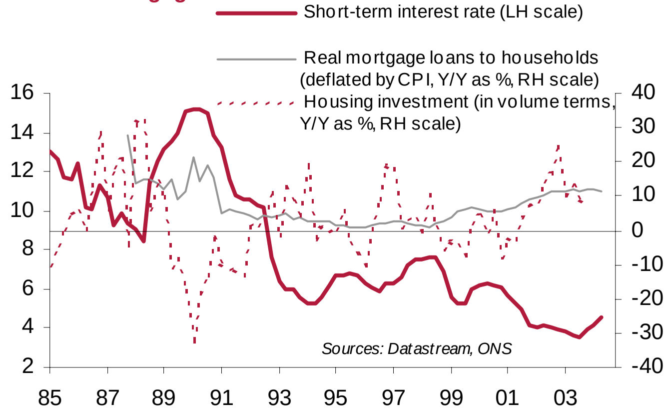


Chart 12C
Spain: Mortgage rate, mortgage loans and household investment

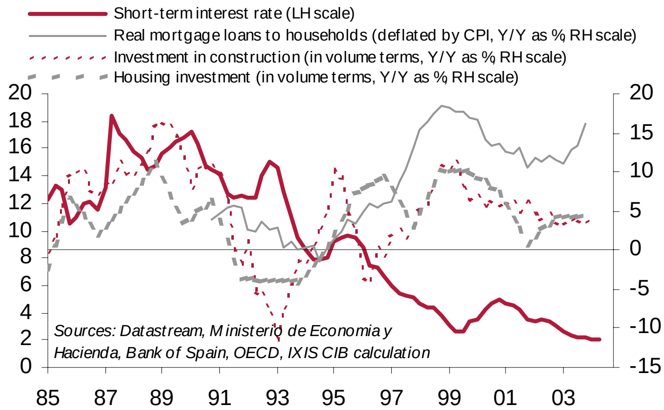


Chart 12D
France: Mortgage rate, mortgage loans and household investment

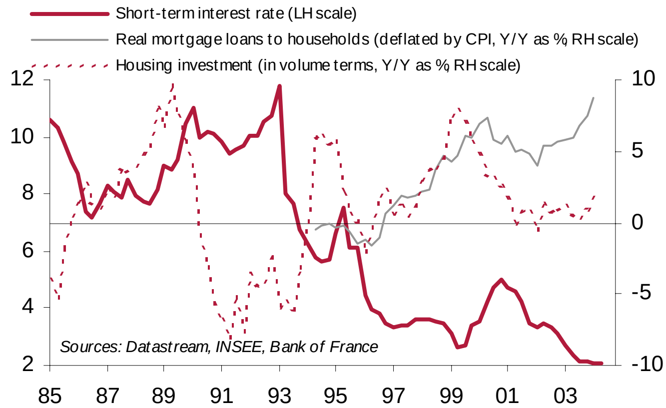


Chart 12E
Italy: Mortgage rate, mortgage loans and household investment

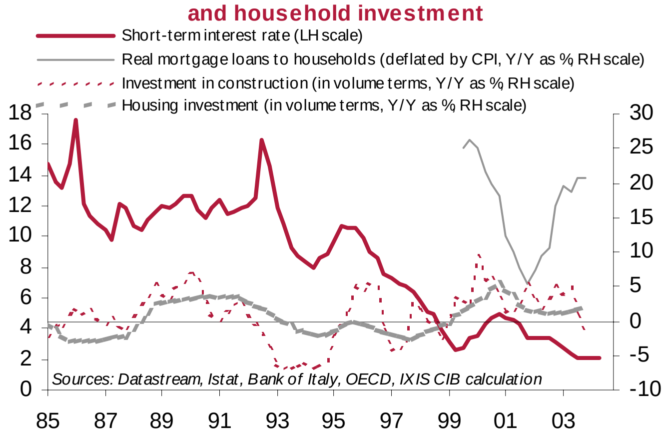
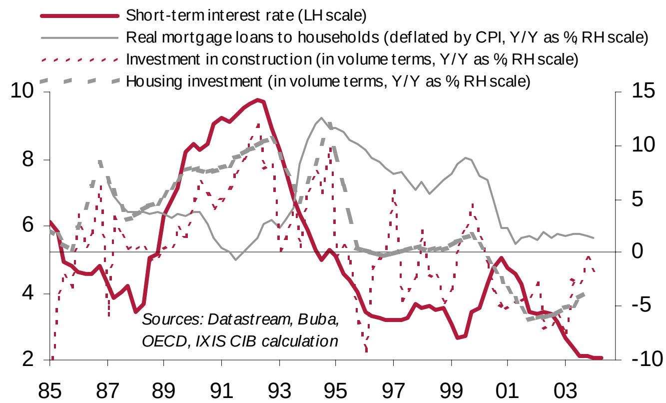


Chart 12F
Germany: Mortgage rate, mortgage loans and household investment



Our breakdown into two groups of countries, between those (the United States, the United Kingdom and Spain, for example) where demand is significantly linked to moves in asset prices and where changes in interest rates have a swift effect on real activity, and those (Germany, France and Italy, for example) where the opposite situation prevails is therefore meaningful and corresponds to observed phenomena.

2 – The nature of transmission mechanisms in monetary policy

We are going to develop a robust theoretical model, explaining trends in asset prices, production, inflation, and interest rates (set by the central bank) in response to demand shocks and inflationary shocks. We analyse first the overall model before specifying two specific cases that correspond to the two groups of countries seen above. First, those: where wealth effects on demand are significant and where monetary policy rapidly influences real activity (production is not inert) and, second, those where on the contrary wealth effects are weak and where production is inert (responds slowly to changes in interest rates).

In the two groups of countries, transmission mechanisms in monetary policies can be expected to be different:

- the credit channel[1] is normally a more important mechanism when there is hardly any disintermediation[2], i.e. market financing;

- the direct effects of asset prices[3] and the effects related to changes in balance sheets (value of guarantees, etc.[4]) are found in the first group of countries, where wealth effects and the holding of assets are substantial[5]; Ehrmann-Fratzcher (2004) confirm that, in the opposite direction, the monetary policy conducted in the United States has a lot of influence on stock market prices, which does create a transmission channel via asset prices, notably via the stock market[6];

- the nature of the interest rate on loans (whether fixed, variable or revisable) changes the rapidity of action and the efficiency of changes in short-term interest rates, although this point has not been studied extensively[7].

Empirical studies about the transmission channels of monetary policy hardly look into[8] the differences that we have just mentioned between countries where asset prices play an important role and where production responds rapidly to changes in interest rates and countries that are in the opposite situation.

These studies highlight:

- legal differences and differences in the financial structure [9];

- the concentration, the size, the capitalisation and liquidity of banks, therefore their behaviour in terms of setting interest rates [10].

These differences seen above (role played by asset prices, nature of loans) have hardly been studied.

The results of empirical studies are also sometimes surprising, when one takes into account these differences in financial structures between countries (within the euro zone, or between Germany and Spain for example).

[1] Bernanke-Blinder (1992), Gertler-Gilchrist (1994).
[2] Hubbard (1995-2001), Cecchetti (1999); Ehrmann-Ganbacorta-Martinez-Pages, Ehrmann (2000), Sevestre-Worms (2001); Kashyap-Stein-Wilcox (1993), BIS (1995).
[3] Mishkin (2001), Lettau-Ludvig Son-Steindel (2001), Kashyap-Stein (1994), Gertler-Gilchrist (1994), Bernanke-Lown (1991).
[4] Bernanke-Gertler (1989-1995), Ceccheti (1995), Hubbard (1995, 2001), Bernanke-Gertler-Gilchrist (1999), Kiyotaki-Moore (1997).
[5] ECB (2002), Allen-Gale (2000).
[6] Mishkin (1995), Meltzer-Mishkin (1995), Reifschneider-Tetlow-Williams (1999).
[7] Borio (1998) is an exception.
[8] Except allusively, Angeloni-Ehrmann (2003).
[9] Cecchetti (2201).
[10] De Bondt-Mojon-Valla (2003), Hofmann (2003), Ehrmann-Gambacorta, Martinez-Pages, Sevestre, Worms (2003), Barrant-Couder-Mojon (1997), Favero-Giavazzi-Flabbi (1999), Kashyap-Stein (1997, 2000), Kishan-Opiela (2000), Cotarelli-Kourells (1994), De Bondt (1999), Mojon (2000).

Some authors find little heterogeneity within the euro zone[11]. Others find odd results [12].

On the other hand, differences appear in the transmission between the United States and the euro zone[13] that seem to be due to the fact that monetary policy influences investment above all in the euro zone and especially consumption in the United States[14].

We are therefore going to try to answer to two questions in this article, starting off from the idea that the gap between the first group of countries (significant wealth effects and low inertia of production) and the second group of countries (low wealth effects and significant inertia in production) is substantial, and changes the reaction of the economy to shocks and monetary policies:

- **which is the preferable model,** between the two groups of countries? In particular, must the countries of the second group (Germany, France and Italy) try to draw nearer to those of the first group (United States and United Kingdom), by introducing wealth-backed loans, by facilitating the utilisation of variable-rate loans, by making loan refinancing easier? We accordingly compare well-being in the two types of country, after the unfolding of demand or inflation shocks, to ascertain the preferable model;

- **is it more or less dangerous in either group of countries, if central banks consider that stabilising asset prices is one of their monetary policy targets?** The stabilisation of prices and activity as well as the smoothing of interest rates are their initial ultimate goal; is it endangered if the stabilisation of asset prices is deemed an additional target? **Is there a conflict between** the usual ultimate goal, and the target of ensuring stability in asset prices? This can effectively depend to a large extent on the financial structure of countries, as we have defined it here.

In fact, it is well known that central banks reject the idea of introducing the stabilisation of asset prices as a monetary policy target, despite the arguments in favour of this introduction: disappearance of speculative bubbles and their destabilising effects on banks notably[15].

The main arguments put forward to reject the idea of stabilising asset prices by central banks are as follows:

- the link between asset prices and inflation can be unstable, depending for example on the nature of shocks [16];

- central banks have no comparative advantage in relation to financial markets to ascertain the reasonable level of asset prices or detect bubbles [17];

- the ability to control asset prices by central banks seems dubious from their point of view;

- transparency would be hurt if the number of targets set by central banks were to increase markedly [18];

- the problems encountered in interpreting trends in asset prices can lead to a loss of credibility [19];

- there can be a conflict between the stabilisation of prices of goods and the stabilisation of asset prices[20];

[11] Kieler-Saarenheimo (1998), Guiso-Kashyap-Panetta-Terlizzese (1999), Angeloni-Kashyap-Mojon (2003).
[12] Mojon-Peersman (2003), and Worms (2003) find that monetary policy is the most efficient in Germany. We prefer the result provided by Van Els-Locarno-Morgan-Villetelle (2003) who find that this is the case in Spain.
[13] Peersman-Smets (2003), Smets-Wouters (2003).
[14] Angeloni-Kashyap-Mojon-Terlizzese (2003).
[15] Ceccheti-Genberg-Lipsky-Wadhwani (1999), Goodhart (1996)).
[16] Freedman (1994).
[17] Bernanke-Gertler (1999), Bernanke (2002).
[18] Bernanke-Laubach-Mishkin-Posen (1999), Mishkin (1999).
[19] Atkeson-Kehoe (2001), Calvo-Vegh (1999), Faust-Svensson (2001), Herrendorf (1999) Persson-Tabellini (1994).
[20] Dupor (2001-2002).

- the stabilisation of asset prices by the central bank generates a moral hazard[21].

We thus deal in this article exclusively with one argument: is there a conflict between targets between the stabilisation of asset values and that of real activity and inflation? Is this conflict more or less severe in the countries of the first group (strong link between the economy and financial markets) or the second group (weak link between the economy and financial markets and weak effect of interest rates on demand for goods)?

II – MODELLING

1 – Our model

Production is inert; it depends of the real interest rate and the real value of assets, it is affected by a hazard.

This is written:

$$(1)\ y_t = \lambda y_{t-1} + (1-\lambda)\left(-\gamma\left(r_t - q_{t+1}\right) + \mu b_t\right) + \varepsilon_t$$

y is the logarithm of production;
r is the nominal interest rate;
q is inflation, $q_{t+1} = p_{t+1} - p_t$, where p is the logarithm of the price;
b is the logarithm of the real value of assets held (equities, property, etc.); $b = a - p$, where a is the par value of these assets;
ε is a demand variable, which is a **white noise.**

The dynamics of asset prices (and of their value, as supply is supposed to be constant) is (see **Appendix 1).**

$$(2)\ E_t\left(b_{t+1}\right) - b_t + \rho\left(\left(y_t - \hat{y}\right) - \left(b_t - \hat{b}\right)\right) = r_t - q_{t+1} - \rho$$

with $\rho = \hat{r} - \hat{q}$, where $E_t\left(b_{t+1}\right)$ represents the mathematical expectation of b_{t+1} conditional to the information held in t. The variables with a ^ represent levels at **the long-term stationary equilibrium** (without any hazard). (2) expresses the equality, as a divergence from the long-term equilibrium, between the real interest rate and the return on assets, the sum of the income generated (relative to the value of assets), as this income is linked to production (hence the term $y_t - b_t$), and capital gains $\left(b_{t+1} - b_t\right)$.

Inflation depends on expected (long-term) inflation and the excess demand for goods in relation to supply; it is affected by a hazard:

$$(3)\ q_{t+1} = p_{t+1} - p_t = \pi + \alpha\left(y_t - z\right) + \eta_t$$

π is expected inflation, z the logarithm of the supply of goods, η the inflation hazard, which is a **white noise.**

In the long term, at the stationary equilibrium given the lack of hazards $(\varepsilon = \eta = 0)$, we have:

[21] Caballero-Krishnamurthy (2003), Illing (2000); Miller-Weller-Zhang (2001).

$$(4)\quad \begin{pmatrix} \hat{y} = z \\ \hat{q} = \pi \\ \hat{b} = \hat{y} - \ell n(\hat{r} - \hat{q}) + \ell n(\theta) \text{(see Appendix 1)} \\ \hat{y} = -\gamma(\hat{r} - \pi) + \mu\hat{b} \end{pmatrix}$$

Production is equal to supply, inflation is equal to long-term inflation, the value (in real terms) of assets rises in line with production, decreases in line with the real interest rate (θ is a constant term); the fourth equation of (4) comes from (1).

The real long-term interest rate is defined by the equilibrium of the product market, i.e.:

$$(5)\quad z(1-\mu) = -\gamma(\hat{r} - \pi) - \mu\ell n(\hat{r} - \pi) + \mu\ell n(\theta)$$

2 – Monetary policy

In the near term, production differs from the supply of goods (because of the presence of hazards), the equilibrium differs likewise from the long-term equilibrium, and the central bank chooses in period t the interest rate to minimise the loss function:

$$(6)\quad L_t = (y_t - z)^2 + A(q_{t+1} - \pi)^2 + B((r_t - q_{t+1}) - (\hat{r} - \pi))^2$$

which includes the deviation of production from supply, of inflation from long-term inflation (with a weight A), and of the real interest rate from the real long-term interest rate (with a weight B). Naturally, if $y_t = z, q_{t+1} = \pi,$ we are in a long-term equilibrium and $r_t = \hat{r}.$ The central bank takes the value b_t of assets as given; in view of (3), it minimises:

$$(7)\quad L_t = (y_t - z)^2 + A(\alpha(y_t - z) + \eta_t)^2 + B(r_t - q_{t+1} - (\hat{r} - \pi))^2$$

where y_t is given by (1), hence, for the choice of the real interest rate:

$$(8)\quad B(r_t - q_{t+1} - (\hat{r} - \pi)) = \gamma(1-\lambda)(1 + A\alpha^2)(y_t - z) + A\alpha\gamma(1-\lambda)\eta_t$$

The real interest rate is higher than its long-term level if production is strong $(y_t > z)$ or if inflation is affected by a positive hazard $(\eta_t > 0)$.

The resolution of the equilibrium and of the dynamics, given the determination (8) of the real interest rate is carried out in **Appendices 2** and **3.** The dynamics has, as is necessary, a stable root (lower than 1) and an unstable root (in excess of 1) as soon as $\mu < 1,$ i.e. the wealth effects on demand are not too substantial.

If $\mu > 1$ (significant wealth effects), a rise in the value b of assets leads to a sharp increase in production, hence a rise in the income distributed by assets that reduces the necessary capital gains and can result in their own value becoming stable, something that has to be avoided, combined with the dynamics of asset values.

We suppose subsequently that $\mu < 1,$ and therefore the dynamics (of the real value b of assets and of production y) has the required characteristics.

The resolution of the dynamics (**Appendix 3**) shows two cases:

- either the **reaction of the interest rate to shocks is weak** $\left(\gamma(1-\lambda)\frac{(1+A\alpha^2)}{B}\text{low}\right)$, or because $\gamma(1-\lambda)$ is low (the interest rate is hardly efficient in terms of obtaining a variation in output), or because B is high (variations in the real interest rate are significantly penalised). In such a case, a positive demand shock $(\varepsilon > 0)$ leads to a rise in asset values, since it implies a rise in income distributed; an inflation shock $(\eta > 0)$ leads to a weak decline in asset values, since the interest rate hardly varies. The case limit $B = +\infty$ (total rigidity of the real interest rate) is studied in **Appendix 4.** We can see that then b (value of assets in real terms) grows in line with ε (the demand shock), but does not vary in line with η (the inflation shock).

- or the **reaction of the interest rate to shocks is strong** $(\gamma(1-\lambda)\text{high}, B\,\text{low})$. A positive demand shock $(\varepsilon > 0)$ then leads to a fall in b (value of assets) because of the reaction of the interest rate; a positive inflation shock $(\eta > 0)$ also drives down b for the same reason (see in **Appendix 4** the borderline case $B \to 0$).

3 – Economy linked or not to financial markets

We have seen above that **two groups of countries** can be distinguished**:**

- those where real activity depends significantly on financial markets, because there are loans backed by borrowers' wealth, and where loans are extended at floating rates, and are easily renegotiable. In these countries, **asset prices have substantial effect on demand and changes in interest rates specially influence real activity.** We represent this (see (1)) by $\lambda = 0$ (no inertia in production in response to changes in real interest rates), and μ is **high** ($\mu < 1$ to ensure the stability of dynamics), i.e. a major effect of the value (in real terms) of assets on demand for goods;

- countries where real activity hardly depends on financial markets, because there is no financing linked to borrowers' wealth, loans are extended at a fixed non-renegotiable rate… We represent these countries by high λ $(\lambda < 1)$, significant inertia in production, and $\mu = 0$ (no effects of asset values on demand for goods).

We are going to examine the effect on the economic equilibrium of **two shocks:**

- **a positive demand shock in period** $t = 0$ $(\varepsilon_0 > 0, \varepsilon_t = 0 \text{ for } t \neq 0)$;

- **a positive inflation shock in period** $t = 0$ $(\eta_0 > 0, \eta_t = 0 \text{ for } t \neq 0)$.

We calculate, in each case, trends in production, inflation, the real interest rate and well-being from the resolution of the dynamics seen above; the comparison of levels of well-being enables us to define the best financing model.

3 – 1 Demand shock

The details of our calculation are given in **Appendices 5** and **7.**

- In the **first group of countries** (financing linked to markets, no inertia in production and major wealth effect), **demand or inflation shocks (which occur only in period 0) have an effect on the economic equilibrium only in period 0.** Production is not inert; as the dynamics of the asset values is forward-looking, as soon as there no shock any more (in $t=1$), asset values align themselves on their long-term value, and this is therefore also the case for other variables. The positive demand shock:

- drives production upwards in $t=0$;
- in consequence, drives inflation upwards;
- thus leads to a rise in the interest rate;
- has an ambiguous effect on asset values; since the interest-rate effect and the production effect oppose one another; if B is low (sharp rise in the real interest rate), it declines; if B is high (significant rigidity in the interest rate), it rises.

- **In the second group of countries** (no wealth effect on demand, significant inertia of production), after the shock, production converges slowly towards its long-term level, while inflation and the real interest rate follow in the wake of production. The effect on asset values of the demand shock has an ambiguous sign, for the same reasons as in the first group of countries (production and interest-rate effects playing in opposite directions).

We compare the loss in the first group of countries (due to the fact that the shock $\varepsilon_0 > 0$ moves the economy away from the stationary equilibrium $(z, \pi, \hat{r} - \pi)$, this loss is concentrated in $t=0$) and the loss (discounted at the rate φ) in the second group of countries (this loss decreases over time).

If B is low (weak inertia of the real interest rate), the shift in the equilibrium in $t=0$ due to the shock is small in the first group of countries, because the rise in the interest rate reduces wealth and this is very efficient in terms of stabilising production.

If B is very high (significant inertia of the real interest rate), production in $t=0$ in the first group of countries is:

$$\text{(9 a)} \quad (y_0 - z)(1 + \rho - \mu\rho) = \varepsilon_0(1 + \rho)$$

The increase in production owing to the shock $\varepsilon_0 > 0$ is amplified by the wealth effect stemming from the rise in asset values.

In the second group of countries, this is:

$$\text{(9 b)} \quad y_0 - z = \varepsilon_0$$

Since there is no wealth effect, but, while $y_t = z$ of $t=1$ in the first group of countries, we are in the second group of countries $y_1 - z = \lambda(y_0 - z)$, where λ (inertia in production) is high.

If the discount rate of the loss is close to ρ, without ambiguity, the loss is also here lower in the first group of countries because the shock does not persist (see **Appendix 7).**

In case of a demand shock, well-being is high in the first group of countries (significant wealth effect and no inertia in production).

If the reaction of monetary policy is strong, its efficiency is improved by the wealth effects in the first group of countries; if it is weak, the second group of countries (small wealth effect and significant inertia in production) is hurt by the persistence of the shock.

3 – 2 Inflation shock

The details of our calculation are given in **Appendices 6** and **7**.

- **In the first group of countries** (major wealth effects and no inertia in production), as in the case of the demand shock, the inflation shock at date $t = 0$ modifies the economic equilibrium only at that point in time.

The inflation shock $(\eta_0 > 0)$ leads to a rise in inflation, and therefore leads to an increase in the real interest rate, which drives down production and asset values.

In the **second group of countries** (lack of wealth effects and significant inertia in production):

- **during the period of the shock** $(t = 0)$, inflation increases, the real interest rate rises and production contracts;
- subsequently $(t \geq 1)$, the inertia in production leads to the level of production remaining lower than the level of the long-term equilibrium $(y_t < z)$, as the gap $y_t - z$ gradually decreases. In consequence, the interest rate and production sink under their long-run levels.

We therefore have:

- in $t = 0, y_0 < z, q_1 > \pi, r_0 - q_1 > \hat{r} - \pi$
- in $t = 1, y_t < z, q_{t+1} < \pi, r_t - q_{t+1} < \hat{r} - \pi$.

Let us compare the losses:

- **If B is low** (low inertia in the real interest rate), the real interest rate is chosen quite freely to minimise: $(y_t - z)^2 + A(\alpha(y_t - z) + \eta_t)^2$.

In $t = 0, \eta_0 > 0,$ and optimal production is given by:

$$(10\text{ a})\quad y_0 - z = \frac{-A\alpha\eta_0}{1 + A\alpha^2}$$

In $t \geq 1, \eta_t = 0,$ and optimal production is simply $y_0 = z,$ equal to the level of the long-term equilibrium.

This is true in both groups of countries, independently from their financial structure, and well-being is then similar in the two groups of countries.

- **If B is high (significant inertia in the real interest rate),** in both groups of countries, we have:

$$(10\text{ b})\quad \begin{cases} y_t - z = 0 \forall t \\ q_1 - \pi = \eta_0 \\ q_{t+1} - \pi = 0, t \geq 1 \end{cases}$$

Since monetary policy does not react to the inflation shock, the latter has no effect on production, whether it depends or not on asset values since they do not vary either. Since production is not affected, whether it is more or less inert has no effect.

This shows that, in the event of an inflation shock, it is indifferent whether countries belong to the first group (large wealth effects, production without inertia) or the second one (small wealth effects, inert production).

4 – Additional objective of asset price stability

We now wish to look at the following question: do central banks have the initial ultimate goal seen above, represented by the loss function (6), and which includes the stabilisation of production, inflation and interest rates; if, moreover, central banks want to stabilise the value b of assets, what is the risk that this will create a conflict of objectives with the initial objective (6)? To what extent, in either group of countries, does the central bank hurt the quality of the usual stabilisation if it adds the asset price stability target to its previous ones?

To answer the question, we suppose that the central bank has a pure asset price stability target (and thus obtains $b_t = \hat{b}$), and we wonder whether, for each group of countries, this significantly hurts the usual well-being (6) in comparison with the usual stabilisation policy (minimisation of (6)). If the loss in well-being (calculated with the loss function (6)) is high, we can draw the conclusion that the conflict of objectives is significant.

The stabilisation of asset values $\left(b_t = \hat{b}, \forall t\right)$ leads to (see (2)) the real interest rate:

$$(11)\quad r_t - q_{t+1} - (\hat{r} - \pi) = \rho(y_t - z)$$

: there is a rise in the real interest rate if production (and therefore the income generated by the asset) increases, to prevent the rise in the price of the asset.

Given (11), and since $b = \hat{b}$, we have:

$$(12)\quad \begin{cases} (y_t - z)(1 + (1-\lambda)\gamma\rho) = \lambda(y_{t-1} - z) + \varepsilon_t \\ q_{t+1} - \pi = \alpha(y_t - z) + \eta_t \end{cases}$$

Hence the solution, by putting ourselves back in the case of the shocks $\varepsilon_0 > 0 \ \left(\varepsilon_t = 0, t \neq 0\right)$ and $\eta_0 > 0 \ \left(\eta_t = 0, t \neq 0\right)$ seen above:

$$(13)\quad \begin{cases} y_t - z = \left(\dfrac{\lambda}{1 + (1-\lambda)\gamma\rho}\right)^t \dfrac{\varepsilon_0}{1 + (1-\lambda)\gamma\rho} \\ q_{t+1} - \pi = \alpha\left(\dfrac{\lambda}{1 + (1-\lambda)\gamma\rho}\right)^t \dfrac{\varepsilon_0}{1 + (1-\lambda)\gamma\rho} + \begin{cases} \eta_0 \text{ in } t = 0 \\ 0 \text{ in } t \geq 1 \end{cases} \\ r_t - q_{t+1} - (\hat{r} - \pi) = \rho\left(\dfrac{\lambda}{1 + (1-\lambda)\gamma\rho}\right)^t \dfrac{\varepsilon_0}{1 + (1-\lambda)\gamma\rho} \end{cases}$$

The real interest rate depends exclusively on production, as is shown by (11), to stabilise asset values. Consequently, the inflation hazard η_0 affects only inflation, and is not transmitted to either the real interest rate, or production.

We compare in **Appendix 8** the loss (calculated with the loss function (6)) corresponding to the equilibrium (13), and the loss (for each group of countries) corresponding to the case where monetary policy minimises the loss (6), i.e. to the usual objective.

In the case of a demand shock, if B is not too high (i.e. if the real interest rate is flexible enough), the loss in well-being (calculated with loss function (6)) if the central bank's target becomes the stabilisation of the value b of assets, instead of the minimisation of (6), is far smaller in the second group of countries (no wealth effect and inert production) than in the first (major wealth effect and no inertia in production).

We have, in the second group of countries, when asset values are controlled (see (12)):

$$(14\text{ a})\quad \begin{cases} (y_t - z)(1+(1-\lambda)\gamma\rho) = \lambda(y_{t-1} - z) + \varepsilon_t \\ q_{t+1} - \pi = \alpha(y_t - z); r_t - q_{t+1} - (\hat{r} - \pi) = \rho(y_t - z) \\ b_t = \hat{b} \end{cases}$$

When the usual loss (6) is minimised:

$$(14\text{ b})\quad \begin{cases} y_t - z = \frac{\lambda}{\Delta}(y_{t-1} - z) + \frac{1}{\Delta}\varepsilon_t \\ \Delta = 1 + \gamma^2(1-\lambda)^2 \frac{(1+A\alpha^2)}{B} \\ q_{t+1} - \pi = \alpha(y_t - z); r_t - q_{t+1} - (\hat{r} - \pi) = \gamma(1-\lambda)\frac{1+A\alpha^2}{B}(y_t = z) \end{cases}$$

Since, in the first group of countries, production is inert (λ close to 1), we can see that the values of production and inflation are similar; the real interest rate varies to a greater extent when the value of assets is stabilised, but this is hardly sanctioned if B is low. The similarity in the values of production and inflation results from the fact that, if λ is close to 1, monetary policy is hardly used when the loss (6) is minimised, since the interest rate is hardly efficient to control production (its coefficient is $\gamma(1-\lambda)$ and low). In the first group of countries, on the contrary, we have, when (6) is minimised $y_t - z = \frac{\mu}{\Delta}(b_t - \hat{b}) + \frac{\varepsilon_t}{\Delta}$.

: a major part of the stabilisation of production is achieved by moves in asset price b_t caused by moves in the interest rate; when $\varepsilon_0 > 0,$ the rise in the interest rate reduces asset values, and this is no longer possible if it is controlled. Furthermore, since $\lambda = 0,$ monetary policy is efficient and is used proactively.

In case of an inflation shock, the loss in well-being owing to the changeover to the control of asset prices is very small in the second group of countries (small wealth effect).

The equilibrium results from:

$$(15\text{ a})\quad \begin{cases} y_t - z = 0 \\ q_1 - \pi = \eta_0 ; q_{t+1} - \pi = 0(t \geq 1) \\ r_t - q_{t+1} - (\hat{r} - \pi) = 0 \end{cases}$$

If loss (6) is minimised:

$$
(15\text{ b})\quad \begin{cases}
y_t - z = -\left(\dfrac{\lambda}{\Delta}\right)^t \dfrac{\eta_0}{\Delta} \dfrac{A\alpha\gamma^2(1-\lambda)^2}{B} \\
q_1 - z = \dfrac{\eta_0}{\Delta}\left(1 + \dfrac{\gamma^2(1-\lambda)^2}{B}\right) \\
q_{t+1} - z = \alpha(y_t - z) \\
r_0 - q_1 - (\hat{r} - \pi) = \dfrac{A\alpha\gamma(1-\lambda)}{\Delta B}\eta_0 \\
r_t - q_{t+1} - (\hat{r} - \pi) = -\dfrac{\gamma(1-\lambda)(1 + A\alpha^2)}{B}(y_t - z)
\end{cases}
$$

We can see that, if λ is close to 1 (which implies $\Delta = 1$), both equilibria are similar. If asset values cannot move, in the event of an inflation shock $(\eta_0 > 0)$, there cannot be a reaction of monetary policy, because it would lead to a move in asset prices.

If loss (6) is minimised, the reaction of monetary policy is weak for the reason already seen above: the inertia in production reduces the efficiency of monetary policy.

All in all, the countries of the first group (large wealth effects, lack of inertia in demand) experience a conflict of objectives between the stabilisation of asset prices and the usual price stability objectives of monetary policy. This conflict is not found in the countries of the second group (small wealth effects and inertia in demand). This is due to the fact that, in the second group of countries, the interest rate is used to a lesser extent to stabilise the economy, because of the inertia in demand, and this generates fewer variations in asset values.

Conclusion: Must France, Germany and Italy change over to the model found in the United States or the United Kingdom with respect to the financing of the economy?

One would first need, as we have just seen, that according to our model these countries accept to let asset prices fluctuate sharply, and thus not seek to keep them in check, and this would generate a conflict of objectives.

If this is the case, we have seen that this change of financing model (greater disintermediation, existence of loans backed by borrowers' wealth, extended at a floating rate, etc.) would improve well-being, especially in the event of demand shocks.

One would therefore expect to see in practice that the countries where interest rates and wealth have a significant effect on real activity (United Kingdom, United States and Spain) show, in comparison with countries that are in the opposite situation (Germany, France and Italy):

- lower variability in GDP growth and inflation;
- higher variability in interest rates and asset prices (stock market prices and property prices).

This forecast drawn from the model proves to be:

- correct with respect to growth, with regard to Spain and the United Kingdom **(Table 1);**

Table 1
Variability in GDP growth

Empirical standard deviation	United States	Germany	France	Italy	Spain	United Kingdom
1990-2004	1.521	1.853	1.434	1.335	1.600	1.541
1995-2004	1.392	1.116	1.337	1.260	0.972	0.690
2000-2004	1.568	1.367	1.502	1.211	0.911	0.898

- not very exact with respect to inflation, as its variability is low in France and Germany (after unification, **Table 2);**

Table 2
Variability in growth of inflation

Empirical standard deviation	United States	Germany	France	Italy	Spain	United Kingdom
1990-2004	1.048	1.458	0.800	1.613	1.549	1.794
1995-2004	0.673	0.507	0.605	1.118	0.935	0.614
2000-2004	0.783	0.438	0.317	0.227	0.562	0.307

- correct for interest rates, as their variability is significant in the United States (especially recently), Spain and the United Kingdom **(Table 3);**

Table 3
Variability in the 3-month interest rate

Empirical standard deviation	United States	Germany	France	Italy	Spain	United Kingdom
1990-2004	1.980	2.449	2.901	3.830	4.423	2.978
1995-2004	1.992	0.812	1.245	2.705	2.254	1.260
2000-2004	2.207	1.015	1.017	1.014	1.015	0.982

- wrong for stock market prices, as they are highly variable in the euro zone in comparison with the United States or the United Kingdom **(Table 4);**

Table 4
Variability in growth of the stock market index

Empirical standard deviation	United States	Germany	France	Italy	Spain	United Kingdom
1990-2004	16.651	22.290	21.491	26.145	24.059	14.186
1995-2004	19.807	24.752	24.928	28.380	25.468	15.743
2000-2004	18.315	28.237	28.576	22.997	18.127	15.047

- correct with respect to property prices, in the case of Spain and the United Kingdom **(Table 5).**

Table 5
Variability in growth in real estate prices

Empirical standard deviation	United States	Germany	France	Italy	Spain	United Kingdom
1990-2004	2.439	2.629	6.396	N/A	8.787	8.354
1995-2004	1.994	1.336	6.138	2.746	6.356	7.574
2000-2004	0.683	0.257	2.434	0.755	1.395	6.681

APPENDIX 1

Determination of the dynamics of asset values

We denote:

A asset values (in absolute terms); $a = \ell n(A)$.
P the level of prices; $p = \ell n(P)$; $q_{t+1} = p_{t+1} - p_t$;
$B = \frac{A}{P}$ the real value of the asset; $b = \ell n(B)$;
Y the level of production; $y = \ell n(Y)$;
r the nominal interest rate.

We denote with a ^ the variables at the long-term stationary equilibrium.

The income generated by holding the asset is supposed be linked to production, equal to $\theta P_t Y_t$

We therefore have:

$$\text{(A 1)} \quad \frac{E_t(A_{t+1}) - A_t}{A_t} + \theta \frac{P_t Y_t}{A_t} = r_t$$

(equality between the nominal interest rate and the expected nominal return on the asset). E_t represents the mathematical expectation calculated at date t .

Hence:

$$\text{(A 2)} \quad \frac{E_t(B_{t+1}) - B_t}{B_t} + \theta \frac{Y_t}{B_t} = b_{t+1} - b_t + \theta \frac{Y_t}{B_t} = r_t - q_{t+1}$$

Hence, by linearising $\frac{Y}{B}$ as a deviation from the long-term equilibrium.

$$\text{(A 3)} \quad E_t(b_{t+1}) - b_t + \theta \frac{\hat{Y}}{\hat{B}}(y_t - \hat{y}) - \theta \frac{\hat{Y}}{\hat{B}}(b_t - \hat{b}) + \theta \frac{\hat{Y}}{\hat{B}} = r_t - q_{t+1}$$

In the long term, $\theta \frac{\hat{Y}}{\hat{B}} = \hat{r} - \hat{q}$ (see (A 2), thus also):

$$\text{(A 4)} \quad \hat{b} = \hat{y} - \ell n(\hat{r} - \hat{q}) + \ell n(\theta)$$

We can therefore rewrite (A 3) as:

$$\text{(A 5)} \quad E_t(b_{t+1}) - b_t + \rho(y_t - \hat{y}) - \rho(b_t - \hat{b}) = r_t - q_{t+1} - \rho$$

where $\rho = \hat{r} - \hat{q}$

i.e. (2) in the text.

APPENDIX 2

Resolution and dynamics

The interest rate is given by (8) in the text.

The dynamics (2) of asset values is rewritten:

$$\text{(A 6)}\quad E_t(b_{t+1})-\hat{b}=\left(b_t-\hat{b}\right)(1+\rho)+\left(r_t-q_{t+1}-(\hat{r}-\pi)\right)-\rho(y_t-z)$$

The determination (1) of demand:

$$\text{(A 7)}\quad y_t-z=\lambda(y_{t-1}-z)-\gamma(1-\lambda)\left(r_t-q_{t+1}-(\hat{r}-\pi)\right)+\mu(1-\lambda)\left(b_t-\hat{b}\right)+\varepsilon_t$$

Or, alternatively, given (8):

$$\text{(A 6')}\quad \begin{aligned} E_t(b_{t+1})-\hat{b}&=\left(b_t-\hat{b}\right)(1+\rho)+\left[\gamma(1-\lambda)\left(\frac{1+A\alpha^2}{B}-\rho\right)\right](y_t-z)\\ &+\left[\frac{A\alpha\gamma(1-\lambda)}{B}\right]\eta_t \end{aligned}$$

and

$$\text{(A 7')}\quad \begin{aligned} &(y_t-z)\left[1+\gamma^2(1-\lambda)^2\,\frac{\left(1+A\alpha^2\right)}{B}\right]\\ &=\lambda(y_{t-1}-z)+\mu(1-\lambda)\left(b_t-\hat{b}\right)+\varepsilon_t\\ &-\eta_t\gamma(1-\lambda)\left[\frac{A\alpha\gamma(1-\lambda)}{B}\right] \end{aligned}$$

hence also:

$$\text{(A 6'')}\quad \begin{aligned} &\left(E_t(b_{t+1})-\hat{b}\right)\left(1+\gamma^2(1-\lambda)^2\,\frac{\left(1+A\alpha^2\right)}{B}\right)\\ &=\left(b_t-\hat{b}\right)\left[\mu(1-\lambda)\left(\gamma(1-\lambda)\frac{\left(1+A\alpha^2\right)}{B}-\rho\right)+(1+\rho)\left(1+\gamma^2(1-\lambda)^2\,\frac{\left(1+A\alpha^2\right)}{B}\right)\right]\\ &+\left(\lambda(y_{t-1}-z)+\varepsilon_t\right)\left(\gamma(1-\lambda)\frac{\left(1+A\alpha^2\right)}{b}-\rho\right)\\ &+\eta_t\,\frac{A\alpha\gamma(1-\lambda)}{B}\left(1+\gamma\rho(1-\lambda)\right) \end{aligned}$$

The characteristic polynom of (A 6'') (A 7') is:

$$P(x) = x^2 - \frac{x}{\Delta}\left[\lambda + \mu(1-\lambda)\left(\gamma(1-\lambda)\frac{(1+A\alpha^2)}{B} - \rho\right) + \Delta(1+\rho)\right] + \frac{\lambda}{\Delta}(1+\rho) \quad \text{(A 8)}$$

hence $\Delta = 1 + \gamma^2(1-\lambda)^2 \frac{(1+A\alpha^2)}{B}$

$$\text{(A 8')} \quad P(1) = -\rho\left(1 - \frac{\lambda}{\Delta}\right) - \frac{1}{\Delta}\mu(1-\lambda)\left(\gamma(1-\lambda)\frac{1+A\alpha^2}{B} - \rho\right)$$

With $1 - \frac{\lambda}{\Delta} > 0$

To have $P(1) < 0$ (which ensures there is a stable root (<1) and an unstable root (>1)), one needs to have:

$$\text{(A 9)} \quad \rho\left(1 - \mu + \gamma^2(1-\lambda)\frac{(1+A\alpha^2)}{B}\right) > -\mu\gamma(1-\lambda)\frac{1+A\alpha^2}{B}$$

and this is certain as soon as $\mu < 1,$ as we will suppose.

APPENDIX 3

Resolution of the dynamics

We start off again from (A 6') (A 7') which we write:

$$\text{(A 10)} \begin{cases} E_t(b_{t+1}) - \hat{b} = H_0(b_t - \hat{b}) + H_1(y_t - z) + H_2\eta_t \\ y_t - z = K_0(y_{t-1} - z) + K_1(b_t - \hat{b}) + K_2\eta_t + K_3\varepsilon_t \end{cases}$$

Hence (ignoring $\hat{b}$ and z for the sake of simplicity).

$$\text{(A 11)} \; E_t(b_{t+1}) - K_0 b_t = H_0(b_t - K_0 b_{t-1}) + H_1(y_t - K_0 y_{t-1}) + H_2(\eta_t - K_0\eta_{t-1})$$

hence:

$$\begin{aligned} & E_t(b_{t+1}) = (K_0 + H_0 + H_1K_1)b_t - H_0K_0b_{t-1} \\ \text{(A 12)} \; & + (H_1K_2 + H_2)\eta_t - H_2K_0\eta_{t-1} \\ & + H_1K_3\varepsilon_t \end{aligned}$$

With:

$$H_0 = 1 + \rho$$

$$H_1 = \gamma(1-\lambda)\frac{(1 + A\alpha^2)}{B} - \rho$$

$$H_2 = \frac{A\alpha\gamma(1-\lambda)}{B}$$

$$K_0 = \frac{\lambda}{\Delta}$$

$$K_1 = \frac{\mu(1-\lambda)}{\Delta}$$

$$K_2 = -\frac{A\alpha\gamma^2(1-\lambda)^2}{B - \Delta}$$

$$K_3 = \frac{1}{\Delta}$$

$$\Delta = 1 + \gamma^2(1-\lambda)^2\frac{(1 + A\alpha^2)}{B}$$

We naturally find once more, by identifying $K_0, H_0, K_1, H_1,$ the characteristic polynom $P(x)$ of (A 8) from **Appendix 2**.

Let us denote x_0 the stable root $(x_0 < 1)$ of $P(x)$.

Let us write the solution in its general form.

$$\text{(A 13)}\quad b_t = D(\varepsilon_t + x_0\varepsilon_{t-1} + \cdots) + E(\eta_t + x_0\eta_{t-1} + \cdots) + F(\eta_{t-1} + x_0\eta_{t-2} + \cdots)$$

We therefore have:

$$\text{(A 14)}\quad E_t(b_{t+1}) = D(x_0\varepsilon_t + x_0^2\varepsilon_{t-1} + \cdots) + E(x_0\eta_t + x_0^2\varepsilon_{t-1} + \cdots) + F(\eta_t + x_0\eta_{t-1} + \cdots)$$

Let us take the terms one by one.

Term in ε_t

$$\text{(A 15 a)}\quad Dx_0 = (K_0 + H_0 + H_1K_1)D + H_1 + K_3$$

Term in ε_{t-1}

$$\text{(A 15 b)}\quad Dx_0^2 = (K_0 + H_0 + H_1K_1)Dx_0 - H_0K_0D$$

which is always verified (x_0 is the root of the dynamics).

We therefore have:

$$\text{(A 15 c)}\quad D = \frac{-H_1K_3x_0}{H_0K_0}$$

Term in η_t

$$\text{(A 16 a)}\quad Ex_0 + F = (K_0 + H_0 + H_1K_1)E + (H_1K_2 + H_2)$$

Term in η_{t-1}

$$\text{(A 16 b)}\quad Ex_0^2 + Fx_0 = (K_0 + H_0 + H_1K_1)(Ex_0 + F) - H_0K_0E - H_2K_0$$

with $x_0^2 = (K_0 + H_0 + H_1K_1)x_0 - H_0K_0$, hence:

$$\text{(A 16 c)}\quad F(K_0 + H_0 + H_1K_1 - x_0) = -H_2K_0$$

Term in η_{t-2}

$$\text{(A 16 d)}\quad Ex_0^3 + Fx_0^2 = (K_0 + H_0 + H_1K_1)(Ex_0^2 + Fx_0) - H_0K_0(Ex_0 + F)$$

which is always verified.

Since $(K_0 + H_0 + H_1K_1)x_0 - x_0^2 = H_0K_0$, (A 16 c) also implies:

$$\text{(A 16 e)}\quad F = \frac{H_2x_0}{H_0}$$

(A 16 a) then implies:

$$\text{(A 16 f)}\quad E(K_0 + H_0 + H_1K_1 - x_0) = \frac{H_2x_0}{H_0} - (H_1K_2 + H_2)$$

with $K_0 + H_0 + H_1K_1 - x_0 = \dfrac{H_0K_0}{x_0}$

We therefore finally have:

$$\text{(A 17)}\quad \begin{aligned} (b_t - \hat{b}) &= -\frac{H_1K_3x_0}{H_0K_0}(\varepsilon_t + x_0\varepsilon_{t-1} + \cdots) \\ &+ \frac{\left(\dfrac{H_2x_0}{H_0} - (H_1K_2 + H_2)\right)}{(K_0 + H_0 + H_1K_1 - x_0)}(\eta_t + x_0\eta_{t-1} + \cdots) \\ &+ \frac{H_2x_0}{H_0}(\eta_{t-1} + x_0\eta_{t-2}\cdots) \end{aligned}$$

with $K_0 + H_0 + H_1K_1 - x_0 > 0$ and with:

$$\text{(A 18)}\quad y_t - z = K_0(y_{t-1} - z) + K_1(b_t - \hat{b}) + K_2\eta_t + K_3\varepsilon_t$$

We have:

- $\dfrac{-H_1K_3x_0}{H_0K_0} > 0$ if $\rho > \gamma(1-\lambda)\dfrac{(1 + A\alpha^2)}{B}$
- $\dfrac{-H_2x_0}{H_0} > 0$
- $\dfrac{-H_2x_0}{H_0} - H_1K_2 - H_2 = -\dfrac{A\alpha\gamma(1-\lambda)}{B}\left(1 - \dfrac{x_0}{1+\rho}\right) + A\alpha\gamma^2\dfrac{(1-\lambda)^2}{B\Delta}\left(\gamma(1-\lambda)\dfrac{(1+A\alpha^2)}{B} - \rho\right)$

with $\Delta = 1 + \gamma^2(1-\lambda)^2\dfrac{(1 + A\alpha^2)}{B}$

This term is without ambiguity negative if $\rho > \gamma(1-\lambda)\dfrac{1 + A\alpha^2}{B}$; borderline cases $B \to 0$ and $B \to \infty$ are studied in **Appendix 4**.

APPENDIX 4

(i) Case $B = 0$ (no penalisation of changes in the interest rate)

If $B = 0$, (8) implies:

$$\text{(A 19)}\quad y_t - z = -\frac{A\alpha}{1 + A\alpha^2}\eta_t$$

(A 7) from **Appendix 2** then implies:

$$\text{(A 20)}\quad \begin{aligned} &(r_t - q_{t+1} - (\hat{r} - \pi))\gamma(1-\lambda) = \frac{A\alpha}{1 + A\alpha^2}\eta_t - \frac{\lambda A\alpha}{1 + A\alpha^2}\eta_{t-1} \\ &+ \mu(1-\lambda)\left(b_t - \hat{b}\right) + \varepsilon_t \end{aligned}$$

hence, for the dynamics of the value of the asset (2):

$$\text{(A 21)}\quad \begin{aligned} &E_t(b_{t+1}) - \hat{b} = \left(b_t - \hat{b}\right)\left(1 + \rho + \frac{\mu}{\gamma}\right) \\ &+ \eta_t \frac{A\alpha}{1 + A\alpha^2}\left(\rho + \frac{1}{\gamma(1-\gamma)}\right) - \frac{\dfrac{\lambda A\alpha}{1 + A\alpha^2}}{\gamma(1-\lambda)}\eta_{t-1} \\ &+ \frac{\varepsilon_t}{\gamma(1-\lambda)} \end{aligned}$$

And this implies:

$$\text{(A 22)}\quad \begin{cases} \left(E_t(b_{t+1}) - \hat{b}\right)\left(1 + \rho + \dfrac{\mu}{\gamma}\right) = E_t(b_{t+2}) - \hat{b} + \dfrac{\dfrac{\lambda A\alpha}{1 + A\alpha^2}}{\gamma(1-\lambda)}\eta_t \\ E_t(b_{t+i}) - \hat{b} = 0 \ \ ; i \geq 2 \end{cases}$$

hence:

$$\text{(A 23)}\quad \begin{aligned} &\left(b_t - \hat{b}\right)\left(1 + \rho + \frac{\mu}{\gamma}\right) = -\eta_t \frac{A\alpha}{1 + A\alpha^2}\left(\rho + \frac{1}{\gamma(1-\lambda)} - \frac{\lambda}{\gamma(1-\lambda)\left(1 + \rho + \dfrac{\mu}{\gamma}\right)}\right) \\ &+ \frac{\lambda A\alpha}{\left(1 + Aa^2\right)\gamma(1-\lambda)}\eta_{t-1} - \frac{\varepsilon_t}{\gamma(1-\lambda)} \end{aligned}$$

(ii) Case $B=+\infty$ (fixed interest rate)

We then have $r_t - q_{t+1}(\hat{r}-\pi)=0$

Thus:

$$\text{(A 24)}\quad \begin{cases} E_t(b_{t+1})-\hat{b}=(b_t-\hat{b})(1+\rho)-\rho(y_t-z) \\ y_t-z=\lambda(y_{t-1}-z)+\mu(1-\lambda)(b_t-\hat{b})+\varepsilon_t \end{cases}$$

hence:

$$\text{(A 25)}\quad E_t(b_{t+1})-\hat{b}=(1+\rho+\lambda-\rho\mu(1-\lambda))(b_t-\hat{b})-\lambda(1+\rho)(b_{t-1}-\hat{b})-\rho\varepsilon_t$$

and:

$$\text{(A 26)}\quad b_t-\hat{b}=\frac{\rho x_0}{(1+\rho)\lambda}(\varepsilon_t+x_0\varepsilon_{t-1}+\cdots)$$

with: $x_0^2-(1+\rho+\lambda-\rho\mu(1-\lambda))x_0+\lambda(1+\rho)=0$

APPENDIX 5

Demand shock in $t = 0$

$$\left(\varepsilon_0 > 0, \varepsilon_t = 0 \text{ pour } t \neq 0\right)$$

We start off from the dynamics resolved in **Appendix 3:**

(A 17) (for asset values), (A 18) (for production), as well as from (with $\eta_t = 0$):

$$\text{(A 27)}\ q_{t+1} - \pi = \alpha\left(y_t - z\right) \text{ (inflation)}$$

$$r_t - q_{t+1} - \hat{r} + \pi = \gamma(1-\lambda)\frac{\left(1 + A\alpha^2\right)}{B}\left(y_t - z\right) \text{ (real interest rate)}$$

(A 17) shows that we have:

$$\text{(A 28)}\ b_t - \hat{b} = -\frac{H_1 K_3 x_0}{H_0 K_0} x_0^t \varepsilon_0$$

$$\text{with} \begin{cases} -\dfrac{H_1 K_3 x_0}{H_0 K_0} = \dfrac{\left(\rho - \lambda(1-\lambda)\dfrac{1 + A\alpha^2}{B}\right)}{\lambda(1+\rho)} x_0 \\ x_0^2 - \left(\dfrac{\lambda}{\Delta} + 1 + \rho + \left(\gamma(1-\lambda)\dfrac{1 + A\alpha^2}{B} - \rho\right)\mu\dfrac{(1-\lambda)}{\Delta}\right)x_0 + (1+\rho)\dfrac{\lambda}{\Delta} = 0 \\ \Delta = 1 + \gamma^2(1-\lambda)^2\dfrac{\left(1 + A\alpha^2\right)}{B} \end{cases}$$

also:

$$\text{(A 29)}\ y_t - z = K_0^t K_3 \varepsilon_0 + K_1\left(b_0 - \hat{b}\right)\left(K_0^t + K_0^{t-1} x_0 + \cdots + x_0^t\right)$$

$$\text{with} \quad \begin{aligned} & K_0 = \frac{\lambda}{\Delta};\ K_3 = \frac{1}{\Delta} \\ & K_1 = \frac{\mu(1-\lambda)}{\Delta} \end{aligned}$$

(i) First group of countries: $\lambda = 0, \ \mu$ ***high***

The dynamics (A 10) becomes:

$$\text{(A 30)} \begin{cases} E_t(b_{t+1}) - \hat{b} = (1+\rho)(b_t - \hat{b}) + \left(\gamma \dfrac{1+A\alpha^2}{B} - \rho\right)(y_t - z) \\ y_t - z = \dfrac{\mu}{\Delta}(b_t - \hat{b}) + \dfrac{1}{\Delta}\varepsilon_t \\ \Delta = 1 + \gamma^2 \dfrac{(1+A\alpha^2)}{B} \end{cases}$$

hence:

$$\text{(A 31)} \quad \begin{aligned} & E_t(b_{t+1}) - \hat{b} = (b_t - \hat{b})\left(1 + \rho + \left(\gamma \frac{1+A\alpha^2}{B} - \rho\right)\frac{\mu}{\Delta}\right) \\ & + \left(\gamma \frac{1+A\alpha^2}{B} - \rho\right)\frac{1}{\Delta}\varepsilon_t \end{aligned}$$

Since $\varepsilon_t = 0, \ t \geq 1, E_t(b_{t+1}) - \hat{b} = 0, \ t \geq 0,$ hence:

$$\text{(A 32)} \begin{cases} (b_0 - \hat{b})\left(1 + \rho + \left(\gamma \dfrac{1+A\alpha^2}{B} - \rho\right)\dfrac{\mu}{\Delta}\right) \\ = \left(\rho - \gamma \dfrac{1+A\alpha^2}{B}\right)\dfrac{1}{\Delta}\varepsilon_0 \\ b_t - \hat{b} = 0, t \geq 1 \end{cases}$$

$$\text{(A 33)} \begin{cases} y_0 - z = \dfrac{\mu}{\Delta}(b_0 - \hat{b}) + \dfrac{1}{\Delta}\varepsilon_0 \text{ ; hence:} \\ (y_0 - z)\left(1 + \rho + \left(\gamma \dfrac{1+A\alpha^2}{B} - \rho\right)\dfrac{\mu}{\Delta}\right) + \varepsilon_0 \dfrac{1+\rho}{\Delta} \\ y_t - z = 0, t \geq 1 \end{cases}$$

$$\text{(A 34)} \begin{cases} q_1 - \pi = \alpha(y_0 - z) \\ q_{t+1} - \pi = 0, t \geq 1 \end{cases}$$

$$\text{(A 35)} \begin{cases} r_0 - q_1 - (\hat{r} - \pi) = \gamma \dfrac{1+A\alpha^2}{B}(y_0 - z) \\ r_t - q_{t+1} - (\hat{r} - \pi) = 0, t \geq 1 \end{cases}$$

(ii) Second group of countries: $\mu = 0, \lambda$ ***high*** $(\lambda < 1)$

The dynamics (A 10) becomes:

$$\text{(A 36)} \begin{cases} E_t(b_{t+1}) - \hat{b} = (1+\rho)(b_t - \hat{b}) + \left(\gamma(1-\lambda)\dfrac{1+A\alpha^2}{B} - \rho\right)(y_t - z) \\ y_t - z = \dfrac{\lambda}{\Delta}(y_{t-1} - z) + \dfrac{1}{\Delta}\varepsilon_t \end{cases}$$

with:

$$\begin{cases} \rho > \gamma(1-\lambda)\dfrac{1+A\alpha^2}{B} (\lambda \text{ close to } 1) \\ \Delta = 1 + \gamma^2(1-\lambda)^2 \dfrac{1+A\alpha^2}{B} \end{cases}$$

We therefore have:

$$\text{(A 37)} \; y_t - z = \left(\frac{\lambda}{\Delta}\right)^t \frac{\varepsilon_0}{\Delta}; t \geq 0$$

$$\text{(A 38)} \; q_{t+1} - \pi = \alpha\left(\frac{\lambda}{\Delta}\right)^t \frac{\varepsilon_0}{\Delta}; \geq 0$$

$$\text{(A 39)} \; r_t - q_{t+1} - (\hat{r} - \pi) = \gamma(1-\lambda)\frac{1+A\alpha^2}{B}\left(\frac{\lambda}{\Delta}\right)^t \frac{\varepsilon_0}{\Delta}; t \geq 0$$

$$\text{(A 40)} \; b_t - \hat{b} = \left(\frac{\rho - \gamma(1-\lambda)\dfrac{1+A\alpha^2}{B}}{1+\rho-\dfrac{\lambda}{\Delta}}\right)\left(\frac{\lambda}{\Delta}\right)^t \frac{\varepsilon_0}{\Delta}$$

APPENDIX 6

Inflation shock in $t=0$

$$\left(\eta_0>0,\eta_t=0\ \ for\ t\neq 0\right)$$

We start off from (A 17), (A 18) as well as from (with $\varepsilon_t=0$) :

$$\text{(A 41)}\quad \begin{cases} q_{t+1}-\pi=\alpha\left(y_y-z\right)+\eta_0 \\ r_t-q_{t+1}-\left(\hat{r}-\pi\right)=\dfrac{\gamma(1-\lambda)\left(1+A\alpha^2\right)}{B}\left(y_t-z\right)+\dfrac{A\alpha\gamma(1-\lambda)}{B}\eta_t \end{cases}$$

(A 17) shows that we have:

$$\text{(A 42)}\quad \begin{cases} b_0-\hat{b}=\dfrac{\left(\dfrac{H_2x_0}{H_0}-\left(H_1K_2+H_2\right)\right)}{\left(K_0+H_0+H_1K_1-x_0\right)}\eta_0 \\ b_1-\hat{b}=\dfrac{\left(\dfrac{H_2x_0}{H_0}-\left(H_1K_2+H_2\right)\right)}{\left(K_0+H_0+H_1K_1-x_0\right)}x_0\eta_0+\dfrac{H_2x_0}{H_0}\eta_0 \\ b_t-\hat{b}=x_0^{t-1}\left(b_1-\hat{b}\right) \end{cases}$$

(i) First group of countries: $\lambda=0,\mu$ ***high*** (<1)

The dynamics (A 6, a 7) from **Appendix 2** is rewritten:

$$\text{(A 43)}\quad \begin{cases} E_t\left(b_{t+1}\right)-\hat{b}=\left(1+\rho\right)\left(b_t-\hat{b}\right)+\left(\gamma\dfrac{\left(1+A\alpha^2\right)}{B}-\rho\right)\left(y_t-z\right) \\ \left(y_t-z\right)=\dfrac{\mu}{\Delta}\left(b_t-\hat{b}\right)-\dfrac{1}{\Delta}\dfrac{A\alpha\gamma^2}{B}\eta_t \\ \Delta+1+\gamma^2\dfrac{\left(A\alpha\gamma^2\right)}{B} \end{cases}$$

hence:

$$\text{(A 43')}\quad \begin{aligned} E_t(b_{t+1}) - \hat{b} &= (b_t - \hat{b}) + \left[1 + \rho + \frac{\mu}{\Delta}\left(\gamma\frac{(1 + A\alpha^2)}{B} - \rho\right)\right] \\ &+ \frac{A\alpha\gamma}{B}\eta_t\left(1 - \frac{\gamma}{\Delta}\left(\gamma\frac{(1 + A\alpha^2)}{B} - \rho\right)\right) \end{aligned}$$

Hence the solution:

$$\text{(A 44)}\quad \begin{cases} (b_0 - \hat{b})\left(1 + \rho + \dfrac{\mu}{\Delta}\left(\dfrac{\gamma(1 + A\alpha^2)}{B} - \rho\right)\right) \\ = -\dfrac{A\alpha\gamma}{B}\eta_0\left(1 - \dfrac{\gamma}{\Delta}\left(\dfrac{\gamma(1 + A\alpha^2)}{B} - \rho\right)\right) \\ b_t - \hat{b} = 0, t \geq 1; 1 - \dfrac{\gamma}{\Delta}\left(\dfrac{\gamma(1 + A\alpha^2)}{B} - \rho\right) = \dfrac{\gamma\rho}{\Delta} \\ +1 - \dfrac{\gamma^2\dfrac{(1 + A\alpha^2)}{B}}{1 + \gamma^2\dfrac{(1 + A\alpha^2)}{B}} > 0 \end{cases}$$

$$\text{(A 45)}\begin{cases} y_0 - z = \dfrac{\mu}{\Delta}(b_0 - \hat{b}) - \dfrac{1}{\Delta}\dfrac{A\alpha\gamma^2}{B}\eta_0 \\ y_t - z = 0, t \geq 1 \end{cases}$$

Or alternatively:

$$\text{(A 45')}\ (y_0 - z)\bullet\left(1 + \rho + \frac{\mu}{\Delta}\left(\frac{\gamma(1 + A\alpha^2)}{B} - \rho\right)\right) = -\frac{A\alpha\gamma}{\Delta B}\eta_0(\mu + \gamma(1 + \rho))$$

then:

$$\text{(A 46)}\ \begin{cases} q_1 - \pi = \alpha(y_0 - z) + \eta_0 \\ r_0 - q_1 - (\hat{r} - \pi) = \dfrac{\gamma(1 + A\alpha^2)}{B}(y_0 - z) + \dfrac{A\alpha\gamma}{B}\eta_0 \end{cases}$$

hence:

$$\text{(A 46')}\quad \begin{aligned} &(q_1 - \pi)\left(1 + \rho + \frac{\mu}{\Delta}\left(\frac{\gamma(1 + A\alpha^2)}{B} - \rho\right)\right) = \frac{\eta_0}{\Delta}\left[1 + \rho + \frac{\gamma}{B}(\mu + \gamma(1 + \rho)) - \mu\rho\right] \\ &(r_0 - q_1 - (r - \pi))\left(1 + \rho + \frac{\mu}{\Delta}\left(\frac{\gamma(1 + A\alpha^2)}{B} - \rho\right)\right) = \frac{A\alpha\gamma}{B\Delta}\eta_0[1 + \rho - \mu\rho] \end{aligned}$$

(ii) The second group of countries is written: $\mu = 0$, λ high (<1)

$$\text{(A 47)}\quad \begin{cases} E_t(b_{t+1}) - \hat{b} = (1+\rho)(b_t - \hat{b}) + \left[\gamma(1-\lambda)\dfrac{(1+A\alpha^2)}{B} - \rho\right](y_t - z) + \dfrac{A\alpha\gamma(1-\lambda)}{B}\eta_t \\ y_t - z = \dfrac{\lambda}{\Delta}(y_{t-1} - z) - \eta_t \dfrac{1}{\Delta}\dfrac{A\alpha\gamma^2(1-\lambda)^2}{B} \end{cases}$$

hence:

$$\text{(A 48 a)}\quad \begin{aligned} y_t - z &= -\left(\frac{\lambda}{\Delta}\right)^t \frac{\eta_0}{\Delta}\frac{A\alpha\gamma^2(1-\lambda)^2}{B} \\ \Delta &= 1 + \gamma^2(1-\lambda)^2\frac{(1+A\alpha^2)}{B} \end{aligned}$$

$$\text{(A 49)}\quad b_t - \hat{b} = \frac{\left(\gamma(1-\lambda)\dfrac{(1+A\alpha^2)}{B} - \rho\right)\dfrac{\eta_0}{\Delta}\dfrac{A\alpha\gamma^2(1-\lambda)^2}{B}}{1+\rho-\dfrac{\lambda}{\Delta}} \bullet \left(\frac{\lambda}{\Delta}\right)^t$$

for $t \geq 1$

$$\text{(A 50)}\quad \begin{aligned} (1+\rho)(b_0 - \hat{b}) = {} & -\frac{A\alpha\gamma(1-\lambda)}{B}\eta_0 \\ & + \frac{\eta_0}{\Delta}\left(\gamma(1-\lambda)\frac{(1+A\alpha^2)}{B} - \rho\right)\frac{A\alpha\gamma^2(1-\lambda)^2}{B} \bullet \left(\frac{1+\rho}{1+\rho-\dfrac{\lambda}{\Delta}}\right) \end{aligned}$$

then:

$$\text{(A 48 b)}\quad \begin{cases} q_1 - \pi = \alpha(y_0 - z) + \eta_0 = \dfrac{\eta_0}{\Delta}\left(1 + \gamma^2\dfrac{(1-\lambda)^2}{B}\right) \\ \text{with } \Delta = 1 + \dfrac{\gamma^2(1+A\alpha^2)(1-\lambda)^2}{B} \\ q_{t+1} - \pi = \alpha(y_t - z) = \left(\dfrac{\lambda}{\Delta}\right)^t \dfrac{\eta_0}{\Delta}\dfrac{A\alpha^2\gamma^2(1-\lambda)^2}{B} \\ t \geq 1 \end{cases}$$

$$\text{(A 48 c)}\quad \begin{cases} r_0 - q_1 - (\hat{r} - \pi) = \dfrac{A\alpha\gamma(1-\lambda)}{\Delta B}\eta_0 \\ r_t - q_{t+1} - (\hat{r} - \pi) = -\dfrac{\gamma(1-\lambda)(1+A\alpha^2)}{B}\left(\dfrac{\lambda}{\Delta}\right)^t \dfrac{A\alpha\gamma^2(1-\lambda)^2}{B}\dfrac{\eta_0}{\Delta} \\ t \geq 1 \end{cases}$$

APPENDIX 7

Comparison of well-being levels

We have:

$$\text{(A 51)}\quad L_t = (y_t - z)^2 + A(q_{t+1} - \pi)^2 + B(r_t - q_{t+1} - (\hat{r} - \pi))^2$$

1 – 1 Demand shock, first group of countries $(\lambda = 0, \mu \text{ high})$

$$\text{(A 52)}\quad \begin{cases} L_0 = \left(1 + A\alpha^2 + \dfrac{\gamma^2(1 + A\alpha^2)^2}{B}\right)\left(\dfrac{\varepsilon_0 \dfrac{1+\rho}{\Delta}}{1 + \rho + \dfrac{\mu}{\Delta}\left(\gamma\dfrac{1 + A\alpha^2}{B} - \rho\right)}\right)^2 \\ L_t = 0 \qquad t \geq 1 \end{cases}$$

1 – 2 Demand shock, second group of countries $(\mu = 0, \ \lambda \text{ high})$

$$\text{(A 53)}\quad L_t = \left[\left(\frac{\lambda}{\Delta}\right)^t \frac{\varepsilon_0}{\Delta}\right]^2 \left(1 + A\alpha^2 + \gamma^2(1-\lambda)^2 \frac{(1 + A\alpha^2)^2}{B}\right)$$

If the authorities' preference for the present is φ, we can calculate:

$$\text{(A 53B)}\quad L = \sum_{t=0}^{+\infty} \frac{L_t}{(1+\varphi)^t} = \left(\frac{\varepsilon_0}{\Delta}\right)^2 \left(1 + A\alpha^2 + \gamma^2(1-\lambda)^2 \frac{(1 + A\alpha^2)^2}{B}\right) \bullet \frac{1}{1 - \dfrac{\left(\dfrac{\lambda}{\Delta}\right)^2}{1+\varphi}}$$

2 – 1 Inflation shock, first group of countries $(\lambda = 0, \ \mu \text{ high})$

$$\text{(A 54)}\quad \begin{cases} L_0 = \dfrac{A\dfrac{\eta_0^2}{\Delta^2}}{\left(1 + \rho + \dfrac{\mu}{\Delta}\left(\gamma\dfrac{(1 + A\alpha^2)}{B} - \rho\right)\right)^2} \left[\begin{aligned} &\frac{A\alpha^2\gamma^2}{B^2}(\mu + \gamma(1+\rho))^2 \\ &+ \left(1 + \rho + \frac{\gamma}{B}(\mu + \gamma(1+\rho)) - \mu\rho\right)^2 \\ &+ A\alpha^2 \frac{\gamma^2}{B}(1 + \rho - \mu\rho)^2 \end{aligned}\right] \\ L_t = 0, t \geq 1 \end{cases}$$

2 – 2 Inflation shock, second group of countries $(\mu = 0,\ \lambda \text{ high})$

$$\text{(A 55)}\quad L_0 = \frac{A\eta_0^2\left(B+\gamma^2(1-\lambda)^2\right)}{B+\gamma^2(1-\lambda)^2\left(1+A\alpha^2\right)}$$

$$\text{(A 56)}\quad L_t = \left[\left(\frac{\lambda}{\Delta}\right)^t \frac{\eta_0}{\Delta}\frac{A\alpha\gamma^2(1-\lambda)^2}{B}\right]^2\left(1+A\alpha^2+\frac{\gamma^2(1-\lambda)^2\left(1+A\alpha^2\right)}{B}\right)^2$$

$$t \geq 1$$

or alternatively:

$$L_t = \left[\left(\frac{\lambda}{\Delta}\right)^t \eta_0 A\alpha\gamma^2(1-\lambda)^2\right]^2 \bullet \frac{\left(1+A\alpha^2\right)}{B} \bullet \frac{1}{B+\gamma^2(1-\lambda)^2\left(1+A\alpha^2\right)}$$

3 – 1 Comparison of the two groups of countries, demand shock

L^1 (first group) > L^2 (second group) if:

$$\text{(A 57)}\quad -(1+\rho)\left(\frac{\lambda}{\Delta}\right)^2 > (1+\varphi)\frac{\mu}{\Delta}\left(\gamma\frac{1+A\alpha^2}{B}-\rho\right)$$

- If B is low, (A 57) is not verified.
- If $B \to \infty$, $\Delta \to 1$, and (A 57) is rewritten:

(A 57') $-(1+\rho)\lambda^2 > -\rho(1+\varphi)\mu$

λ and μ are high (close to 1); if $\varphi \approx \mu$, (A 57'') is rewritten: $\rho > 1$, and this is not possible.

: we still have $L^1 < L^2$

3 – 2 Comparison of two groups of countries, inflation shock

L^1 (first group) > L^2 (second group) if:

$$\left[\frac{A\alpha^2\gamma^2}{B^2}(\mu+\gamma(1+\rho))^2+\left(1+\rho+\frac{\gamma}{B}(\mu+\gamma(1+\rho))-\mu\rho\right)^2+\frac{A\alpha^2\gamma^2}{B}(1+\rho-\mu\rho)^2\right]\bullet$$

(A 58)
$$\frac{\frac{1}{\Delta^2}}{\left(1+\rho+\frac{\mu}{\Delta}\left(\frac{\gamma(1+A\alpha^2)}{B}-\rho\right)\right)^2}>\frac{\left(B+\gamma^2(1-\lambda)^2\right)}{B+\gamma^2(1-\lambda)^2(1+A\alpha^2)}$$

$$+\left(\alpha\gamma^2(1-\lambda)^2\right)^2\frac{1+A\alpha^2}{B}\frac{A}{B+\gamma^2(1-\lambda)^2(1+A\alpha^2)}\bullet\frac{\left(\frac{\lambda}{\Delta}\right)^2}{1+\varphi}\bullet\frac{1}{1-\frac{\left(\frac{\lambda}{\Delta}\right)^2}{1+\varphi}}$$

Let us distinguish the two polar cases:

(i) $B=+\infty$ ***; we then have*** $\Delta=1$

The left-hand side member of (A 58) tends towards 1; the right-hand side member also towards 1 (which is due only to the loss term for period 0).

(ii) $B=0$ ***; we then have:***

$$\begin{cases}\Delta B=\gamma^2(1-\lambda)^2(1+A\alpha^2)\\(\lambda=0 \text{ in the first group of countries})\\\Delta=+\infty\end{cases}$$

The left-hand side member of (A 58) tends towards $\frac{1}{1+A\alpha^2}$; the right-hand side towards $\frac{1}{1+A\alpha^2}$ (which is due to the loss term corresponding to $t=0$). In all cases, we therefore have $L^1=L^2$.

APPENDIX 8

Loss when asset values are controlled

When asset values are controlled, the economic equilibrium is given by (13) of the text.

The calculated loss (with the discount rate φ) is thus, in the two groups of countries; **in the event of stabilisation of** b.

- **in the event of a demand shock** $(\varepsilon_0 > 0)$**:**

$$\text{(58 a)} \quad L^A = \left[\sum_{t=0}^{+\infty}\left(\frac{\lambda}{1+(1-\lambda)\gamma\rho}\right)^{2t}\frac{1}{(1+\varphi)^t}\right]\frac{\varepsilon_0^2}{(1+(1-\lambda)\gamma\rho)^2}\bullet\left(1+A\alpha^2+B\rho^2\right)$$

- **in the event of an inflation shock** $(\eta_0 > 0)$**:**

$$\text{(58 b)} \quad L^A = A\eta_0^2$$

In the first group of countries ($\lambda = 0, \mu$ is high), the loss is, if the loss is **minimised:**

- **in the event of a demand shock:**

$$\text{(59 a)} \quad L^1 = \left(\frac{\varepsilon_0(1+\rho)}{\Delta(1+\rho)+\mu\left(\gamma\dfrac{1+A\alpha^2}{B}-\rho\right)}\right)^2\bullet\left(1+A\alpha^2+\frac{\gamma^2\left(1+A\alpha^2\right)^2}{B}\right)$$

- **in the event of an inflation shock:**

$$\text{(59 b)} \quad L^1 = \frac{A\dfrac{\eta_0^2}{\Delta^2}}{\left(1+\rho+\dfrac{\mu}{\Delta}\left(\dfrac{\gamma\left(1+A\alpha^2\right)}{B}-\rho\right)\right)^2}\bullet \left(\frac{A\alpha^2\gamma^2}{B^2}(\mu+\gamma(1+\rho))^2+\left(1+\rho+\frac{\gamma}{B}(\mu+\gamma(1+\rho))-\mu\rho\right)^2+A\alpha^2\frac{\gamma^2}{B}(1+\rho-\mu\rho)^2\right)$$

In the second group of countries $(\mu = 0, \lambda \text{ high})$, the loss is:

- **in the event of a demand shock:**

$$\text{(60 a)}\quad L^2 = \left[\sum_{t+0}^{+\infty}\left(\frac{\lambda}{\Delta}\right)^{2t}\frac{1}{(1+\varphi)^t}\right]\left(\frac{\varepsilon_0}{\Delta}\right)^2\left(1+A\alpha^2+\gamma^2(1-\lambda)^2\frac{\left(1+A\alpha^2\right)}{B}\right)^2$$

- **in the event of an inflation shock:**

$$\text{(60 b)}\quad L^2 = \frac{A\eta_0^2\left(B+\gamma^2(1-\lambda)^2\right)}{B+\gamma^2(1-\lambda)^2\left(1+A\alpha^2\right)} + \left[\sum_{t=1}^{+\infty}\left(\frac{\lambda}{\Delta}\right)^{2t}\frac{1}{(1+\varphi)^t}\right]\bullet\left(\eta_0 A\alpha\gamma^2(1-\lambda)^2\right)^2\bullet\frac{\left(1+A\alpha^2\right)}{B}\bullet\frac{1}{B+\gamma^2(1-\lambda)^2\left(1+A\alpha^2\right)}$$

with $\Delta = 1+\gamma^2(1-\lambda)^2\frac{\left(1+A\alpha^2\right)}{B}$

Let us compare the losses

- **First group of countries** $(\lambda = 0, \mu \text{ high})$**, demand shock:**

$$\text{(61 a)}\quad L^A - L^1 = \frac{\varepsilon_0^2}{(1+\gamma\rho)^2}\left(1+A\alpha^2+B\rho^2\right) - \varepsilon_0^2\left[\frac{1+\rho}{\left(1+\rho-\mu\rho+\gamma\frac{1+A\alpha^2}{B}(\mu+\gamma(1+\rho))\right)}\right]\bullet\left(1+A\alpha^2+\frac{\gamma^2\left(1+A\alpha^2\right)^2}{B}\right)$$

- First **group of countries, inflation shock:**

$$\text{(61 b)}\quad L^A - L^1 = A\eta_0^2 - \frac{A\eta_0^2}{\left(1+\rho-\mu\gamma+\gamma\frac{1+A\alpha^2}{B}(\mu+\gamma(1+\rho))\right)^2}\bullet\left(\frac{A\alpha^2\gamma^2}{B^2}(\mu+\gamma(1+\rho))^2+\left(1+\rho+\frac{\gamma}{B}(\mu+\gamma(1+\rho))-\mu\rho\right)^2+A\alpha^2\gamma^2\left(B(1+\rho-\mu\rho)^2\right)\right)$$

- **Second group of countries** $(\mu = 0, \lambda \text{ high})$, **demand shock:**

$$\text{(62 a)}\quad \begin{aligned} L^A - L^2 &= \left[\sum_{t=0}^{+\infty}\left(\frac{\lambda}{1+(1-\lambda)\gamma\rho}\right)^{2t}\frac{1}{(1+\rho)^t}\right]\frac{\varepsilon_0^2}{(1+(1-\lambda)\gamma\rho)^2}\bullet\left(1+A\alpha^2+B\rho^2\right) \\ &-\left[\sum_{t=0}^{+\infty}\left(\frac{\lambda}{\Delta}\right)^{2t}\frac{1}{(1+\varphi)^t}\right]\left(\frac{\varepsilon_0}{\Delta}\right)^2\left(1+A\alpha^2+\gamma^2(1-\lambda)^2\frac{(1+A\alpha^2)^2}{B}\right) \end{aligned}$$

- **Second group of countries, inflation shock:**

$$\text{(62 b)}\quad \begin{aligned} L^A - L^1 &= A\eta_0^2 - \frac{A\eta_0^2\left(B+\gamma^2(1-\lambda)^2\right)}{\left(B+\gamma^2(1-\lambda)^2(1+A\alpha^2)\right)} \\ &-\left[\sum_{t=1}^{+\infty}\left(\frac{\lambda}{\Delta}\right)^{2t}\frac{1}{(1+\varphi)^t}\right]\bullet\left(\eta_0 A\alpha\gamma^2(1-\lambda)^2\right)^2\bullet\frac{(1+A\alpha^2)}{B}\bullet\frac{1}{\left(B+\gamma^2(1-\lambda)^2(1+A\alpha^2)\right)} \end{aligned}$$

(i) Demand shock

Since $\lambda \approx 1$, we have:

$$\text{(63 a)}\quad L^A - L^2 \approx \frac{1+\varphi}{\varphi}\varepsilon_0^2 B\rho^2$$

$$\text{(63 b)}\quad \begin{cases} L^A - L^1 \approx \dfrac{\varepsilon_0^2}{(1+\gamma\varphi)^2}\left(1+A\alpha^2\right) \text{if } B \text{ low} \\ L^A - L^1 \approx \dfrac{\varepsilon_0^2}{(1+\gamma\varphi)^2}B\rho^2 \text{ if } B \text{ high} \end{cases}$$

(ii) Inflation shock

We have:

$$\text{(64 a)}\quad L^A - L^2 \approx 0 \text{ (since } \lambda \text{ is high)}$$

$$\text{(64 b)}\quad \begin{cases} L^A - L^1 \approx A\eta_0^2\dfrac{A\alpha^2}{1+A\alpha^2} \text{if } B \text{ low} \\ L^A - L^1 \approx 0 \text{ sif } B \text{ high} \end{cases}$$

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