Financial Crisis, the Dynamic of Real Liabilities and Wealth Transfers*

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The aim of this paper is to study what mechanisms of financial crises or financial fragility induce wealth transfers. Although the surge of financial crisis in the 90's has triggered abundant literature on many aspects such as its causes, consequences, and management; redistributive aspects of financial crises have been under studied. Apart from its impacts in terms of income inequalities (see Baldacci et al. (2002) for instance) there has been little concerns about the wealth transfers it might entail. With the exception of Halac and Schmukler (2003) who directly address in an empirical manner the question of wealth transfers induced by the crisis management, most of the time this issue is only indirectly raised in the literature on crisis management (see Calomiris et al. (2004)). Two weaknesses can be formulated with respect to existing works: firstly it only considers transfers induced by crisis management and ignores transfers taking place during the boom prior to the financial crisis, secondly it relies on monographs or descriptive statistics (due to the lack of data) but mostly disregards theoretical work. Our purpose is to build a framework that enables us to better identify and understan these issues.

1 Liabilities and wealth transfers

This section intends to show how the dynamics of liabilities during a financial crisis induces different wealth transfers. Our explanation takes place in a boom and bust cycle. Transfers are of two types.

1. Between borrowers and lenders
2. Between taxpayers and financial markets participants

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1.1 Between borrowers and lenders

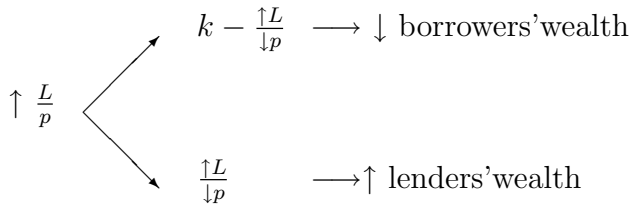
The boom is characterized by an unstable dynamic of liabilities. Liabilities induce wealth transfers as it appears negatively in the net wealth of borrowers and positively in the wealth of lenders. In addition, a crisis occurs to the extent that at some point additional liabilities are not transformed into new capital. The mechanism is the same whomever the lender is (domestic or foreign financial institutions, households) what ever the borrowers is (firms, households) or what ever the liabilities considered (loans, private bond, money or equities). In the following illustration, it is assumed that borrowers are firms and lenders are households. Firms net real worth is equal to its stock of capital minus the real value of its liabilities, and lenders wealth corresponds to the real value of its financial assets.

Agents Wealth	Borrower (firm)	Lender	Total
Real wealth	$+k-\frac{L}{p}$	$+\frac{L}{p}$	+k

To the extent that real liabilities increase, the net wealth of borrowers reduces and the wealth of lenders increases. Real liabilities can increase in two ways:

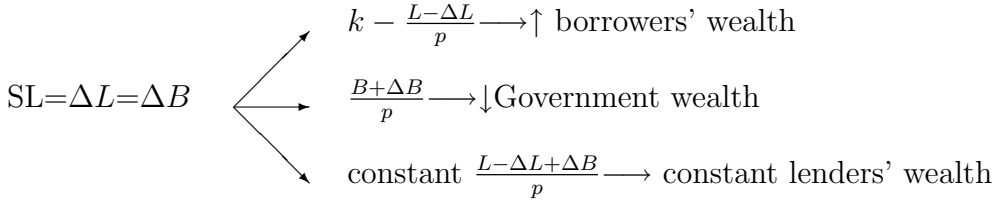
1. increase in nominal liabilities
2. decrease in prices

Firstly, nominal liabilities increase if new debt is not transformed into additional capital. It may be used for instance either to cover unprofitable investment or at financing unsold inventories. Secondly, the depressing effects of the crisis may lead to price reduction if excess capacity appears on the good market as was the case during the great depression or the japanese crisis. This adverse effect on real debt was underlined by Bernanke in Bernanke et al. (1996) "...it is reminiscent of Fisher's "debt-deflation" argument, that redistributions between creditors and debtors arising from unanticipated price changes can have important real effects. Indeed, Fisher argued that this kind of mechanism accounted for the depth and protractedness of the Great Depression...To the extent loans from abroad are denominated in units of a foreign currency, an exchange rate collapse redistributes wealth from domestic borrowers to foreign lenders".



1.2 From taxpayers to financial market participants: the socialization of losses

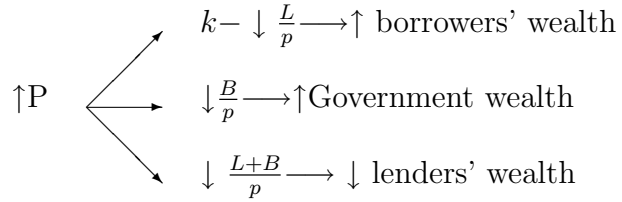
In the crisis, borrowers may go bankrupt and lenders suffer losses. The value of equities might go to zero if the firm disappears or the company might default on its credit if it borrowed private bonds or bank loans. Meanwhile, public authorities step in and set different mechanisms to sustain the economic activity and avoid a major crisis. The fiscal cost of the resolution is significant (it can reach 50 percent of GDP in some cases (Honohan and Kliengebiel, 2003))and aims mainly at solving over-indebtedness whatever the kind of response (bank recapitalization/nationalization; debt relief schemes, transfer of non performing loans to a public entity) or at alleviating potential losses of lenders (depositors bailouts) (see Calomiris et al. (2004) for a taxonomy of financial crisis resolution mechanisms). As Halac and Schmukler (2003) define them, they constitute a "transfer from non participants to participants of financial markets". Calomiris et al. (2004) names it reallocations of "wealth towards banks and corporate debtors and away from taxpayers". More generally they are characterized by a *socialization of losses*. In our table, as there is no explicit banking system, one way to represent this type of transfer would be to reduce private debt by SL (the amount of loss socialization) and to increase public debt by the same amount.



Borrowers gains from this policy as it reduces their level of indebtedness. Public debt increases and lenders are unaffected as each reduction of private debt is matched by new bond. In addition potential non performing loans are compensated by very secured public bonds, and the economy might gain

in stability. [1]

An interesting excercice would be to assess the efficiency of the different public responses to instability and their consequences in terms of wealth transfers. For example, during a period of debt deflation, positive price shocks may stop debt deflation but also alter wealth transfers as inflation tends to reduce the real value of borrowers debt either private or public and the real value of lenders' assets.



Such a price policy could be driven by the central bank in order to ease debt reduction. Such a mechanism could be called a "reverse transfer" as it takes place from lenders to borrowers. In addition, it has the advantage of having no direct fiscal cost for public authorities.

2 The model

Within the post keynesian literature, there are numerous models of financial crisis/ financial fragility that try to reproduce some aspects of Hyman Minsky analysis. Meanwhile, since the first model by Taylor and O'Connel (1985) there hasn't been a concensus on a canonical model as underlined by Dos Santos (2005). Many model à la Minsky have in common that they explain in one way or another debt accumulation by the interplay of firms investment, interest rate, wage cost and retained earning (see Keen (1995) for instance). Meanwhile, the paradox of this literature is that the financial aspects of all these models are usually not so detailed. There has been little attempts to integrate portfolio choice to the exception of Taylor and O'Connel (1985) and Franke and Semmler (1989) or to model credit rationing as in Stiglitz (Stiglitz and Weiss, 1981) or Bernanke (Bernanke et al., 1996) to the exception of Franke and Semmler (1989). In addition, the formalism of the banking system is usually oversimplified while banking crises are usually

[1] A good example of this transfer is the East Asian Financial crisis or any developing country's financial crisis. National government subscription to new loans, at the IMF for instance, were mostly used to maintain the currency convertibility. In this way many western financial institutions avoided huge losses that a devaluation would have brought about. Beyond the international wealth transfer, it is a borrower lender transfer.

a key feature of financial crises.

Our work is based on a familiy of dynamic models of macroeconomic growth developed by Flaschel et al. (1997) and Chiarella and Flaschel (2000). More precisely, we try to merge two types of models. A model of debt deflation (Chiarella, Flaschel, and Semmler, Chiarella et al.) that is closely related to some models of Keen (Keen, 1995) (Keen, 1999) and a model of monetary growth (Chiarella et al., 2006) that makes use of Blanchard types stock market dynamic (Blanchard, 1981). In this way, it may be possible to integrate two stylized facts related to financial fragility: asset bubble and debt deflation as, for instance, is the case in Japan. Notwithstanding, it must be underlined that our work is similar to Chiarella et al. (2003). Our version is greatly simplified and focuses on the financial elements of the model. In addition, the stock and flow consistent tables used in a growing number of publications (see (Lavoie and Godley, 2001) or Lavoie and Godley (2004) for instance) are used to present the different elements of our model.

2.1 Feedback effects

The aim of this subsection is to present the major elements that interact within the model, and how they may be related. We can only partially present the global picture given the large number of variables.

2.1.1 Isolated feedback effects

There are four main feedback effects taking place in this model.

- Rose effect

This results from the interaction of the relative speeds of adjustment of price and wage (Rose, 1967). Under specific circumstances, their effects on production can be cumulative.

$$\Downarrow p, \downarrow w \longrightarrow \uparrow \frac{w}{p} \longrightarrow \uparrow C \Downarrow I \longrightarrow \downarrow AD \longrightarrow \downarrow y \longrightarrow \Downarrow p, \downarrow w$$

If prices are more flexible then wages, disequilibrium of goods and labor market induce higher real wages. In a profit led economy (Bhaduri and Marglin, 1990), aggregate demand lessens. The negative impact on production reduces prices and wages further, as it aggravates the imbalance. On the contrary, if prices are less flexible than wages, the Rose effect is stabilizing. In a wage led economy, price flexibility is stabilizing, as higher real wages stimulate consumption, which in turn reduces disequilibrium on goods and labour market.

$$\Downarrow p, \downarrow w \longrightarrow \uparrow \frac{w}{p} \longrightarrow \Uparrow C \downarrow I \longrightarrow \uparrow AD \longrightarrow \uparrow y \longrightarrow \uparrow p, \uparrow w$$

- Blanchard stock market instability

$$\uparrow \pi_e^e \longrightarrow \uparrow r_e^e \longrightarrow \uparrow D_e \longrightarrow \uparrow p_e \longrightarrow \uparrow \pi_e^e$$

Under certain conditions, an increase in the expected price of equities, raises the expected return on equities r_e^e. The resulting higher demand for equities appreciates equity prices (Blanchard, 1981). Under adaptive expectations, expectations about equity price are revised upwards. As the expected return on equities is $r_e^e = \frac{\eta\rho(1-D)PK}{p_e E} + \pi_e^e$, a necessary condition for an equity market bubble to take place is that $\dot{\pi_e^e} > \dot{p_e}$. As the equity market feeds back positively in the real market through consumption, an equity bubble boosts aggregate demand and production.

- Deflationary Fisher effect

Fisher highlighted for the great depression how downward price might have destabilizing consequences by increasing real debt. Lower price also has a direct effect on real debt as real debt equals nominal debt over price (Irving, 1933).

$$\downarrow p \longrightarrow \uparrow d \longrightarrow \downarrow \rho \longrightarrow \downarrow I \longrightarrow \downarrow AD \longrightarrow \downarrow y \longrightarrow \downarrow p$$

- Stabilizing interest rate policy

The interest rate policy follows a Taylor rule. The adjustment of the interest rate is countercyclical.

$$\uparrow \mathrm{y} \longrightarrow \uparrow \mathrm{p} \longrightarrow \uparrow \mathrm{r} \longrightarrow \downarrow \mathrm{I} \longrightarrow \downarrow \mathrm{y}$$

2.1.2 Integrated feedback effects and debt accumulation

The aim of this section is to try to better understand the principle of debt accumulation that may results from the interaction of the above partial feedback chains. Our starting point is the relationship between debt, retained earnings and profit. Taken in isolation, they have a cumulative effect on each other, as can be seen on the first diagram of Fig 2.1.2. A positive debt

shock leads to further debt accumulation to balance lower retained earning ceteris paribus. The relationship between investment, debt and profit is slightly more complex. Assuming that investment is a positive function of the profit rate and a negative function of debt, two stabilizing feedbacks must be summed (see the diagram 2 of Fig 2.1.2). Increasing debt reduces the profit rate. Since investment is lower because of higher debt and lower profit, debt shifts back. Some other components of the profit rate must be brought into the picture. The interest rate is one of them. Assuming that the interest rate follows some kind of Taylor rule restricted to the output gap, the countercyclical variation of the cost of credit constitutes another stabilizing chain. The depressed economy resulting from higher debt lowers interest rate. Smaller financial commitment pushes up the profit rate and retained earnings of firms (see the third diagram of Fig 2.1.2).

The adjustment of real wage to economic fluctuations is also likely to modify debt accumulation, as the cost of labour is a major component of firms profitability. Different posibilities arise related to the component of aggregate demand as well as to the relative speed of adjustment of nominal wage and price. An economy may qualify as profit led (see diagram 4 of Fig 2.1.2) when aggregate demand is mainly determined by the profit rate through investment and as wage led (see diagram 5 of Fig 2.1.2) when aggregate demand is mainly determined by consumption. In both situations, price flexibility has a negative direct impact on the profit rate. As seen previously, higher debt has a negative impact on economic activity. Excess supply of labour and goods leads to lower nominal wage and price. To the extent that prices are more flexible than nominal wage, real wage increases and thus reduces the rate of profit and increases debt. Meanwhile, in a profit led economy, the destabilizing forces are reinforced by the negative impact of lower profitability on investment whereas higher real wage stimulates aggregate demand through consumption in a wage led economy. In other words, if price flexibility leads directly to higher debt accumulation, it might indirectly have stabilizing effects depending on whether the Rose effect is stabilizing or not. Taking for instance, a positive shock on production, more flexible prices reduce real wage. The higher profitability has a direct positive impact on debt accumulation. Meanwhile, the positive effect of profitability on investment may be such that the level of debt rises.

In (see diagram 6 of Fig 2.1.2), the occurence of the Fisher effect is also represented by the arrow between price and debt. The Fisher debt deflation effect states that lower prices increase real debt. Since it reduces investment and economic activity, it further lowers prices. The Blanchard equity market dynamic is incorporated in diagram 7 of Fig 2.1.2. The positive relationship between expected return of equity price and equity price may be influenced

by the evolution of the profit rate as it determines dividends. Then, the dynamics of the stock market is related to the real economy through capital gain and asset holders consumption. The effect of the stock market dynamic depends on the size of capitalist consumption and on the degree of price flexibility as dividends depend on the evolution of the profit rate. In addition, debt accumulation is determined by the share of profit distributed to shareholders. The greater this share, the greater need for external funds to finance investment.

2.2 Tables of stocks and flows

Dos Santos (2005) has recently stressed that models like Minsky lack a clear and coherent financial structure whereas financial market behaviors are the key determinant of crises in Minsky's analysis. In order to check the consistency of our model, we present the so-called stock and flow matrix in line with Godley (1999) and Lavoie and Godley (2001). The three following tables (1, 2, 3) integrate flows of funds with balance sheets and insure that flows come from somewhere and go somewhere.

Table 1: Balance sheets

	Rentiers	Firms	Banks	Government	Total
Capital		$+pK$			$+pK$
Money/Deposits	$+M_c$		$-M$		0
Loans		$-D$	$+D$		0
Bonds GVT	$+B_g$			$-B_g$	0
Equities	$+Ep_e$	$-Ep_e$			0
Total	$+W_c$	$+W_f$	0	$-B$	$+pK$

The model deals with 5 types of agents: workers households, assets holders, a government, a bank and firms. And there are 4 financial assets: money, credit, public bonds and equities. The different tables are not detailed now but during the presentation of the different components of the model.

2.3 Worker households

Workers households (table 2) receive labor income wL^d that is a function of nominal wage and labor demand. Workers have a propensity to consume

Table 2: Flows of funds

	Workers	Rentiers	Firms Current	Banks	Government	Total
Consumption	$-C$		$+C$			0
Investment			$+I$			0
Gvt spendings			$+G$		$-G$	0
Wages	$+W$		$-W$			0
Taxes	$-T_w$	$-T_c$			$+T$	0
bonds interest rate		$+rB_g^c$			$-rB_g$	0
Loans interest rate			$-i_l D$	$+rD$		0
Dividends		$+(1-\alpha_\rho)\rho(1-d)$	$-(1-\alpha_\rho)\rho(1-d)$			0
Banks income		$+rD$		$-rD$		
Total		S_c	S_f	0	S_g	Total Savings

Table 3: Sources and uses of funds

	Rentiers	Firms	Banks	Government	Total
Money	$+\Delta M_c$		$-\Delta M$		0
Equities	$+p_e\Delta E$	$-p_e\Delta E$			0
Capital		$+p\Delta K$			$+p\Delta K$
Loans		$-\Delta D$	$+\Delta D$		0
Bonds	$+\Delta B_g$			$-\Delta B$	0
Total	S_c	S_f	0	S_g	Total Savings
Δ net worth	$+\Delta W_c$	$+\Delta W_f$	0	ΔW_G	Total Savings

equal to 1. The increase of the active labor population is a constant.

$$pC = (1-\tau_w)wL^d \quad (1)$$

$$\hat{L} = \gamma \quad (2)$$

2.4 Households' asset holders

$$
\begin{aligned}
Y_c &= (1-\tau_c)((1-\alpha_\rho)\rho(1-d)+Y_b) && (3)\\
M_c^d &= \beta_{mc}^d(p_e E + B) && (4)\\
\dot{M}_c^d &= \beta_{mc}(M_c^d - M_c) + (\gamma+\delta+\bar{\pi})M_c && (5)\\
B_g^d &= f_b(r, r_e^e)W_n^c && (6)\\
Ep_e^d &= f_e(r, r_e^e)W_n^c && (7)\\
W_n^c &= W^c - M_c && (8)\\
C_c &= c_1 Y_c + c_2 W^c && (9)\\
r_e^e &= \alpha_\rho \rho(1-d)/\tilde{q} + \pi_e && (10)\\
\pi_e &= \beta_{\pi_e}(\hat{p_e} - \pi_e) && (11)\\
\hat{p_e} &= \hat{p} + \hat{k} - \hat{E} - \dot{d}/(1-d) && (12)
\end{aligned}
$$

The income of asset holders (table 2) equals dividends distributed to shareholders, plus income of banks that is transferred to them to insure the flow consistency in line with Lavoie and Godley (2001). To release this strong assumption, it would be necessary to integrate banks own funds. As it makes the model much more complex we leaves it for future improvements. Interest on public bonds do not appears as a component of income as it is assumed that they taxed at 100%. This heroic assumption is nevertheless necessary to find a steady state. Financial income are taxed at a rate τ_c. Asset holders consume is a function of their financial income and wealth. The wealth effect links the stock market dynamic to the real economy. A Blanchard instability will feedback on the business cycle through aggregate demand. Apart from equities and public bonds, their wealth is composed by money M_c^d. Money is hold for speculative purpose, and is a function of the stock of equities. The allocation of savings between equities and bonds follows a Tobin's portfolio. Such an approach assumed that each asset is held in a certain proportion of agent's wealth and that this proportion varies with respect to the differential rate of return between the different assets. The return on public bond is the rate of interest r set by the Central banks whereas the rate of return on equities is the share of profit distributed to shareholders over the value of the capital stock $\tilde{q}$. In addition, asset holders anticipate possible capital gains or losses such that they consider the expected rate of return on equities. They extrapolate that tomorrow capital gains or losses will follow to some extent today's capital gains or losses. Note that it is assumed that taxes are lump sum such that it does not affect rentiers portfolio allocation. The sum of each function must be equal to one $f_e + f_b = 1$. Assets are assumed to be gross substitute, what implies that $\partial f_b/\partial r > 0$, $\partial f_b/\partial r_e < 0$, $\partial f_e/\partial r < 0$

and $\partial f_e/\partial r_e > 0$. Equity price will adjust to equal demand and supply. It should be noted that the interest rate is set by the central bank and that it is not the variable that clears the bond market. Meanwhile we will show by use of the Walras law (see next section) that as long as the equity market is in equilibrium the bond market is in equilibrium too. Eventually, $\hat{p_e}$ would be very difficult to obtain as it is the first derivation of the solution of a polynome of second degree. In order to avoid to compute the first derivation of the tobin's q, it is assumed that asset holders are fundamentalist trader and that they assume that the value of the Tobin' s q is 1. They expected that equity price adjust towards this value.

2.5 Firms

The budget constraint of firms is:

$$\dot{D} = p(I - \delta K) - (1 - \eta_\rho)\rho(1 - d) - p_e\dot{E} \tag{13}$$

Firms use internal funds and issue equities and debt to finance investment[2].

$$\begin{aligned}
\gamma &= n + n_l && (14)\\
Y^p &= y^p K && (15)\\
U &= Y/Y^p = y/y^p && (16)\\
L^d &= l_y Y && (17)\\
V &= L^d/L && (18)\\
p_e\hat{E} &= n + \alpha_{e1}(q - q_0) + \alpha_{e2}(d - d_0) && (19)\\
\rho &= (pY - wL^d - \delta pK - iD)/PK(1 - d) && (20)
\end{aligned}$$

$$\begin{aligned}
\hat{K} &= I/K && (21)\\
I &= \alpha_1^k(y/y^p - \bar{U})K + \alpha_2^k(d_0 - d)K + \alpha_3^k(\rho - \bar{\rho})K + \gamma K + \delta K && (22)\\
q &= (p_e E)/(pK - D) = (p_e E)/pK(1 - d) && (23)\\
\tilde{q} &= p_e E/pK && (24)
\end{aligned}$$

We assume a constant production function. It involves that production and labor demand are a constant function of the capital stock. Profit is the difference between the revenue from selling the goods produced and the different costs that firms face, mainly wages and financial commitment. Financial

[2]We do not consider price change in the budget constraint of firms for the sake of simplicity. In addition, equity price is taken into account to some extend in the intensive form budget constraint as the rate of equity issue n is multiplied by $\tilde{q}$ to express new equity issue

commitments are composed by interest income on credit and dividend paid to shareholders. There is a hierarchy between the different sources of financing. Firms rely first on its internal funds as they do not involve any financial payments. Then, firms raise funds on the equity market by issuing new stocks. There are many different ways to model equity supply by firms. Some authors express it as a function of the capital stocks as they considered that it is a small source of net funds Lavoie and Godley (2001). Some others express it as a varying function of investment, indebtedness, or assets prices Chiarella et al. (2003). We express the new issue of stocks as equal to the growth rate of the population, plus the weighted deviation from the steady state of Tobin's q and the debt level. This rule enable firms to pursue a twofold objectives: a certain level of equity valuation to satisfy shareholders as well as some substitution between the different sources of financing. The resulting needs of funds are met by contracting new loans. Firms net wealth is composed by the value of its capital stock minus the value of the stock of equities and the value of its credits. Investment is a function of different variables that reflects profitability, the business cycle or the level of indebtedness. The Tobin's q is equal to the monetary value of equities divided by the capital stock net of debt. We choose the capital stock net of debt as the portion of the capital that is financed by credit is likely to be transferred to investors in case of the firm bankruptcy. Financial institutions are the first served in case of a liquidation. Debt deflation might have a negative effect on investment as rising interest payments reduces banks profitability.

2.6 Banking sector

$$\dot{D}^s = \dot{D}^d \tag{25}$$

$$\dot{M}^s = \dot{M}^d \tag{26}$$

$$Y_b = +rD \tag{27}$$

The banking system is modeled in the simpliest way. Banks accept money and supply credits without restriction. There is therefore no credit rationing and no financial accelerator. Banks income is composed by interest on credit and is transfered to asset holders in order to meet the assumption of a zero wealth banking sector. Steady states of money and credit is choosen in such a way that $M_0 = D_0$ at the equilibrium. Nevertheless, at the aftermath of a shock, money and credit dynamic may diverge. A better formulation of the financial system would be to introduce a central banks, to express the allocation of banks funds between credit and public bonds a function of portfolio, to formulate credit rationing and banks own funds.

2.7 Public sector

$$
\begin{aligned}
pT &= \tau_c(\eta_\rho \rho(1-d) + iD) + rB + \tau_w(wL^d) && (28)\\
G &= \psi K && (29)\\
\dot{B} &= pG + rB - pT && (30)\\
\dot{r} &= \beta_{r1}(r_0 - r) + \beta_{r2}(\hat{p_y} - \bar{\pi}) + \beta_{r3}(y/y^p - \bar{U}) && (31)
\end{aligned}
$$

The government taxes financial and labor income. In order to compute the equilibrium point of the system, it must be assumed that the government taxes all interests on public bonds such that they disapear from their budget constraint. Its spending is formulated in a very simple manner and it is proportional to the stock of capital. Bonds are issued as a result of the gap between taxes and spending. The objective of the central bank is not the quantity of money but the level of the interest rate. The central bank pursued an interest rate level that follows a Taylor rule. There are two main targets: the rate of inflation as well as the state of the business cycle. Some extended version could be considered too. It could for instance incorporate the indebtedness of the private sector or the value of the stock market.

2.8 Wage-price interaction and Good market adjustment

$$
\begin{aligned}
\hat{w} &= \kappa(\beta_w(L^d/L - \bar{V}) + \kappa_w \beta_p(Y/Y^p - \bar{U})) && (32)\\
\hat{p} &= \kappa(\kappa_p(\beta_{w1}(L^d/L - \bar{V}) + \beta_p(Y/Y^p - \bar{U})) && (33)
\end{aligned}
$$

The wage-price interaction is drawn from Chiarella and Flaschel (2000). In the spirit of Rowthorn Rowthorn (1977) it is based on the idea that price are not only determined by the level of wages but also by the ability of firms to set prices. It is represented by a double Phillips curves. It gives rise to the so-called Rose effect where an adjustment of the nominal wage level will be either reinforced or dampened by the resulting variation of prices depending on their respective speeds of adjustment.

Following Asada (1999), the good market is in disequilibrium and adjust to reduce the gap between demand and supply. It incorporates the basic idea involved by the keynesian multiplier. Aggregate demand is composed by consumption of workers and asset holders, plus investment of firms and public spending. We can already foresee that a stock market valuation will boost aggregate demand and economic prosperity through consumption of asset holders while a stock market depreciation will damage the economy.

$$\dot{Y} = \alpha(pC + c_1 Y_c + c_2 W_c + I + G - Y) + \gamma Y \quad (34)$$

2.9 Walras law

By use of the Walras law, our portfolio approach can be simplified to one equation. If the equity market is in equilibrium, it is possible to show that the bond market will necessarily be in equilibrium too (knowing that the money market and the credit market are always in equilibrium). For that purpose we must show that total savings absorbs new assets.

$$S_c = \dot{B} + p_e \dot{E}^d + \dot{M}_c \quad (35)$$
$$S_g = -\dot{B} \quad (36)$$
$$S_f = (1 - \eta_\rho)\rho(1 - d) \quad (37)$$

Knowing that ex post investment equals savings we have:

$$P(I - \delta K) = S_c + S_f + S_g \quad (38)$$
$$P(I - \delta K) = \dot{B} + p_e \dot{E}^d + \dot{M}_c + (1 - \eta_\rho)\rho(1 - d) - \dot{B} \quad (39)$$

As $M = D$ at the equilibrium, replacing M by D into the good market equilibrium condition:

$$I = S \quad (40)$$
$$P(I - \delta K) = \dot{D} + p_e \dot{E}^d + (1 - \eta_\rho)\rho PK \quad (41)$$
$$\dot{D} = P(I - \delta K) - (1 - \eta_\rho)\rho(1 - d) - p_e \dot{E}^d \quad (42)$$

From the budget constraint of firms, we can say that $p_e \dot{E}^d = p_e \dot{E}^s$, demand for new equities equals its supply. It entails that if the equity market is in equilibrium than bond market will be in equilibrium too.

2.10 The model in intensive form

In this section, we give the intensive form representation of the model. Intensive form means that each nominal variable is divided by the nominal value of the stock of capital pK. For instance,$d = D/pK$. $\hat{l}$, $\dot{r}$ and $\dot{\pi_{ec}}$ have just been divided by pK. $\hat{\omega}$ comes from $\hat{w} - \hat{p}$. Eventually, $\dot{d}$, $\dot{y}$, $\dot{b}$ and $\dot{m_c^d}$ are the result of the first derivation of the nominal variable over the stock of capital. For instance, $\dot{d} = \dot{D}/pK - (\hat{K} + \hat{p})d$.

$$\hat{\omega} = \kappa\big((1-k_p)(\beta_w(l^d/l-\bar{V})+(k_w-1)\beta_p(y/y^p-\bar{U})\big) \quad (43)$$

$$\hat{l} = \gamma-(g_k-\delta) \quad (44)$$

$$\dot{y} = \alpha(y^d-y)+(\gamma+\delta-g_k)y \quad (45)$$

$$\dot{r} = \beta_{r1}(r_0-r)+\beta_{r2}(\hat{p}-\bar{\pi})+\beta_{r3}(y/y^p-\bar{U}) \quad (46)$$

$$\dot{d} = g_k-\delta-\big(n+\alpha_{e1}(q-q_0)+\alpha_{e2}(d-d_0)\big)\tilde{q}-(1-\eta_\rho)\rho(1-d)-(\hat{p}+g_k-\delta)d \quad (47)$$

$$\dot{\pi_{ec}} = \beta_{\pi_{ec}}(\hat{p}^e-\pi_{ec}) \quad (48)$$

$$\dot{b} = \psi+rb-t-(\hat{p}+g_k-\delta)b \quad (49)$$

$$\dot{m_c} = \beta_{mc}(m_d(b+\tilde{q})-m_c)+(\gamma+\delta+\bar{\pi}-g_k-\hat{p})m_c \quad (50)$$

Some algebraic relationships must be added:

$$g_k = \alpha_1^k(y/y^p-\bar{U})+\alpha_2^k(d_0-d)+\alpha_3^k(\rho-\rho_0)+\gamma+\delta \quad (51)$$

$$\rho = (y-\omega l_y y-\delta-rd)/(1-d) \quad (52)$$

$$\kappa = 1/(1-\kappa_w\kappa_p) \quad (53)$$

$$l_d = l_y y \quad (54)$$

$$t = t_w+t_c=\tau_w\omega l^d+\tau_c(rd+\eta_\rho\rho(1-d))+rb \quad (55)$$

$$y_c = (1-\tau_c)\big(\eta_\rho\rho(1-d)\big)+rd \quad (56)$$

$$w^c = b+\tilde{q}+m_c \quad (57)$$

$$y^d = (1-\tau_w)\omega l^d+c_1y_c+c_2w^c+g_k+\psi \quad (58)$$

$$\hat{p}^e = \hat{p}+g_k-\delta-n-\dot{d}/(1-d) \quad (59)$$

In intensive form our system has 8 dimensions. There are now 4 variables (q,d,b,m) from the financial sector that feeds back into the real dynamics. The bonds dynamic does not have any direct influence. On the contrary the stock market and the real debt play a major role as it directly enters aggregate demand and the investment function.

2.11 Steady states

In this section, the equilibrium point of the system are computed. To save space details of the computation are not given. Note nevertheless that the value of the Tobin's is choosen arbitrary. If it is usually set to 1, it is here set to less than unity as a Tobin's q equal to 1 entails zero net wealth of firms.

$$
\begin{aligned}
g_k^0 &= \delta + \gamma && (60)\\
\rho^0 &= \bar{\rho} && (61)\\
q^0 &= 0.5 && (62)\\
d_0 &= (\gamma - nq^0 - (1-\eta_\rho)\rho_0)/(\gamma - nq^0 - (1-\eta_\rho)\rho_0 + \bar{\pi}) && (63)\\
\tilde{q}^0 &= (1-d_0)q^0 && (64)\\
y^0 &= y^p\bar{U} && (65)\\
l_0^d &= l_y y^0 = l_y y^p \bar{U} && (66)\\
l^0 &= l_0^d/\bar{V} = l_y y^p \bar{U}/\bar{V} && (67)\\
p_0 &= 1 && (68)\\
\omega^0 &= \frac{A}{((1-\tau_w)y^0/x0 - c_1(1-\tau_c)y_0 + c_2(\tau_c y^0 - \tau_w y^0/x0)/(\bar{\pi}+\gamma))} && (69)\\
\pi_e^0 &= \bar{\pi} + \gamma - n && (70)\\
r_0 &= (y^0(1-\omega^0) - \delta - \rho^0(1-d_0))/d_0 && (71)\\
b^0 &= \big(\psi - \tau_w\omega_0 y_0 - tau_c(\eta_\rho rho_0(1-d_0) + r_0 d_0)\big)/(\bar{\pi}+\gamma) && (72)\\
m^0 &= \beta_{md}(q_0(1-d_0) + b^0) && (73)\\
re_0 &= \eta_\rho\rho_0(1-d_0)/\tilde{q}^0 + \pi_{e0} && (74)
\end{aligned}
$$

With $A = (y^0 - \gamma - \delta - \psi - c_2(d_0 + q^0(1-d_0)) - c_1(1-\tau_c)\eta_\rho\rho^0(1-d_0) - c_1(1-\tau_c)(y^0 - \delta - \rho^0(1-d_0)) - c_2(\psi - \tau_c\eta_\rho\rho^0(1-d_0) - \tau_c(y^0 - \delta - \rho^0(1-d_0)))/(\bar{\pi}+\gamma))$.

Two additional restrictions must be set on parameters. The demand for bonds at the steady state must be consistent with the supply of bonds. $f_{b0}(b_0 + \tilde{q_0}) = b_0$. It gives the value of the parameters α_{b0}:

$$\alpha_{b0} = \frac{\psi - \tau_w\omega_0 y_0 - tau_c(\eta_\rho rho_0(1-d_0) + r_0 d_0)}{\psi - \tau_w\omega_0 y_0 - tau_c(\eta_\rho rho_0(1-d_0) + r_0 d_0) + q_0(1-d_0)(\bar{\pi}+\gamma)} \quad (75)$$

The second condition is that money demand at the steady state must be equal to the demand of credit: $m_0 = d_0$. It gives us the value of the parameters β_{md}.

$$\beta_{md} = d_0/(q_0(1-d_0) + b^0) \quad (76)$$

3 Decomposition of the different effects

As there are many effects interacting simultaneously, we propose that we integrate them step by step in a series of nested models in order to detail their different influences on debt accumulation. In order to keep the model simple, a version without a government sector is used. The main changes are that there is no public spending and that the portfolio must be reformulated. Asset holders now allocates their savings between equities and deposits. This gives us a 6 dimensional model:

$$\begin{aligned}
\hat{\omega} &= \kappa\big((1-k_p)(\beta_w(l^d/l-\bar{V})+(k_w-1)\beta_p(y/y^p-\bar{U})\big) && (77)\\
\hat{l} &= \gamma-(g_k-\delta) && (78)\\
\dot{y} &= \alpha(y^d-y)+(\gamma+\delta-g_k)y && (79)\\
\dot{r} &= \beta_{r1}(r_0-r)+\beta_{r2}(\hat{p}-\bar{\pi})+\beta_{r3}(y/y^p-\bar{U}) && (80)\\
\dot{d} &= g_k-\delta-\big(n+\alpha_{e1}(q-q_0)+\alpha_{e2}(d-d_0)\big)\tilde{q}-(1-\eta_\rho)\rho(1-d)-(\hat{p}+g_k-\delta)d && (81)\\
\dot{\pi_{ec}} &= \beta_{\pi_{ec}}(\hat{p^e}-\pi_{ec}) && (82)\\
& && (83)
\end{aligned}$$

Expression for the following variables must be integrated in the above system.

$$\begin{aligned}
g_k &= \alpha_1^k(y/y^p-\bar{U})+\alpha_2^k(d_0-d)+\alpha_3^k(\rho-\rho_0)+\gamma+\delta && (84)\\
\rho &= (y-\omega l_y y-\delta-rd)/(1-d) && (85)\\
\kappa &= 1/(1-\kappa_w\kappa_p) && (86)\\
l_d &= l_y y && (87)\\
y_c &= \eta_\rho\rho(1-d)+rd && (88)\\
w^c &= \tilde{q}+dep && (89)\\
dep &= f_d(\tilde{q}+dep) && (90)\\
y^d &= \omega l^d+c_1y_c+c_2w^c+g_k && (91)\\
\hat{p^e} &= \hat{p_y}+g_k-delta-n-\dot{d}/(1-d) && (92)
\end{aligned}$$

The first step illustrates how debt, retained earnings, interest commitment and investment interact. It is one way to illustrate the economy represented in diagram 3 of Fig 2.1.2. The second step introduce the wage-price interaction to integrate the impact of real wage adjustment on debt accumulation and also to enable debt deflation. The condition for debt deflation are illustrated for both a profit led economy and a wage led economy. In a third step, the dynamic of the stock market and its effect on aggregate demand are taken

into account. Eventually, a simulation of the full model is presented and will be the benchmark for the following section.

The first two graphs of Fig 3 represent the basic case of debt accumulation that results from the interplay amounginvestment, retained earnings, profit rate, indebtedness and interest rate. More precisely it focuses on the stabilizing effect of a Taylor rule interest rate policy as the graphs of the upper left and right corners differ only to the extend that the speed of reaction of interest rate with respect to the output gap is different. In order to isolate the case of debt accumulation we set all reaction coefficients to zero except for the coefficients for the goods market β_y, β_{k1} and β_{k2} that stand for the sensitivity of investment to profitability and the business cycle, as well as β_{r3} the reactio coefficient of interest rate with respect to the output gap. The simulation is based on a debt shock of 25% chosen to be very large to underline the stable behavior of the system. It must be noted that setting some coefficients to zero enable to highlight some of the effects but it is not as convenient as if the system of equation were rewritten. The debt shock shifts up investment as the ratio of profit over the stock of capital net of debt improves. While investment stimulates production, lower retained earnings require additional debt. The interest rate shifts as a result of the Taylor rule which in turn slows down investment, and output. Higher interest continues to increase the level of debt for some time. Debt desaccumlation can take place when investment is small enough. Debt reaches a minimun when interest rate are low and retained earnings are high. The depression stops once the interest rate starts decreasing and the rate of profit starts increasing. On the upper right hand graph, lowering the sensitivity of interest rate to the business cycle cannot stabilize the interaction between debt, profit and investment. In the first case, the fast adjustment of interest rate is able to stabilize investment and output to avoid debt accumulation.

The next step is to introduce two additional mechanisms in order to allow for debt-deflation. The first one is a wage-price interaction. We follow the so-called Rose effect that models wage and price adjustment through a double Phillips Curve. This mechanism will determine the dynamics of real wage that influence aggregate demand through two channels: the rate of profit that determines investment and consumption. It modifies the dynamics of debt as it is not neutral in terms of retained earnings and the level of investment. The relative speed of adjustment of wage and price may have different outcomes in a profit led economy or in a wage led economy. The second mechanism deals with the introduction of debt into the investment function $\alpha_3^k \neq 0$. In a situation of high indebtedness, the negative impact on investment might trigger a spiral of depressed economic situation, as well as depressed prices and increasing debt.

The wage price interaction might have very different outcomes whether the economy considered is profit led or wage led. In a profit led economy, a relatively greater wage flexibility is stabilizing. For example, if a positive shock hits the economy, the labor and goods markets improve, which appreciates nominal wage and price. The subsequent higher real wage reduces the rate of profit and investment and the goods and labor markets may come back to their steady state. This pattern is simulated in the lower right hand corner of 3. We tried to be as close as possible to a profit led economy by replacing consumption with its steady state value in the aggregate demand equation. Even if it is just an approximation, aggregate demand is only a function of the rate of profit through investment $\alpha_2^k = 0$. In fact, the 10% shock on debt reduces investment as the investment function is now a negative function of debt $\alpha_2^k \neq 0$. If lower retained earnings make higher debt financing necessary, lower investment stabilises the debt trajectory. An additional stabilizing mechanism is the fast adjustment of nominal wage that lowers real wage and maintains retained earnings. In this case, the self reinforcing debt deflation spiral is counteracted by the stabilizing evolution of the real wage. On the lower left hand graph, more flexible prices are destabilizing by reducing investment through its direct impact on the retained earnings but also through its negative impact on indebtedness. The Fisher effect is stronger and the Rose effect is destabilizing. The simulation shows that investment is dependent on the real wage, but that if indebtedness drops at the beginning of the downturn because of lower investment, it turns up before the business cycle because of deflation. Then, debt accumulation is prolonged as investment is increasing upward going. In this case deflation would tend to extend the downturn or to slowdown the recovery.

In a wage led economy, it is the relatively faster adjustment of price that is stabilizing. A positive shock on production for instance leads to wage and price inflation. The resulting lower real wage improves profitability but reduces consumption. Aggregate demand being more dependent on consumption rather than profit, aggregate demand is reduced and the economy might return to its steady state value. In this case, debt deflation that arises from flexible price will take place only if the negative effect of indebtedness on investment is strong enough. The stabilizing case is illustrated in the upper left hand graph of Fig 3. Higher debt reduces retained earnings and investment. The depressed economic situation lowers price and wage. Price deflation has a cumulative effect on indebtedness, but the appreciation of the real wage sustains aggregate demand and economic activity which ends the goods and labour markets disequilibrium. Price flexibility is such that real wage adjusts to counteract the destabilizing effect of higher indebtedness: the Fisher effect is weaker than the stabilizing Rose effect. In the upper right hand

graph, price flexibility is slightly smaller and is not sufficient to contain the destabilizing debt accumulation, and debt deflation. The simulation shows that debt increases when prices are decreasing. The upturn is reversed once prices have increased such that they start to reduce real wage and aggregate demand. The reduction of real wage and investment allow firms to reduce their indebtedness. Meanwhile, decreasing prices push up debt. Lower prices tend at some point to raise real wages which sets the basis for a phase of expansion.

The lower left hand corner simulates the introduction of wealth effects and aims at illustrating how the stock market dynamics may have destabilizing effects. It is here assumed that asset holders consume part of their income in a certain proportion of their income and wealth. Once we increase the speed of reaction of expected return of equities, the greater stock market fluctuations feed back into the real side of the economy through greater fluctuation of asset holders consumption and aggregate demand.

The lower hand right corner simulates the extended model presented above. This version include a public sector and money hold by asset holders. This simulation serves as a benchmark for the following simulation that will address the issue of the effects of public intervention on the dynamic of the model. This benchmark case allows for debt accumulation, debt deflation and stock market instability within a wage led economy.

4 Wealth transfers

In this section, we reproduce graphically the wealth transfers entailed by the dynamic of liabilities. All wealth transfers are based on the benchmark simulation of the lower right hand graph of Fig 3. And all variables are in real terms unless it is specified.

The upper right hand graph of Fig 3 reproduces our different agents wealth dynamics entailed by the benchmark simulation. Total wealth is always equal to 1, the value of the stock of capital which confirms that our model is consistent in terms of stocks. We will discuss transfers associated with the four kinds of liabilities present in our model: equities, debt, money and public bonds.

At first glance, asset holders, the lender in our framework, have a dynamic of wealth opposed to the wealth dynamic of firms the main borrowers in our framework. It is mainly due to the dynamic of equities that generates transfers between equity holders (asset holders) and equity issuers (firms). The decomposition of firms and asset holders wealth in the upper right hand corner and lower left hand corner respectively confirms that equity price

fluctuations are a main source of wealth fluctuation. Fluctuations of the stock market generate a transfer within financial market participants or other words between lenders and borrowers. The greater the stock market instability generated by Blanchard links between expected return and equity demand, the greater the transfers.

The second types of wealth transfers is associated with debt. An unstable dynamic of debt is the main stylized fact of a period of financial fragility. As debt appears positively in lenders balance sheet and negatively in borrowers balance sheets, a rising debt is a transfer from borrowers to lenders. In our framework, banks assets rises with debt (see the lower right hand graph) and firms wealth decreases with debt (see the upper right hand graph).

The third kind of transfer is associated with money. In our framework, asset holders hold money in a certain proportion of their two other assets, bonds and equities and banks accommodate all demand for money. The banking system is modeled in the simplest possible way. Its wealth is zero at the steady state ($m_0 = d_0$) and there is no profit, no banks own funds or non-performing loans. As money is a credence hold by households on banks, higher demand for money is a transfer from the banking system to households. It is in line with our assumption that an unstable dynamic is a transfer from borrowers towards lenders, from financial institutions to asset holders.

The fourth transfer is linked with public debt. The government issue debt to close the gap between its spending and income and asset holders acquire all public bonds. Fluctuations of the government budget constraints leads to a transfer between lenders and borrowers.

Our simulation of wealth dynamic confirms that the fluctuations of the nominal value of financial assets generate transfers between the issuer of assets and the purchaser of assets for the simple reason that an asset appears positively in the lenders balance sheet and negatively in the borrower's balance sheet. In a period of financial fragility the transfer take place from borrowers toward lenders while in a period of financial tranquility it takes place from lenders to borrowers. It is possible to make a distinction between the types of assets. Transfers involving debt, bonds and money are related to their quantity as they have a fixed price. Transfers involved by equities however are linked with the quantity of share exchange in the market but more importantly by the variation of share price. In addition, variation of the price level generates transfers as it changes the real value of these assets. In a period of deflation, lowering prices raises the real value of liabilities and assets which generates a transfer from borrowers to lenders. On the contrary, inflation induces the opposite transfer as it reduces the real value of assets and liabilities. As an illustration, the upper right corner of Fig 4 shows that

during a period of deflation the real value of debt is greater than the nominal value of debt and inversely during a period of inflation.

All assets fluctuations are coordinated in our simulation with the exception of public bonds. In our framework, asset holders hold creedence on the three other types of agents but do not have any liabilities. Consequently, they benefit from a period of financial fragility and deflation. On the contrary, governments and firms hold liabilities solely but no financial assets. Their wealth is reduced in period of debt accumulation and deflation. Eventually, banks have an intermediate situation as they hold assets in the form of credit and liabilities in the form of money.

If asset holders seem to benefit from the accumulation of liabilities by others economic agents, it must be pointed out that an unstable dynamic leads to bankruptcies of firms and banks if it is not kept within reasonable bounds. In such as case, equities loose their value, firms default on their credit and banks go bankrupted which entails severe costs to asset holders. In other words, if asset holders benefit from the pre financial crisis, they suffer losses during the financial crisis. The degree to which public intervention may stabilize the economy is therefore of importance as proper public intervention may reduce the depth of the crisis. In addition, as various tools are at the disposal of public authorities it might be of interest to assess the effects of these interventions in terms of wealth transfers. This is the purpose of the following section. Models about the probability of crisis usually compare simulation based on a different sets of parameters and on their related conditions of stability. As our focus is on the effect of public reaction at the moment of the crisis, the change in policy variable takes place during the benchmark simulation.

4.1 Fiscal policy: socialization of losses

This section aims at understanding how fiscal intervention by the government may modify the dynamic of the model and the wealth transfers generated. In line with the Minsky view of the stabilizing effect of public intervention and more generally with the post-keynesian literature, public intervention stabilizes the business cycle. Fiscal policy limits the transfers involved between capitalists who lend money and capitalists who borrow money but at the cost of an additional public deficit. In this sense it can be argued that fiscal policy is a transfer from taxpayers towards financial market participants. In other words, it can be said that the costs are shared "democratically".

4.1.1 Increasing public spendings

Fiscal policy is modeled in two ways. In the first case, public spending g is made endogenous. In Fig 4.1.1 public expenditure shift up from $g = 0.225$ to $g = 0.335$ at time 130. Higher public spending is beneficient through the positive influence on aggregate demand that sustains investment and profitability. At the same point in time, fluctuations are much lower in Fig 4.1.1 rather than in the benchmark simulation represented by the lower right hand graph of Fig ure 3. Ultimately, the time of the explosion of the system is delayed.

This type of fiscal policy has an indirect effect on wealth as it is a transfer of flows. In terms of wealth transfers, the dampened oscillations of liabilities entail dampened wealth transfers between borrowers and lenders. Meanwhile, additional public deficit reduces the wealth of the public sector. In general, all agents benefit from public intervention as it delays the crisis that would have generated losses for asset holders, firms and banks as a result of the system bankruptcy. Meanwhile, gains are not equally distributed. Asset holders are the first beneficiaries as they took advantages of their position of lenders. Transfers were in their advantage before public intervention. The fiscal policy delays the time of potential losses. And, their wealth shifts up as additional public bonds are issued to finance the deficit. Firms are also favored by smaller fluctuations. By sustaining the demand for goods, the fiscal policy sustains profitability which helps firms to face interest payments. Concerning banks, their situation is paradoxical as they are both creditors and debtors. On the one hand, they are penalized by the stabilization of debt. On the other hand, the stabilization of money demand is positive for their liabilities. At the time of intervention, the temporary increase of asset holders' wealth and the temporary decrease of firms' wealth is due to the stock market appreciation that is generated by the portfolio adjustments to higher public spending. If a higher interest rate tends to favor the demand for bonds, the higher quantity of bonds also favors the demand for equities as the demand for assets is a function wealth.

4.1.2 Debt buy out

The second type of public policy deals with a government buy out of private debt. Public interventions during financial crises aim mainly at alleviating the private sector indebtedness through bank recapitalization/nationalization, debt relief schemes or transfers of non performing loans to a public entity for instance. Their common point is that they all organize the transfer of some part of private debt to a public institution. In the real world, these policies

usually target banks in order to improve the health of the financial sector and to restore the credit channel. As our simple banking system does not allow for banks own funds or non performing loans, one way to model the socialization of debt is to assume that government buys out part of firms debt.

In Fig ure 4.1.2, the government buys 10% of the firms indebtedness at two points in time $t = 120$ and $t = 210$. This debt transfers stop the dynamic of the system. Meanwhile, it must be repeated on a regular basis, as it does not involve any modification of the system parameters. These transfers have temporary positive effects to the extend that they reduce the level of indebtedness and to the extend that they impede debt accumulation.

In terms of wealth, all agents benefit globally from such a policy as it contains the unstable dynamic within viable boundaries. Firms benefit directly from the reduction of indebtedness. Meanwhile, additional government bonds have a negative indirect effect on their wealth as they generate a surge in equity prices. Transfers toward the banking system are limited while transfers toward asset holders are amplified. Asset holders benefit both from the increasing public debt and from higher equity price. In addition, as money is proportional to bonds and equities, asset holders' wealth is also positively affected by the dynamic of money demand. Banks are hurt both by a reduction of the level of debt and by a higher demand for money. It must be underlined here that the special situation of the banking sector is mainly related to its oversimplification. Lastly, the buy out of private debt, requires the public sector to issue bonds to cover the cost of these interventions, which temporarily reduces its wealth.

4.2 Monetary policy: transfers amoung financial market participants

4.2.1 Interest rate shock

Monetary policy is an important macroeconomic tool. There has been intense controversies regarding its goal during the East Asian Financial Crisis. More generally, a decrease in interest rate is used by governments to foster investments and to ease firms budget constraints during slow down. If interest rates follow in our framework a counter cyclical Taylor rule, it would be interesting to assess the effects of an interest rate shock on the behaviour of the dynamic system. Intuitively, interest rate shocks may alter debt accumulation because of its effects on the rate of profit. It may not be neutral in terms of wealth dynamic as the interest rate determines financial flows between lenders and borrowers.

Figure 4.2.1 is based on a simulation where the interest rate is reduced by 30% of its value at two points in time $t = 120$ and $t = 170$. These shocks stabilize the economy temporarily but they are not sufficient to go back to the resting point. By reducing financial commitments, debt accumulation slows down and keeps the economy within reasonable bounds.

In terms of wealth transfers, all agents benefit from the stabilization of the business cycle as losses entailed by the a possible economic breakdown is avoided. When interest rates fall and debt accumulation slows down, the transfers between firms and banks is limited. Stock transfers are reduced at the aftermath of revenue transfers. The same should happen between the government and asset holders as public finance is also concerned with interest payment except that the interest rate does not appear in the government budget constraint in our case. Eventually, at the time of the interest rate shock, the relatively higher return of stock with respect to bonds pushes up the demand for equities through the portfolio. It generates a temporary wealth transfer between firms and asset holders as well as between banks and asset holders.

4.2.2 Price shock

As price deflation plays a key role in debt accumulation, and contributes to magnifying transfers, it is of interest to assess the effect of price shock on the dynamic of the economy and on wealth transfers. By stopping debt deflation, positive price shock might stop debt accumulation and wealth transfers.

The following simulation is based on a positive price shock of 2.5% at time $t = 145$. A slightly different simulation is done here. The left column of Fig 4.2.2 is the benchmark case while the right column represents the positive price shock. The positive price shock occurs at the beginning of the deflation period. It tends to stop deflation temporarily and to delay the explosion of the system.

In terms of wealth transfers, transfers between participants of financial markets are limited by the more stable dynamic. The result is very similar to that of public buy out of private except that it involves no fiscal cost. In addition, by lowering the real value of financial assets, the price shock favors borrowers to the expense of owners of assets.

5 Conclusion

In conclusion, we tried to develop a model of debt accumulation, debt deflation and equity dynamic. Financial elements plays an important role in

the unstable dynamic of the system. In fact, debt deflation and the equity market dynamic are unstable. They also interact with real variable such as price and wage. Under certain circumstances the distribution of income is modified in such a way that debt accumulates. Meanwhile, there are strong forces such as the interest rate behaviour or the Rose effect that may keep the system within resonable boundaries to generate stability or fluctuation around the resting point.

In terms of wealth transfers, we were able to simulate that the accumulation of liabilities that characterises period of financial fragility generates a transfer from borrowers towards lenders. And that public intervention may be useful to stabilize the economy and to minimize losses. Public action may be classified in two categories. The first category deals with flows of income such as increasing public spending or decreasing interest rates. The second category acts directly upon the real value of the stock of assets such as debt buy out or price shock. To summarize our point of view, it is possible to say that gains are private during the boom preceeding the crisis in the sense that owners of financial assets accumulate wealth. Losses however are socialized during the crisis through fiscal policy. Meanwhile, monetary tools may be very efficient without involving any fiscal cost as they tend to reverse the transfers that took place between lenders and borrowers.

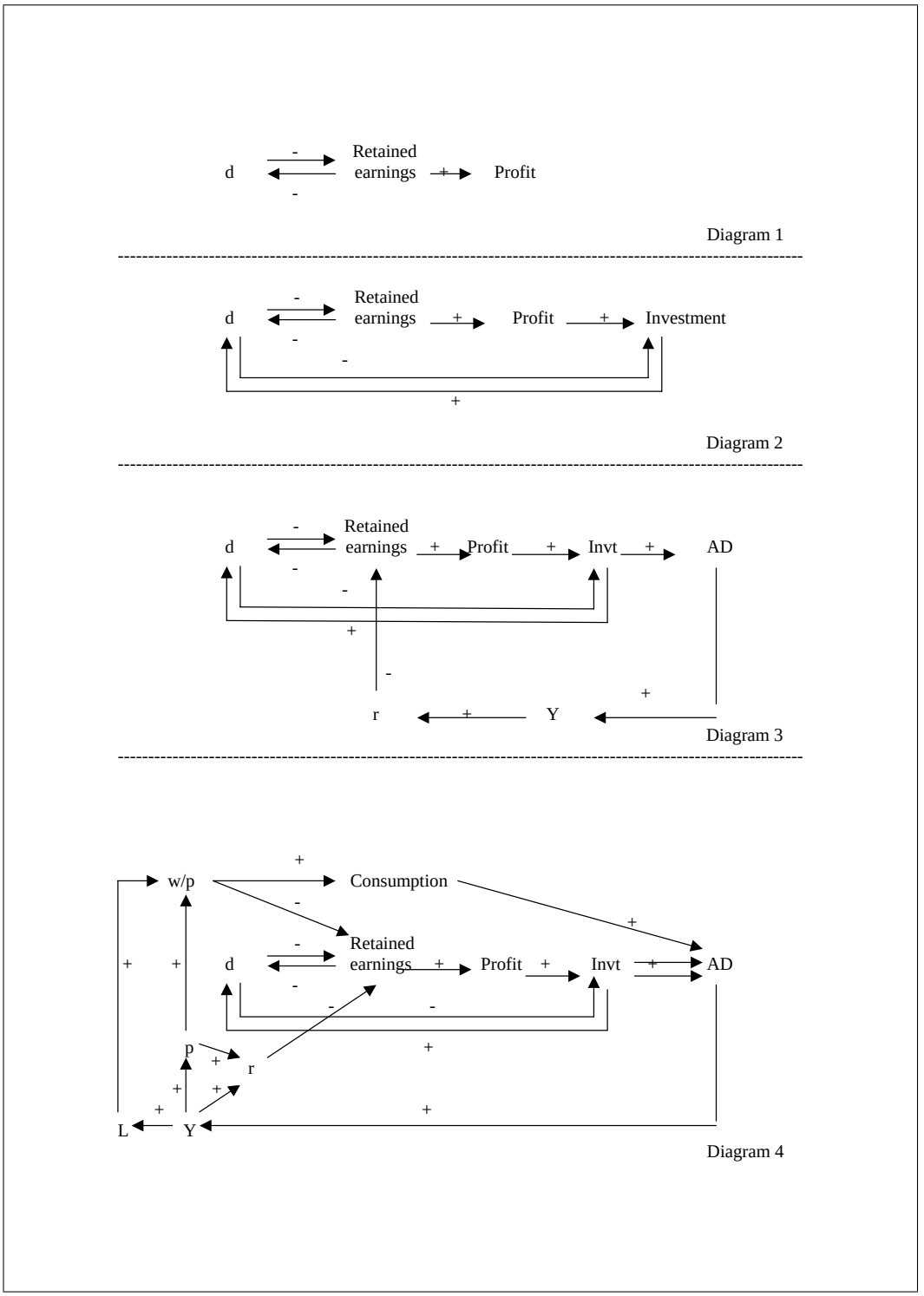


Figure 1: Debt accumulation 1

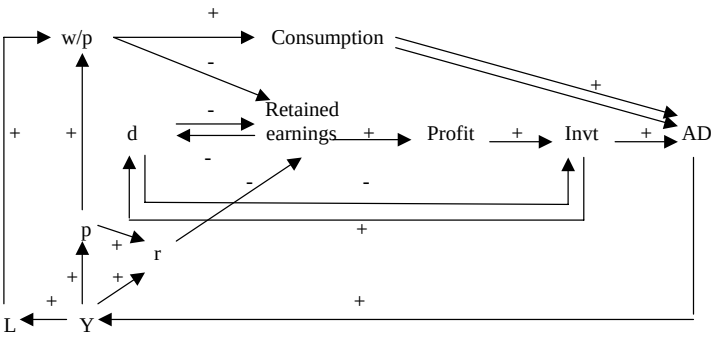


Diagram 5

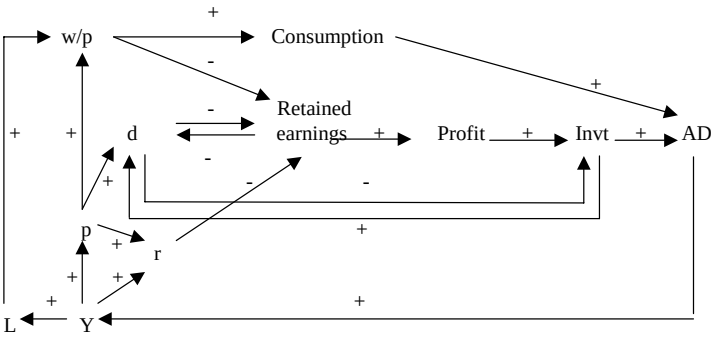


Diagram 6

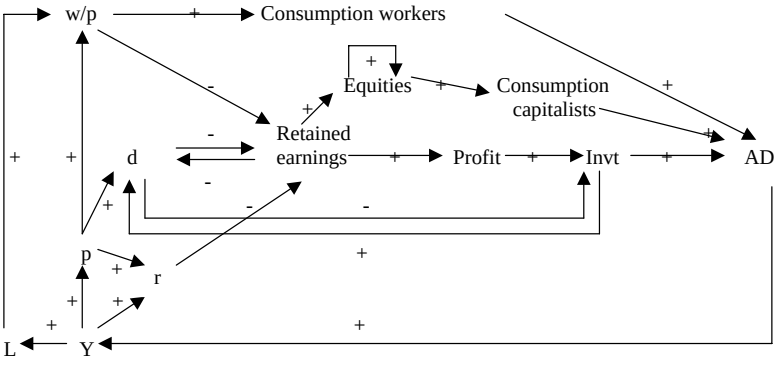
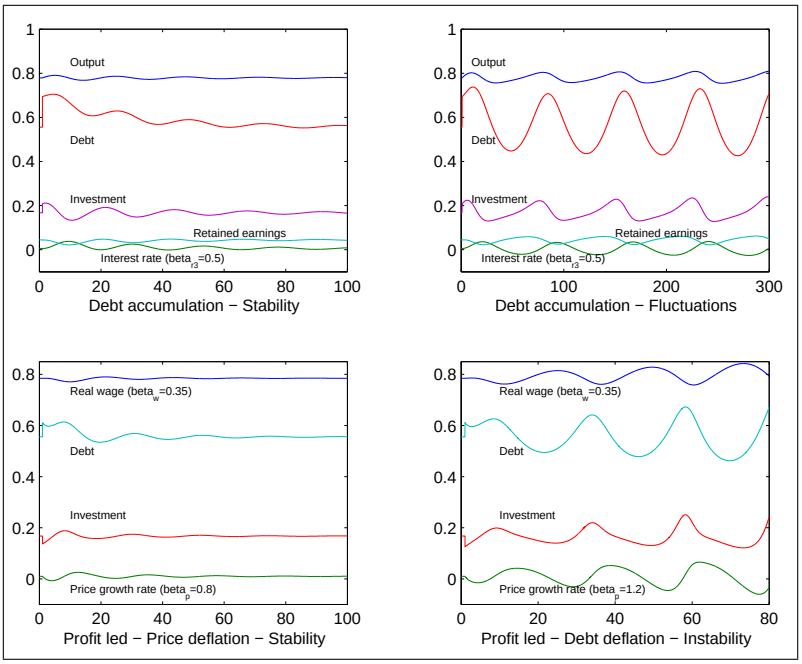
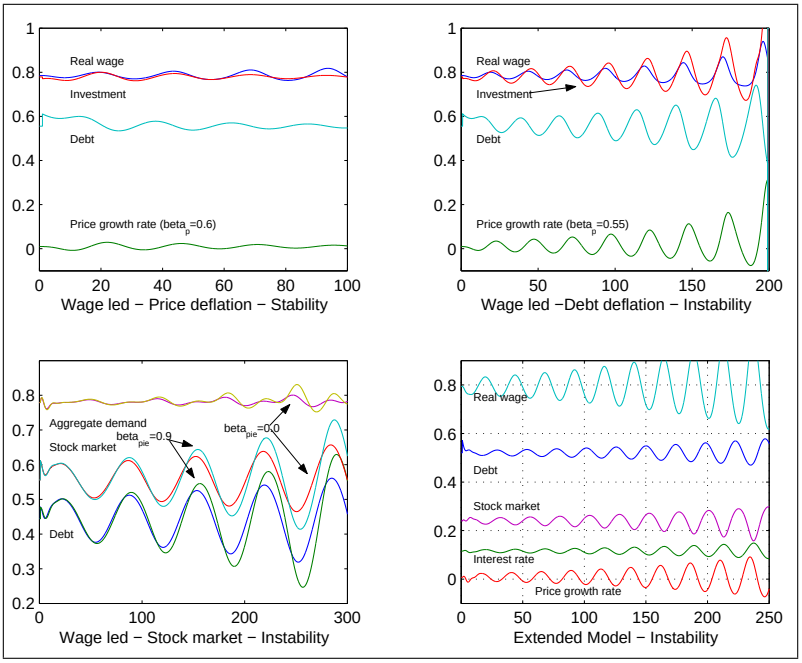


Diagram 7

Figure 2: Debt accumulation 2


Output
Debt
Investment
Retained earnings
Interest rate (beta_r3=0.5)
Debt accumulation − Stability
Debt accumulation − Fluctuations
Real wage (beta_w=0.35)
Price growth rate (beta_p=0.8)
Price growth rate (beta_p=1.2)
Profit led − Price deflation − Stability
Profit led − Debt deflation − Instability


Real wage
Investment
Debt
Price growth rate (beta_p=0.6)
Price growth rate (beta_p=0.55)
Wage led − Price deflation − Stability
Wage led −Debt deflation − Instability
Aggregate demand
Stock market
beta_pie=0.9
beta_pie=0.0
Wage led − Stock market − Instability
Stock market
Interest rate
Price growth rate
Extended Model − Instability

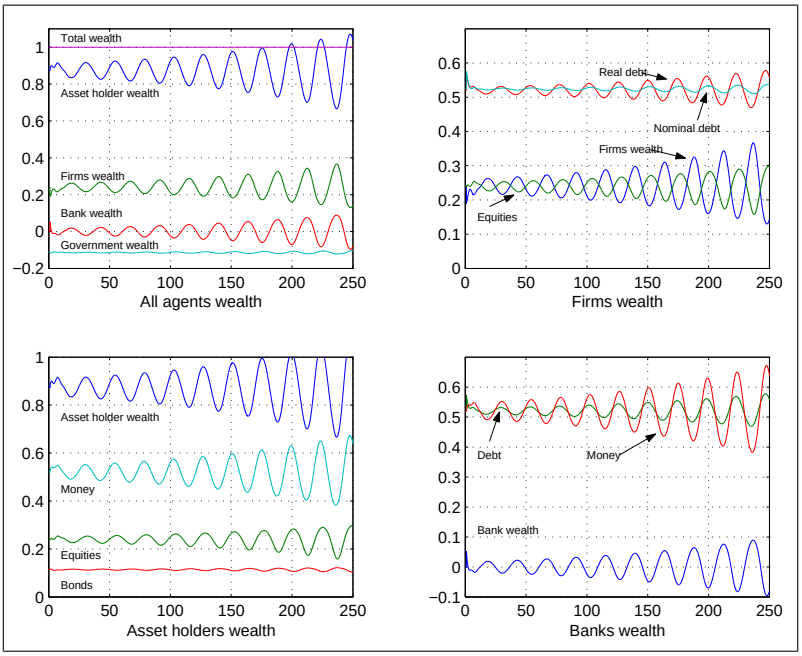


Figure 3: Wealth transfers

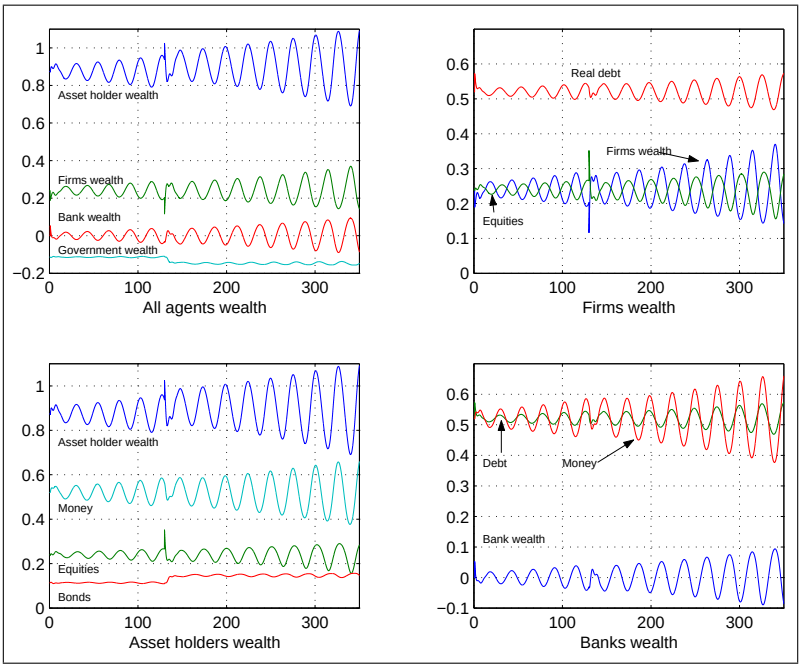


Figure 4: Effects of higher public spending

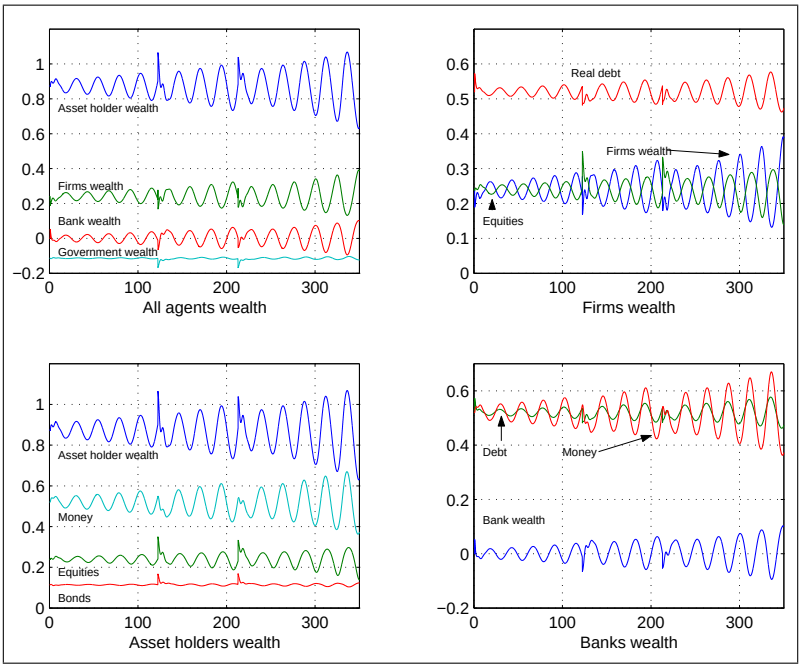


Figure 5: Effects of public buy out of private debt

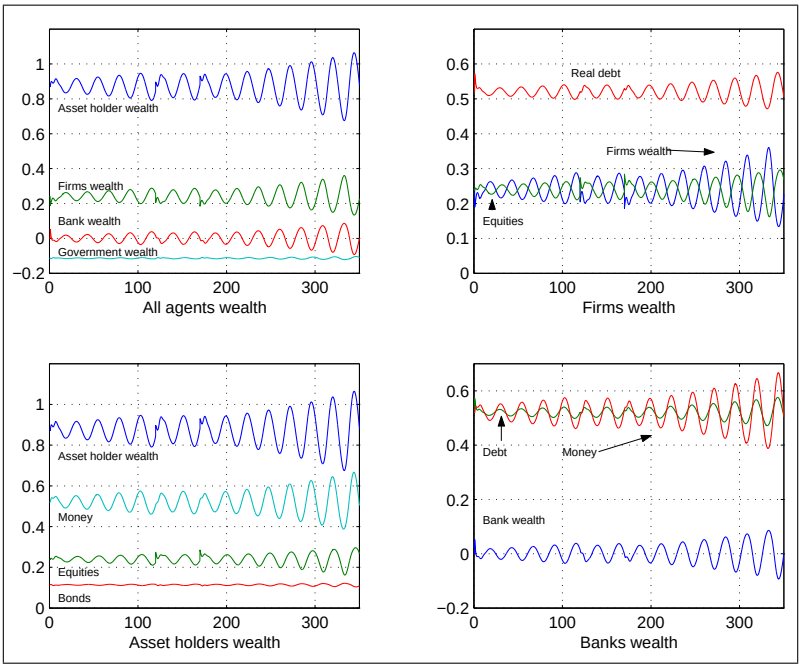


Figure 6: Effects of interest rate shock

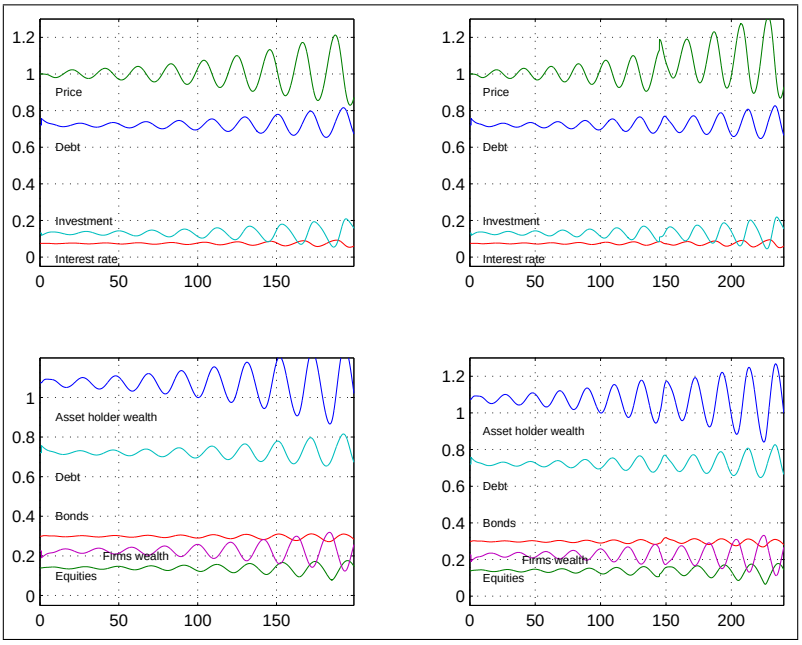


Figure 7: Effects of price shock

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