Discussion of “Monetary Policy and the Predictability of Nominal Exchange Rates”
by Martin Eichenbaum, Benjamin Johannsen and Sergio Rebelo

Adrien Auclert

Bank of Portugal
12 June 2017
This paper

1. Presents a new empirical fact:
   - Current level of the RER predicts NER in the long run

2. Shows that this is consistent with most New Open Economy Macro models:
   - Transitory shocks move the RER between two countries
   - Both central banks target inflation
   - So the adjustment happens mostly via the NER

   This could be a hugely influential paper!
   - For theory, applied work in academia, and policy
   - Two possible pitfalls with the empirics: intercept problem and small-sample bias
   - Both can easily be solved
Overview of the paper

- **Real exchange rate** or RER of (say) Australia vs. US:

\[ Q_t \equiv \varepsilon_t \frac{P_t^*}{P_t} \]

- price of Australian basket relative to US basket, in same currency
- \( \varepsilon_t \) is nominal exchange rate, USD per AUD
- \( P_t^* \) is Australian CPI, \( P_t \) is US CPI
- \( \varepsilon_t \uparrow \) is nominal USD depreciation, \( Q_t \uparrow \) is real USD depreciation

- In logs,

\[ q_t = e_t + p_t^* - p_t \]

- A widely studied topic in intal finance
Forecasting nominal exchange rates

▶ EJR combine two widely-agreed upon observations:

1. $Q_t \sim 1$ (PPP) in the long-run, though very slow [Rogoff 1996]
2. $\frac{P_t^*}{P_t}$ stable in inflation-targeting ('Taylor rule') countries

▶ ⇒ Nominal exchange rate at $t + k$:

$$\epsilon_{t+k} = \epsilon_t \frac{P_{t+k}^*}{P_{t+k}} \frac{P_t}{P_t^*} \frac{Q_{t+k}}{Q_t}$$
Forecasting nominal exchange rates

- EJR combine two widely-agreed upon observations:

  1. $Q_t \rightsquigarrow 1$ (PPP) in the long-run, though very slow [Rogoff 1996]
  2. $\frac{P_t^*}{P_t}$ stable in inflation-targeting ('Taylor rule') countries

- ⇒ Nominal exchange rate at $t + k$:

$$E_{t+k} = E_t \frac{P_{t+k}^*}{P_{t+k}} \frac{P_t}{P_t^*} \frac{1}{Q_t}$$
Forecasting nominal exchange rates

- EJR combine two widely-agreed upon observations:
  1. $Q_t \sim 1$ (PPP) in the long-run, though very slow [Rogoff 1996]
  2. $\frac{P^*_t}{P_t}$ stable in inflation-targeting ('Taylor rule') countries

- $\Rightarrow$ Nominal exchange rate at $t + k$:

$$E_{t+k} = E_t \frac{1}{Q_t}$$

- Can this beat the random walk model? [Meese-Rogoff 1983]
Forecasting nominal exchange rates

- EJR combine two widely-agreed upon observations:
  1. $Q_t \sim 1$ (PPP) in the long-run, though very slow [Rogoff 1996]
  2. $\frac{P_t^*}{P_t}$ stable in inflation-targeting ('Taylor rule') countries

- ⇒ Nominal exchange rate at $t + k$:

$$E_{t+k} = E_t \frac{P_{t+k}^*}{P_{t+k}} \frac{P_t}{P_t^*} \frac{Q_{t+k}}{Q_t}$$

- Can this beat the random walk model? [Meese-Rogoff 1983]
  - With log RER mean-reversion coefficient of $\rho$, suggests forecast

$$e^f_{t+k} = e_t + k (\pi^* - \pi) + (\rho^k - 1) q_t$$

where $\pi^*$, $\pi$ are inflation targets abroad and at home
Seems promising
Seems promising

![Graph of USD_AUD showing forecast and actual values from 1975q1 to 2005q1. The graph includes lines for e, MR fcast, and EJR fcast, with a focus on the log scale for the y-axis.](image)
Works like a charm
Works like a charm
**Intercept problem**

- Previous graphs drawn under the normalization $q_T = 0$
- Real exchange rates always require a normalization
  - NER known, but price indices are computed relative to a base year
  - Difficult to know *in real time* what the level of $Q_t$ is
- Not important for in-sample results, which focus on slope
  - but relevant for out-of-sample forecasts
  - and more generally for empirical exchange rate forecasting literature
- Current data uses only national price indices
  - Uses past inflation to estimate the level of $Q_t$
  - **Instead**: could try to get $Q_t$ from intal goods price comparisons
Small sample bias problem

- Main estimates are for forecasting regression

\[ e_{t+k} - e_t = \alpha + \beta_k (e_t + p^*_t - p_t) + \epsilon_t \]  

- Main finding is \( \hat{\beta}_k < 0 \), with \( |\hat{\beta}_k| \) and \( R^2 \) increasing in \( k \)
- Really nice: model generates same sign and magnitudes

**Potential problem**: small sample bias.
- Consider a null in which \( e_t \) a random walk + no price diff

\[ e_{t+1} = e_t + \eta_t \]
\[ p^*_t - p_t = 0 \]

- What does the following small sample regression predict?

\[ e_{t+k} - e_t \rightarrow e_t \]

- Application: sample size \( T = 136 \) quarters, \( k = 40 \) quarters
Small sample bias

- Forecasting regression

\[ e_{t+k} - e_t = \alpha + \beta_k e_t + \epsilon_t \]  \hspace{1cm} (2)

<table>
<thead>
<tr>
<th></th>
<th>( k = 1 ) year</th>
<th>3 years</th>
<th>5 years</th>
<th>7 years</th>
<th>10 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>MC Simulations</td>
<td>( \beta_k )</td>
<td>-0.14</td>
<td>-0.40</td>
<td>-0.59</td>
<td>-0.74</td>
</tr>
<tr>
<td></td>
<td>( R^2 )</td>
<td>0.08</td>
<td>0.22</td>
<td>0.33</td>
<td>0.41</td>
</tr>
<tr>
<td>EJR—for AUD</td>
<td>( \beta_k )</td>
<td>-0.20</td>
<td>-0.70</td>
<td>-1.06</td>
<td>-1.12</td>
</tr>
<tr>
<td></td>
<td>( R^2 )</td>
<td>0.10</td>
<td>0.39</td>
<td>0.59</td>
<td>0.60</td>
</tr>
</tbody>
</table>

- With \( T = 34 \) years, bias is large (\( \approx 50\% \) of result)

- Paper compares empirical \( \hat{\beta}_k \) with \( \text{plim} \) from theory
  - (in simplest case, theory says \( \mathbb{E}[e_{t+k}] = \rho^k e_t \), so \( \text{plim} \hat{\beta}_k = \rho^k - 1 \))
  - **Solution**: run regression in artificially generated model data
  - This nets out the small sample bias
Monte-Carlo simulation: sample path

Long horizon forecast: $T=136$ quarters, $k=40$ quarters

$q_t$ vs. $e_{t+k} - e_t$
Monte-Carlo simulations
Conclusion on empirics

- Conclusion: in-sample results suffer from a bias
  - Could try to do direct bias correction to data, or (simpler) compare model and data with identical bias
- Hence, out-of-sample results deserve more emphasis!
  - especially since they do not require ex-post information on $Q_t$
- Note: the empirical literature on exchange rate forecasting runs

$$e_{t+k} - e_t = \alpha + \beta f_t + \epsilon_t$$

on 'fundamental' ($f_t$) determinants. Did not seem to focus much on PPP. Why not?
Review of the theory

- New open economy macro model where:
  - Fundamental shocks affect the flexible-price RER in a transitory way
  - Home productivity ↓ or govt spending ↑ → ToT ↓ → RER ↓
  - Monetary policy follows a Taylor rule, so stabilizes inflation
  - Most of the adjustment to shocks happens via NER

- Argument is extremely general. Suggestion:
  - Under flex prices, consider a benchmark Taylor rules where both countries track their natural rate
  - Then, $\pi_t = \pi_t^* = 0$ always ⇒ All adjustment is through NER!
  - More generally, there is exchange rate pass through to inflation
  - ⇒ more than 100% of adjustment has to go through nominal
Added bells and whistles

- Want the model to be consistent with empirically volatile and persistent exchange rates, and unconditional UIP failure
- Get this from slow-moving real shocks and spread shocks
- Main intuition clearly remains. Why these added bells and whistles?
- What about other targets? Despite incomplete markets, the model is likely inconsistent with consumption-ReR correlation, for example (Backus-Smith puzzle)
• Really nice and thought-provoking paper!
  • Proposes a coherent, intuitive story of RER adjustment, relevant for most floats today
  • Works both in theory and in practice
  • Connection can be made even tighter
Thank you!