Interdependence of Monetary Policy and Exchange Rates

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Introduction

- Exchange rates are a key macroeconomic variable.

- Policymakers, businesses, traders and academics all pay attention.

- Understandable since it affects a number of macro variables:
  - current account
  - foreign exchange reserves
  - bank and firm balance sheets
  - other variables indirectly
Questions

- Three questions surround exchange rates
  - what factors determine exchange rate behavior?
  - how does monetary policy affect exchange rates?
  - what should the policy be towards exchange rates?
- Focus today is on first two
- Focus is on monthly/quarterly frequency, not daily
Exchange Rate Puzzles Everywhere

- Exchange rate behavior represents puzzles everywhere.
- Profit logic cannot seem to explain standard medium term exchange rate movement.
- Effects of monetary policy on exchange rates is also puzzling.
- Some puzzles are solvable, others are harder.
Exchange Rate Determination

- Two basic approaches to exchange rate determination
  - logic of goods trade
  - logic of asset trade

- Exchange rate pricing follows some arbitrage relationship
  - goods trade: purchasing power parity (PPP)
  - asset trade: interest parity (IRP)
Purchasing Power Parity

- PPP: \( P = EP^* \)

- Cost of living should be changing at same rate across countries when expressed in the same currency

- This preserves the relative purchasing power of the rupee compared with the dollar

- Holds better for developing countries

- Not a good fit for developed countries: excess volatility puzzle
The Developing World: Rupee against the USD

Inflation differential and Rupee depreciation

Inflation differential | Rupee depreciation | Rs/$
The Developed World: USD against the Euro

Inflation Differential and Dollar’s Depreciation

Sources: NY Fed, Eurostat, IMF
Interest Parity Conditions

- Two conditions:
  - covered interest parity
  - uncovered interest parity

- Covered interest parity typically holds

- Uncovered interest parity fails
  - forward premium anomaly
  - carry trade profits

- Puzzle???
Monetary Policy and Exchange Rates

- Old question: how does monetary policy affect exchange rates?
- Conventional wisdom: monetary tightening (higher interest rates) appreciate the currency
- Evidence mostly for developed countries: it holds
New Evidence on Monetary Policy and Exchange Rates

- Joint work by Hnatkovska-Lahiri-Vegh (2016)
- Look at a broader set of 72 countries
  - 25 developed and 47 developing
  - monthly data for 1974-2010
- Re-examine the empirical relationship between monetary policy and exchange rates
Empirical approach

- Monetary policy proxied by interest rates
  - T-Bill rates
  - Discount rate (if T-Bill not available)
- Exchange rates are defined as LCU/USD
- Examine relationship using simple correlations and VARs
Exchange rate regimes

- Use flexible exchange rates regimes taken from Reinhart-Rogoff (2004)

- A country could have multiple flexible rate episodes during the sample period
  - minimum 24 months data for each episode
  - 80 country-episodes pairs in total: 25 developed, 55 developing
Simple correlations

<table>
<thead>
<tr>
<th></th>
<th>Developed</th>
<th>Developing</th>
</tr>
</thead>
<tbody>
<tr>
<td>$corr(\ln E_t, i_t - i_t^{us})$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mean</td>
<td>-0.09</td>
<td>0.24</td>
</tr>
<tr>
<td>median</td>
<td>-0.08</td>
<td>0.36</td>
</tr>
<tr>
<td>$corr(\Delta_t \ln E, \Delta_t (i - i^{us}))$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mean</td>
<td>-0.10</td>
<td>0.13</td>
</tr>
<tr>
<td>median</td>
<td>-0.11</td>
<td>0.13</td>
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</tbody>
</table>

$\ln E_t = \beta_0 + \beta_1(i_t - i_t^{us}) + \varepsilon_t$

- mean($\hat{\beta}_1$) = -0.74
- 95% c.i.($\hat{\beta}_1$) = [-0.94; -0.54]

$\Delta_t \ln E_t = \alpha_0 + \alpha_1 \Delta_t (i_t - i_t^{us}) + u_t$

- mean($\hat{\alpha}_1$) = -0.44
- 95% c.i.($\hat{\alpha}_1$) = [-0.57; -0.31]
Vector AutoRegressions (VARs): Exogenous interest rate rule

Bivariate VAR specification:

- ordering: $i - i^US, \ln E$

<table>
<thead>
<tr>
<th></th>
<th>(a). Levels</th>
<th>(b). First-differences</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>impact</td>
<td>1 month</td>
</tr>
<tr>
<td>Industrial countries:</td>
<td>84%</td>
<td>88%</td>
</tr>
<tr>
<td>appreciation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Developing countries:</td>
<td>75%</td>
<td>75%</td>
</tr>
<tr>
<td>depreciation</td>
<td></td>
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</table>
Exchange Rate Response to Monetary Policy

- Developing countries behave differently from developed countries
- Developing country response is contrary to convention wisdom
- Exchange rate response puzzle???
Central banks in different countries may be responding to domestic conditions differently.

Different ability of monetary authorities to precommit to not responding to exchange rate changes in two groups of countries?

Risk premium shocks hitting developed and developing countries may be different.
VARs: Endogenous interest rate rules

▶ Specification 2. With price level: \( \ln P, i - i^{US}, \ln E \)

▶ Specification 3. With CPI inflation: \( \pi, i - i^{US}, \ln E \)

▶ Specification 4. With expected inflation: \( \pi_{t+1} - \pi^U_{t+1}, i_t - i^U_t, \ln E_t \)

▶ Specification 5. With risk premium shocks: \( rp, i - i^{US}, \ln E \)

▶ Specification 6. With output: \( \ln y, i - i^{US}, \ln E \)

▶ Specification 7. All shocks: \( rp, \ln y, \ln P, i - i^{US}, \ln E \)

▶ Specification 8. Structural VAR:
  ▶ interest rates have no long-run effects on the real exchange rate
### VAR results

Impulse response of exchange rate to interest rate shock

<table>
<thead>
<tr>
<th>Equation</th>
<th>Variables</th>
<th>Industrial</th>
<th>Developing</th>
<th>(a). Levels</th>
<th>1 month</th>
<th>3 months</th>
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<tbody>
<tr>
<td>(2):</td>
<td>$\ln P, i - i^{US}, \ln E$</td>
<td>appreciation</td>
<td>depreciation</td>
<td>82%</td>
<td>82%</td>
<td>82%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>76%</td>
<td>67%</td>
<td>74%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3):</td>
<td>$\pi - \pi^{US}, i - i^{US}, \ln E$</td>
<td>appreciation</td>
<td>depreciation</td>
<td>82%</td>
<td>82%</td>
<td>82%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>67%</td>
<td>69%</td>
<td>69%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(4):</td>
<td>$\pi_{t+1} - \pi^{US}_{t+1}, i_t - i^{US}_t, \ln E_t$</td>
<td>appreciation</td>
<td>depreciation</td>
<td>82%</td>
<td>82%</td>
<td>82%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>71%</td>
<td>69%</td>
<td>71%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(5):</td>
<td>$rp, i - i^{US}, \ln E$</td>
<td>appreciation</td>
<td>depreciation</td>
<td>72%</td>
<td>84%</td>
<td>84%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>72%</td>
<td>72%</td>
<td>69%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(6):</td>
<td>$\ln y, i - i^{US}, \ln E$</td>
<td>appreciation</td>
<td>depreciation</td>
<td>84%</td>
<td>89%</td>
<td>84%</td>
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<tr>
<td></td>
<td></td>
<td>64%</td>
<td>73%</td>
<td>64%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(7):</td>
<td>$rp, \ln y, \ln P, i - i^{US}, \ln E$</td>
<td>appreciation</td>
<td>depreciation</td>
<td>83%</td>
<td>92%</td>
<td>92%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>70%</td>
<td>60%</td>
<td>70%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Panel VARs: Impulse response (levels)

(a) industrial countries

(b) developing markets

Figure: Exchange rate response to interest rate shock
Resolving the Puzzle

- Higher interest rates typically have three effects
  - increased demand for domestic currency denominated assets: liquidity demand effect
  - higher cost of credit: output effect
  - increase in debt service: fiscal effect

- Liquidity demand effect: appreciates currency

- Credit and fiscal effects depreciate currency

- Net effect depends on relative strengths of these offsetting forces
Key to puzzle: Liquidity Demand effect

Liquidity demand effect much stronger in developed countries:

Dependent variable: 1–appreciation, 0–depreciation

<table>
<thead>
<tr>
<th></th>
<th>(i)</th>
<th>(ii)</th>
<th>(iii)</th>
<th>(iv)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-developing, 0-developed</td>
<td>-0.4073***</td>
<td>-0.1835</td>
<td>0.0362</td>
<td>0.2452</td>
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<tr>
<td></td>
<td>(0.1658)</td>
<td>(0.2763)</td>
<td>(0.2577)</td>
<td>(0.3467)</td>
</tr>
<tr>
<td>( d/h )</td>
<td>0.0440</td>
<td>0.0460</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0336)</td>
<td>(0.0498)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( m/y )</td>
<td></td>
<td></td>
<td>0.0545***</td>
<td>0.0551***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.0164)</td>
<td>(0.0169)</td>
</tr>
<tr>
<td>( N )</td>
<td>36</td>
<td>36</td>
<td>36</td>
<td>36</td>
</tr>
</tbody>
</table>
Main Takeaway

- Financial development and financial deepening are key factors underlying puzzle

- Developed countries have much higher deposit base which strengthens the positive effect

- The lower dependence on bank finance and better fiscal institutions also help
Inflation Targeting and Exchange Rates

- Since early 1990s inflation targeting has become popular amongst central banks
- India recently joined this group

- Key principle of pure inflation targeting
  - only target of policy is the (CPI) inflation rate
  - target inflation rate and policy instrument to achieve target should be clearly communicated
  - no other variable will be targeted by monetary policy
Implications of Inflation Targeting Policy

- Policy is *supposed* to ignore employment and output developments

- Implicit idea: stable inflation is best way to attain output stability

- Monetary transmission from interest rates to demand (and output) will affect inflation

- Exchange rate is supposed to *float freely* to stabilize relative prices and output markets
Exchange Rate Behavior of Inflation Targeters

- How do markets price exchange rates in countries without an exchange rate target?

- Example of Canada

  - 1.1.74-31.12.91: Flexible rates but not inflation targeter
    - Correlation between exchange rate and oil prices: +43 percent
    - CAD tended to **depreciate** when world oil prices rise
  
  - 1.1.92–present: Inflation targeting period
    - Correlation between exchange rate and oil prices: -82 percent
    - CAD tends to **appreciate** when the world oil price rises
Inflation Targeters and Oil Prices

- Canadian dollar appears to have become an oil currency since inflation targeting

- What about other inflation targeting countries?

- I looked at 27 countries during the period 1.1.74 to 31.7.17

- Countries adopted inflation targeting at various points during this period
## Baseline Results

<table>
<thead>
<tr>
<th>Variables</th>
<th>Exchange Rate</th>
<th>Exchange Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil Price</td>
<td>7.987***</td>
<td>13.90***</td>
</tr>
<tr>
<td>Oil Price*Inflation Target</td>
<td>-9.190***</td>
<td>-15.03***</td>
</tr>
<tr>
<td>Oil Net Exports share</td>
<td>-0.767***</td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>9,221</td>
<td>5,976</td>
</tr>
</tbody>
</table>

* ***p < 0.01  ** *p < 0.05  * p < 0.1
Puzzle???

- What is going on?

- Possibility: markets need a nominal anchor to price
  - it could be either a quantitative target or a price target
  - traditional monetary policy has a quantity target for either money supply or for output

- Pure inflation targeting does not provide any anchor

- Targeting inflation may not be enough to anchor currency value

- Markets could be using oil prices as a substitute anchor
Implications

- Exchange rate behavior of inflation targeters raises issues
  - rising oil prices may imply appreciating currencies of inflation targeters
  - if INR stays stable against the USD then rupee may depreciate against inflation targeting currencies
  - overall effective nominal exchange rate would tend to depreciate
- Even an implicit exchange rate target could help to stabilize the currency
Conclusions

▶ Exchange rate behavior in the medium/long term is often puzzling

▶ Some of the puzzles are resolvable with structural approaches

▶ Others are more difficult and require further study

▶ Anchoring of expectations for exchange rates may be an important factor that monetary policy may need to take into account