Equilibrium Exchange Rate against EUR

Lubos Komarek

Presentation Outline

Motivation

1 Introduction
2 Equilibrium exchange rate concepts
- Positive approaches
- Normative approaches

3 Estimates of the equilibrium exchange rate of the Czech koruna
- Statistical methods
- BEER
- FEER

4 Monetary policy discussion and estimates of the equilibrium exchange rate

5 Summary

Motivation

- To prepare for policymakers models of ERER
- Based on ERER to discuss:
  - Setting the level of equilibrium appreciation in core macroeconomic model of the CNB;
  - Possible identification of misalignment (or bubble) on the exchange rate;
  - Competitiveness of the Czech Republic;
  - Risks of the euro adoption.
- To build up econometrics tools form estimating the ERER (requirements from EC, ECB, etc. Before entry to ERM II).

1 Introduction

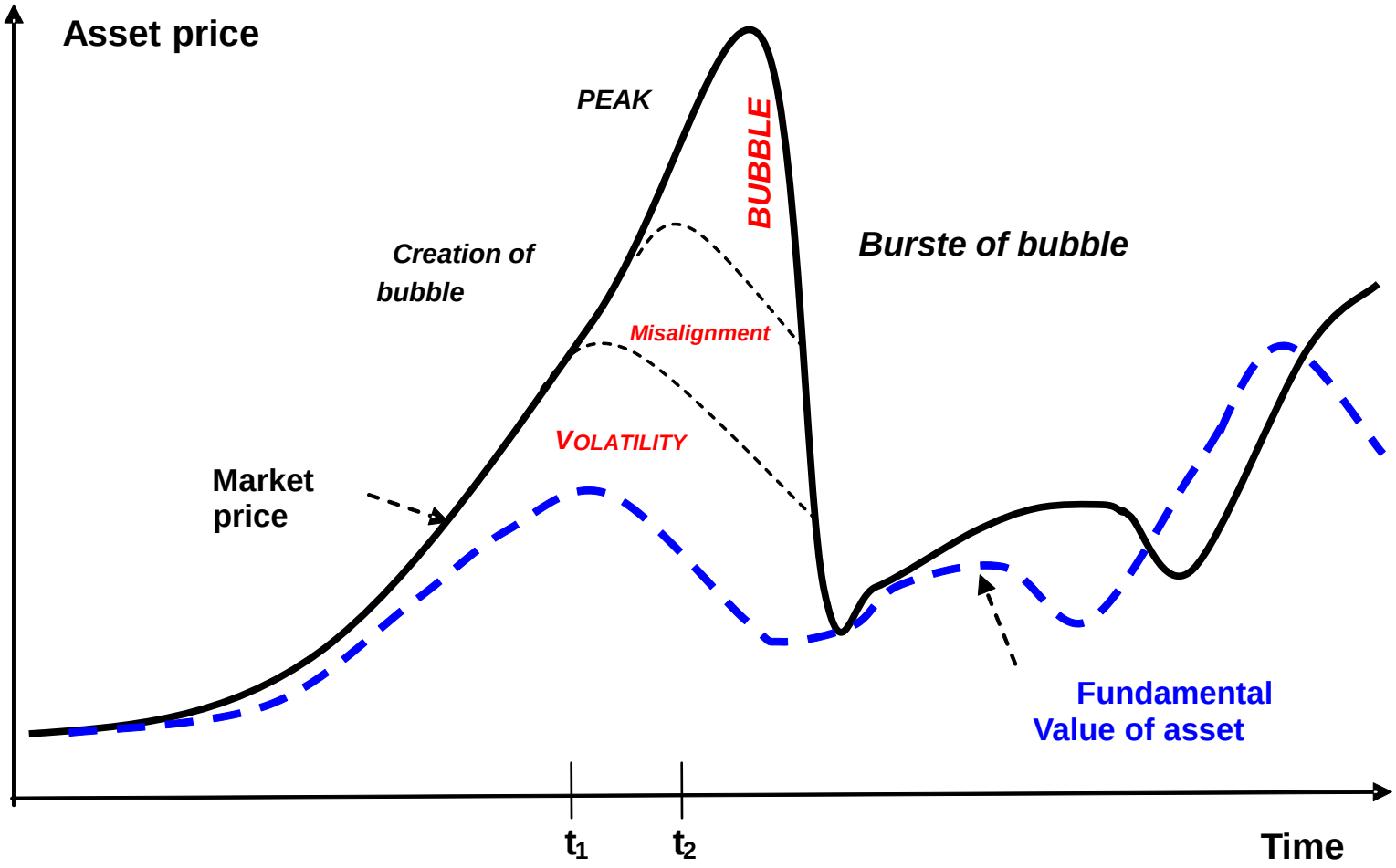
- To

„Motivation“

ECB (2003): *”the central rate should reflect the best possible assessment of the equilibrium exchange rate at the time of entry into the mechanism. This assessment should be based on a broad range of economic indicators and developments while also taking account for the market rate.”…*

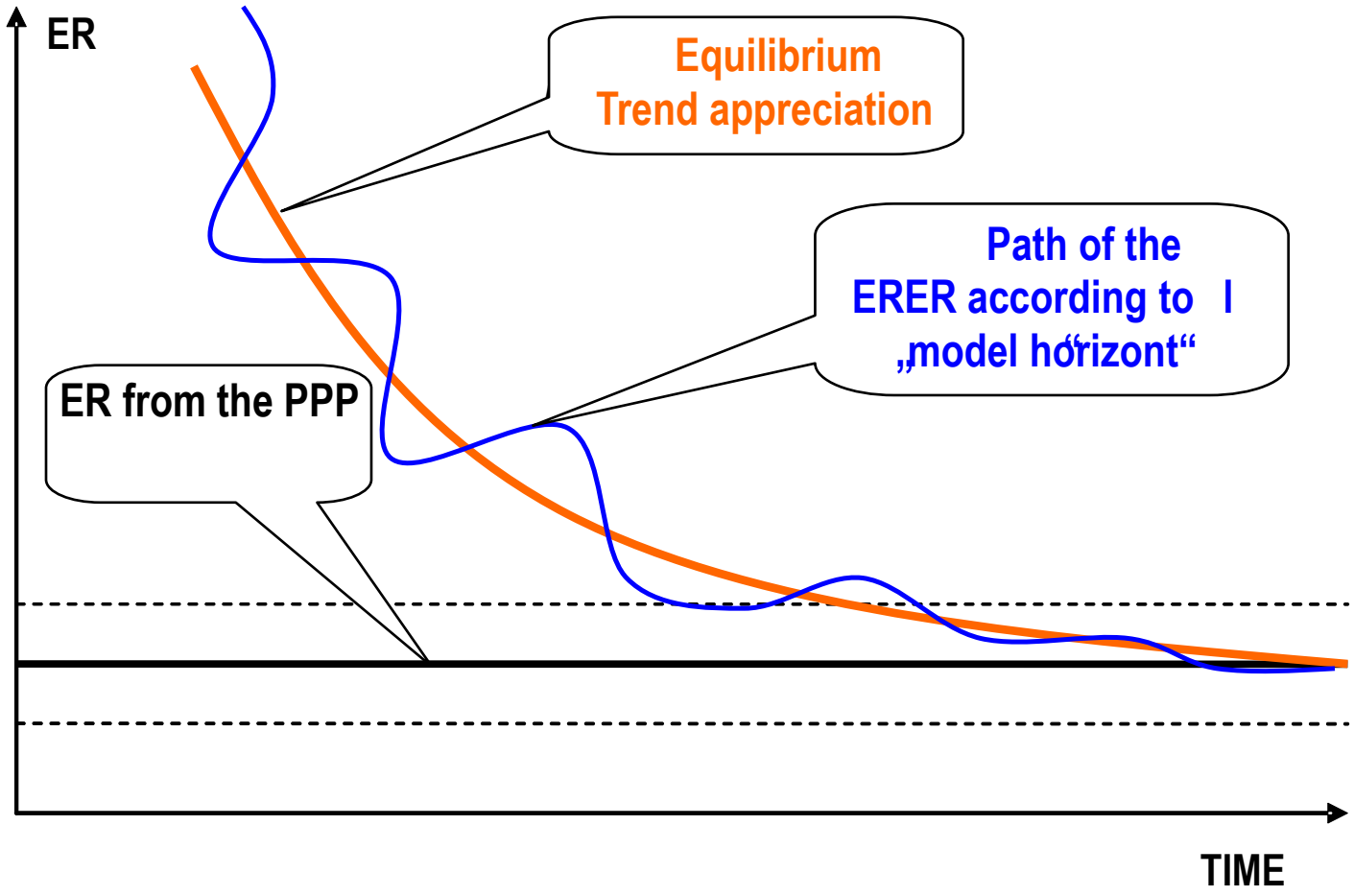
18th December 2003

Volatility, misalignment, bubble …

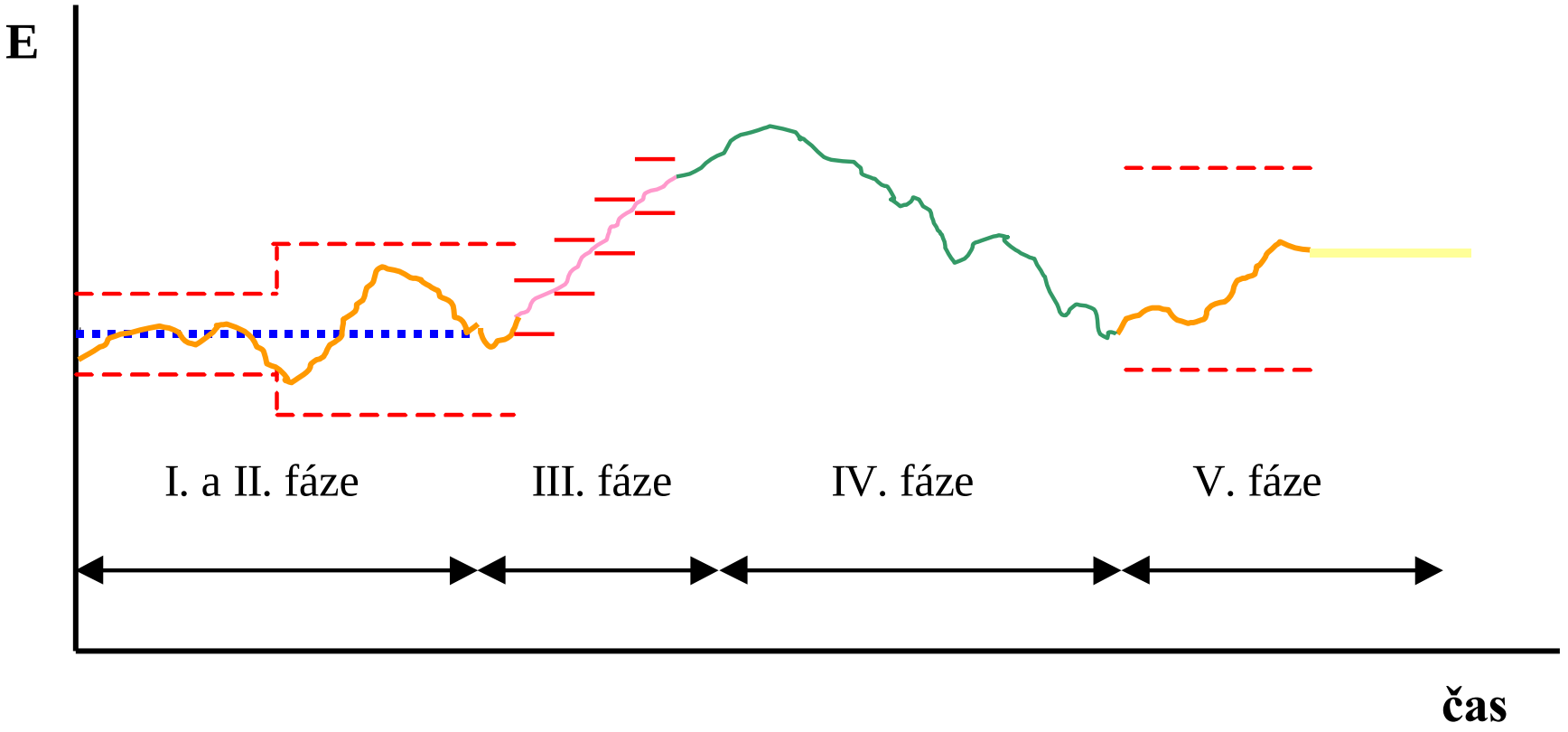


Source: Komarek et al. (2012)

Trend Real Appreciation



„Life cycle“ of a currency before euro

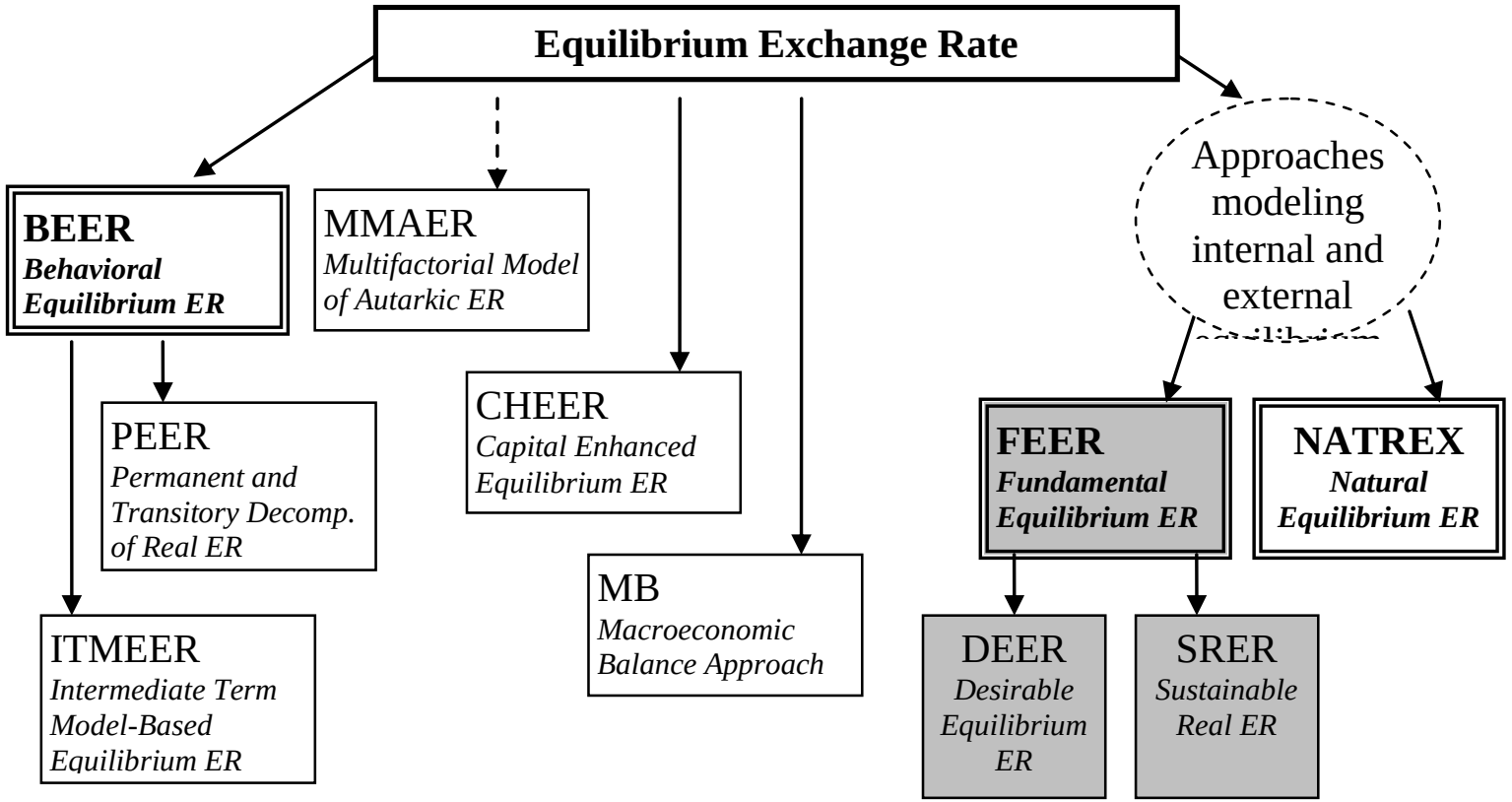


2 Equilibrium exchange rate concepts - I.

- **Positive approaches:** are using current values of variables and current policies….
- **Normative approaches:** are using not only current variables, but also „desirable“ model relationships and trajectories, which we would like to reach…

2. Equilibrium exchange rate concepts - II.

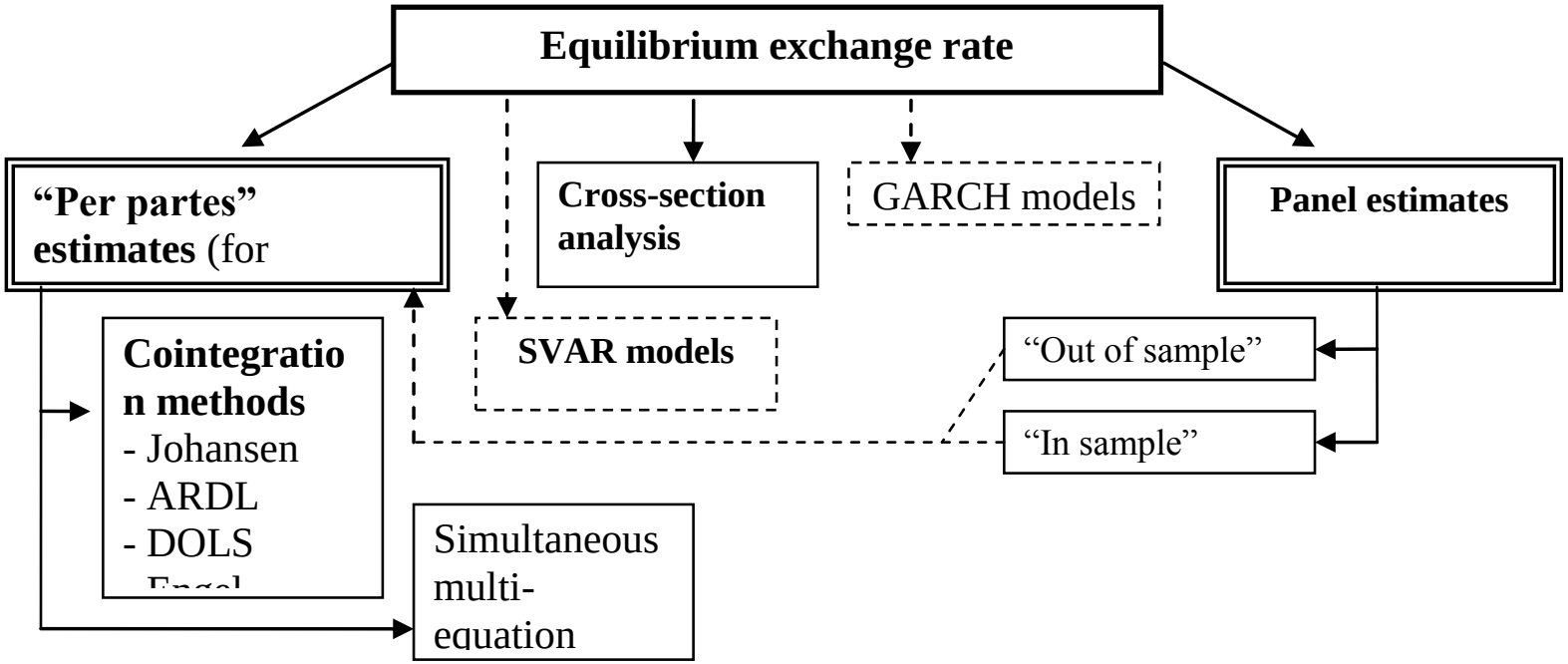
Figure 1
Equilibrium exchange rate concepts



… but for example Driver a Westaway (2004) distinguishes up to 14 approaches.

3. Empirical approaches

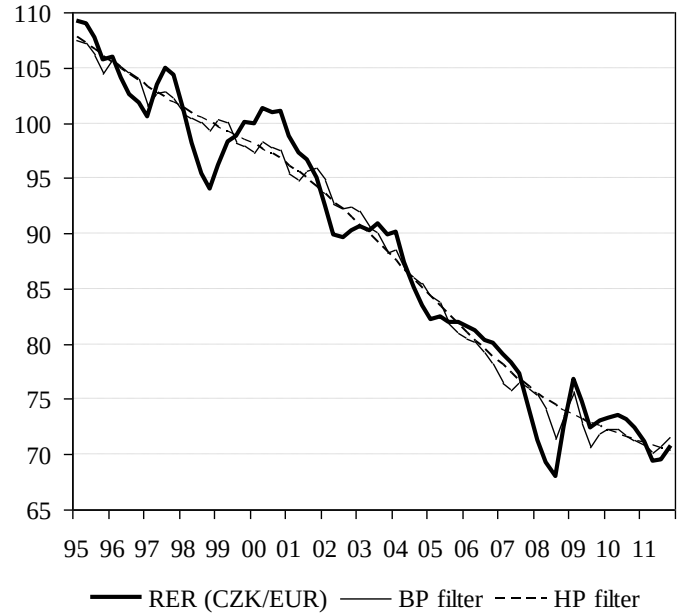
Figure 2
Empirical methods used to estimate equilibrium exchange rates



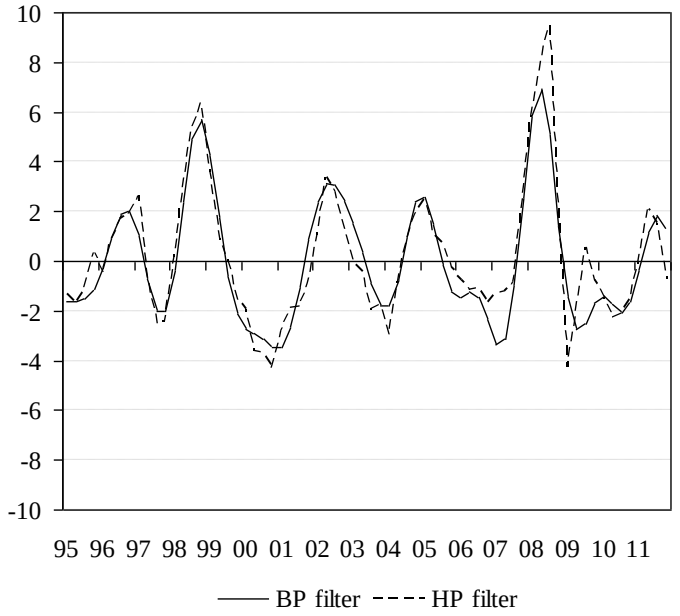
3.1 Statistical methods

Figure 3
Real bilateral exchange rate of the koruna against the euro using the HP filter and the BP filter

a) HP filter and BP filter



b) Misalignment of HP filter and BP filter



Note: For misalignment, (+) denotes overvaluation and (–) denotes undervaluation.
Source: Authors' calculations using CNB, CZSO, and Bloomberg data.

3.2 Economics behind ERER

[1] Productivity

Productivity and productivity differential (dprod; -) = GDP_R/E

- via „price“ chanel: ↑dprod ⇒ higher domestic π ↑ (p↑) ⇒ rer ↓ [rer= ner + (p*-p)]
(this channel is associated with the well known Ballasa-Samuelson effect)

- via „exchange rate“ chanel: ↑dprod ⇒ higher economic growth ⇒ higher demand for the domestic currency relative to the foreign currency ⇒ ner ↓ ⇒ rer ↓

Overall: An increase in productivity should result in an appreciation of the RER.

3.2 Economics behind ERER

[2] Foreign direct investment

Foreign direct investment (fdi; -) = FDI/ GDP_N

- transition variable, proxy for many channels and effects

- via financial account: ↑*fdi* ⇒ higher supply for foreign currency ⇒
⇒ *ner* and *rer* ↓

- via „productivity“ and „price“ channel: ↑*fdi* ⇒ higher productivity ⇒ π↑ ⇒ ⇒ *rer*↓

Overall: An increase in fdi should result in an appreciation of the RER, but could be different in the longer time horizon (profit outflows).

3.2 Economics behind ERER

[3] Terms of trade

Terms of trade (tot; -) = P_{ex}/P_{im}

- endogenous improvement:

$\uparrow$*tot* $\Rightarrow$ P_{ex} rise due to quality improvement $\Rightarrow$ domestic prices (p)$\uparrow$ $\Rightarrow$ *rer* $\downarrow$

- exogenous improvement:

$\uparrow$*tot* $\Rightarrow$ because of a positive shock to TOT (decrease in prices of raw materials $\Rightarrow$ substitution effect (firms produces more exportable and less non-tradable goods) $\Rightarrow$ AS $\uparrow$ $\Rightarrow$ $w_T\uparrow \wedge w_{NT}\uparrow \Rightarrow P_{NT}\uparrow \Rightarrow$ domestic prices (p)$\uparrow \wedge$ CA (improves) $\Rightarrow$ *rer* $\downarrow$ (if country mainly imports raw materials)

Our model: An increase in tot should result in an appreciation of the RER.

3.2 Economics behind ERER

[4] Openness

Openness (open; ambiguous) = $(Ex+Im)/GDP_N$

- <u>open as liberalisation phenomenon:</u>

higher trade restrictions (tightening of trade policy) $\Rightarrow$ $P_T\uparrow$ $\Rightarrow$ domestic prices (p)$\uparrow$ $\Rightarrow$ *rer*$\downarrow$

- <u>open as country risk phenomenon:</u>

more open economy $\Rightarrow$ smaller country risk

NMS: higher open of NMS (especially due to the trade liberalisation $\wedge$ lower country risk) should lead to the appreciation of RER. However, the transformation aspect is gradually decreasing.
Our model: Overall effect is ambiguous.

3.2 Economics behind ERER

[5] Net foreign assets

Net foreign assets (nfa; -) = NFA/GDP_N

$NFA \uparrow \Rightarrow$ domestic income $\uparrow \Rightarrow$ larger expenditure on domestic goods $\Rightarrow$
$P_{NT} \uparrow \Rightarrow$ domestic prices $(p) \uparrow \Rightarrow$ *rer* $\downarrow$

Overall: An increase in nfa should result in an appreciation of the RER.

3.2 Economics behind ERER

[6] Real interest rates differential

Real interest rate differential (drir; -) = real LR- real LR*

drir↑ ⇒ higher demand for domestic assets ⇒ *rer* ↓ (currently), but also indicates - according to UIP condition - depreciation expectations in the future.

<u>More complex view:</u>

absorption ↑ (relative to savings) ⇒ upward pressure on the RIR (if capital mobility is not perfect) ⇒ demand for T and NT ↑ ⇒ *rer* ↓

Our model: An increase in drid should result in an appreciation of the RER.

3.2 Economics behind ERER

[7] Government spending

Government spending (gs;+, ambiguous) = GS/GDP_N

- in the short run

GS ↑ ⇒ public consumption ↑ (due to a higher share of NT goods in public consumption relative to private consumption) ⇒ demand for NT goods ↑ ⇒ P_{NT} ↑ ⇒ domestic prices (P) ↑ ⇒ *rer* ↓

- in the long run (middle run)

∑ GS ↑ ⇒ growing budget deficit ⇒ possible destabilisation of an economy (if current GS > then sustainable GS ≈ Maastricht criterium)

⇒ rer ↑

Our model: An increase in gs should result in an appreciation of the RER.

3.3 BEER

$$RER = f(DPROD; NFA; THFK; NX), \qquad (1)$$

$$RER_t = -0.1123\ DPROD_t - 0.0261\ NFA_t - 0.4582\ THFK_{t-1} - 1.4613\ NX_t + 156.3$$

$$(0.0378)^{***} \qquad (0.0034)^{***} \qquad (0.0832)^{***} \qquad (0.2802)^{***}$$

$$(R^2 = 0.9917 \quad S.E. = 1.1159 \quad D\text{-}W = 1.94)$$

RER – real exchange rate deflated by PPI index

DPROD – producitivity differential (the Czech Republic against eurozone)

NFA – net foreign asset over GDP

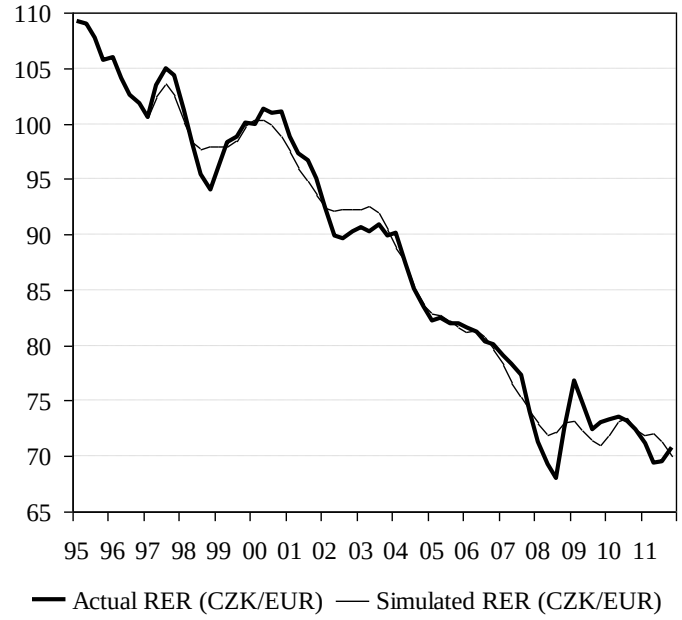
THFK – real investment over GDP

NX – net export over GDP

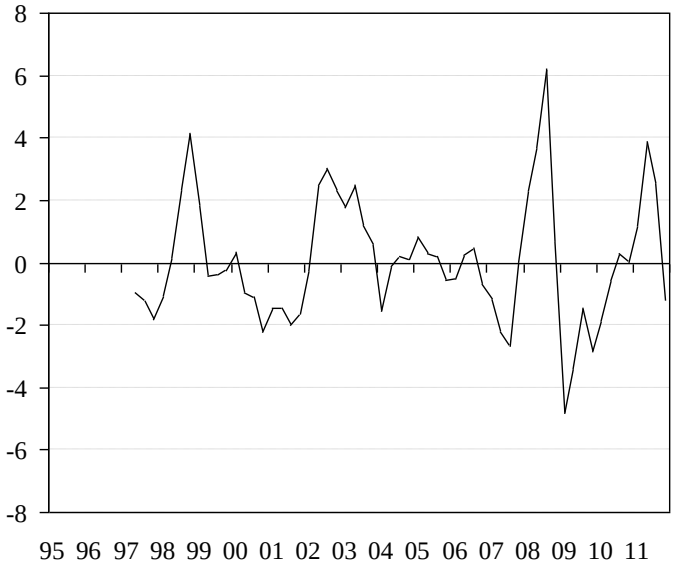
3.3 BEER – results

Figure 4
Estimate of the equilibrium real exchange rate and its misalignment according to the BEER model

a) BEER



b) BEER misalignment (in %)



Note: For misalignment, (+) denotes overvaluation and (–) denotes undervaluation.
Source: Authors' calculations using CNB, CZSO, Bloomberg, Datastream, and AMECO (European Commission) data.

3.4 FEER – export equation

$$Exports: \quad lnX = f(lnMEMU;\ lnRER;\ lnDPROD;\ lnFDI^{X}), \qquad (2)$$

$$Exports: X_t = FDI^{X}_t + exp(0.49\ lnMEMU_t + 1.35\ lnRER_t + 2.32\ lnDPROD_t - 14.96)$$

$$(0.006)^{***} \qquad (0.147)^{***} \qquad (0.111)^{***}$$

$$R^2 = 0.88 \qquad S.E. = 0.034$$

Export equation:

X – export from the Czech Republic

FDI^X – foreign direct investment

MEMU – import of eurozone

RER – real exchange rate deflated by PPI

DPROD – differential in productivity

3.4 FEER – import equation

Imports: $lnM = f(lnDD; lnRER; lnX),$ *(3)*

$$Imports: lnM_t = 0.74\ lnDD_t - 1.41\ lnRER_t + 0.24\ lnX_t + 5.93$$

$$(0.249)^{***} \qquad (0.221)^{**} \qquad (0.098)^{**}$$

$$R^2 = 0.73 \quad S.E. = 0.049$$

Export equation:

M – import from the Czech Republic
DD – domestic demand
RER – real exchange rate deflated by PPI
X – export of the Czech Republic

3.4 FEER – basic equations

$$NX_t = X_t - M_t \quad (1)$$

$$Y_t = DD_t + NX_t \quad (2)$$

$$Y^{GAP}{}_t = Y_t - Y^{EQ}{}_t \quad (3)$$

$$Y^{N}{}_t = Y_t * P^{Y}{}_t \quad (4)$$

$$CA^{EB}{}_t = CA^{EQ}{}_t * Y^{N}{}_t \quad (5)$$

$$NX^{N}{}_t = P^{X}{}_t * NX_t + M_t (1 - P^{M}{}_t/P^{X}{}_t) * P^{X}{}_t \quad (6)$$

$$CA^{GAP}{}_t = NX^{N}{}_t - CA^{EB}{}_t \quad (7)$$

CA^{EB} – sustainable balance of the balance of payments

CA^{EQ} – sustainable level of CA/HDP v b.c.

CA^{GAP} – deviation of the CA from external equilibrium

NX – net real export

Y – real GDP growth

Y^{GAP} – deviation of the GDP form internal balance

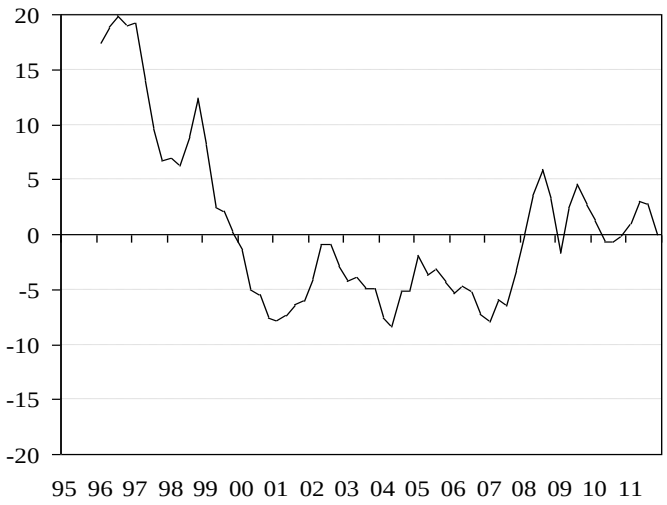
Y^{EQ} – potential GDP (Cobb-Douglas production function)

3.4 FEER – results

Figure 5
Estimate of the equilibrium real exchange rate and its misalignment according to the FEER model

a) FEER

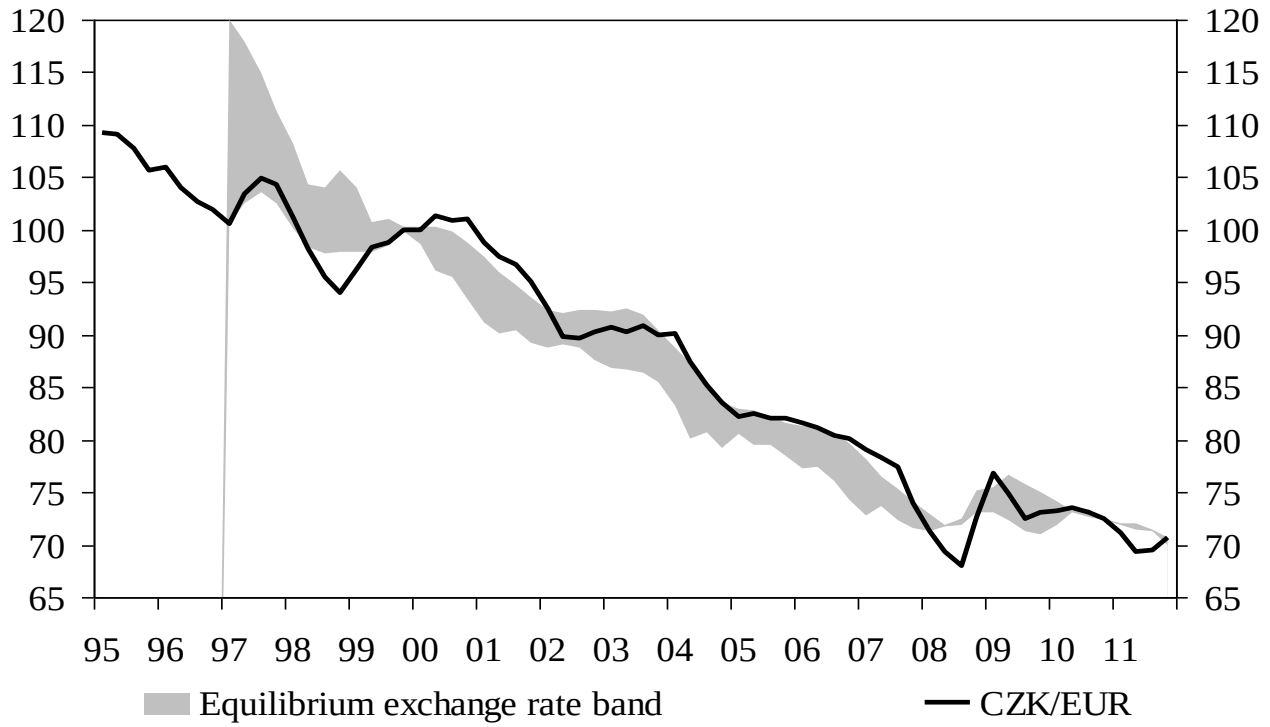
b) FEER misalignment (in %)



Note: For misalignment, (+) denotes overvaluation and (–) denotes undervaluation
Source: Authors' calculations using CNB, CZSO, Bloomberg, Datastream, and AMECO (European Commission) data.

Real equilibrium band

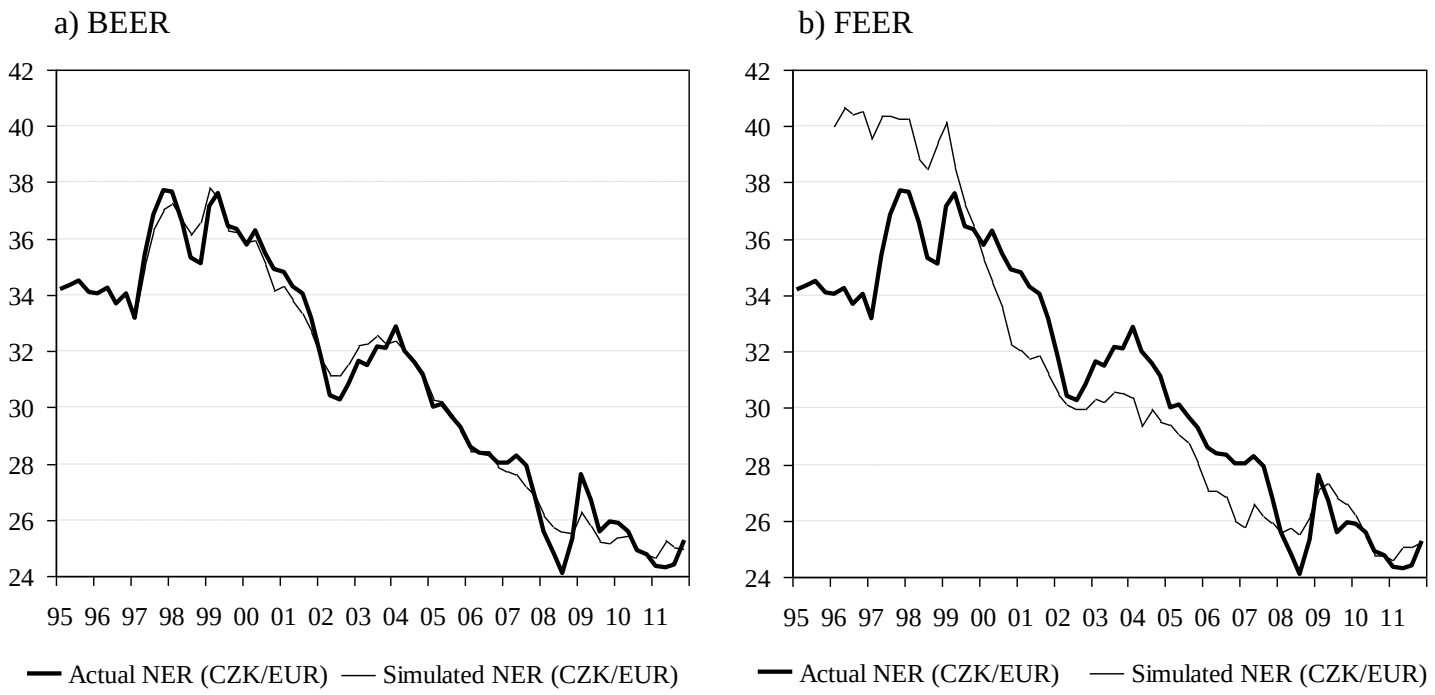
Equilibrium real exchange rate band according to the BEER and FEER models



Source: Authors' calculations using CNB, CZSO, Bloomberg, Datastream, and AMECO (European Commission) data.

4. MP discussion and ERER

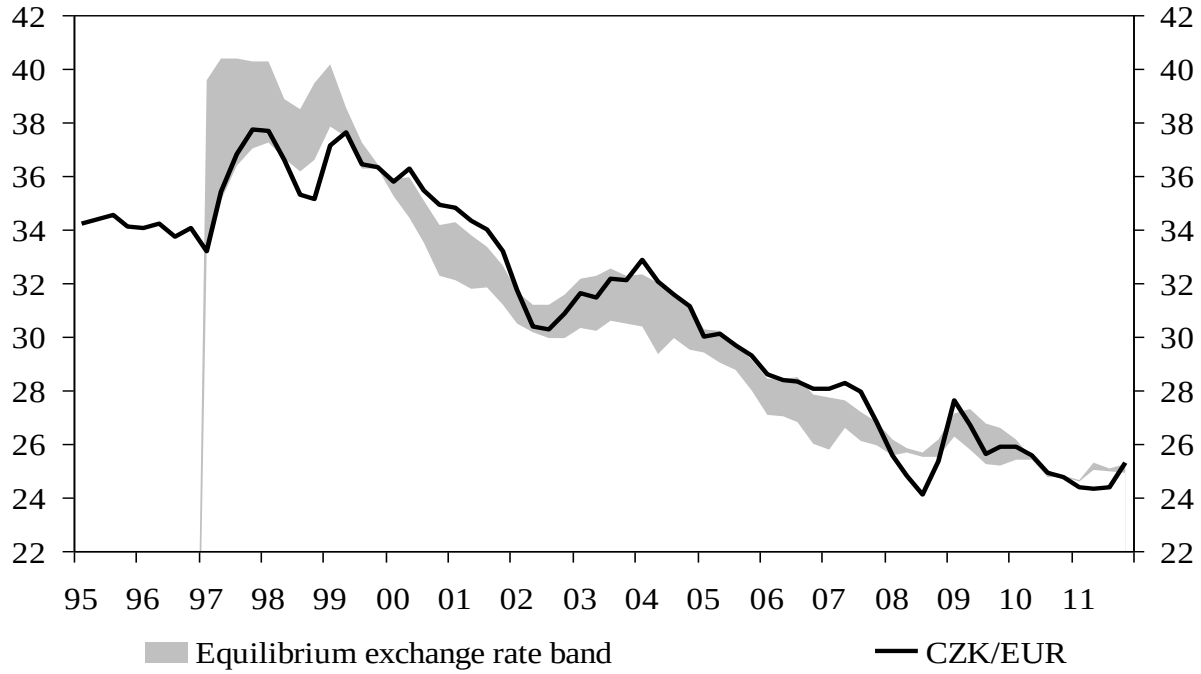
Figure 7
Estimate of the equilibrium nominal exchange rate according to the BEER and FEER models



Source: Authors' calculations using CNB, CZSO, Bloomberg, Datastream, and AMECO (European Commission) data.

Nominal equilibrium band

Figure 8
Equilibrium nominal exchange rate band according to the BEER and FEER models



Source: Authors' calculations using CNB, CZSO, Bloomberg, Datastream, and AMECO (European Commission) data.

5. Summary

- Important analysis for the small open economy
- Potential to identify misalignment, bubble
- Two models of ERER: BEER and FEER (similar outcomes)

Literature (Applied to the Czech Republic)

BEER: (Behavioural Equlibrium Exchange Rate):

- Komárek, L. Melecký, M. (2007): "The Behavioral Equilibrium Exchange Rate of the Czech Koruna", Transition Studies Review, 14 (1), s. 105-121, 2007
- Komárek, L. – Melecký, M. (2008): "Transitional appreciation of equilibrium exchange rates and the ERM II", Transition Studies Review, 15 (1), s. 95-110, 2008
- Komárek, L. – Motl, M. (2012): BEHAVIOURAL AND FUNDAMENTAL EQUILIBRIUM EXCHANGE RATE OF THE CZECH KORUNA. Politická ekonomie.

FEER: (Fundamental Real Exchange Rate):

- Šmídková, K. (1998): Estimating the FEER for the Czech Economy, Výzkumná práce ČNB č. 87.
- Komárek, L. – Motl, M. (2012): BEHAVIOURAL AND FUNDAMENTAL EQUILIBRIUM EXCHANGE RATE OF THE CZECH KORUNA. Politická ekonomie.