



Banks, Fiscal Policy and the Financial Crisis*

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The recent financial crisis has highlighted the close links between the health of the banking system and of government finances.

The financial crisis originating from mortgage markets and has become a sovereign debt crisis, in some countries in the Euro area.

This paper intends to set up a model which allows us to understand how mortgage market losses and sovereign losses transmit into the rest of the economy.

Standard DSGE models with a representative household have difficulties to generate aggregate effects from purely redistributive shocks:

- from borrowers and lenders in the case of mortgage losses
- from governments to households in the case of sovereign losses.

Standard models also do not consider specific constraints under which banks are operating.

To meet these two requirements, this paper builds on:

- Iacoviello (2005) and Iacoviello and Neri (2010) who distinguish between borrower and lender households.
- Several recent DSGE models with banks. See, especially, Gerali, Neri, Sessa and Signoretti (2010), Kollmann, Enders and Müller (2011) and Kollmann, Roeger and in't Veld (2012).

Adding a banking system also allows us to analyse the effects of bank rescue measures and compare them to the effects of standard fiscal measures.

Novel feature of our analysis:

The academic debate on fiscal stimulus during crisis concentrates on government purchases, transferses, and tax cuts-- e.g., Coenen *et al.* (2010), Drautzburg and Uhlig (2010) and Forni and Pisani (2011).

However, a key aspect of fiscal policy during the crisis were sizable measures to support the banking system, e.g., in the form of bank asset purchases and bank recapitalizations by governments.

Structure of the presentation

- Section 2 documents bank losses, and fiscal measures, during the financial crisis.
- Section 3 describes the model.
- Section 4 discusses estimates of model parameters.
- Section 5 analyses the implied responses of macro/ financial variables to shocks and policies.
- Section 6 reports the historical contributions of shocks to EA real activity.

2. Bank losses and fiscal measures

EA bank losses: about EUR 500 bn in 2008-2011.

Only 50% of the losses experienced by EA banks originated from EA assets.

Worldwide bank losses: about EUR 900 bn.

These realized losses are smaller than loss forecasts made in 2008/09.

IMF Global Financial Stability Report (April 2009) predicts:

EA loan losses of about EUR 1 tri, and world-wide losses of 2.8 tri.

Roubini and Schwab predict:

Total losses of 3.6 tri and 5 tri dollar respectively.

Table 1: Conventional fiscal stimulus measures (as % of GDP)

	US		EU	
	2009	2010	2009	2010
<i>Government expenditure</i>	0.67	0.80	0.30	0.15
<i>Transfers</i>	0.64	0.20	0.24	0.09
<i>Tax reductions</i>	0.67	0.77	0.29	0.49
Total fiscal stimulus	1.98	1.77	0.83	0.73

Source: Coenen et al (2010).

Table 2: EA state aid for banks (cumulative, as % of GDP)

	Feb-09	May-09	Aug-09	Dec-09	Oct-10	Dec-10	Apr-11
<i>Purchases of impaired bank assets</i>	0.43	0.45	0.75	2.84	2.15	2.00	1.94
<i>Recapitalizations</i>	1.09	1.45	1.67	1.88	2.17	2.21	2.11
Total aid	1.52	1.90	2.42	4.72	4.32	4.21	4.05

Source: Commission services (survey based)



3. The Model

We extend the model presented by Iacoviello (2005), which distinguishes collateral constrained borrowers and lenders.

We add a corporate banking sector to this model, which is engaged in mortgage lending and holds a fraction of domestic government bonds and holds internationally traded bonds.

The bank receives funds in the form of deposits and bank capital.

In the market for deposits the bank interacts with risk averse savers and the bank raises bank capital in the stock market/entrepreneurs, where it competes for equity with non financial firms.

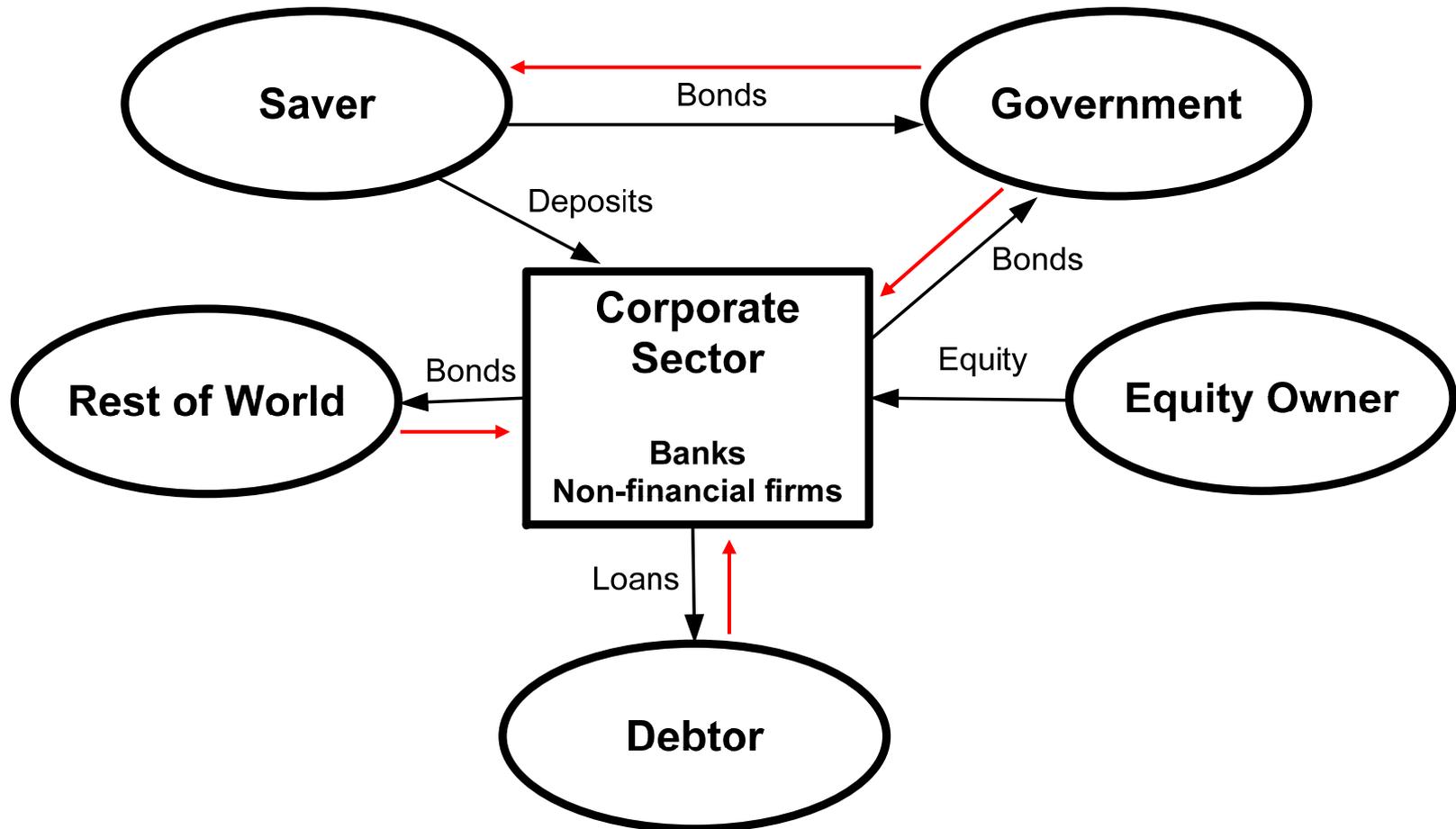
Banks face three types of risk:

Losses from non performing mortgage loans,

Sovereign bond losses

Losses from foreign bonds.

Figure: Financial flows and losses in the model



3.2. The bank

Bank Balance Sheet

Assets	Liabilities
L (Mortgage loans)	BK (bank capital)
B^B (Government bonds)	D (Deposits)
eF (Foreign assets)	

The bank faces a capital requirement constraint:

This may reflect a legal requirement, or market pressures.

The bank bears a real cost Φ_t if her capital differs from the target value:

$$\Phi_t^x = \frac{1}{2} \phi^x \cdot (x_t)^2, \phi^x \geq 0,$$

Bank excess capital: (difference between actual and target)

$$x_t \equiv (L_{t+1} + B_{t+1}^B + e_t F_{t+1} - D_{t+1} - \gamma \cdot (L_{t+1} + B_{t+1}^B + e_t F_{t+1})) / P_t$$

Note $-x$: Capital shortfall or excess leverage

Pin down the bank's steady state portfolio:

$$\Phi_t^B = \frac{1}{2} \phi^B \cdot (B_{t+1}^B / P_t - \Gamma^B)^2 \text{ and } \Phi_t^F = \frac{1}{2} \phi^F \cdot (e_t F_{t+1} / P_t - \Gamma^F)^2 \text{ (with } \phi^B, \phi^F, \Gamma^B, \Gamma^F > 0).$$

This can be justified by the idea that these bonds provide liquidity services.

Exogenous Losses: $\Delta_t^L \geq 0$, $\Delta_t^F \geq 0$ $\Delta_t^B \geq 0$.

Subsidies: S_t

The bank's period t budget constraint is:

$$D_t R_t^D + L_{t+1} + B_{t+1}^B + e_t F_{t+1} + \kappa \cdot (D_{t+1} + L_{t+1} + e_t F_{t+1}) + P_t \Phi_t^x + P_t \Phi_t^B + P_t \Phi_t^F + d_t^B =$$

$$D_{t+1} + L_t R_t^L - P_t \Delta_t^L + B_t^B R_t^B - P_t \Delta_t^B + e_t F_t R_t^F - P_t \Delta_t^F + P_t S_t,$$

where d_t^B is the bank's dividend.

Bank marginal operating costs: κ



3.3. The entrepreneur

The entrepreneur controls the bank and non financial firms consumes her dividend income.

Managers take the entrepreneurs discount factor into account when making investment decisions

Non financial Firms:

FOC: Capital

$$E_t \rho_{t,t+1} R_{t+1}^K = 1, \quad (1)$$

$R_{t+1}^K \equiv \iota_t \cdot [(p_{t+1}^I / P_{t+1}) \cdot \partial Y_{t+1} / K_{t+1} + (1 - \delta) / \iota_{t+1}]$: the gross return on physical investment.

$\rho_{t,t+1}$: the entrepreneur's intertemporal marginal rate of substitution.

Banks:

FOC: Deposits (and eq (1))

$$E_t R_{t+1}^K - (R_{t+1}^D - E_t \pi_{t+1}) \cong \kappa - \phi^x \cdot x_t. \quad (5)$$

return on investment = the entrepreneur's marginal cost of borrowing via the bank

= real interest rate on deposits, + the marginal bank operating costs + the marginal cost of bank leverage, $-\phi^x \cdot x_t$.

This condition is key: If $\phi^x > 0 \Rightarrow$ wedge between the interest rate an investor has to pay and the interest rate the saver receives.

FOC: Loans

$$R_{t+1}^L - R_{t+1}^D \cong 2\kappa - \gamma \cdot \phi^x \cdot x_t, \quad (6)$$

Similar to condition 5: lending rate spread $R_{t+1}^L - R_{t+1}^D$, if the bank faces and operative bank capital requirement, $\phi^x > 0$.

FOC: Government bonds

$$R_{t+1}^L - R_{t+1}^B \cong \kappa - \phi^B \cdot (B_{t+1}^B / P_t - \Gamma^B). \quad (7)$$

The spread between the mortgage loan rate and the sovereign bond rate is inversely related to the bank's holdings of sovereign debt:

Government:

$$B_{t+1} = R_{t+1}^B B_t - P_t \Delta_t^B - P_t \Delta_t^P + P_t G_t + P_t S_t - P_t T_t^P - P_t T_t^i.$$



4. Calibration and estimation

Estimation period: EA over the period 1995q1 to 2011Q3.

The values of most structural parameters are standard.

Here we only focus on the new elements:

Ratio of gross household debt to annual GDP: 45%. (ECB Monthly Bulletin)

The entrepreneur (20% of the population) holds 65% of total private sector wealth. (The Luxembourg Wealth Study 2006).

We set the discount rate of the patient worker at 0.9925, which implies a steady state government bond rate of 3%.

The discount factors of the impatient household and of the entrepreneur are set at 0.97, which implies a steady state return on the entrepreneur's net worth of 12%.

Steady state bank capital ratio: 10%,

30% of all government bonds are held by the bank.

The parameter ϕ^x is set so that 1 percentage point rise in the bank capital ratio lowers the spread between the mortgage loan rate and the deposit rate by 40 basis points per annum, as suggested by empirical estimates of the response of the loan rate spread reported by Kollmann (2012).

Some stylized facts

Table 5.1 : Euro Area - Financial Crisis 2008-2010:

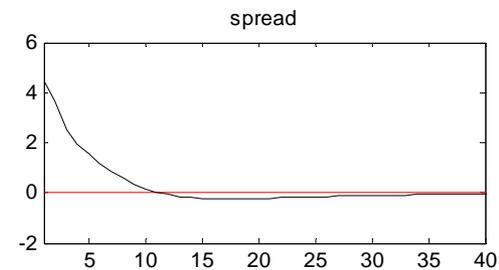
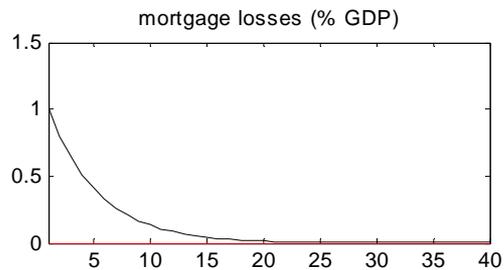
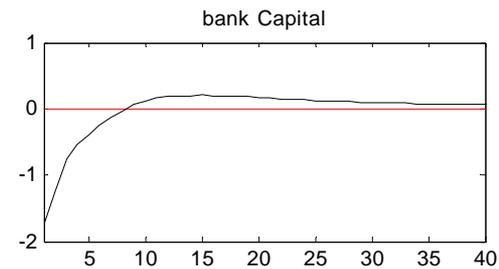
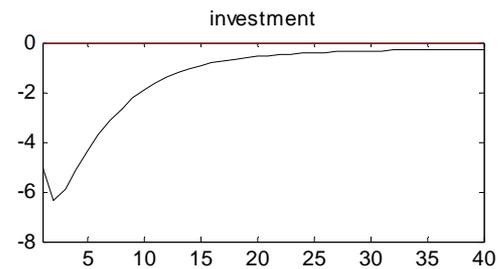
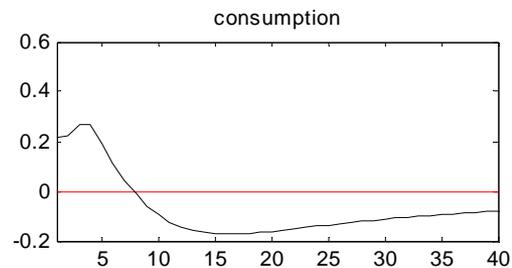
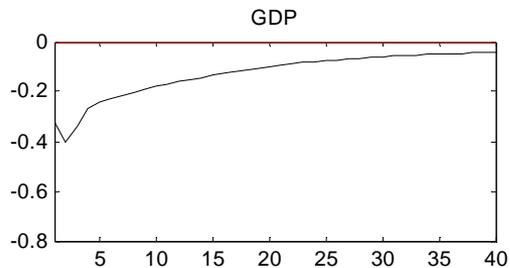
	EA		
	2008	2009	2010
GDP growth	0.5	-4.2	1.8
Gov. Consumption growth	2.3	2.5	0.5
Consumption growth	0.7	-1.7	0.8
Corp.investment growth	2.3	-20.0	4.3
Res. investment growth	1.2	-9.3	-5.2
Employment growth	0.9	-1.9	-0.5

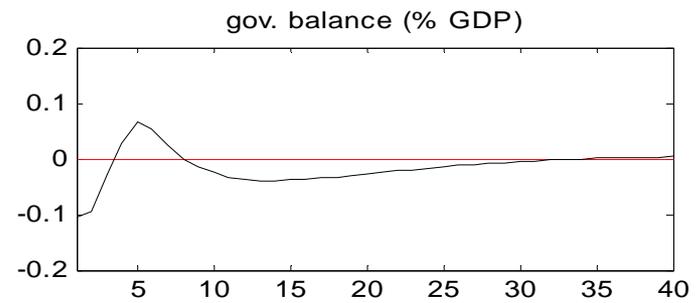
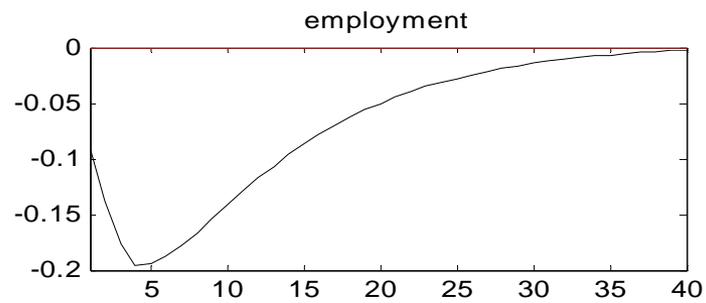
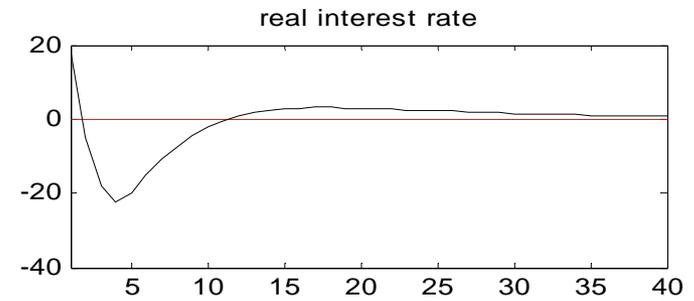
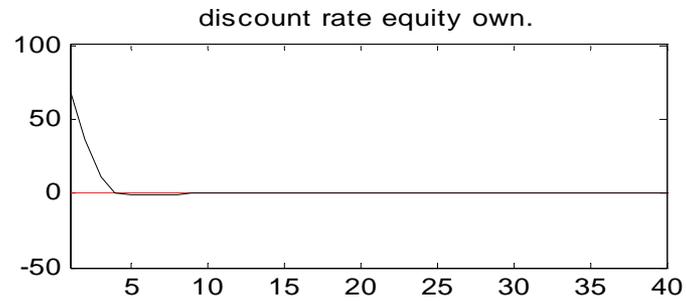
Table 5.2: Greece and Portugal - Sovereign Debt Crisis 2010-2011:

	GR		PO	
	2010	2011	2010	2011
GDP growth	-3.5	-6.2	1.4	-1.9
Gov. Consumption growth	-7.2	-8.5	1.3	-3.2
Consumption growth	-3.6	-6.2	2.3	-4.2
Investment growth	-15.0	-15.9	-4.9	-11.6
Employment growth	-2.3	-5.7	-1.5	-1.1

5. Simulation Experiments

5.1 Domestic and foreign mortgage losses: (1% of quarterly GDP)





Wealth transfer from banks to domestic and foreign borrowers.

Bank options:

(1) increase deposits, (2) reduce dividends, (3) reduce lending;

Because of increasing costs of excess leverage it is optimal for the bank to limit the erosion of bank capital by reducing dividends until the discount rate of entrepreneurs is equalized to the deposit rate plus the marginal cost of undershooting the capital target (eq (5)).

Entrepreneurs require a higher discount rate as response to a cut in dividends, since lower dividends in period t reduces their income in period t relative to their expected future income and because of the leverage constraint they can only borrow at rising cost from savers.



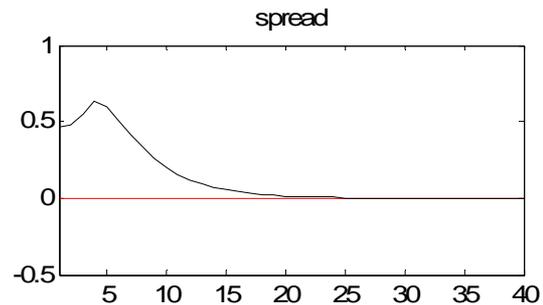
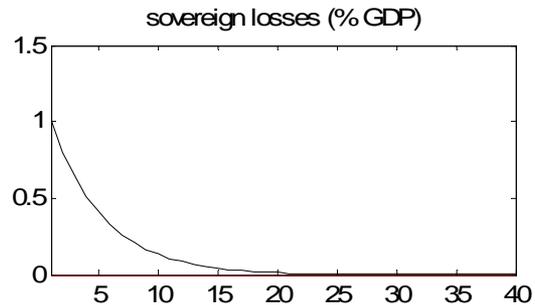
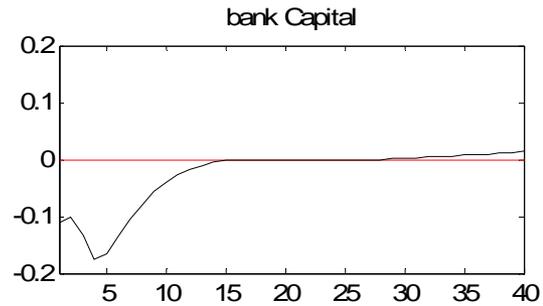
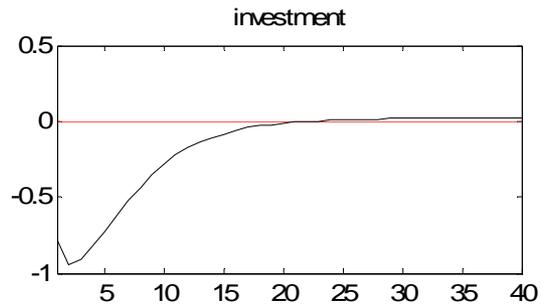
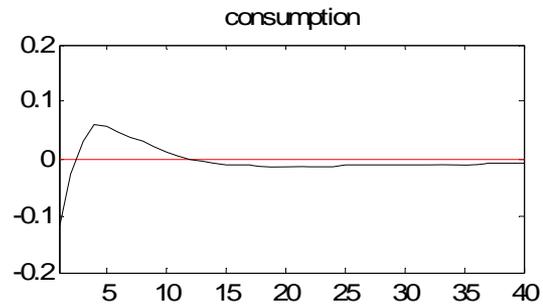
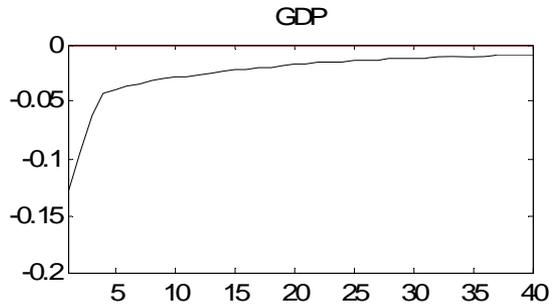
The leverage constraint drives a wedge between the rate at which savers supply funds and the rate at which investors can borrow. This is what Hall (2009) calls a financial friction.

Since in an integrated equity market, shareholders apply the same discount rate to banks and non financial firms, managers of non financial firms apply this discount rate for evaluating investment projects by equating the discount rate to the marginal product of capital.

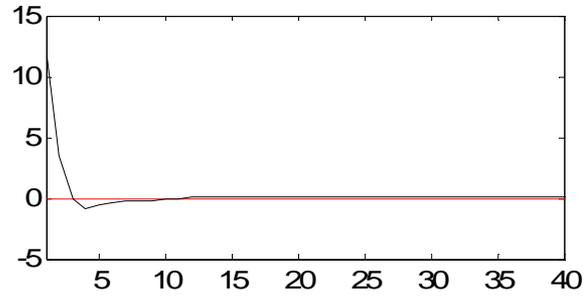
Reducing investment is optimal since it avoids a too strong reduction of consumption for equity owners.

Private consumption: less affected, mortgage loss is partly wealth transfer from the bank to the impatient worker.

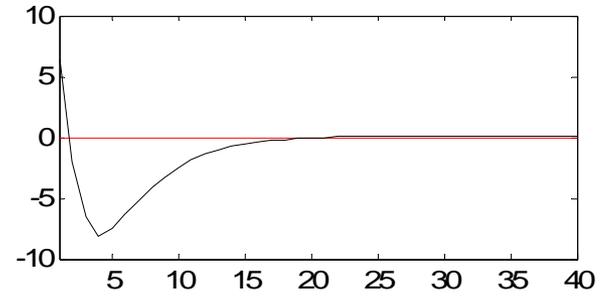
5.2 Sovereign default (1% of quarterly GDP)



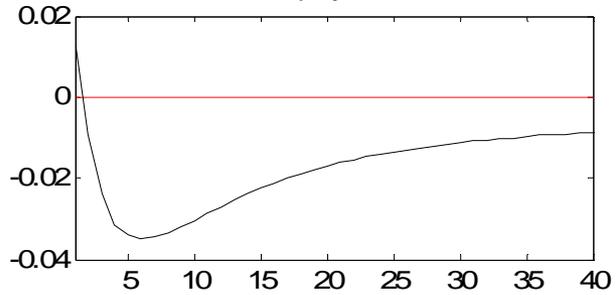
discount rate equity own.



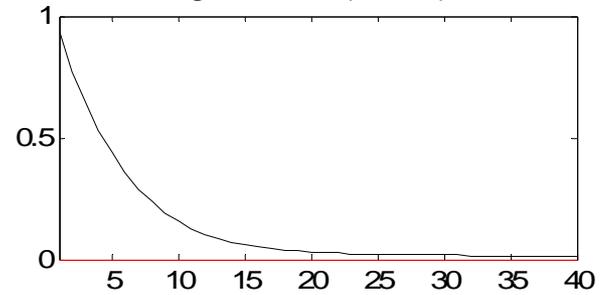
real interest rate



employment



gov. balance (% GDP)





Wealth transfer from saver households and banks to the government.

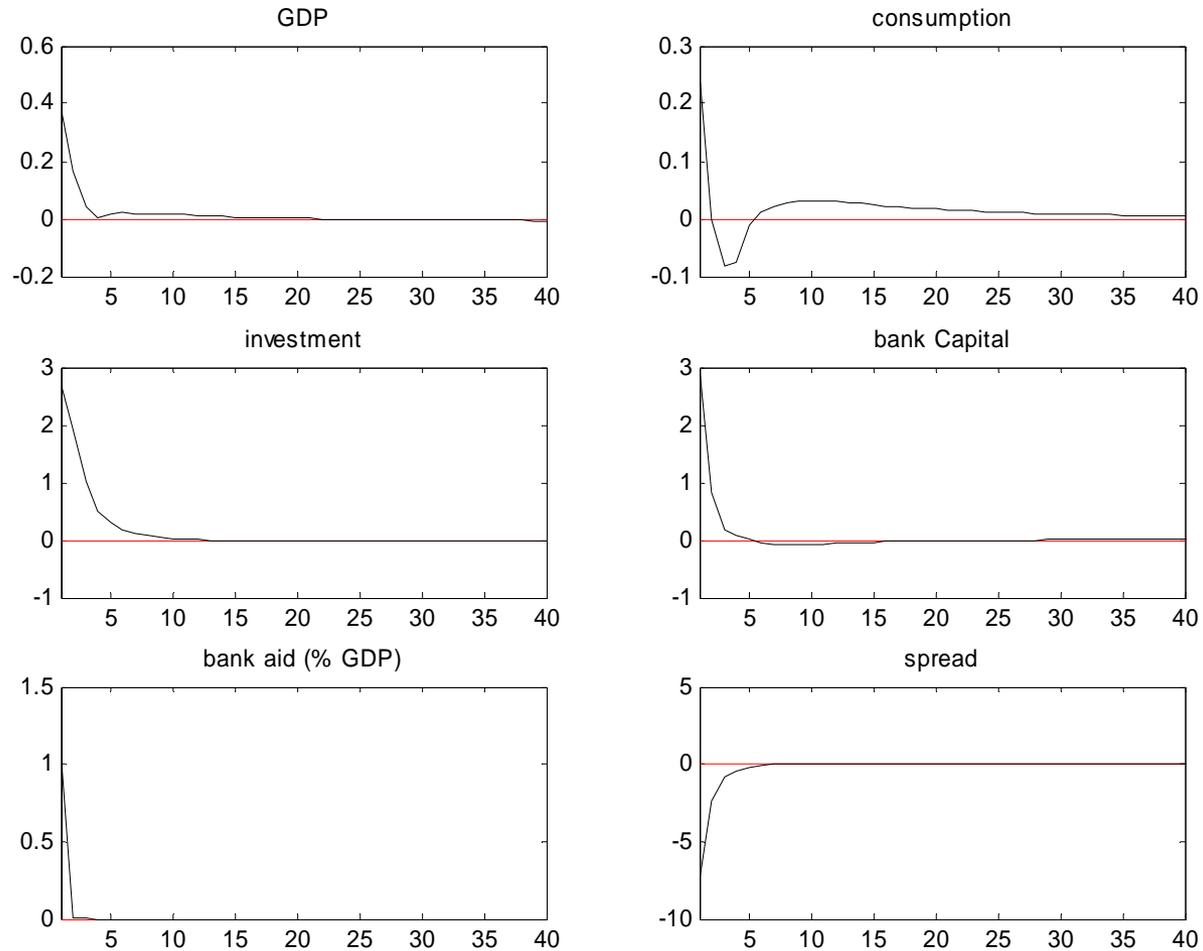
Note: Without banks holding government bonds sovereign default has a negligible effect on real activity because of Ricardian equivalence.

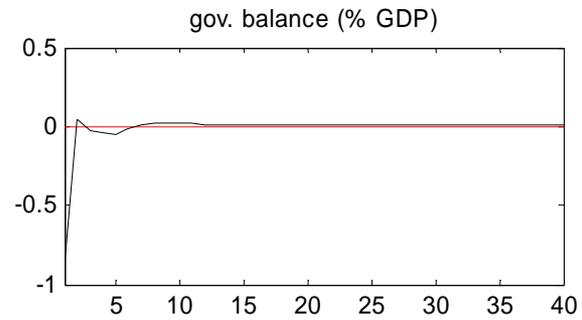
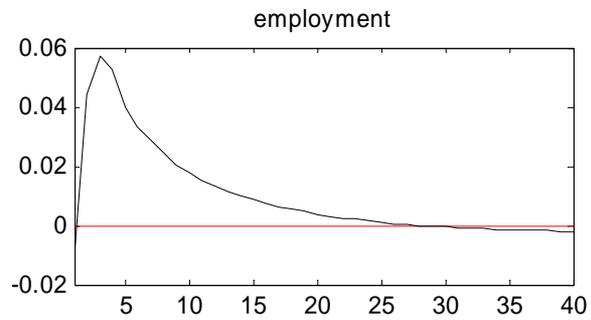
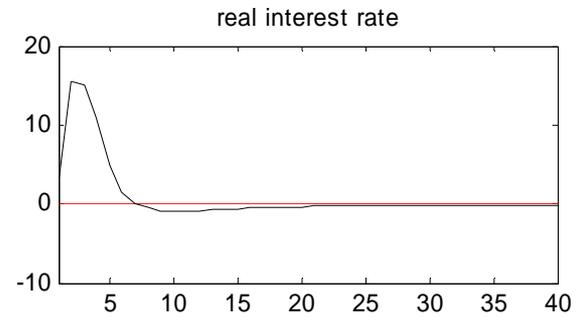
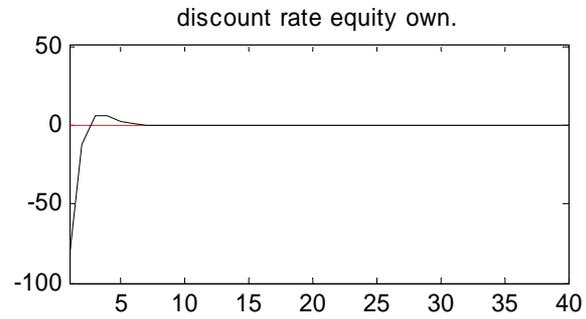
With banks incurring losses, the transmission is similar to the case of mortgage losses.

Banks reduce dividends => increases the discount rate of equity owners and drives a wedge between the rate at which savers supply funds and the rate at which investors can borrow. => reduces investment.

Investment is more affected than private consumption, since the households' future tax burden falls

5.3.1 Bank aid (1% of quarterly GDP)







Transfer from the government (workers) to the banking sector (entrepreneur).

For the bank this is a reversal to the loss shock.

The bank partly increases bank capital in order to reduce the costs of excessive leverage and partly increases dividends.

This policy reduces the borrowing constraint of equity owners and allows for a reduction of their discount rate.

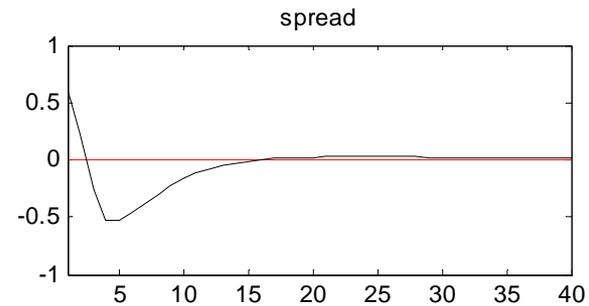
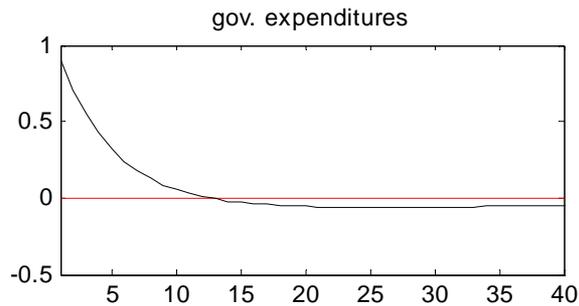
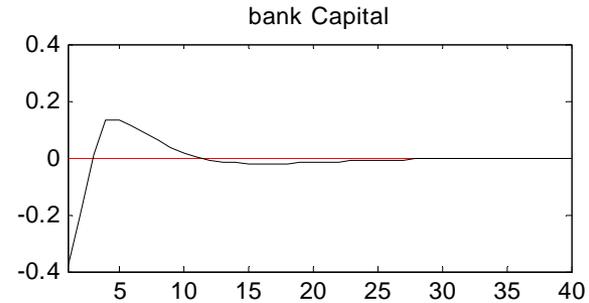
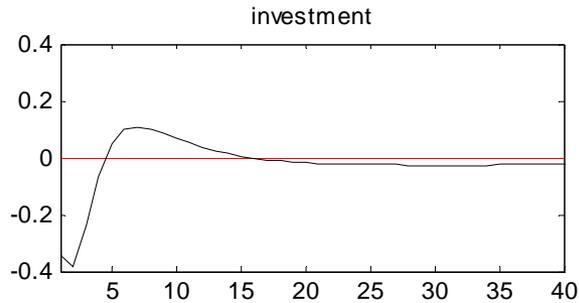
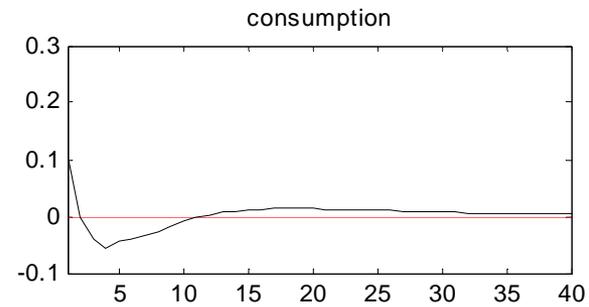
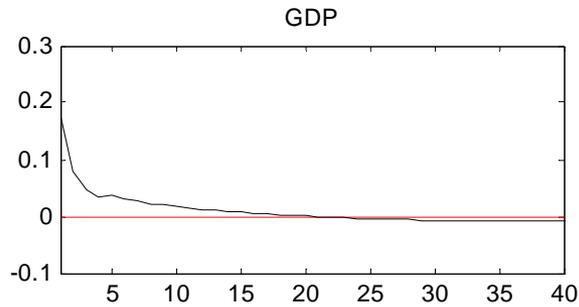
This increases investment.

State bank aid is a particularly powerful fiscal policy measure in response to a loan loss shock, since it directly offsets the shock within the banking sector (provided the timing is correct).

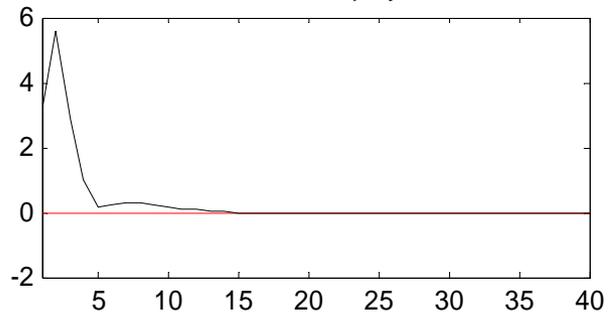
There is no perfect stabilization, since the state aid for banks has distributional effects (transfer from workers to entrepreneurs).

Since MPC out of current income is higher for borrowers a bank subsidy (of the same size as the loss) cannot completely offset the loss shock.

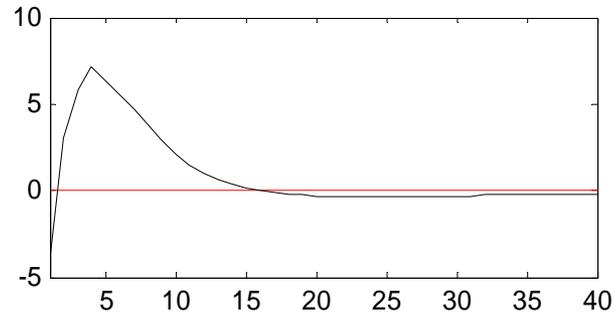
5.3.2 Government purchases



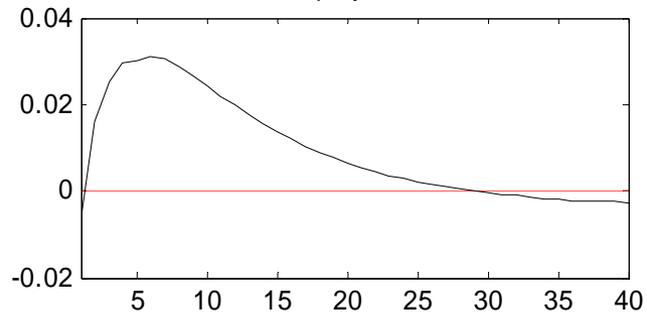
discount rate equity own.



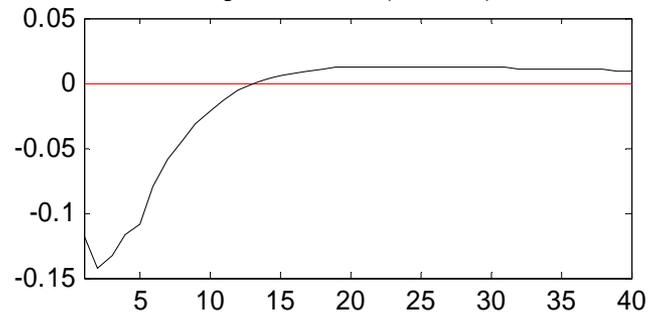
real interest rate



employment



gov. balance (% GDP)



The capital market imperfections which we have introduced hardly affect the standard fiscal multiplier as typically generated by DSGE models. In the short run, a temporary increase of government purchases crowds out private demand, in particular corporate investment. Private consumption is initially positive because consumption of credit constrained households respond positively to an increase in real wage income. However in the medium term consumption is dominated by Ricardian households.

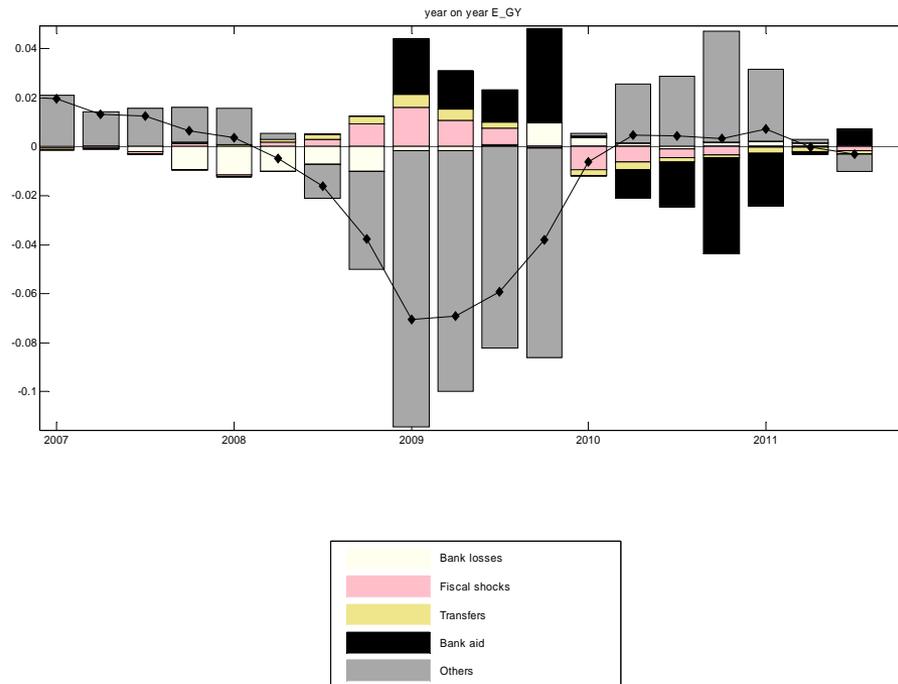
6. Shock decompositions

The previous section has shown that bank aid has some desirable properties, especially in cases where financial crises are driven by losses to the banking sector.

However, asset losses do not necessarily constitute the most important adverse shock in financial crises:

- Deleveraging of private households (in the case of mortgage losses) can be important sources of negative demand responses.
- If the bust has been preceded by a housing and/or corporate investment bubble, investment is likely to fall strongly in order to correct for excess capacities which were buildup erroneously during the boom.
- The economy will be hit by a reduction of external demand in case of a global financial crisis.
- Consumption and investment can be down because of confidence effects.
- Aggregate productivity can be down because the tradable sector responds more strongly to the financial crisis shock.

GDP growth



Bank losses reduce GDP growth in the EA until 2009Q2.

Bank losses explain well the turnaround of growth late 2007 and 2008.

BUT: They are not the main shocks driving GDP in 2009.

Fiscal stimulus and bank aid have a stabilising effect in 2009.

But measures reduced growth already in 2010.

BUT: using actual ex post losses probably underestimates the effect and does not reflect properly loss expectations over the year 2009

Table Actual and expected bank losses

	Actual losses (Bio Euro)	Expected cumulative losses (Bio. Dollar)
2008q1	160	400 (G7); 600 (UBS)
2008q2	140	945 (IMF)
2008q3	190	1400 (IMF)
2008q4	280	5000 Schwab/World Economic Forum
2009q1	110	2200 (IMF); 3600 Roubini
2009q2	110	2700 (IMF)
2009q3	25	---
2009q4	75	2800 (IMF)

Conclusions

We have developed a tractable macro model with a banking sector in order to trace the effects of losses (mortgage + sovereign) hitting banks.

We find that both mortgage market loss shocks as well as sovereign loss shocks have similar transmission mechanisms into the real economy and strongly affect non residential investment.

This seems to be consistent with recent experience in the EA and the US (concerning mortgage market shocks) and with the experience of some countries in the EA (concerning (expectations) of sovereign losses).

We find that both standard fiscal measures and bank aid policies contributed significantly towards stabilizing GDP in 2009.