Announced regime switch: Are business cycles getting synchronized?
Transition towards the unilateral peg

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1 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
Presentation outline

1. Introduction
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3. Welfare over the transition period
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Motivation

- Czech Republic is considering monetary union entry
- Montenegro unilaterally adopted Euro
  - 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
Presentation outline

1. Introduction

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5. Correlation evolution
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
Generalization of monetary regimes:

- **Pre-transition regime (independent monetary policy):**
  \[ i_t^l = \rho_i i_{t-1} + (1 - \rho_i)(\rho_\pi \pi_t^{CPI} + \rho_y y_t + \rho_e \Delta e_t) \]
  - 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:**
  \[ i_t^T = regime_t \ i_t^l + (1 - regime_t) \ i_t^U, \text{ where } regime_t \in \{0, 1\} \]
Information buffer

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

\[
\begin{align*}
\text{regime}_t & = \mathit{inf}_{t,1} \\
\mathit{inf}_{t,1} & = \mathit{inf}_{t-1,2} + \nu_{t,1} \\
\mathit{inf}_{t,2} & = \mathit{inf}_{t-1,3} + \nu_{t,2} \\
& \vdots \\
\mathit{inf}_{t,N-1} & = \mathit{inf}_{t-1,N} + \nu_{t,N-1} \\
\mathit{inf}_{t,N} & = \nu_{t,N},
\end{align*}
\]

- \( \mathit{inf}_{t,i}, \ i \in 1, \ldots, N \) are new endogenous variables,
- \( \nu_{t,i}, \ i \in 1, \ldots, N \) 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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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 \( \tau \in \langle 0, 1 \rangle \)
Welfare over the transition period

Loss function evaluation

Loss function

Loss

Transition length

τ

Loss

0

9
17
25
33
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

0

20
40
60
80
100
120

0

1

9
17
25
33
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

F. Brázdík

Announced regime switch
Welfare over the transition period

Optimal function for the transition: $\rho_i$
Optimal function for the transition: $\rho_\pi$
Optimal function for the transition: $\rho_y$
Optimal function for the transition: $\rho_e$
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Irfs

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

Impulse response functions

CPI inflation

Output

Δe

Nominal int. rate

Imported inflation

Domestic inflation

Deviation

Periods

Deviation

Periods

Deviation

Periods

Deviation

Periods

Deviation

Periods
Impulse response functions

Irf (Transition length): Preference shock

- **CPI inflation**
- **Output**
- **Δe**
- **Nominal int. rate**
- **Imported inflation**
- **Domestic inflation**

Periods: 1, 3, 5, 7, 9, 11, 13, 15, 17

Deviation

- **CPI inflation**
- **Output**
- **Δe**
- **Nominal int. rate**
- **Imported inflation**
- **Domestic inflation**
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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

- Nominal int. rate
- CPI inflation
- Output
- ∆e

Correlation evolution over periods.
Correlation evolution

Correlation: Foreign inflation rate

- Nominal interest rate
- CPI inflation
- Output
- Δe

Correlation vs. Periods

<table>
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<tr>
<th>Periods</th>
<th>0.05</th>
<th>0.1</th>
<th>0.15</th>
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<tr>
<td>CPI</td>
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<td>-0.1</td>
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<tr>
<td>Output</td>
<td>-0.15</td>
<td>-0.1</td>
<td>-0.05</td>
<td>0</td>
<td>0.05</td>
<td>0.1</td>
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<tr>
<td>Δe</td>
<td>-0.35</td>
<td>-0.3</td>
<td>-0.25</td>
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<td>-0.1</td>
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Periods: 5, 9, 13
Correlation: Foreign interest rate

- **Nominal int. rate**
- **CPI inflation**
- **Output**
- **\( \Delta e \)**
Correlation evolution

Correlation: Foreign output

- Nominal int. rate
- CPI inflation
- Output
- ∆e

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Correlation evolution

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

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<td>Output growth</td>
<td>1.05</td>
<td>1.00</td>
<td>2.28</td>
<td>1.00</td>
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<td>Nominal interest rate</td>
<td>1.38</td>
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<td>-0.35</td>
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<td>CPI inflation</td>
<td>3.14</td>
<td>-0.12</td>
<td>3.34</td>
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<tr>
<td>Change in nominal ex. rate</td>
<td>8.37</td>
<td>0.17</td>
<td>8.12</td>
<td>0.11</td>
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<td>Foreign output gap</td>
<td>0.81</td>
<td>0.02</td>
<td>0.74</td>
<td>0.03</td>
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<tr>
<td>Foreign inflation</td>
<td>0.66</td>
<td>0.21</td>
<td>0.81</td>
<td>-0.02</td>
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<tr>
<td>Foreign nom. int. rate</td>
<td>0.65</td>
<td>-0.03</td>
<td>0.73</td>
<td>-0.02</td>
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