Monetary Policy Rules and Foreign Currency Positions

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Financial globalisation

- Dramatic increase in gross external portfolio positions since the 1990s:

Note: Average of G7 data excluding Germany. Source: Lane and Milesi-Ferretti (2007)
Currency composition of external balance sheets

- Most developed countries have a positive net foreign currency exposure, i.e. more foreign currency assets than liabilities.
- For example: UK has foreign currency assets about three times its GDP and foreign currency liabilities about twice its GDP.
- 10% balanced sterling depreciation implies a wealth transfer to the UK of about 10% of GDP.
- Most developing countries have a negative net foreign currency exposure BUT...
Shift towards a more positive foreign currency exposure

- Developed countries: more positive net foreign currency exposure
- Developing countries: smaller net negative exposures.

Distribution of aggregate foreign currency exposures (1994-2004). Source: Lane and Milesi-Ferretti (2010), Figure 3.
Shift towards a more positive (less negative) foreign currency exposure

Source: Lane and Milesi-Ferretti (2010).
Brazilian Foreign Liabilities in Domestic Currency

Currency Exposure

Source: Lane and Shambaugh AER Dataset

Source: Lane and Milesi-Ferretti (2010).
This paper

- Investigate the role of monetary policy and the composition of shocks for foreign currency portfolios.
- Central banks around the world started to put more emphasis on price stability since the mid 1980’s.
- Demand-side shocks more prominent (evidence from business cycle and asset pricing literature)

⇒ What do these facts imply for the currency composition of external balance sheets?
Overview of Main Results

- In a world where supply shocks are dominant, larger commitment to price stability by central banks implies shorter foreign currency positions.
  - As monetary policy responds aggressively to stabilize inflation, interest rate becomes countercyclical, so as the value of the domestic currency.
  - Domestic currency becomes a better hedge than foreign currency.
  ⇒ Shorter positions in foreign currency.

- More prominent demand shocks helps reconcile stronger emphasis on price stability with longer foreign currency positions.
  - Positive news about future productivity move demand
  - Price stability requires procyclical interest rates and procyclical domestic currency.
  ⇒ Longer positions in foreign currency.

- Also, we show that as monetary policy moves towards a more flexible exchange rate regime, countries also have incentives to increase their exposure to foreign currency.
Related literature

1. Optimal portfolios in DSGE
   - Devereux and Sutherland (2008, 2011), Engel and Matsumoto (2009),
   Devereux, Sutherland, Senay (2013)...

2. Monetary policy rules and exchange rate determination
   - Benigno and Benigno (2008), Clarida and Waldman (2007)

3. The role of demand (or news) shocks
   - in driving business cycles: Lorenzoni (2011), Schmitt-Grohe and Uribe
     (2012), Fujiwara et al. (2008), Nam and Wang (2010)...
   - in driving asset pricing: Pavlova and Rigobon (2007), Song (2014)...

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Monetary Policy Rules and Foreign Currency Positions
Plan

- Summarize building blocks of the model
- Present analytical results using a simple version of the model without news
- Numerical sensitivity analysis
  - with respect to monetary policy reaction coefficients
  - with respect to the relative variance of demand shocks
Main features of the model

2-country 2-good production model with

- sticky prices
- trade in domestic and foreign bonds in each country
- country-specific shocks to productivity (anticipated and unanticipated) and monetary policy shocks
  - Anticipated shocks work as demand shock
- internationally incomplete markets (6 shocks, 2 bonds)
Approximated solution

- Excess return on foreign bonds is the unanticipated depreciation:
  \[ \hat{r}_{x,t+1} = \hat{r}_{F,t+1} - \hat{r}_{H,t+1} = \hat{S}_{t+1} - E_t \hat{S}_{t+1} + O(\varepsilon^2) \]

- Foreign bond portfolio, \( \hat{\alpha} \), determined by covariance between relative consumption (adjusted for the real exchange rate) and excess return, \( \hat{r}_x \)
  - Short position in foreign currency, \( \hat{\alpha} < 0 \): if foreign (domestic) currency depreciate (appreciate) in bad times
  - Long position in foreign currency, \( \hat{\alpha} > 0 \): if foreign (domestic) currency appreciate (depreciate) in bad times
Partial equilibrium solution

\[ \tilde{\alpha} = -\frac{1}{2(1 - \beta)} \frac{Cov_t(\Lambda_{Y^R,t+1}, \hat{r}_{x,t+1})}{Var_t(\hat{r}_{x,t+1})}. \]  

(1)

where \( \Lambda_{Y^R,t+1} \) as the ‘surprise at time \( t + 1 \)' about the present discounted value of future relative income adjusted by the real exchange rate:

\[ \Lambda_{Y^R,t+1} \equiv E_t \sum_{j=0}^{\infty} \beta^j \Delta \hat{Y}_{t+1+j}^R - E_t \sum_{j=0}^{\infty} \beta^j \Delta \hat{Y}_{t+1+j}^R \]  

(2)

▶ It is optimal to take a long position in foreign currency (i.e. \( \tilde{\alpha} > 0 \)) if foreign currency appreciates in periods when income is lower at home than abroad, i.e. \( Cov_t(\Lambda_{Y^R,t+1}, r_{x,t+1}) < 0 \)

▶ This covariance will critically depend on monetary policy:
  ▶ monetary policy \( \Rightarrow \) interest rates \( \Rightarrow \) exchange rates
Analytical solution in the simplest version of the model

- Simplify the model
  - Endowment economy
  - Flexible prices
  - Inflation-targeting Taylor rule

- What does the model imply for the link between monetary policy rules and optimal foreign currency positions?
Analytical solution

- Steady-state foreign bond holdings:

\[
\hat{\alpha} = -\frac{(1 - \nu)(2\nu - 1)\Lambda_1 \left[ 1 - \frac{\beta}{1-\beta} (\phi_{\pi} - 1)\Lambda_4 \frac{\sigma_z^2}{\sigma_u^2} \right]}{(1 - \beta) \left( (1 + 2\nu (\theta - 1)) \Lambda_2 \frac{\sigma_R/\phi_{\pi}^2}{\sigma_u^2} + \rho (2\nu - 1)^2 \left[ 1 - \Lambda_4 \frac{\sigma_z^2}{\sigma_u^2} \right] \right)}
\]

- If \(\sigma_z^2 = 0\) \(\implies\) \(\hat{\alpha} < 0\) for reasonable parameter values (some home bias and domestic and imported goods are substitutes)

- If \(\phi_{\pi} > \bar{\phi}_{\pi}\) \(\implies\) \(\partial \hat{\alpha}_{tr|\sigma_M^2 = 0} / \partial (\sigma_z^2 / \sigma_u^2) > 0\)
Inflation targeting and optimal foreign currency portfolio

- Adverse supply shock:
  \[ Y \downarrow, C \downarrow, \pi \uparrow \implies R \uparrow. \]
  From UIP \( S \downarrow \implies \text{go short in foreign bonds } \tilde{\alpha} < 0 \)

- Adverse demand shock:
  \[ Y \downarrow, C \downarrow, \pi \downarrow \implies R \downarrow. \]
  From UIP \( S \uparrow \implies \text{go long in foreign bonds } \tilde{\alpha} > 0. \)
## Calibration of the Sticky Price Model under LCP

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Taylor Rule</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta$</td>
<td>Steady-state discount factor</td>
<td>0.99</td>
</tr>
<tr>
<td>$\rho$</td>
<td>CRRA</td>
<td>2</td>
</tr>
<tr>
<td>$\varpi$</td>
<td>Inverse of Frisch elas.</td>
<td>2.5</td>
</tr>
<tr>
<td>$\theta$</td>
<td>Elas. of subs. across dom. and foreign goods</td>
<td>2</td>
</tr>
<tr>
<td>$\nu$</td>
<td>Preference for domestic goods in consumption</td>
<td>0.85</td>
</tr>
<tr>
<td>$\phi$</td>
<td>Elas. of subs. across domestic varieties</td>
<td>10</td>
</tr>
<tr>
<td>$\kappa$</td>
<td>Calvo parameter of price stickiness</td>
<td>0.75</td>
</tr>
<tr>
<td>$\delta$</td>
<td>Depreciation rate of capital</td>
<td>0.025</td>
</tr>
<tr>
<td>$\Phi$</td>
<td>Capital adjustment cost parameter</td>
<td>1.3</td>
</tr>
<tr>
<td>$\zeta$</td>
<td>Persistence of unanticipated productivity shocks</td>
<td>0.95</td>
</tr>
<tr>
<td>$p$</td>
<td>Lag of the anticipated productivity shock</td>
<td>6</td>
</tr>
<tr>
<td>$\phi_{\pi}$</td>
<td>Reaction to inflation</td>
<td>2.5</td>
</tr>
<tr>
<td>$\phi_Y$</td>
<td>Reaction to output</td>
<td>0</td>
</tr>
<tr>
<td>$\phi_S$</td>
<td>Reaction to nom. exchange rate</td>
<td>0</td>
</tr>
<tr>
<td>$\sigma_u$</td>
<td>Standard dev. of unanticipated TFP shocks</td>
<td>0.0045</td>
</tr>
<tr>
<td>$\sigma_R$</td>
<td>Standard dev. of interest rate shocks</td>
<td>0.0024</td>
</tr>
<tr>
<td>$\sigma_{z}/\sigma_u$</td>
<td>Relative size of news shocks wrt TFP shocks</td>
<td>1.65</td>
</tr>
<tr>
<td>Cor($u_i, u_j^*$)</td>
<td>Cross-country corr. of $u_i$ shocks $i = a, u$</td>
<td>0.25</td>
</tr>
</tbody>
</table>
## Bond Portfolio and Business Cycle Moments: Data vs. Model

<table>
<thead>
<tr>
<th></th>
<th>Data</th>
<th>Benchmark (1)</th>
<th>Only TFP (2)</th>
<th>Only TFP News (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\tilde{\alpha}_B^*/\beta \tilde{Y}$</td>
<td>0.53</td>
<td>1.09</td>
<td>-5.22</td>
<td>4.76</td>
</tr>
<tr>
<td>Std(Y)</td>
<td>1.57</td>
<td>1.68</td>
<td>0.79</td>
<td>0.83</td>
</tr>
<tr>
<td>Std(C)/Std(Y)</td>
<td>0.76</td>
<td>0.30</td>
<td>0.37</td>
<td>0.29</td>
</tr>
<tr>
<td>Std(I)/Std(Y)</td>
<td>4.55</td>
<td>3.62</td>
<td>3.44</td>
<td>3.64</td>
</tr>
<tr>
<td>Std(N)/Std(Y)</td>
<td>0.75</td>
<td>0.55</td>
<td>0.51</td>
<td>0.56</td>
</tr>
<tr>
<td>Std(Q)/Std(Y)</td>
<td>3.06</td>
<td>0.51</td>
<td>0.65</td>
<td>0.57</td>
</tr>
<tr>
<td>Corr(Y,C)</td>
<td>0.84</td>
<td>0.80</td>
<td>0.73</td>
<td>0.81</td>
</tr>
<tr>
<td>Corr(Y,I)</td>
<td>0.91</td>
<td>0.99</td>
<td>0.97</td>
<td>0.99</td>
</tr>
<tr>
<td>Corr(Y,N)</td>
<td>0.87</td>
<td>0.65</td>
<td>0.53</td>
<td>0.70</td>
</tr>
<tr>
<td>Corr(Y,Y*)</td>
<td>0.44</td>
<td>0.41</td>
<td>0.33</td>
<td>0.41</td>
</tr>
<tr>
<td>Corr(C,C*)</td>
<td>0.36</td>
<td>0.43</td>
<td>0.48</td>
<td>0.39</td>
</tr>
<tr>
<td>Corr(I,I*)</td>
<td>0.28</td>
<td>0.34</td>
<td>0.33</td>
<td>0.33</td>
</tr>
<tr>
<td>Corr(N,N*)</td>
<td>0.40</td>
<td>0.44</td>
<td>0.22</td>
<td>0.46</td>
</tr>
</tbody>
</table>

Notes: Data is from Mandelman et al.(2011) calculated for the U.S and an aggregate of 15 countries for the period between 1973:1 to 2006:4. Column (1) reports business cycle moments when the model is calibrated as in the previous table. Column (2) (Column (3)) reports business cycle moments when the model is calibrated as in the previous table except $\sigma_z/\sigma_u = 0$ ($\sigma_z = 0.0045$ and $\sigma_u = 0$).
Impulse Responses to Anticipated and Unanticipated TFP Shocks

(a) Inflation
(b) Output
(c) Consumption
(d) Investment
(e) Labor Productivity
(f) Real Exchange Rate (Q)
(g) Nominal Exchange Rate
(h) Relative Cons. adjusted by RER
Foreign Currency Portfolio and Determinants with Respect to the Inflation Reaction Coefficient

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Foreign Currency Portfolio and Determinants with Respect to the Exchange Rate Reaction Coefficient

(a) Foreign Bonds/GDP

(b) C-C*\(Q/\rho\)

(c) RX1

(d) Q

(e) Foreign Bonds/GDP

(f) C-C*\(Q/\rho\)

(g) RX1

(h) Q

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Conclusion

- A move towards an inflation targeting regime when demand shocks are prominent would induce investors to be more exposed to foreign currency (and have more of their liabilities in domestic currency).
- News shock can act as a demand shock, increasing relative consumption and domestic prices at the same time.
  \[ \rightarrow \] making foreign currency a good hedge.
- There needs to be a sufficient role for news shocks if the workhorse portfolio model is to reconcile the increased emphasis on price stability with longer foreign currency positions.
- Move to more flexible exchange rate regimes can also help explain facts
Further steps

- Understand foreign currency positions during and post crisis
Consumers

The representative agent in home economy chooses $C_t, \frac{M_t}{P_t}, L_t, \alpha_{H,t}$ and $\alpha_{F,t}$ to maximise

$$U_t = E_t \sum_{s=t}^{\infty} \beta^{s-t} \left[ \frac{C_1^{1-\rho}}{1-\rho} + \chi \log \left( \frac{M_s}{P_s} \right) - K \frac{L_1^{1+\omega}}{1+\omega} \right]$$

with

$$C_t = \left[ \nu \frac{1}{\theta} C_{H,t}^{\theta-1} + (1-\nu) \frac{1}{\theta} C_{F,t}^{\theta-1} \right]^\frac{\theta}{\theta-1},$$

subject to the budget constraint

$$\alpha_{H,t} + \alpha_{F,t} + \frac{M_t}{P_t} = \alpha_{H,t-1} r_{H,t} + \alpha_{F,t-1} r_{F,t} + \frac{M_{t-1}}{P_{t-1}} \frac{P_{t-1}}{P_t} + \frac{P_{H,t}}{P_t} Y_t - C_t - T_t,$$

where $\alpha_{H,t} + \alpha_{F,t} \equiv NFA_t$, $\alpha_{H,t} + \alpha^*_t = 0$ and $\alpha_{F,t} + \alpha^*_t = 0$. 
Firms

- Production technology faced by each monopolistically competitive firm:

\[ Y_t = A_t(u_t K_t)^\mu (L_t)^{1-\mu} \]

where \( A_t \) is a common stochastic productivity shock that follows an AR(1) process.

\[ \log A_t = \zeta \log A_{t-1} + \log z_{t-p} + \varepsilon_{A,t}, \quad 0 \leq \zeta \leq 1, \quad (6) \]

\[ \log z_t = \zeta_z \log z_{t-1} + \varepsilon_{z,t}, \quad 0 \leq \zeta_z \leq 1. \quad (7) \]

- \( \varepsilon_{A,t} \) : Unanticipated productivity shock

- \( \varepsilon_{z,t} \) : "News shocks" - productivity shock anticipated \( p \) periods in advance
  (works as a demand shock)
Price Setting

- Prices change at random intervals à la Calvo.
- At each period a fraction $\kappa \in [0, 1)$ of randomly selected firms cannot change their prices.
- The remaining $1 - \kappa$ fraction of firms chooses prices optimally to maximise expected discounted value of future profits from selling at home and abroad subject to the demand functions for $\tilde{Y}_{H,t}$ and $\tilde{Y}^*_H,t$.
- Export prices can be set in the currency of the importer (LCP - benchmark) or the currency of the exporter (PCP).
Policy rules

- Home country

\[ R_{H,t+1} = \beta \left( \frac{P_t}{P_{t-1}} \right)^{\phi_\pi} \left( \frac{Y_t}{Y_{t-1}} \right)^{\phi_Y} \left( \frac{S_t}{S_{t-1}} \right)^{\phi_S} \exp(\varepsilon_{R,t}) \]  

where \( E_{t-1}[\varepsilon_{R,t}] = 0 \) and \( \text{Var}[\varepsilon_{R,t}] = \sigma_R^2 \).

- Foreign country

\[ R_{F,t+1}^* = \beta \left( \frac{P_t^*}{P_{t-1}^*} \right)^{\phi_\pi} \left( \frac{Y_t^*}{Y_{t-1}^*} \right)^{\phi_Y} \exp(\varepsilon_{R^*,t}) \]  

where \( E_{t-1}[\varepsilon_{R^*,t}] = 0 \) and \( \text{Var}[\varepsilon_{R^*,t}] = \sigma_{R^*}^2 \).