Comparing different monetary policy regimes in the context of entering the EMU

Viktors Ajevskis and Kristīne Vītola

Bank of Latvia

What Do We Do?

- estimate a small open economy DSGE model (Gali and Monasselli, 2005) for Latvia with Lubik and Schorfheide (2007) simplifications using Bayesian methods.
- simulate the model using different policy parameters and compare the results under various policy rules.

Results

- For estimated parameter set inflation turns out more volatile under inflation targeting than under the exchange rate peg.

Motivation

- All new EU member states are required to join the European Monetary Union (EMU) and adopt the euro as official currency.
- For this purpose all countries are required to meet the Maastricht convergence criteria and exchange rate mechanism ERM II .
- ERM II supposes that countries participating in this mechanism have to keep $\pm$15% wide target zone against euro.

Motivation, cont'd

- Latvian CPI inflation in December 2008 – 15.3%. Inflation Maastricht criterion – 4.1%

- The causes - rapid credit growth which in turn boosted domestic demand and boom in both real estate and construction sectors. At the same time, it has resulted in the overheating of Latvian economy with soaring consumer prices at the outcome.

Motivation , cont'd

- The ± 15 % fluctuation band offers an opportunity to conduct relatively more independent monetary policy with elements of inflation targeting.
- Floating exchange rate policy acts as a "shock absorber" which helps to stabilize the domestic economy in the face of the foreign monetary shocks.

Motivation , cont’d

- ERM II mechanism stipulates that a country may keep its exchange rate within a narrower corridor than ± 15 % which is the case of Latvia (± 1%).
- Will widening of the exchange rate target zone and carrying out monetary policy with elements of inflation targeting help to curb inflation in Latvia up to the level necessary to satisfy the Maastricht criterion?

- To evaluate different monetary policies we estimate a small open economy DSGE model for Latvia using Bayesian methods and compare the simulation results under various policy rules.

General modelling features

- Small size small open economy DSGE (as small as possible, (Gali and Monasselli, 2005) with Lubik and Schorfheide's (2007) simplifications)
- Nominal frictions:
- Monopolistic competition and Calvo sticky prices
- Taylor rule (with changes in exchange rate) for monetary policy

Model setup

Households

A representative household maximizes utility given by

$$E_0 \sum_{t=0}^{\infty} \beta^t \left[\frac{(C_t / A_t)^{1-\sigma} - 1}{1-\sigma} - \frac{N_t^{1+\varphi}}{1+\varphi} \right]$$

where σ and φ represent household's risk aversion and labour supply aversion,
N_t denotes hours worked, A_t is a world technology process,
and C_t is a composite consumption index defined as

$$C_t \equiv \left[(1-\alpha)^{\frac{1}{\eta}} (C_{H,t})^{\frac{\eta-1}{\eta}} + \alpha^{\frac{1}{\eta}} (C_{F,t})^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}}$$

$0 \leq \alpha \leq 1$ is a share of imports in GDP (degree of openness)

$\eta > 0$ is the substitutability between domestic and foreign goods from the standpoint of domestic consumer

The household maximizes its utility subject to a borrowing constraint

$$\int_0^1 P_{H,t}(j)C_{H,t}(j)dj + \int_0^1\int_0^1 P_{i,t}(j)C_{i,t}(j)djdi + D_t \leq D_{t-1}R_t + W_tN_t + T_t$$

for t = 0, 1, 2, … where $P_{H,t}(j)$ is the price of differentiated domestic good j and $P_{i,t}(j)$ is the price of differentiated good j imported from country i. R_t is return on investment $D_{t\text{-}1}$ held at the end of period t-1 (including shares in firms). W_t stands for the nominal wage, and T_t denotes lump-sum transfers (taxes).

Firms

The domestic economy is populated by a continuum of firms $j \in [0, 1]$, each produces a differentiated good using the same technology

$$Y_t(j) = A_t N_t(j)$$

where $a_t \equiv \log A_t$ is described by the AR(1) process $a_t = \rho_a a_{t-1} + v_t$

Calvo pricing:

Each firm may change its price with probability $1 - \theta$ every period

(fraction $1 - \theta$ of firms reset their prices, the rest θ keep their prices unchanged)

Firms' price setting mechanism:

A firm reoptimizing in period *t* will choose the price $\overline{P}_{H,t}$ to maximize the present market value of its profits generated while the price remains effective

$$\max_{\overline{P}_{H,t}} \sum_{k=0}^{\infty} \theta^k E_t \left\{ Q_{t,t+k} \left(\overline{P}_{H,t} Y_{t+k|t} - \Psi_{t+k}(Y_{t+k|t}) \right) \right\} = 0$$

subject to the set of demand constraints

$$Y_{t+k|t} = \left(\frac{\overline{P}_{H,t}}{P_{H,t+k}} \right)^{-\varepsilon} \left(C_{H,t+k} + \int_0^1 C^i_{H,t+k} di \right) = \left(\frac{\overline{P}_{H,t}}{P_{H,t+k}} \right)^{-\varepsilon} \hat{C}_{H,t+k} \equiv Y^d_{t+k}\left(\overline{P}_{H,t} \right)$$

where

$Q_{t,t+k} \equiv \beta^k (\widetilde{C}_{t+k} / \widetilde{C}_t)^{-\sigma} (A_t / A_{t+k})(P_t / P_{t+k})$ is the stochastic discount factor for nominal payoffs

$\Psi_t(\cdot)$ is the cost function

$Y_{t+k|t}$ is $t + k$ period output of a firm that last reset its price in period *t*

A Simplified version

We estimate the model of Gali and Monacelli (2005) simplified by Lubik and Schorfheide (2007)

$\varphi = 0, \quad \eta = 1, \quad \gamma = 1, \quad 1/\sigma = \tau$

σ and φ - household's risk aversion and labour supply aversion

η - substitutability between domestic and foreign goods from the standpoint of domestic consumer
γ - the substitutability between goods imported from different markets.

Model equations

$$\tilde{y}_t = E_t\{\tilde{y}_{t+1}\} - (\tau + \alpha(1-\tau)(2-\alpha))(r_t - E_t\{\pi_{t+1} + \alpha\Delta s_{t+1}\} - \rho_z z_t) + \alpha(2-\alpha)\left(\frac{1-\tau}{\tau}\right)E_t\left\{\Delta\tilde{y}^*_{t+1}\right\}$$

$$\pi_t = \beta E_t\{\pi_{t+1}\} + \alpha\beta E_t\{\Delta s_{t+1}\} - \alpha\Delta s_t + \frac{\lambda}{\tau + \alpha(2-\alpha)(1-\tau)}(\tilde{y}_t - \tilde{y}_t^n)$$

$$\pi_t = \Delta e_t + (1-\alpha)\Delta s_t + \pi_t^*$$

$$r_t = \rho_R r_{t-1} + (1-\rho_R)[\psi_1\pi_t + \psi_2\tilde{y}_t + \psi_3\Delta e_t] + \varepsilon_t^R$$

$$\Delta s_t = \rho_s \Delta s_{t-1} + \varepsilon_t^s$$

$$y_t^* = \rho_{y^*} y_{t-1}^* + \varepsilon_t^{y^*}$$

$$\pi_t^* = \rho_{\pi^*}\pi_{t-1}^* + \varepsilon_t^{\pi^*}$$

$$z_t = \rho_z z_{t-1} + \varepsilon_t^z$$

where $\tilde{y}_t^n \equiv -\frac{\alpha(2-\alpha)(1-\tau)}{\tau}\tilde{y}_t^*$

Data description

- 1998q2 to 2007q2
- Output growth rates – log differences of GDP, scaled by 100
- Inflation rates – log differences of CPI, multiplied by 400
- The terms of trade – the relative price of exports in terms of imports, in log differences, scaled by 100
- policy rate – overnight money market rate
- exchange rate – avg of commercial banks' bid and ask rates of lat to SDR by 2005 and to EUR afterwards, log differences, scaled by 100
- overnight rates and exchange rates are averaged over the respective quarter
- GDP, CPI, export and import price indices are seasonally adjusted
- All series are demeaned prior to estimation

Estimation

- We estimate a small open economy DSGE model using Bayesian methods.
- The prior mean of the exchange rate coefficient is set at high value of 400 to ensure the fixed exchange rate regime.

Prior distributions and posterior estimation results

Prior		**Posterior, (60 000 iterations)**		
Name	**Density**	**Mean**	**90% interval**	
Taylor rule response to inflation, ψ_1	G(2, 0.5)	0.515	0.251	0.712
Taylor rule response to output, ψ_2	G(0.05, 0.13)	0.016	0	0.032
Taylor rule response to exchange rate, ψ_3	G(400,100)	44.801	44.782	44.82
Taylor rule inertia, ρ_r	B(0.2,0.1)	0.896	0.896	0.896
openess, α	B(0.4,0.2)	0.627	0.623	0.638
steady state interest rate, r	G(2.5, 0.5)	2.292	1.928	2.686
Phillips curve slope,λ	G(0.5,0.25)	0.618	0.607	0.625
risk aversion, τ	G(0.2,0.1)	0.153	0.147	0.156
Term of trade, ρ_s	B(0.1,0.05)	0.137	0.134	0.141
Technology, ρ_z	B(0.1,0.05)	0.606	0.606	0.606
World output, ρ_{y*}	B(0.99,0.05)	0.954	0.922	0.993
World inflation, $\rho_{\pi*}$	B(0.5, 0.2)	0.422	0.42	0.424
σ_r	IG(0.45,4)	0.712	0.705	0.72
σ_s	IG(2,4)	1.594	1.472	1.735
σ_z	IG(1, 4)	1.275	1.232	1.314
σ_{y*}	IG(0.75, 4)	0.924	0.903	0.949
$\sigma_{\pi*}$	IG(0.25, 4)	0.319	0.312	0.327

Standard deviations for the benchmark model and various exchange rate regimes

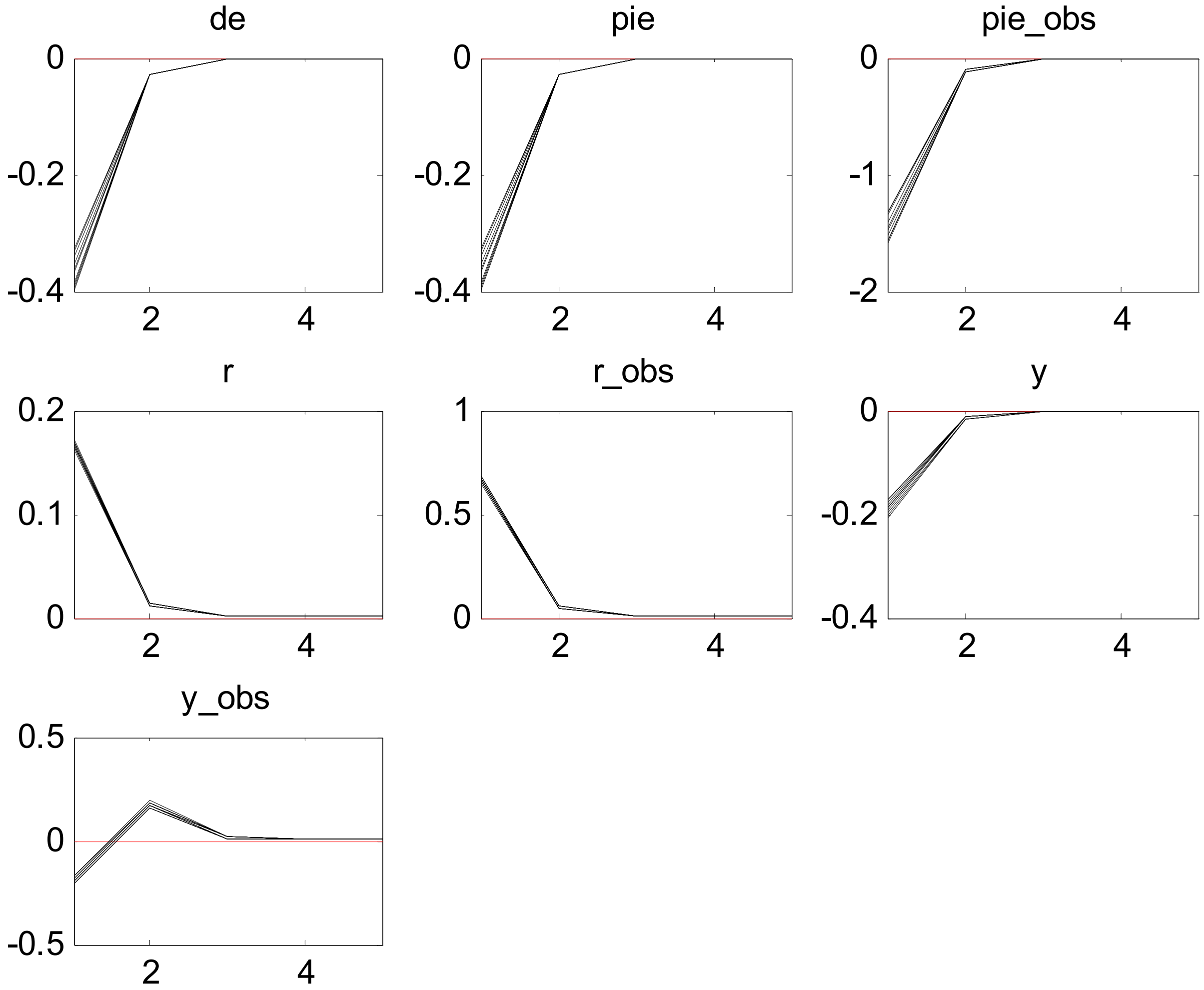
Variable	Benchmark model	$\psi_1 = 0.515, \psi_2 = 0.016$		
	$\psi_1 = 0.515, \psi_2 = 0.016, \psi_3 = 44.801$	$\psi_3 = 2.0$	$\psi_3 = 1.0$	$\psi_3 = 0.6$
Δe	0.329	1.944	2.880	3.689
π	2.275	7.320	11.104	14.403
r	5.518	1.932	1.736	1.701
y	5.149	5.262	5.617	5.885

Standard deviations for ψ_3 = 0.6 and various inflation and output gap targeting regimes

Variable	$\psi_1 = 1.5, \psi_2 = 0.016$	$\psi_1 = 2, \psi_2 = 0.016$	$\psi_1 = 2, \psi_2 = 0.6$
Δe	2.282	2.007	1.819
π	8.403	7.156	6.182
r	1.824	1.898	1.937
y	5.281	5.224	5.095

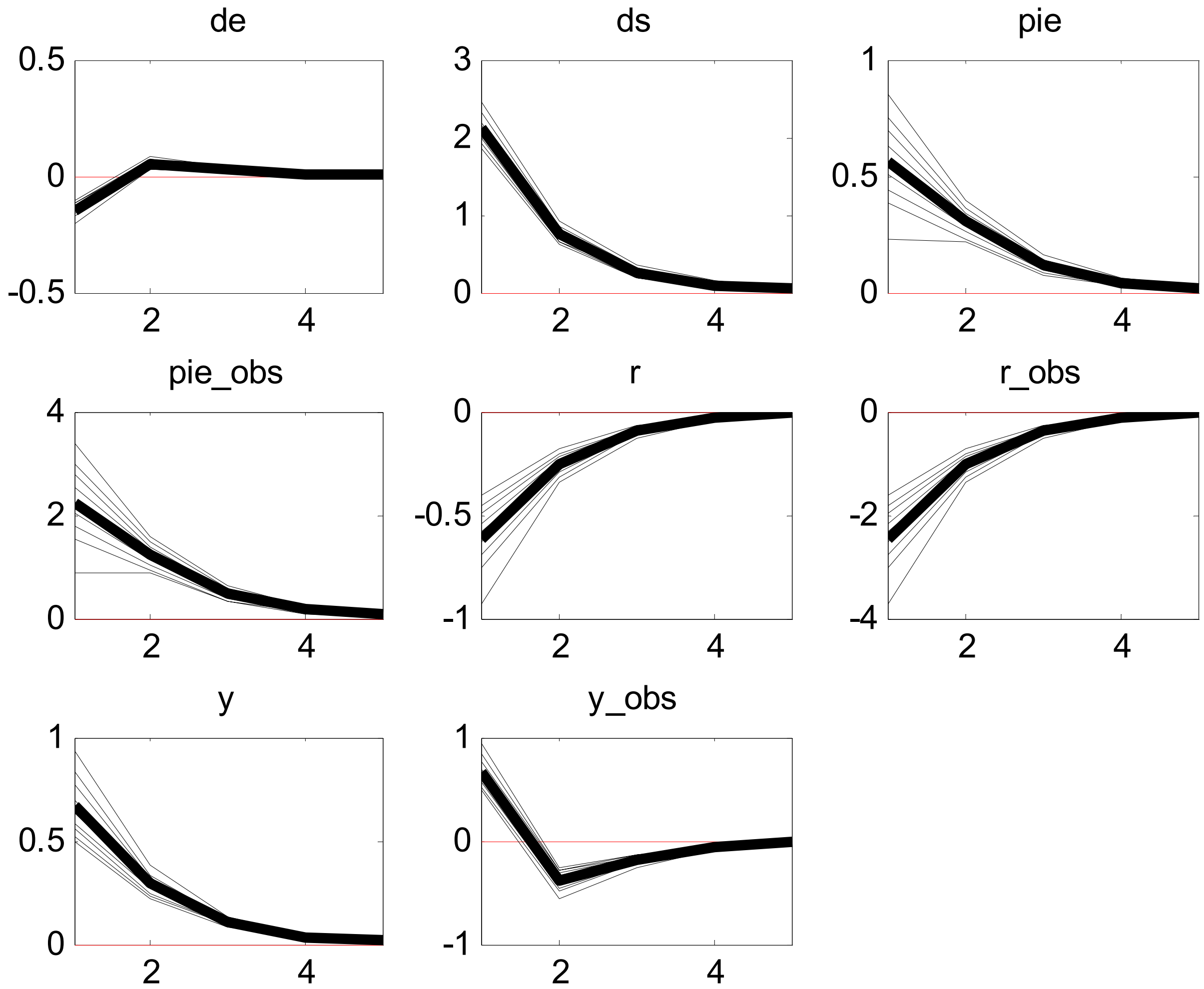
Bayesian impulse responses to shocks (1)

Response to monetary shock ε^r



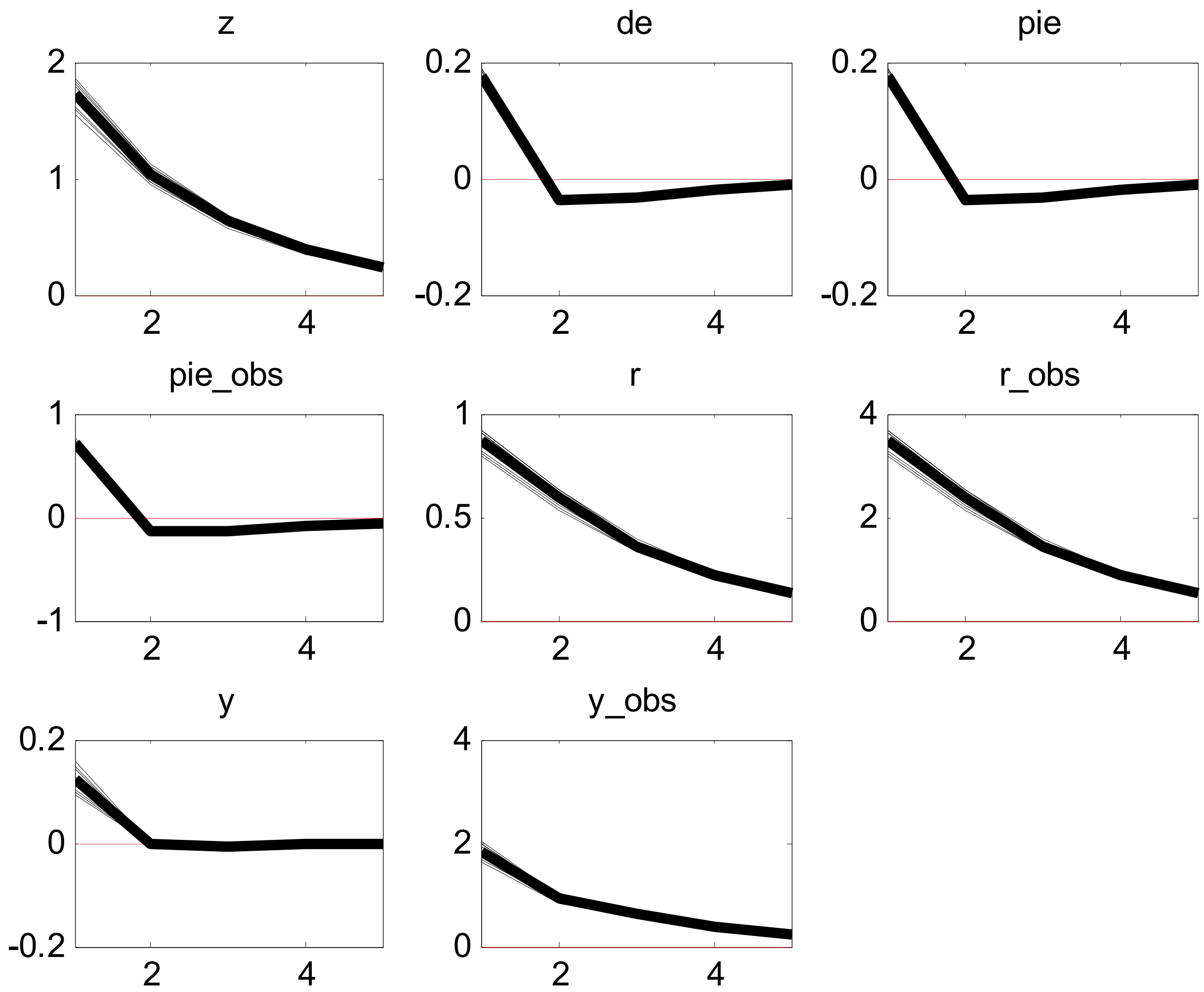
Bayesian impulse responses to shocks (2)

Response to terms of trade shock ε^s



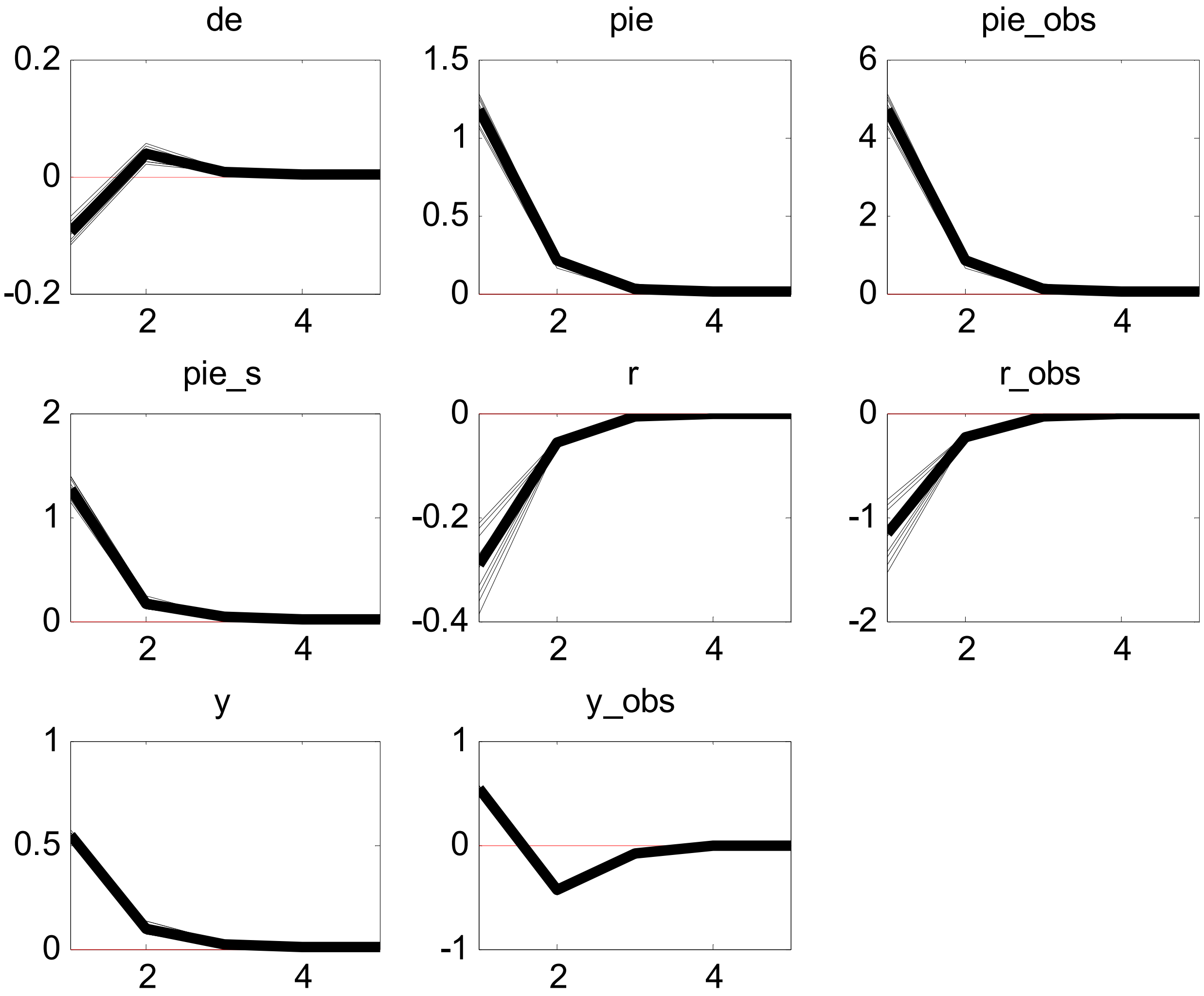
Bayesian impulse responses to shocks (3)

Response to productivity shock ε^z



Bayesian impulse responses to shocks (4)

Response to foreign inflation shock ε^{π^*}



Conclusions

- Very simple small open economy DSGE model estimated with Bayesian econometrics using Latvian data gives plausible results
- Provided estimated coefficients simulation results are in favour of the more tied exchange rate peg in terms of iflation volatility

What should be done?

- LS model is very simple, but it turns out that different set of parameters gives different outcome in terms of which monetary policy is better. For this model it is interesting to investigate "structural" changes, i.e. singularities of such function as inflation, output volatilities, and impulse responses in parameter space. (Sensitivity analysis could be useful)
- More sophisticated model:
- financial frictions
- Fear of Floating (Calvo and Reinhart, 2002), dollarisation – 80% loans are in euro in Latvia.
- Central Bank credibility

What should be done?

- Linear-Quadratic (LQ) approach to optimal monetary policy analysis (Rotemberg & Woodford, 1997). Sometimes coefficients in Taylor rule are unreasonable.