Impact of the Credit Crunch on the Polish Economy (preliminary and incomplete)

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Plan of the Presentation

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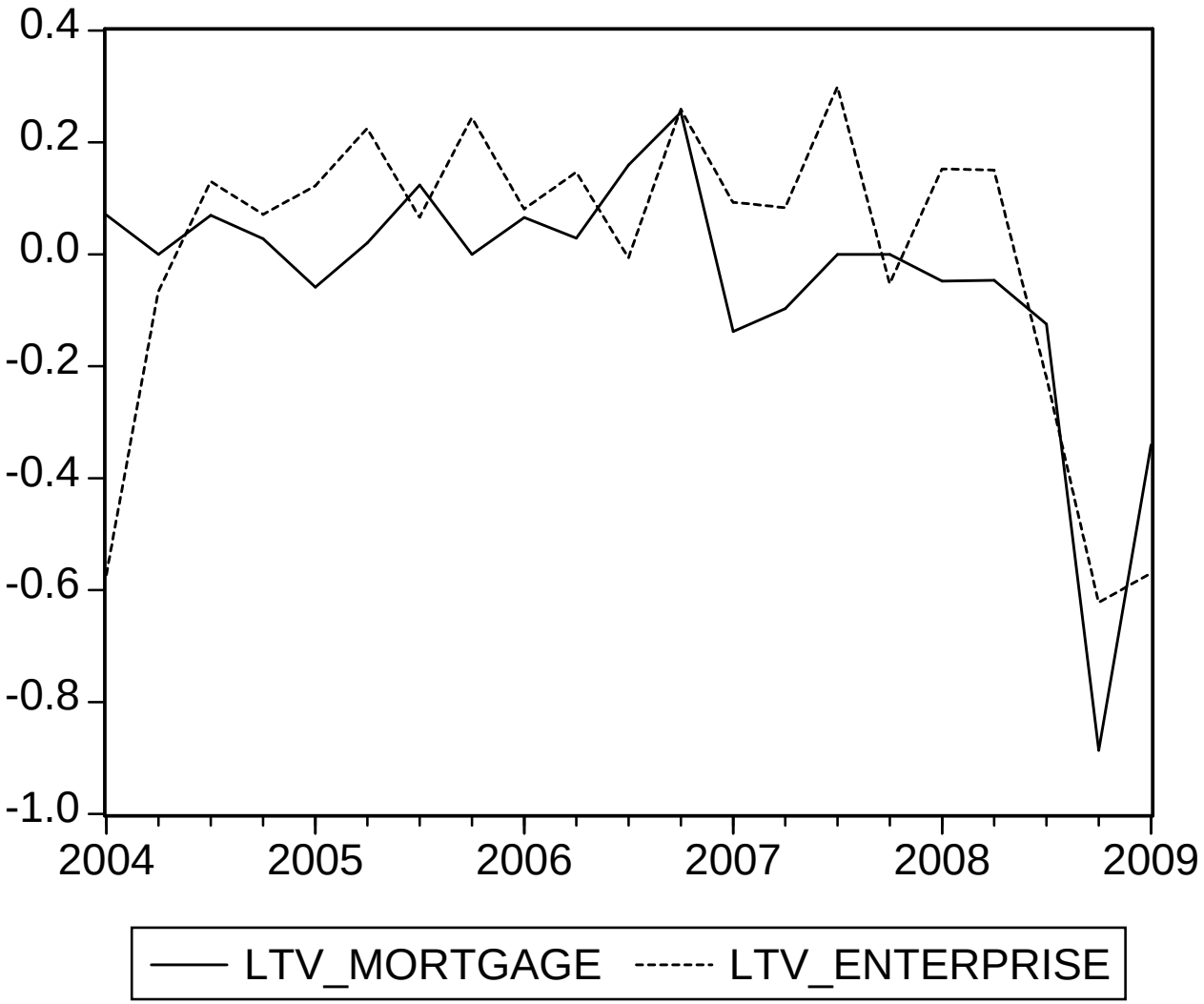
Main recent shocks in Poland

- Credit crunch
  - increase in lending restrictions
  - increase in spreads between the intebank rates and the credit rates.
  - decline in loans to households and firms
- Decline in external demand for Polish goods and services (and decline in export)
- Depreciation of the Polish zloty.
- Capital outflow?

Main recent shocks in Poland

Lending restrictions in Poland. (*Source: NBP*)



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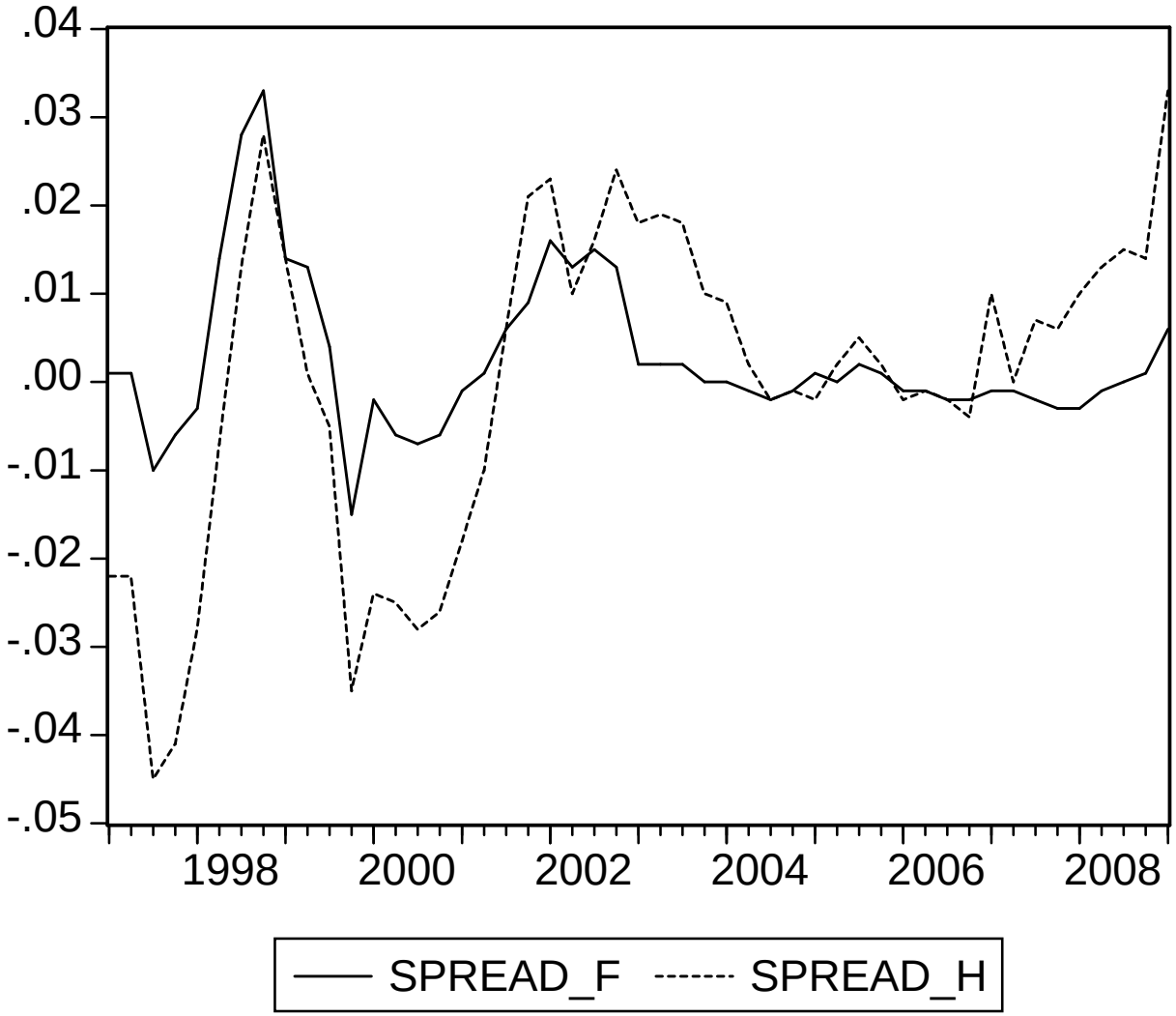
Spreads on loans to households in Poland. (*Source: NBP*)



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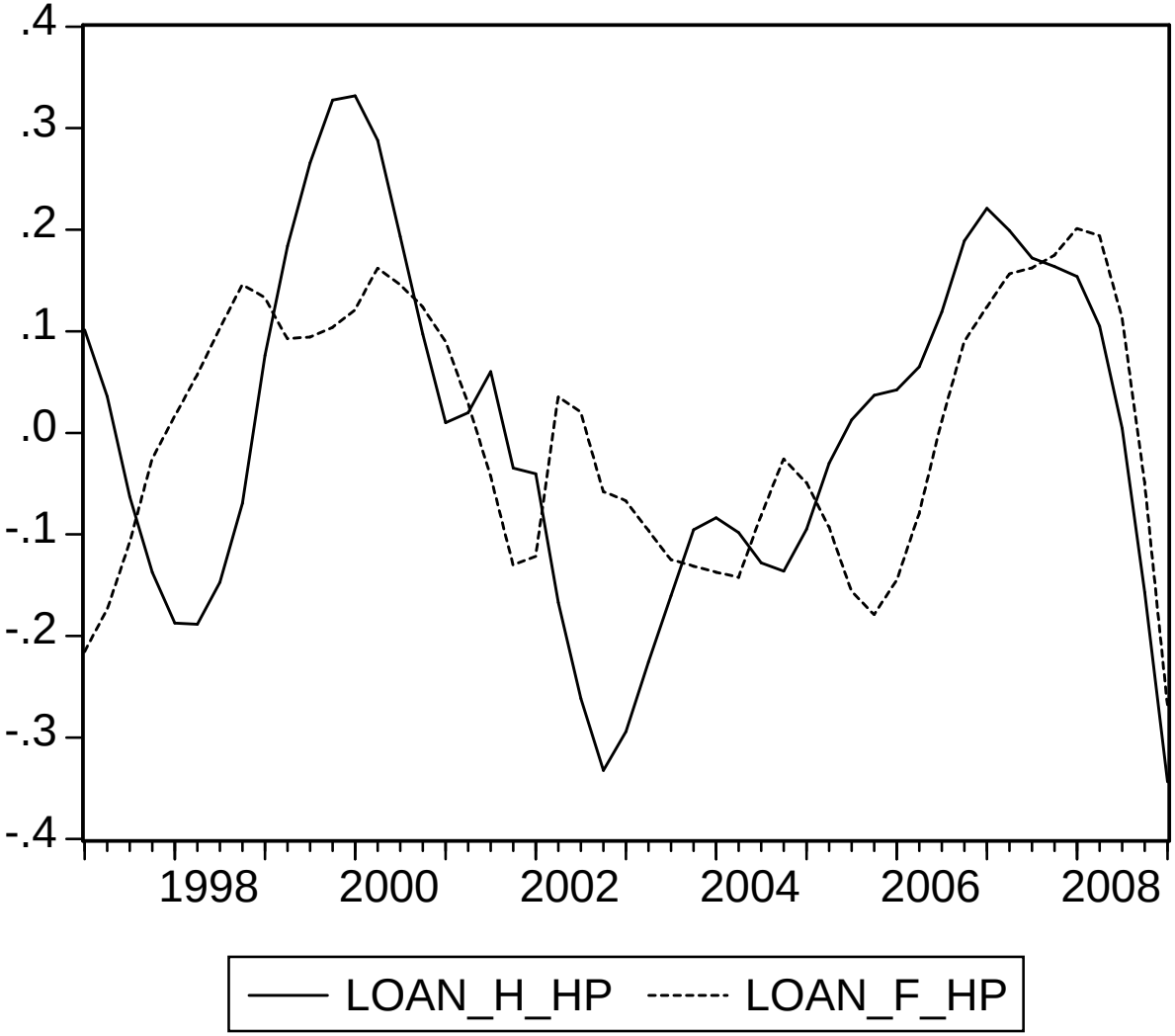

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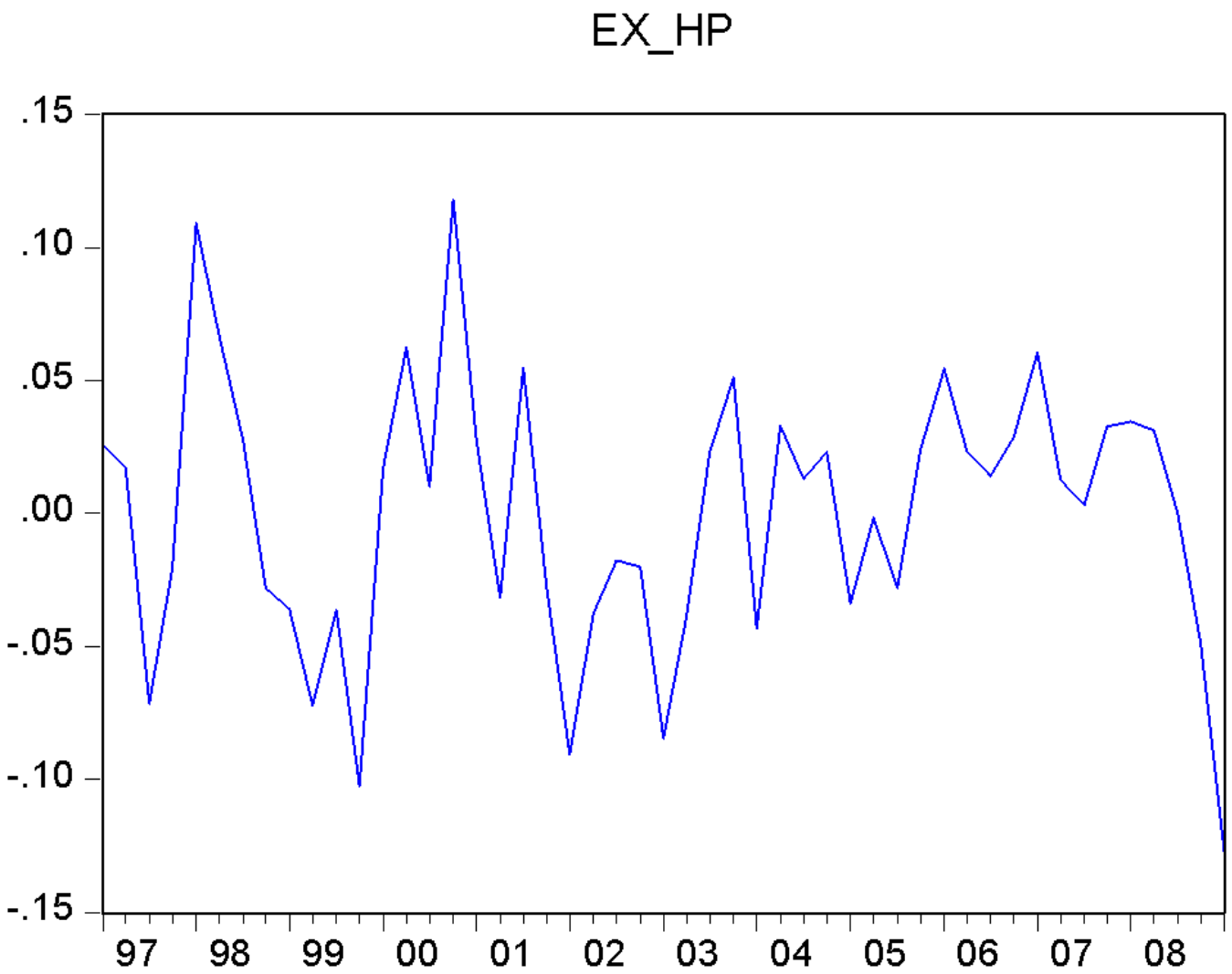
Export in Poland. (*Source: Central Statistical Office*)



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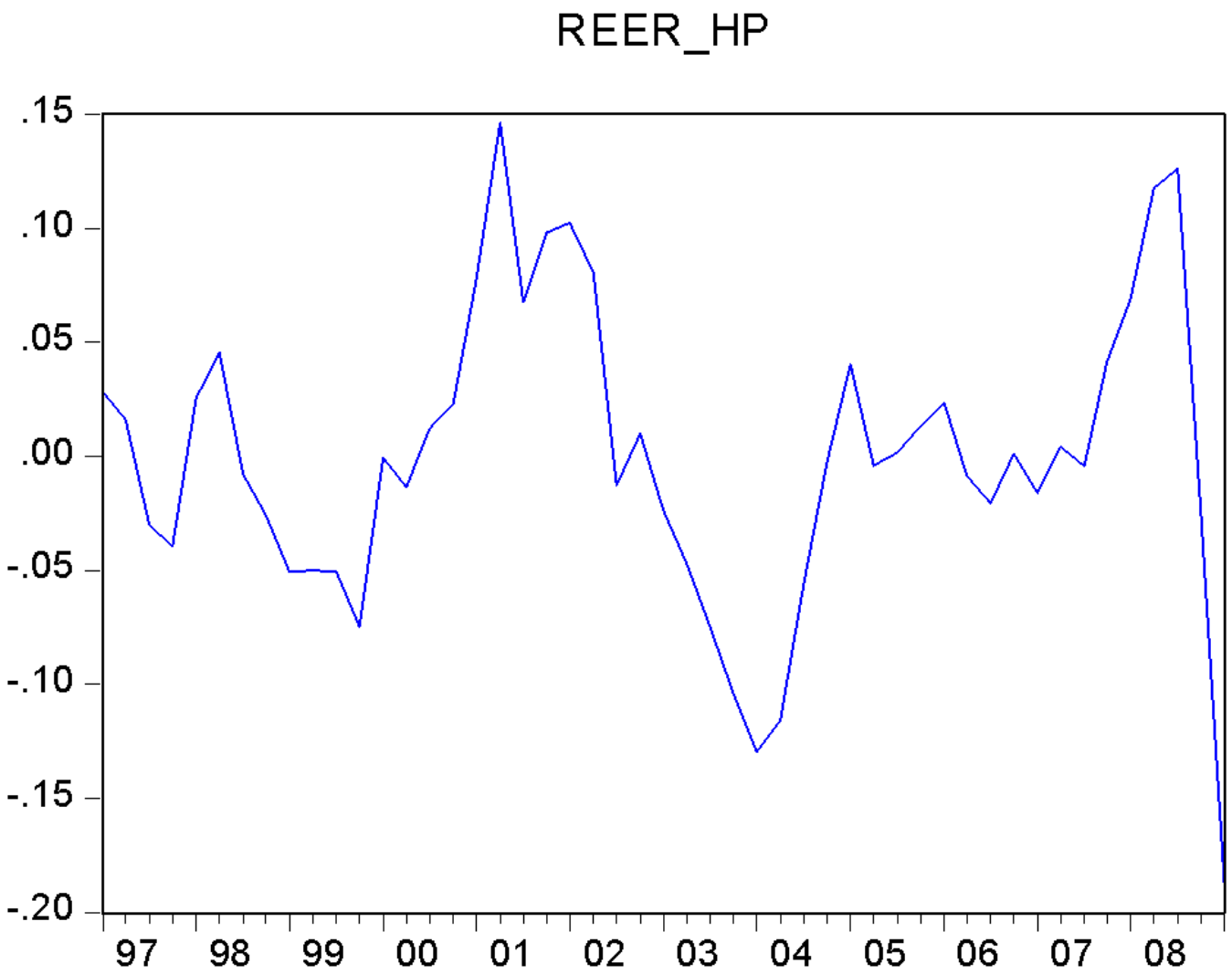
Real exchange rate in Poland. (*Source: NBP*)



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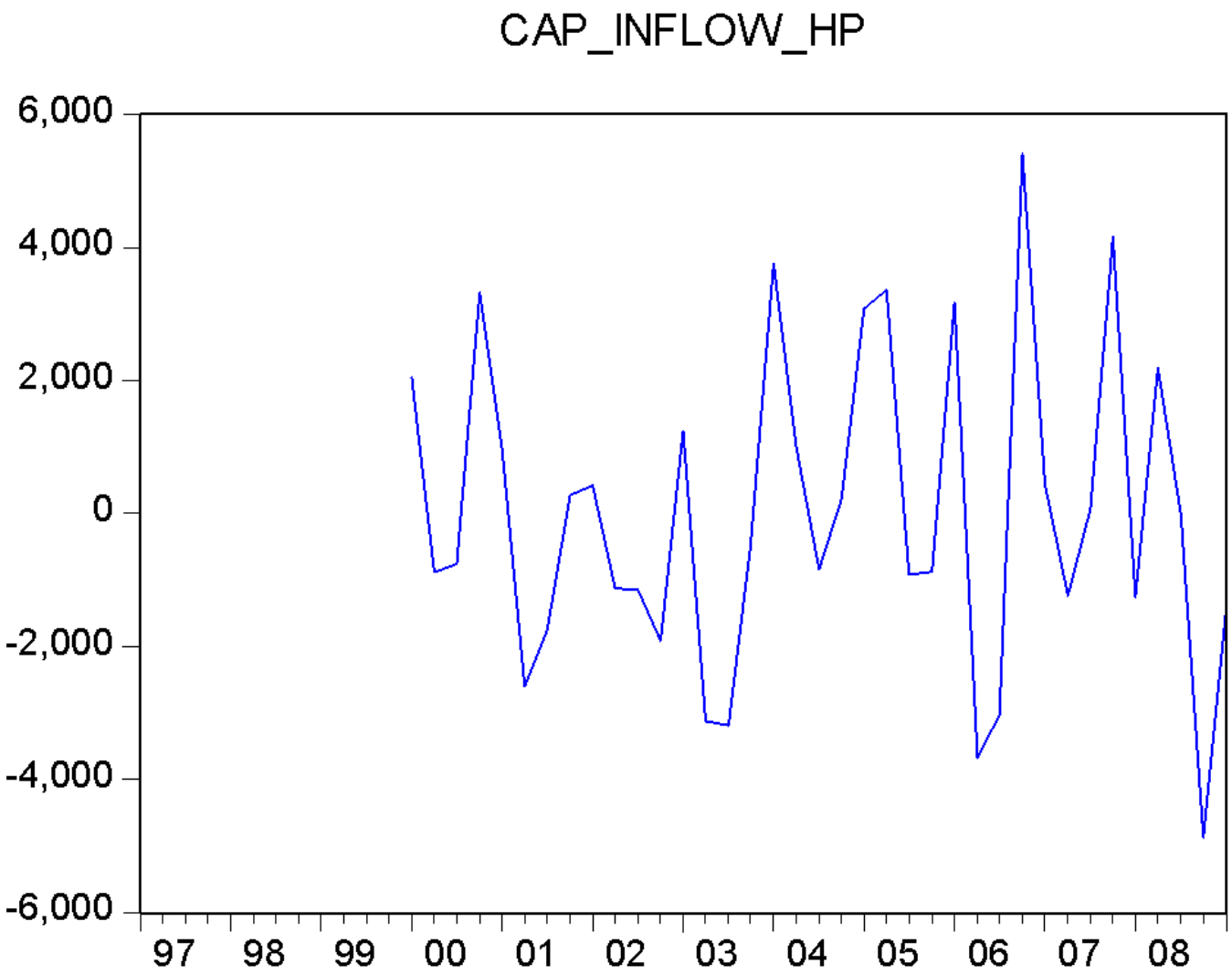
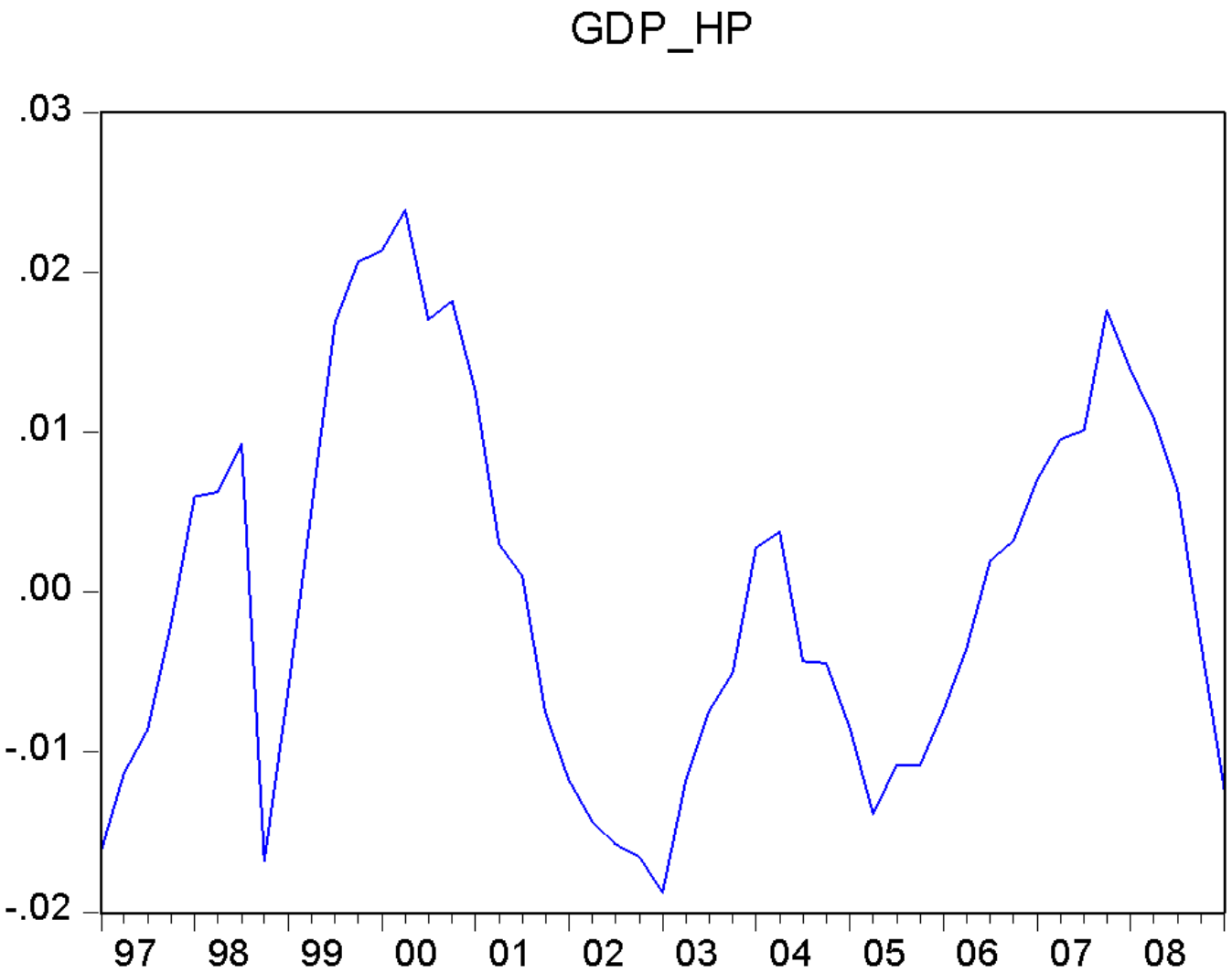
Capital inflow. (*Source: NBP*)



Response of GDP (*Source: Central Statistical Office*)



Question

- What is the role of financial frictions in this process?
- How much of GDP decline is generated by financial frictions?

Methodology

- Dynamic Stochastic General Equilibrium (DSGE) of Polish economy.
- The advantages of DSGE models
  - They take into account the influence of future on today's decisions in a coherent way (rational expectations)
  - Microfoundations
  - Calibration/Estimation of the so called deep parameters (describing e.g. preferences, technologies) - gives rise to the possibility of studies on changes in policies (this approach is immune to the Lucas critique)

Plan of the Presentation

Key Features

- New Keynesian model of business cycle
- Non-neutrality of monetary policy due to:
  - Nominal rigidities - prices and wages are set according to a Calvo scheme (Calvo, 1983)
- Monetary Policy
  - Taylor rule (Taylor, 1993)
- Financial frictions - we extend Iacoviello (2005):
  - stochastic shocks to credit constraints and spreads,
  - small open economy.

Basic structure

- Standard new Keynesian model of business cycle fluctuations.
- Households
- Monetary and fiscal authorities
- Three stages of production: final good producers, intermediate good producers, and wholesale good producers (entrepreneurs)
- Housing and capital producers.
- Prices of intermediate goods and wages are sticky.
- Banking sector, nominal rigidities, spreads plus credit constraints.
- Perfect competition in the other markets

Households

- There are two types of households: patient, P, and impatient, I. The type $i \in \{P, I\}$ maximizes utility

  $$E_0 \sum_t (\beta_i)^t u(c_t, \chi_t, n_t, \varepsilon_t), \text{ subject to}$$

  the budget constraint and the borrowing constraint

  $$R^H_{L,t} L^i_t \leq m^H_t E_t \left[P_{\chi,t+1} (1 - \delta_\chi) \chi^i_t \right]$$

  where $m^F_t \sim AR(1)$. Thus consumers need housing as collateral to get a loan.
- In equilibrium patient HHs save and impatient HHs borrow.

Wholesale good producers (entrepreneurs)

- Do not work, run firms. Sell their product in a competitive market.
- Are impatient ($\beta_E = \beta_I$).
- Own capital use it as collateral for loans.
- Maximize utility

$$E_0 \sum_t (\beta_E)^t u(c_t, \varepsilon_t), \text{ subject to}$$

the flow of funds, the production function and the borrowing constraint

$$R^F_{L,t} L^F_t \leq m^F_t E_t \left[P_{k,t+1} \left(1 - \delta_k\right) k_t \right]$$

where $m^F_t \sim AR(1)$. Thus producers need capital as collateral to get a loan.

Other producers

- Other producers are standard.
- Intermediate good producers operate in monopolistic environment. Have sticky prices - Calvo pricing. Do not own capital.
- Final good producers put together domestic and foreign intermediate goods (imperfect substitutability) and sell final goods in a competitive market. Do not own capital.
- Housing and capital good producers are standard (cost of installation).

Banking
Deposits

- Policy rate - the interbank rate R_t.
- Banks collect deposits from patient households and deposit them in the interbank market. $z_{D,t} \sim AR(1)$ affects the spread between the interbank rate R_t and the HHs deposit rate $R^H_{D,t}$ (follows from $D_{IB,t} = z_{D,t} D_t$).
- There are nominal rigidities (Calvo) that slow down the adjustment of the interest rates. The flexible deposit rate is (in log deviations from the steady state) $\hat{R}^H_{D,t} = \hat{z}_{D,t} + \hat{R}_t$. With nominal rigidities this relationship becomes more complex.

Banking
Loans

- Furthermore, banks take loans in the interbank market and grant loans to impatient HHs and firms. $z_{L,t} \sim AR(1)$ affects the spread between the interbank rate R_t and the lending rate $R_{L,t}$ (follows from $L_t = z_{L,t} L_{IB,t}$).
- There are nominal rigidities (Calvo) that slow down the adjustment of the interest rates. The flexible HHs loan rate is (in log deviations from the steady state) $\hat{R}^H_{L,t} = \hat{R}_t - \hat{z}^H_{L,t}$ and for firms $\hat{R}^F_{L,t} = \hat{R}_t - \hat{z}^F_{L,t}$. With nominal rigidities this relationship becomes more complex.
- Borrowing constraints tied to housing (HHs) and capital (firms).
- Banks have also access to the international nominal interest rate adjusted for risk premium.

Monetary and fiscal authority

- Central bank - the Taylor rule; log-linear version of the form:

$$\hat{R}_t = \gamma_R \hat{R}_{t-1} + (1-\gamma_R)[\gamma_\pi \hat{\pi}_t + \gamma_{GDP} \hat{GDP}_t] + \varphi_t$$

- The government budget, very simplified (to keep Ricardian equivalence only patient HHs are taxed)

$$G_t = T_t^P$$

where

$$G_{t+1} = \left(1-\rho_g\right)\mu_g + \rho_g G_t + \epsilon_{g,t+1},\ \epsilon_{g,t} \sim N\left[0, \sigma_g\right]$$

Definition of Decentralized Equilibrium

Definition

An equilibrium is a set of allocations and prices, that:

- solves the decision problems of all agents populating the economy
- satisfies the government budget constraints
- satisfies the Taylor rule
- clears all markets

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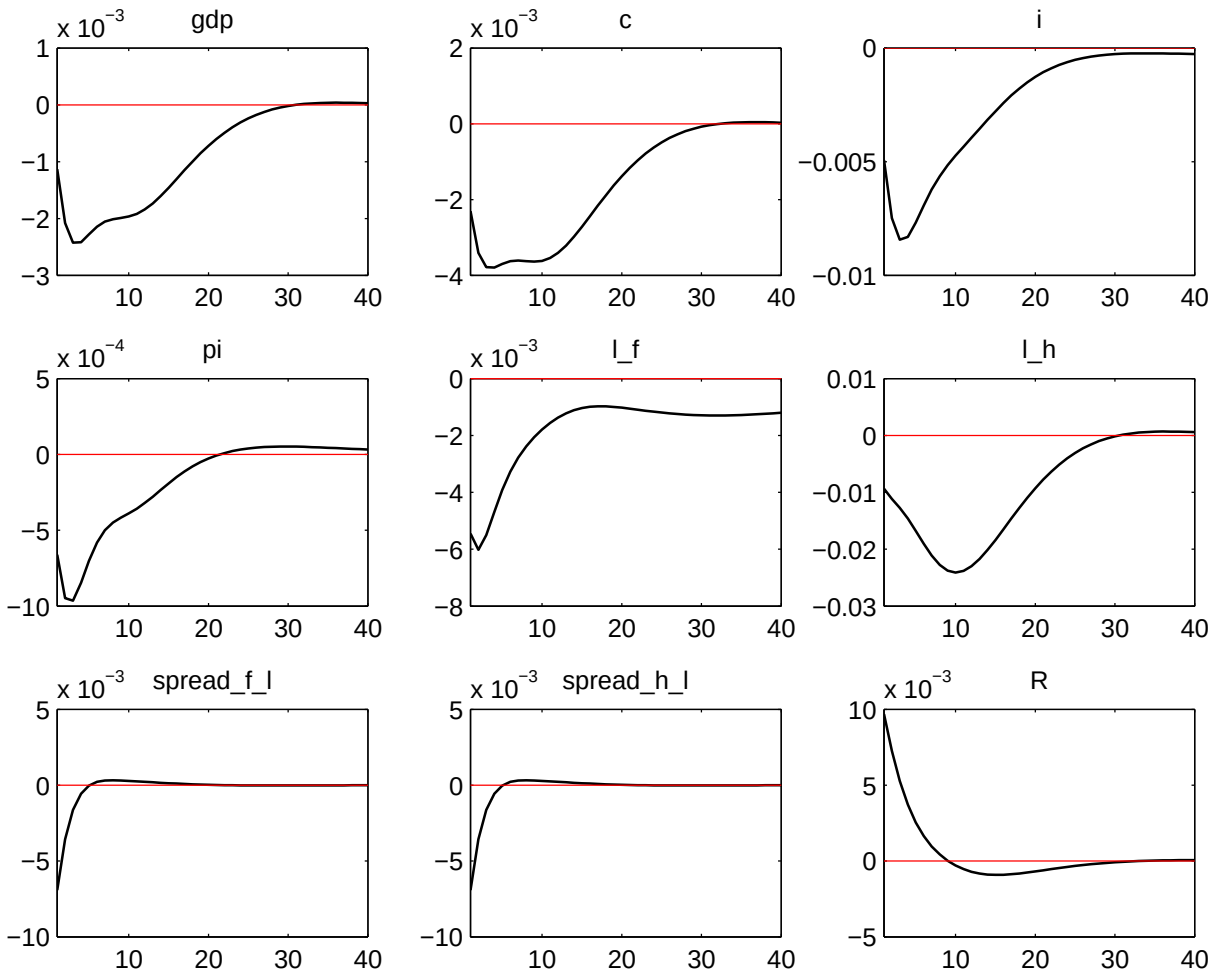
Solution

- The model was solved with 1-st order perturbation (linearization)
- The model parameters were crudely calibrated.
- In future we plan Bayesian estimation and/or proper calibration.

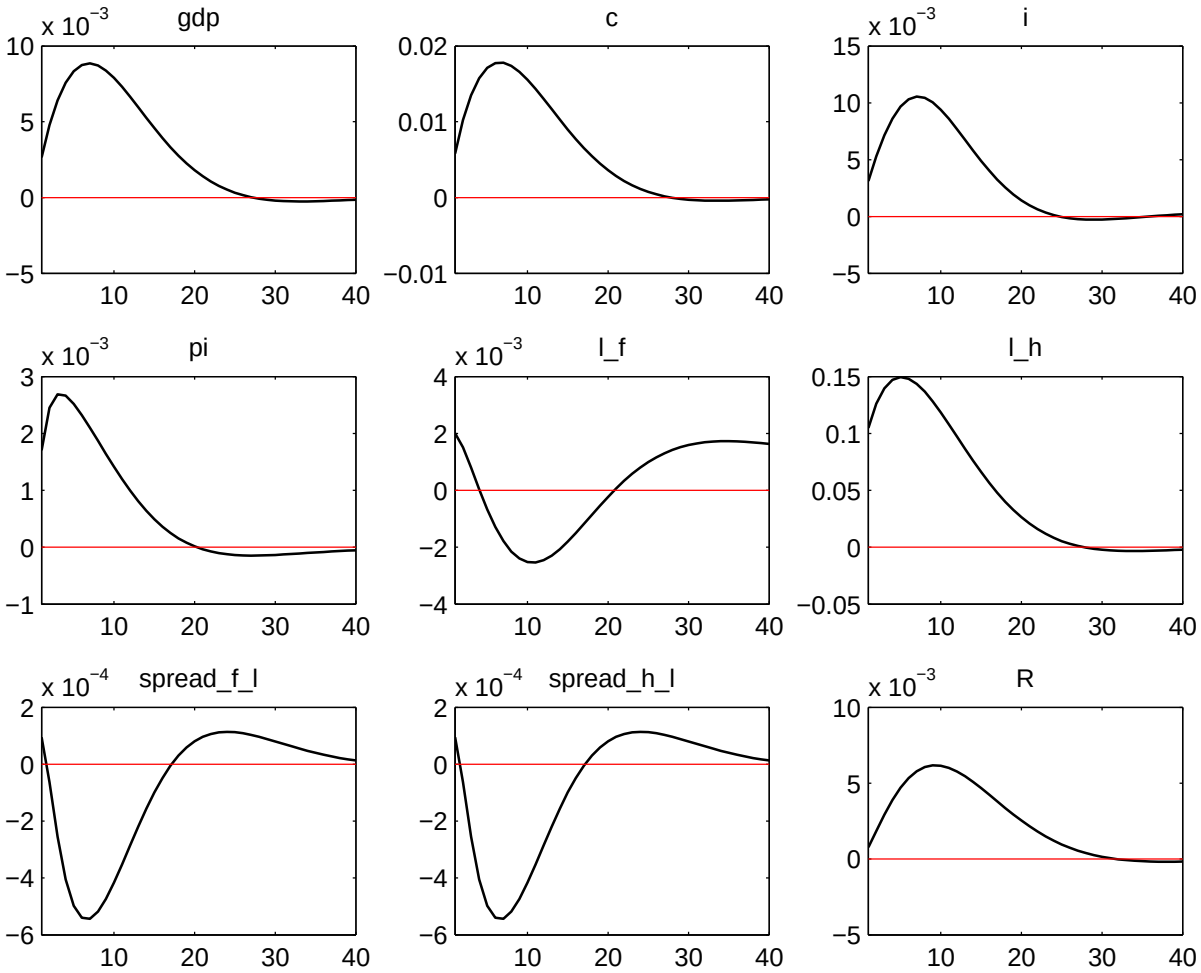
Calibrated model parameters

- A group of parameters are taken from the literature (parameters that affect business cycle behavior).
- A group of parameters is obtained from the data (parameters that affect the steady state).
- Crude calibration of the shocks affecting financial markets
  - the initial shocks to spreads were calibrated to match the observed change to spreads.
  - the initial shocks to LTVs were calibrated to match (given previous calibration of the shocks to spreads) the observed decline in loans.
  - persistence was not calibrated, it was set at reasonable values.

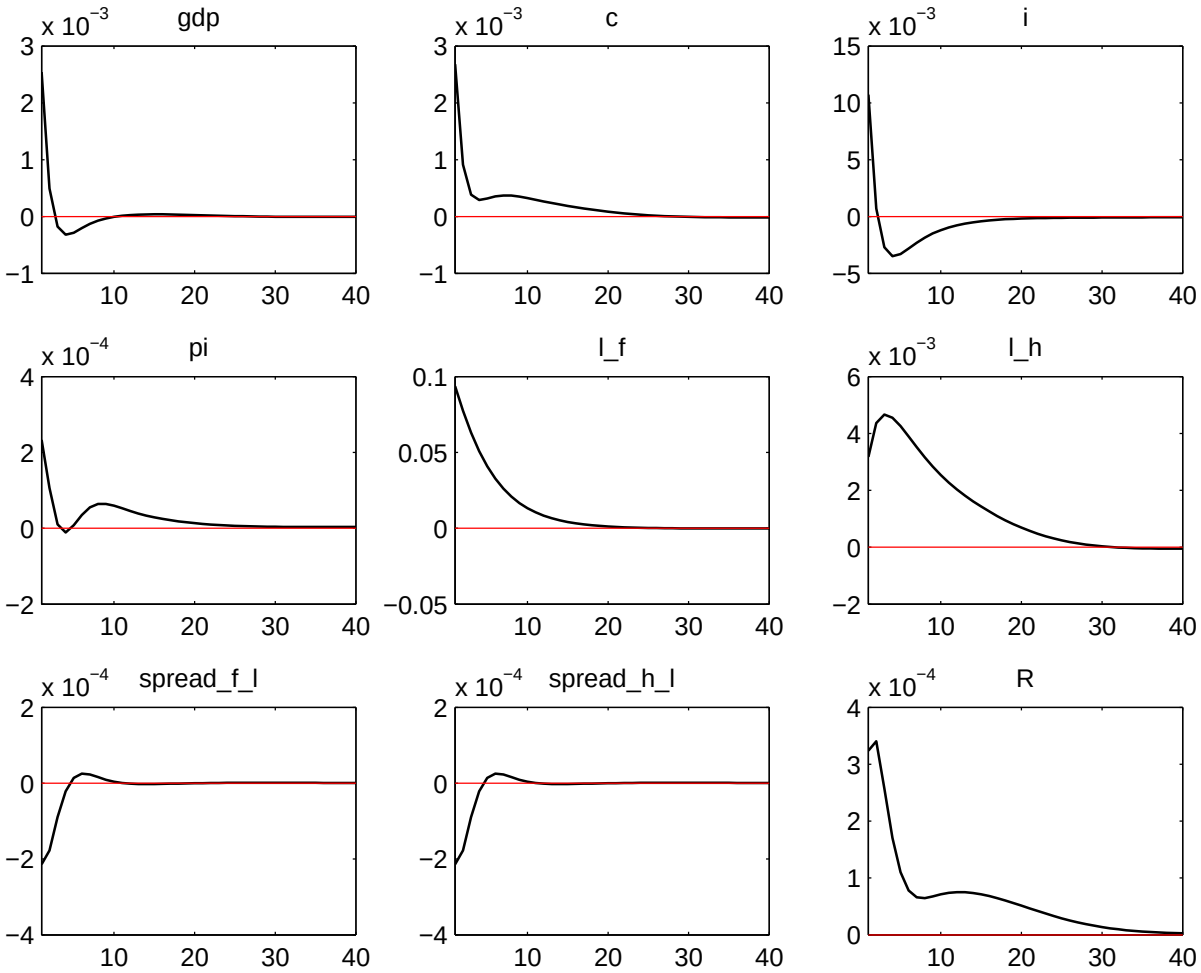
IRF to a monetary policy shock



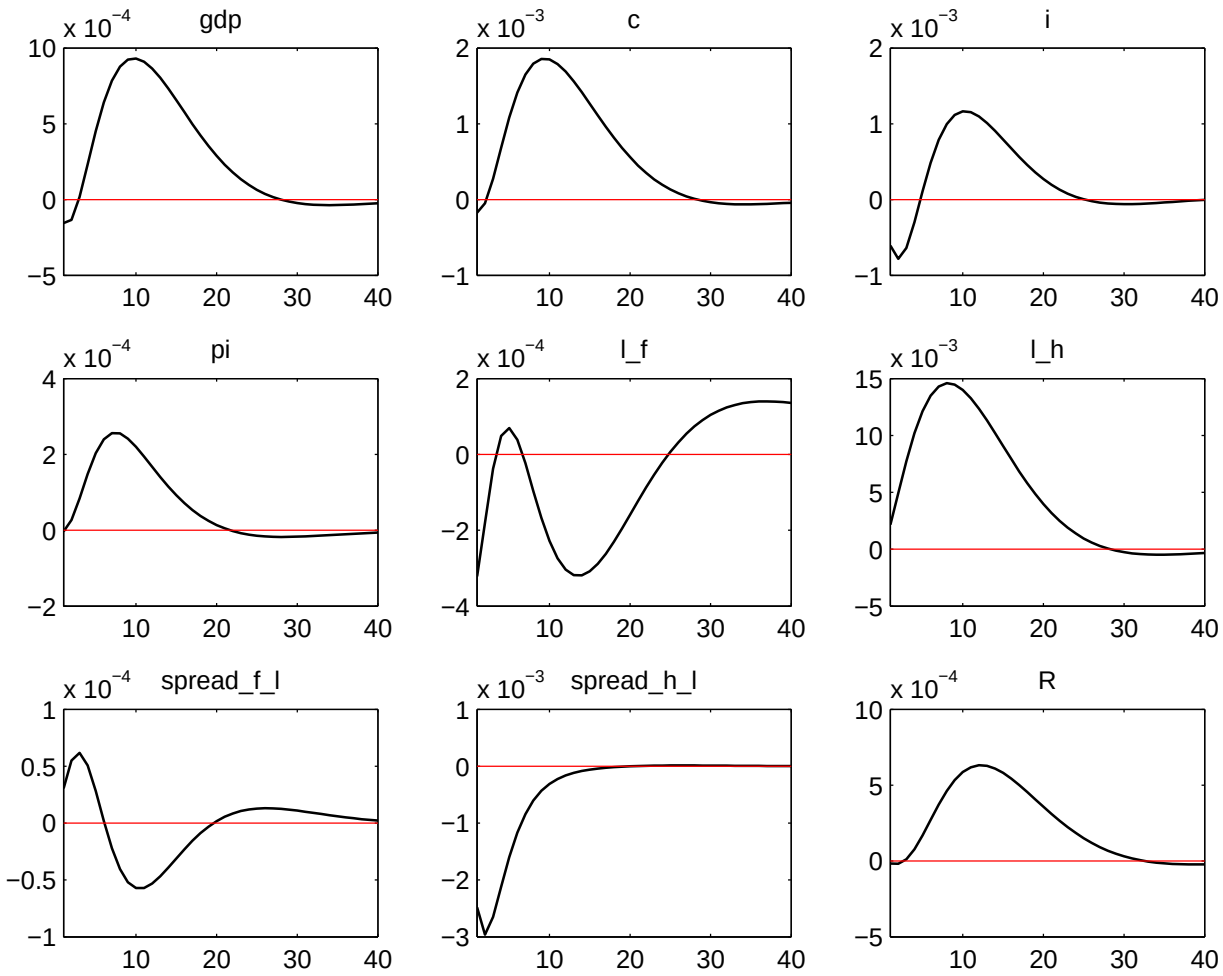
IRF to a 10% households LTV shock



IRF to a 10% firms LTV shock



IRF to a spread on loans to HHs shock



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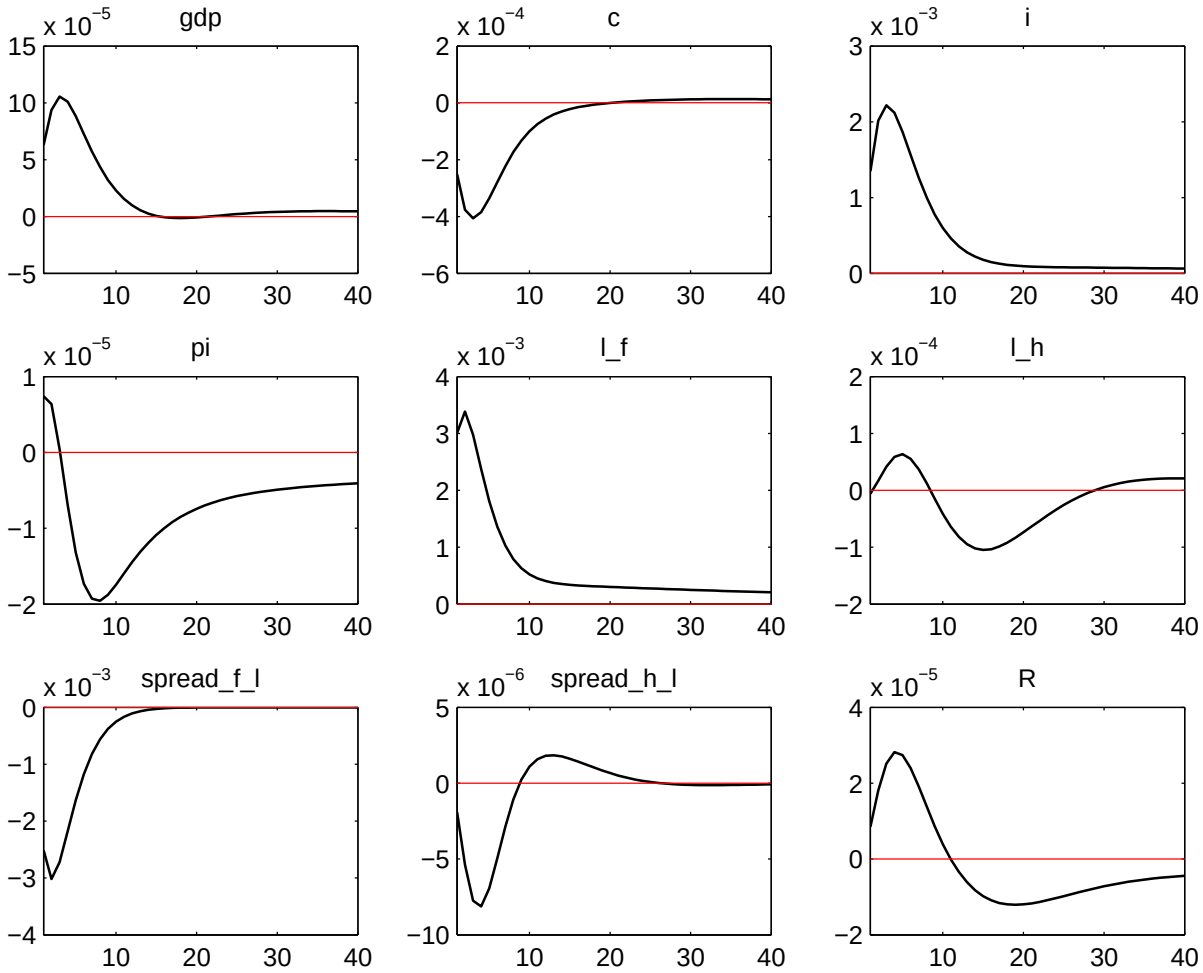

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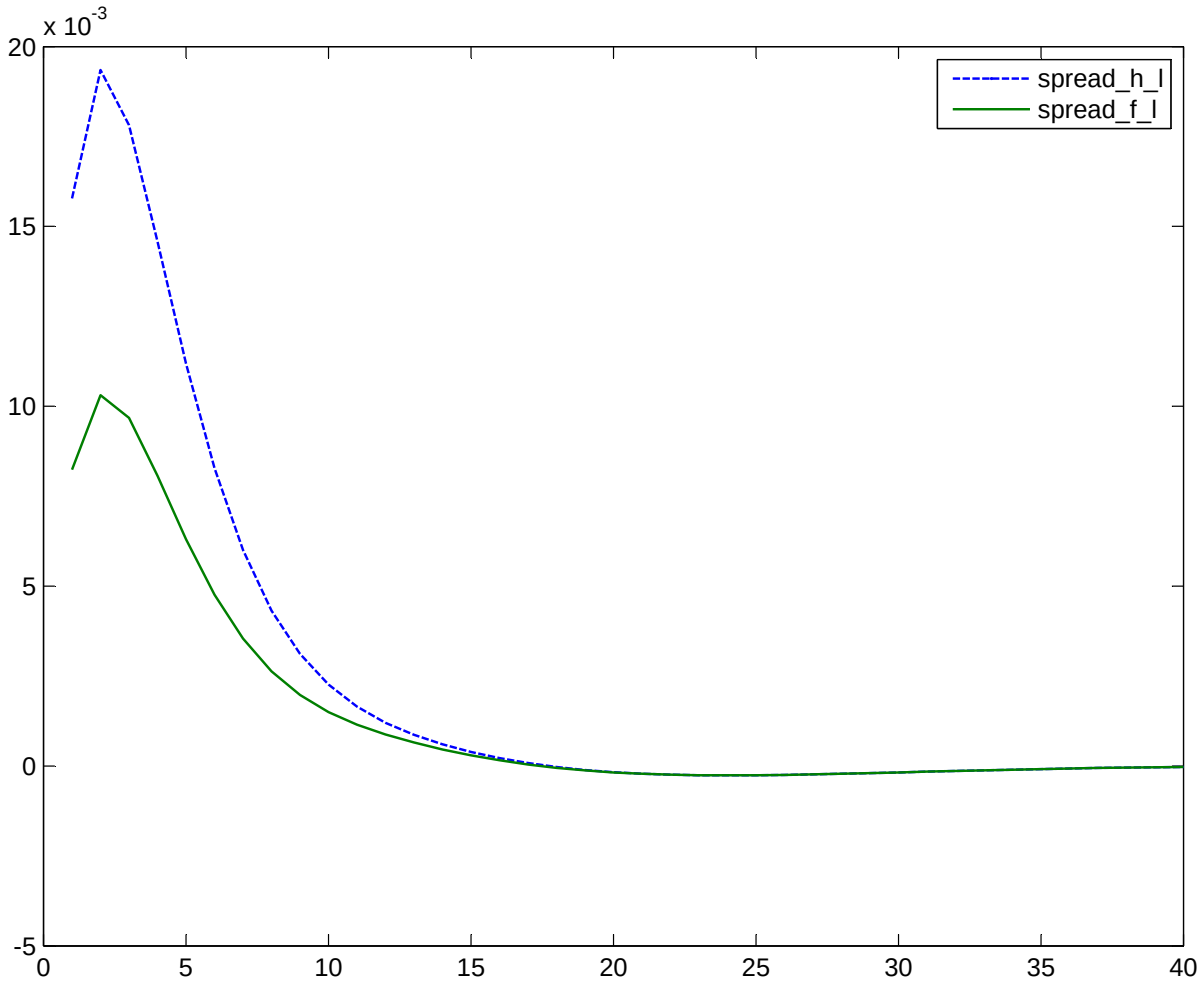
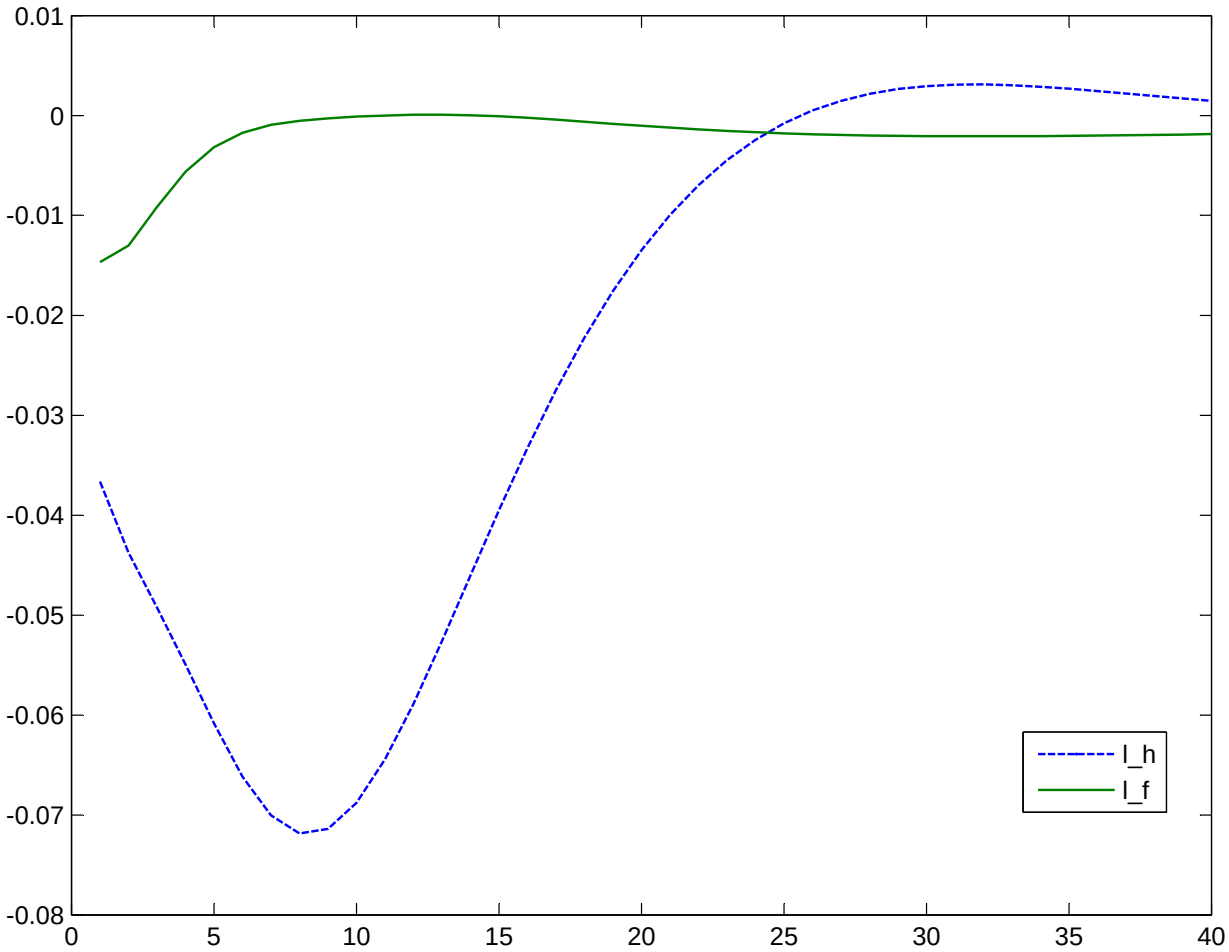
Simulation description

- The goal of the simulation is to find the impact of the credit crunch alone.
- Shocks to spreads set to match values to match observed change in spreads.
- Shocks to LTVs set to match (given the previously calibrated initial shocks to spreads) observed decline in loans.
- Persistence set at reasonable values.
- Two questions:
  - do we need shocks to LTVs?
  - does the credit crunch alone have an important effect?
- Given that the crudeness of the calibration results should be only treated as a documentation of the model's possibilities.

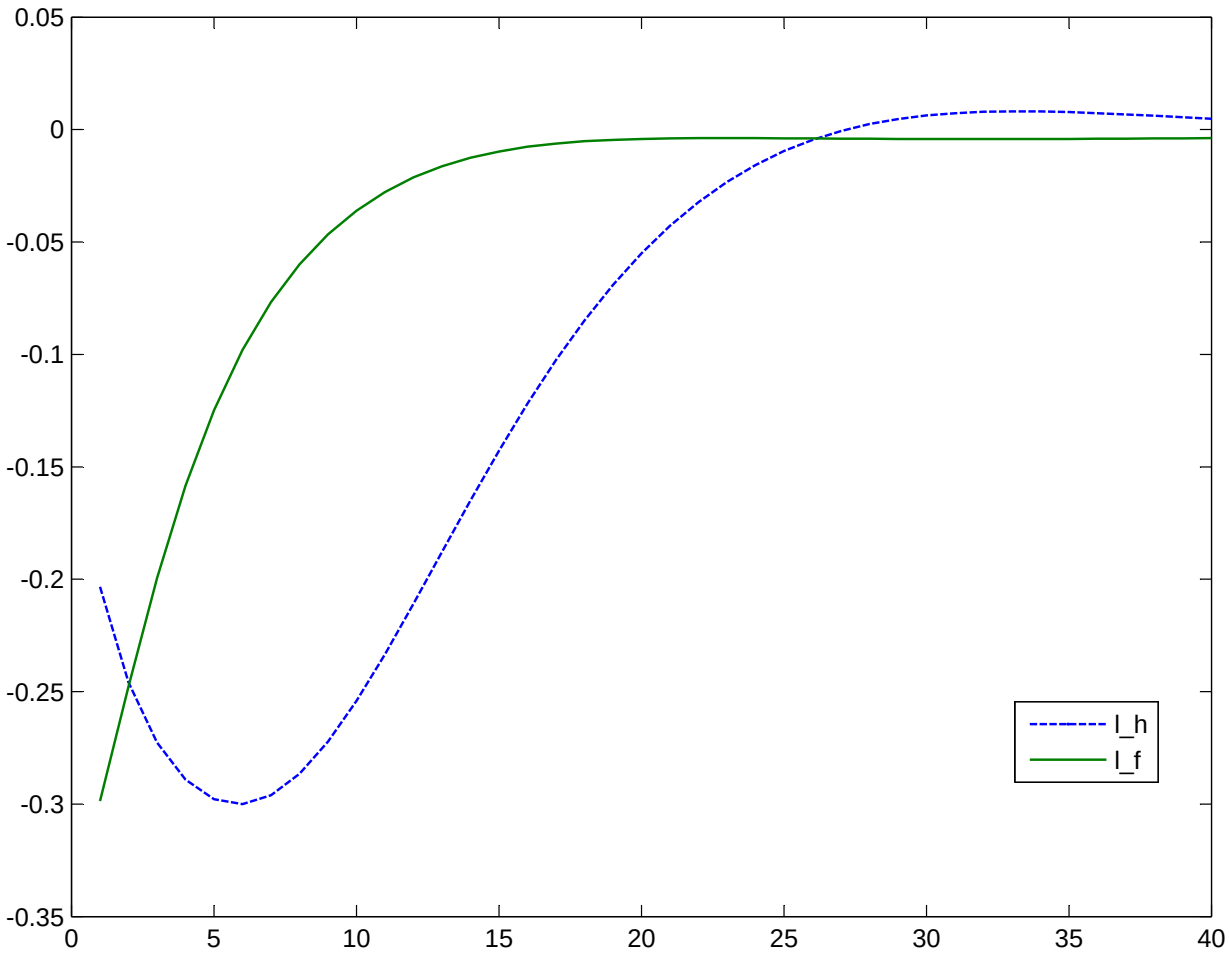
Spreads in the model



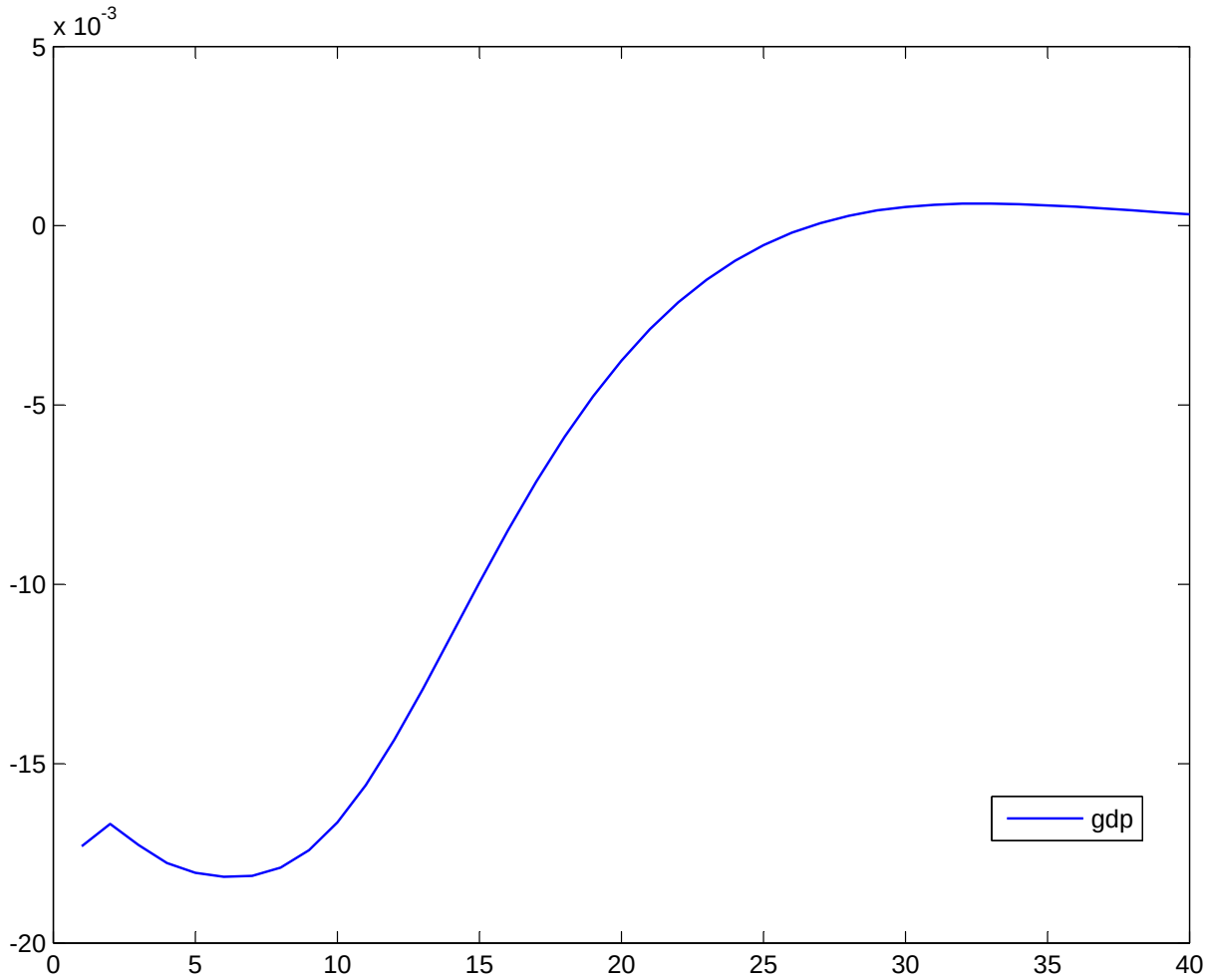
Spreads as a source of the credit crunch in the model



Spreads and LTVs as a source of the credit crunch in the model



Credit crunch and GDP in the model



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Summary and work for the nearest future

- Model seems to be very promising in terms of its ability to replicate the credit crunch impact.
- A proper calibration or Bayesian estimation needs to be done
- It should result in a proper decomposition of shocks.
- Financial frictions seem to have an important effect on the economy.
- Spreads alone may not be enough to quantitatively replicate the observed behavior of financial variables thus also shocks to LTVs are needed.
- Possibly policy analysis.