

# Announced regime switch: Are business cycles getting synchronized?

Transition towards the unilateral peg

František Brázdík

frantisek.brazdik@cnb.cz

Center for Economic Research and Graduate Education of Charles University  
Czech National Bank<sup>1</sup>

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<sup>1</sup>The views expressed here are my own and do not necessarily represent the views of the CNB. 

# Outline

- 1 Introduction
- 2 Model
- 3 Welfare over the transition period
- 4 Impulse response functions
- 5 Correlation evolution

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# Motivation

- Czech Republic is considering monetary union entry
- Montenegro unilaterally adopted Euro
- Macroeconomic stability in small open economy environment: Collard & Dellas (2002)
  - ▶ variance of series
  - ▶ evolution of variance
- Currency peg regime can support macroeconomic stability:
  - ▶ Cuche-Curti et al. (2008): rigidity in the goods market
  - ▶ Dellas and Tavlas (2003): presence of nominal rigidities

# Models of regime switch

## Questions:

- How will the response to shocks of interest rates change over the transition period?
- What monetary regime is optimal for transition?
- Are business cycles getting synchronized over the transition period?

## Goal:

- Modeling a monetary regime switch in DSGE model
  - ▶ Farmer, Waggoner and Zha (2007): Recent works rely on Markov switching processes
  - ▶ Introduce new theoretical framework for regime switch modeling

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# Model I

Justiniano and Preston (2004) framework:

- Two countries:
  - ▶ Home – small economy
    - ★ Optimizing agents: households and firms
  - ▶ Foreign – large economy (monetary union)
    - ★ Exogenous processes
- Domestic agents:
  - ▶ Households: habit formation
  - ▶ Firms: domestic producers, importers, and final good producer

# Model II

- Model features:
  - ▶ No capital
  - ▶ All goods are tradable
  - ▶ Complete markets: Symmetric equilibrium
  - ▶ Nominal rigidities: Monopolistic competition
    - ★ Monopolistic competition: Intermediate good
    - ★ Inflation indexation of good prices
    - ★ Importers: Law of one price gap
    - ★ Final good aggregation: Dixit-Stiglitz form



# Model III

- Domestic monetary policy rules:
  - ▶ Pre-transition:  
Targeting of inflation, output gap or change in nominal exchange rate
  - ▶ Transition:  
Policy rule with knowledge of regime switch
  - ▶ Post-transition:  
Rule of offsetting foreseen changes in the nominal exchange rate

# Monetary policy rules

Generalization of monetary regimes:

- Pre-transition regime (independent monetary policy):

$$i_t^I = \rho_i i_{t-1} + (1 - \rho_i)(\rho_\pi \pi_t^{CPI} + \rho_y y_t + \rho_e \Delta e_t)$$

- ▶ where  $0 \leq \rho_i < 1$ ,  $\rho_\pi > 1$ ,  $\rho_y > 0$  and  $\rho_e \geq 0$

- Post-transition regime (stability of exchange rate):

$$i_t^U = \hat{\rho}_e \sum_{j=t}^{\infty} \left(\frac{1}{2}\right)^{t-j} \Delta E_t[e_j]$$

- ▶ where  $\rho_e = 2.0$

- Transition regime:

$$i_t^T = \text{regime}_t i_t^I + (1 - \text{regime}_t) i_t^U, \text{ where } \text{regime}_t \in \{0, 1\}$$

# Information buffer I

- Future information is added to the state space
- Agents foresee the future changes of monetary regime
- Regime indicator:

$$\begin{aligned}
 regime_t &= inf_{t,1} \\
 inf_{t,1} &= inf_{t-1,2} + \nu_{t,1} \\
 inf_{t,2} &= inf_{t-1,3} + \nu_{t,2} \\
 &\vdots \\
 inf_{t,N-1} &= inf_{t-1,N} + \nu_{t,N-1} \\
 inf_{t,N} &= \nu_{t,N},
 \end{aligned} \tag{1}$$

- $inf_{t,i}$ ,  $i \in 1, \dots, N$  are new endogenous variables,  
 $\nu_{t,i}$ ,  $i \in 1, \dots, N$  are information shocks in the period  $t$ .

# Information buffer II

- Announcement is modeled as a series of information shocks realization
- 

$$\nu_{k,i} = \begin{cases} 1, & i \leq T; \\ 0, & i > T, \end{cases}$$

- $\nu_{l,i} = 0, \forall i$  and in the all subsequent periods  $l, l > k$
- $\nu_{l,i}$  is zero mean and zero variance random variable

# Solution

Three models:

- Model of independent policy: linear
  - Transition period model: quadratic
  - Final period model: linear
- 1 Solve model:
    - ▶ Easy for independent a final period model
    - ▶ Transition period: Second order approximation of the monetary policy rule
    - ▶ Dynare++: fast solver for large problems
  - 2 Estimate model of independent policy
    - ▶ Dynare: Bayesian estimation
  - 3 Define scenarios:
    - ▶ Evaluate information shocks
    - ▶ Simulate the linear model

# Estimation results

- High value of the openness parameter: 0.35
- Monetary policy rule: high interest rate smoothing, inflation stability is almost 3 times more preferred than output stability; matches the policy rule as used in CNB's forecasting model
- Slightly more rigidity in domestic good sector than in imported good
- Inflation indexation: 0.56

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# Transition period: Welfare evaluation I

What monetary regime is optimal for the transition?

Assumptions:

- Pre-transition period: estimated regime
- Transition period: Optimal regime

Welfare evaluation:

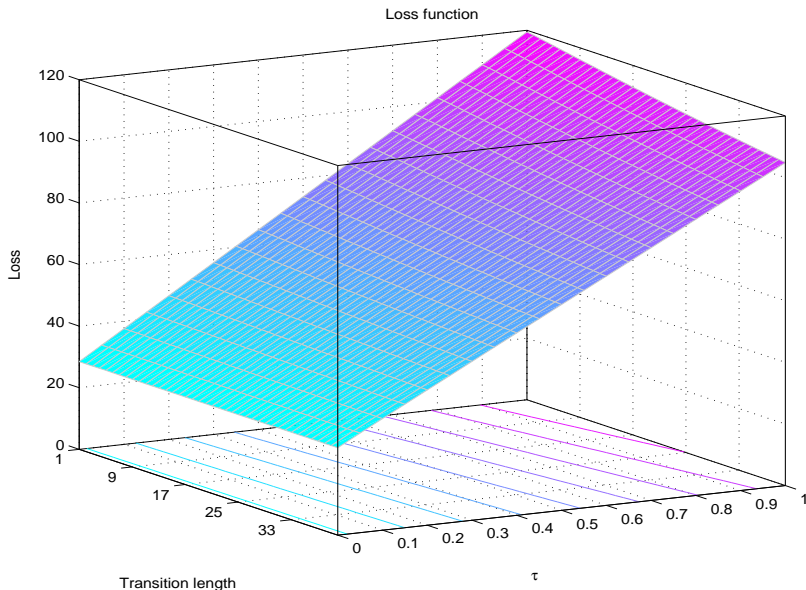
- Santacreu (2005):

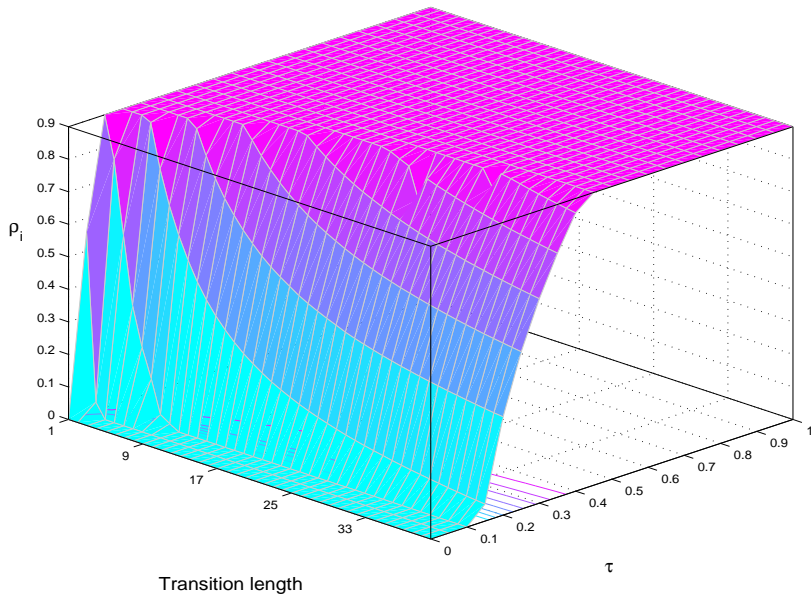
$$L_t = \tau \text{Var}(\pi_t) + (1 - \tau) \text{Var}(y_t) + \frac{\tau}{4} (\Delta i_t),$$

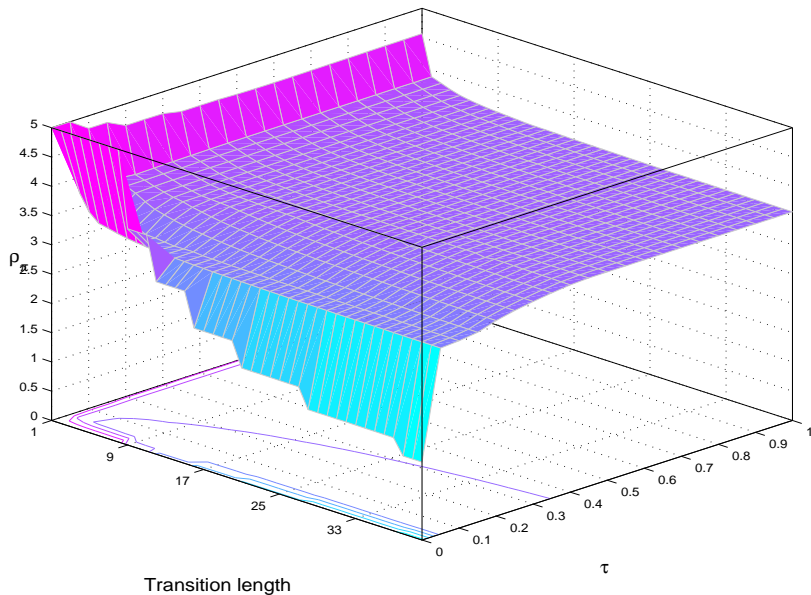
where  $\tau \in \langle 0, 1 \rangle$



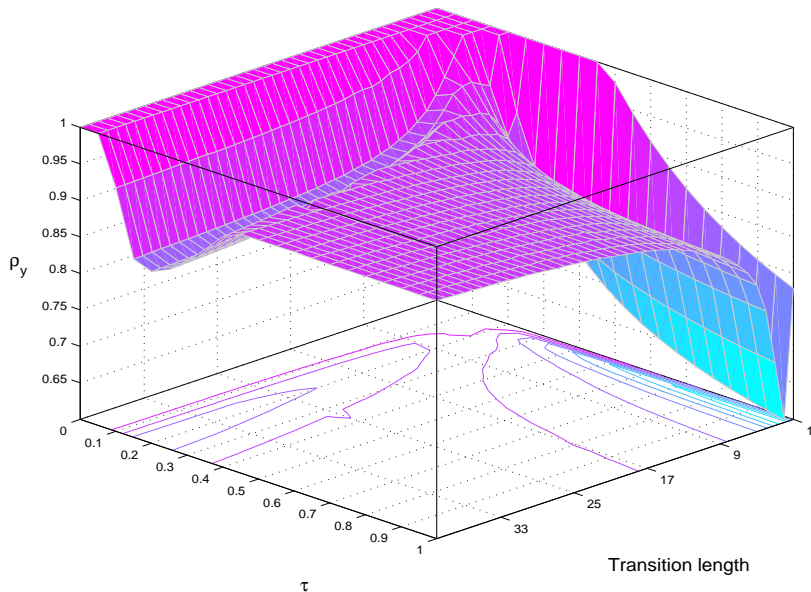
# Loss function evaluation

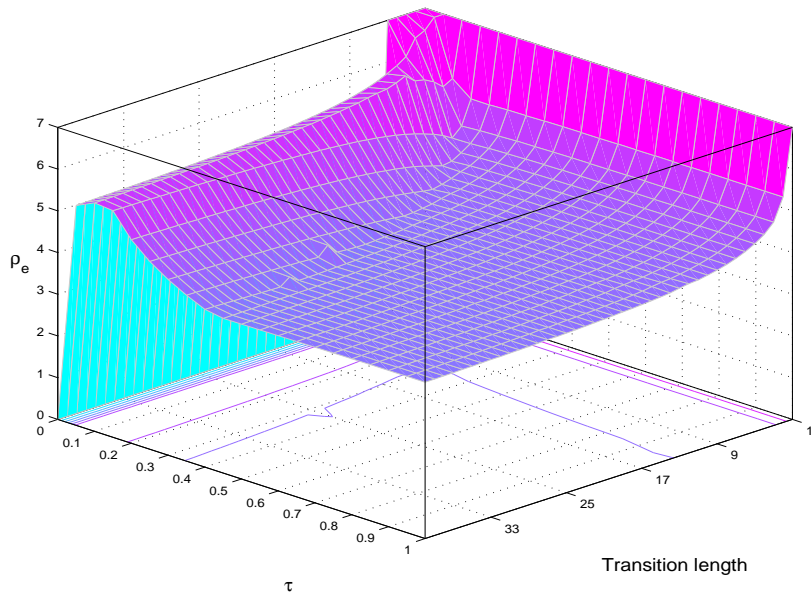


Optimal function for the transition:  $\rho_i$ 

Optimal function for the transition:  $\rho_\pi$ 

Transition length

Optimal function for the transition:  $\rho_y$ 

Optimal function for the transition:  $\rho_e$ 

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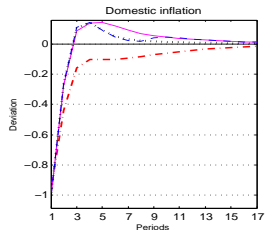
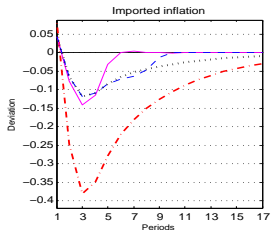
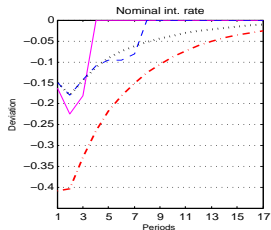
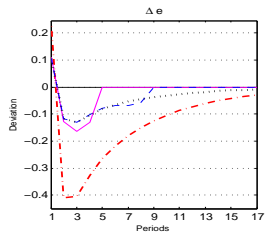
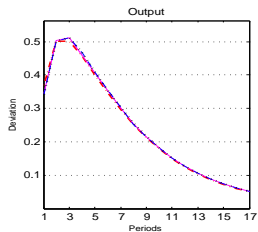
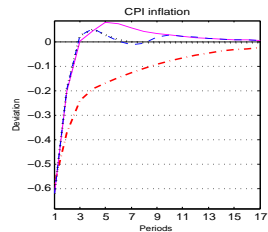
## Irf

How will the response to shocks of interest rates change over the transition period?

Compare responses:

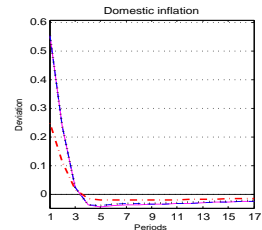
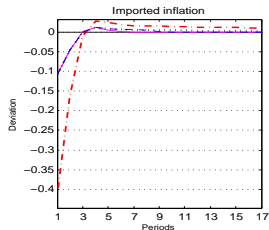
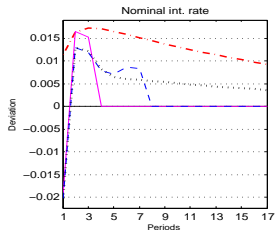
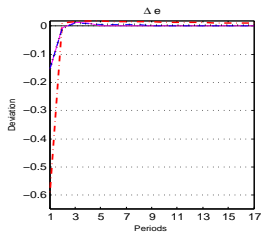
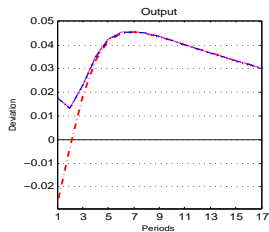
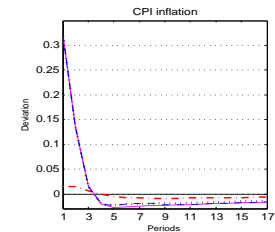
- Examine the effect of the transition period length
- Examine the effects of choice of the transition period regime
  - ▶ Choice of weights in the monetary policy rule to reflect standard regimes

## Irf (Transition length): Technology shock





## Irf (Transition length): Preference shock



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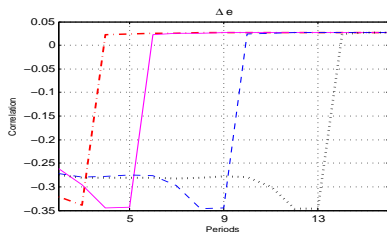
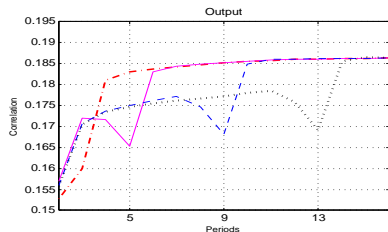
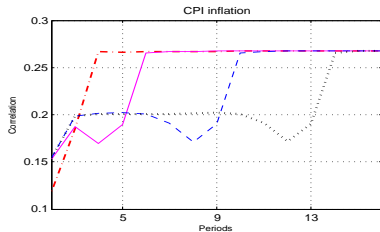
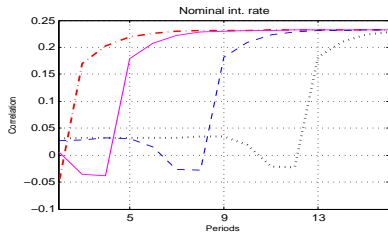
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# Business cycles correlations

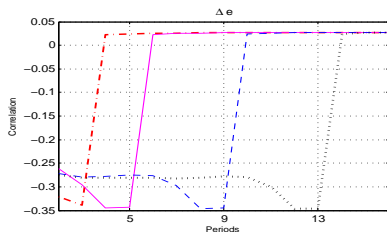
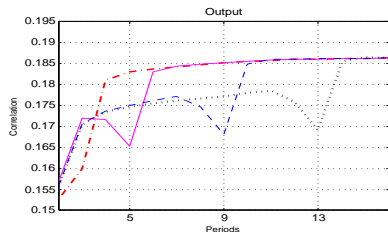
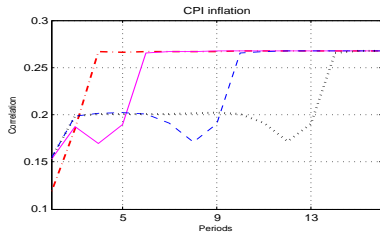
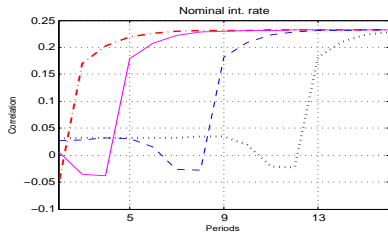
Are business cycles getting synchronized over the transition period?

- Exchange rate stabilization vs lost of monetary policy influence on inflation
- Interest rate gets more correlated with the changes in the exchange rate over the transition period

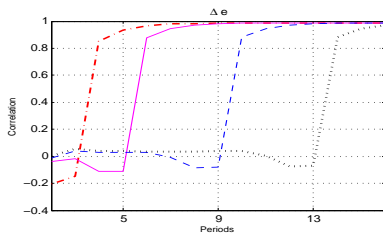
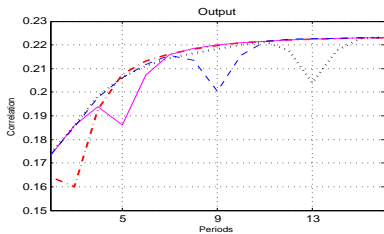
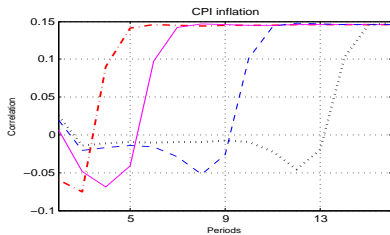
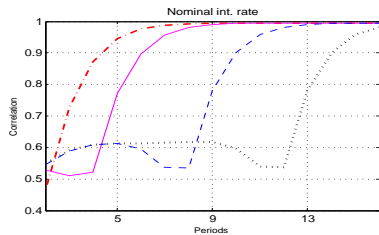
# Correlation: Foreign inflation rate



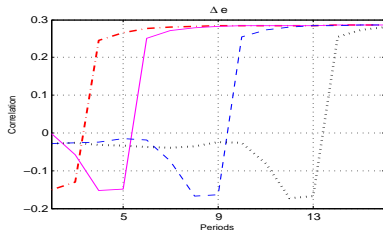
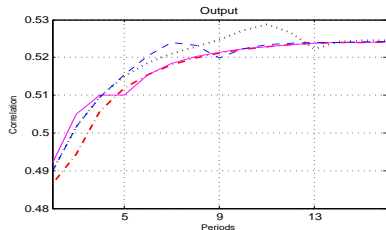
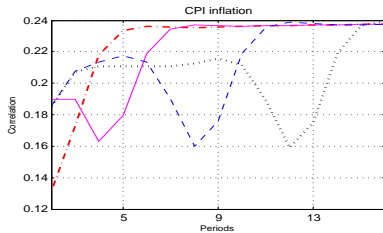
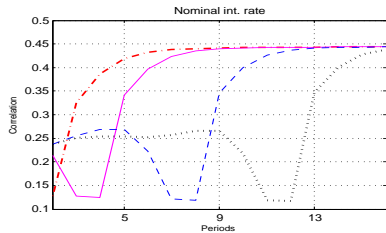
# Correlation: Foreign inflation rate



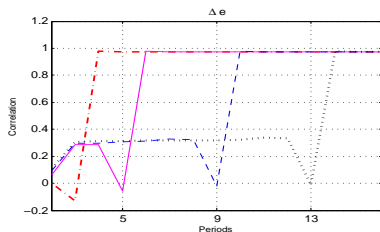
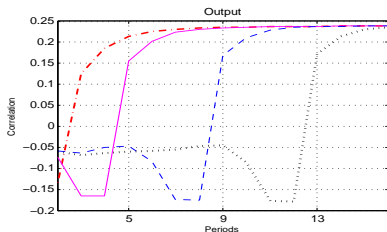
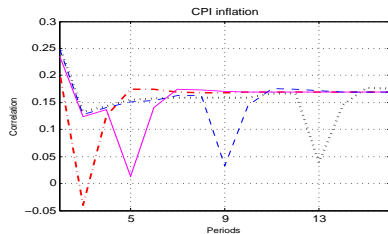
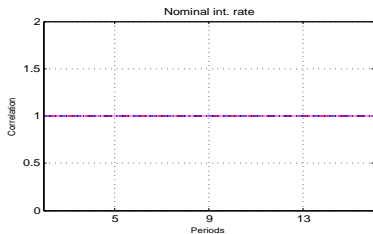
# Correlation: Foreign interest rate



# Correlation: Foreign output



# Correlation: Domestic interest rate





# Policy implications

- Influence of monetary policy on inflation and output
  - ▶ The inflation-interest rate correlation drops mainly in the initial and late phase of the transition.
  - ▶ Monetary policy gains contractionary power towards the end of the transition
    - ★ Increase in interest rate signals to depreciation under the post-transition regime
- Consistently with the experiment design the interest rate - exchange rate correlation increases

# Conclusion

## Goals:

- Alternative approach to modeling of regime switch is presented
- Evolution of macroeconomic stability is evaluated
- Optimal policy for transition

## Future research:

- Extended model: non-linear effects, announcement uncertainty

# Moments comparison

Variable	Data		Model	
	Std. dev.	Corr.	Std. dev.	Corr.
Output growth	1.05	1.00	2.28	1.00
Nominal interest rate	1.38	-0.53	0.53	-0.35
CPI inflation	3.14	-0.12	3.34	-0.06
Change in nominal ex. rate	8.37	0.17	8.12	0.11
Foreign output gap	0.81	0.02	0.74	0.03
Foreign inflation	0.66	0.21	0.81	-0.02
Foreign nom. int. rate	0.65	-0.03	0.73	-0.02