Monetary and Financial Policies in Emerging Markets

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Emerging market economies tend to be vulnerable to global financial cycle

Why?

How to conduct monetary policy?

How to coordinate with macro-prudential policy?

Approach: Open Economy New Keynesian + Banks
Foreign debt \( \epsilon_t D_t^* \)

Bank finance
\[ Q_t K_t^b + \chi_t^b = D_t + \epsilon_t D_t^* + N_t \]

Transaction cost \( \chi_t^b \)

Direct finance: \( Q_t K_t^h \)

Deadweight Loss

Foreigners

Banks

Home deposit \( D_t \)

Businesses

Households
Transmission of external financial shocks

1. Foreign interest rate rises $R_t^* \uparrow$

2. Foreign exchange rate depreciates $\epsilon_t \uparrow$

3. Inflation rate rises $\pi_t \uparrow$

4. Home interest rate rises $i_t \uparrow$

5. Capital price falls $Q_t \downarrow$

6. Value added productivity $\downarrow$

7. Export increases $E_{xt} \uparrow$

8. Bank net worth decreases $N_t \downarrow\downarrow$

9. Output $Y_t \uparrow\downarrow$

10. Capital investment decreases $I_t \downarrow$

11. Transmission of external financial shocks

12. Value added productivity $\downarrow$

13. Inflation rate rises $\pi_t \uparrow$
Model

\[ Y_t = \left( \int_0^1 y_{it} \frac{\eta-1}{\eta} \, di \right) \frac{\eta}{\eta-1} : \text{final goods} \]

\[ y_{it} = A_t \frac{\left( k_{it}' \right)^{\alpha_K}}{\alpha_K} \left( m_{it} \right)^{\alpha_M} \left( \frac{l_{it}}{1 - \alpha_K - \alpha_M} \right)^{1 - \alpha_K - \alpha_M} \]

\[ m_t^C = \frac{1}{A_t} Z_t^{\alpha_K} \epsilon_t^{\alpha_M} \omega_t^{1 - \alpha_K - \alpha_M} \]

\[ \text{Max} \ E_0 \left\{ \sum_{t=0}^{\infty} \Lambda_{0,t} \left[ \left( \frac{p_{it}}{P_t} - m_t^C \right) y_{it} - \frac{\kappa}{2} \left( \frac{p_{it}}{p_{it-1}} - 1 \right)^2 Y_t \right] \right\} \]

\[ \pi_t (\pi_t - 1) = \frac{\eta}{\kappa} \left( m_t^C - \frac{\eta-1}{\eta} \right) + E_t \left[ \Lambda_{t,t+1} \frac{Y_{t+1}}{Y_t} \pi_{t+1} \left( \pi_{t+1} - 1 \right) \right] \]

where \( \pi_t = \frac{P_t}{P_{t-1}} \)
Capital accumulation

\[ K_t = I_t + \lambda K_{t-1} \]

Cost of Investment

\[
\text{Cost of Investment} = \left[ 1 + \frac{\kappa I}{2} \left( \frac{I_t}{I} - 1 \right)^2 \right] I_t
\]

Export

\[
E_{Xt} = \left( \frac{P_t}{e_t P^*_t} \right)^{-\varphi} \quad Y_t^* = \epsilon_t^\varphi Y_t^*, \quad \text{where } \epsilon_t = \frac{e_t P_t^*}{P_t^*}
\]

\[ P_t^* = P^* = 1 \]
Household

Each household consists of a continuum of workers and bankers

Each banker manages a bank until retires with probability $1 - \sigma$, and then brings back the net worth as dividend

Equal number of workers become new bankers with start-up funds given by the household

Household saves in home currency deposit and capital ownership. To own capital, household needs management cost

$$\frac{x^h}{2} \left( \frac{K^h_t}{K_t} \right)^2 K_t$$

Household members consume together
Household’s choice

\[ E_t \left[ \sum_{t=0}^{\infty} \beta^t \ln \left( C_t - \frac{\zeta_0}{1 + \zeta} L_t^{1+\zeta} \right) \right] \]

\[ 1 = E_t \left( \Lambda_{t,t+1} \frac{Z_{t+1} + \lambda Q_{t+1}}{Q_t + \frac{\chi^b K^h_t}{K_t}} \right) \]

Bank’s Flow-of-funds

\[ Q_t k^b_t + \frac{\chi^b (\epsilon_t d^*_t)^2}{2 Q_t k^b_t} = n_t + d_t + \epsilon_t d^*_t \]

\[ n_t = (Z_t + \lambda Q_t) k^b_{t-1} - R_t d_{t-1} - \epsilon_t R^*_t d^*_{t-1} \]

Bank franchise value

\[ V_t = E_t \{ \Lambda_{t,t+1} [(1 - \sigma) n_{t+j} + \sigma V_{t+1}] \} \]
\[ Z_t \text{ is realized} \]

**B/S of Bank**

<table>
<thead>
<tr>
<th>Bank loan ( Q_t k_t^b )</th>
<th>Deposit ( d_t )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Costs ( \chi^b \frac{(\epsilon_t d_t^*)^2}{Q_t k_t^b} )</td>
<td>Foreign debt ( \epsilon_t d_t^* )</td>
</tr>
<tr>
<td>Net worth: ( n_t )</td>
<td></td>
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</tbody>
</table>

**Incentive constraint:**
\[ \theta Q_t k_t^b \leq V_t \]

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Figure 2: Timing
The bank chooses the leverage multiple $\phi_t = \frac{Q_t k_t^b}{n_t}$ and the share of foreign borrowing $x_t = \frac{\epsilon_t a_t^*}{Q_t k_t^b}$ to maximize Tobin’s Q

$$\frac{V_t}{n_t} = \psi_t = E_t \left[ \Lambda_{t,t+1}(1 - \sigma + \sigma \psi_{t+1}) \frac{n_{t+1}}{n_t} \right], \text{ st. } \psi_t \geq \theta \phi_t$$

$$\phi_t = \phi \left( \frac{\mu_t}{\nu_t^+}, \frac{\mu_t^*}{\nu_t^+} \right), \quad x_t = x \left( \frac{\mu_t^*}{\nu_t^+} \right)$$

$$\mu_t = E_t \left[ \Lambda_{t,t+1}(1 - \sigma + \sigma \psi_{t+1}) \left( \frac{Z_{t+1} + \lambda Q_{t+1}}{Q_t} - R_{t+1} \right) \right]$$

$$\mu_t^* = E_t \left[ \Lambda_{t,t+1}(1 - \sigma + \sigma \psi_{t+1}) \left( R_{t+1} - \frac{\epsilon_{t+1}}{\epsilon_t} R_{t+1}^* \right) \right]$$

$$\nu_t = E_t \left[ \Lambda_{t,t+1}(1 - \sigma + \sigma \psi_{t+1}) R_{t+1} \right]$$
Bank balance sheet

\[ Q_t K_t^b \left( 1 + \frac{\chi^b}{2} x_t^2 \right) = \phi_t N_t \left( 1 + \frac{\chi^b}{2} x_t^2 \right) = N_t + D_t + \epsilon_t D_t^* \]

\[ N_t = (\sigma + \xi) (Z_t + \lambda Q_t) K_{t-1}^b - \sigma R_t D_{t-1} - \sigma \epsilon_t R_{t-1}^* D_{t-1}^* \]

Capital market

\[ K_t = K_t^b + K_t^h \]

Net foreign debt

\[ \epsilon_t D_t^* = x_t Q_t K_t^b = x_t \phi_t N_t \]

\[ D_t^* = R_{t-1}^* D_{t-1}^* + M_t - \frac{1}{\epsilon_t} E_{xt} \]
Goods market equilibrium

\[ Y_t = C_t + \left[ 1 + \frac{\kappa I}{2} \left( \frac{I_t}{I} - 1 \right)^2 \right] I_t + E_{Xt} \]

\[ + \frac{\kappa}{2} (\pi_t - 1)^2 Y_t + \frac{\chi^h (K_t^h)^2}{2 K_t} + \frac{\chi^b}{2} x_t^2 Q_t K_t^b \]

Net output

\[ Y_t^n = Y_t - \epsilon_t M_t - \frac{\kappa}{2} (\pi_t - 1)^2 Y_t - \frac{\chi^h (K_t^h)^2}{2 K_t} - \frac{\chi^b}{2} x_t^2 Q_t K_t^b \]

Monetary policy rule

\[ i_t - i = (1 - \rho_i) \omega_{\pi} (\pi_t - 1) + \rho_i (i_{t-1} - i) + \xi_t^i \]
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\theta$</td>
<td>divertable proportion of asset</td>
<td>0.401</td>
</tr>
<tr>
<td>$\sigma$</td>
<td>survival probability</td>
<td>0.94</td>
</tr>
<tr>
<td>$\xi$</td>
<td>fraction of assets brought by new banks</td>
<td>0.0045</td>
</tr>
<tr>
<td>$\kappa^b$</td>
<td>managem’t cost parameter of foreign borrowing</td>
<td>0.0197</td>
</tr>
<tr>
<td>$\beta$</td>
<td>discount rate</td>
<td>0.985</td>
</tr>
<tr>
<td>$\zeta$</td>
<td>inverse of Frisch elasticity of labor supply</td>
<td>0.333</td>
</tr>
<tr>
<td>$\kappa^h$</td>
<td>management cost parameter of direct finance</td>
<td>0.0197</td>
</tr>
<tr>
<td>$\alpha_M$</td>
<td>cost share of imported intermediate goods</td>
<td>0.18</td>
</tr>
<tr>
<td>$\omega$</td>
<td>fraction of non-adjusters $\kappa = \frac{(\eta-1)\omega}{(1-\omega)(1-\beta\omega)}$</td>
<td>0.66</td>
</tr>
<tr>
<td>$\varphi$</td>
<td>price elasticity of export demand</td>
<td>1</td>
</tr>
<tr>
<td>Symbol</td>
<td>Description</td>
<td>Value</td>
</tr>
<tr>
<td>-------</td>
<td>--------------------------------------------------</td>
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</tr>
<tr>
<td>$R^*$</td>
<td>foreign interest rate</td>
<td>1.04</td>
</tr>
<tr>
<td>$R$</td>
<td>deposit interest rate</td>
<td>1.06</td>
</tr>
<tr>
<td>$R_k$</td>
<td>rate of return on capital for bank</td>
<td>1.08</td>
</tr>
<tr>
<td>$\phi$</td>
<td>bank leverage multiple</td>
<td>4</td>
</tr>
<tr>
<td>$x$</td>
<td>foreign debt-to-bank asset ratio</td>
<td>0.25</td>
</tr>
<tr>
<td>$\frac{K}{Y-\epsilon M}$</td>
<td>capital-output ratio</td>
<td>1.98</td>
</tr>
<tr>
<td>$K^b/K$</td>
<td>share of capital financed by banks</td>
<td>0.75</td>
</tr>
<tr>
<td>$\frac{\epsilon D^*}{Y-\epsilon M}$</td>
<td>foreign debt-to-GDP ratio</td>
<td>0.37</td>
</tr>
<tr>
<td>$Y - \epsilon M$</td>
<td>GDP</td>
<td>10.1</td>
</tr>
<tr>
<td>$\chi^h (K^h)^2 / K$</td>
<td>cost of direct finance</td>
<td>0.01</td>
</tr>
</tbody>
</table>
Impulse response to foreign interest rate shock

- Net output
- Consumption
- Investment
- Export
- Import (log(ε M))
- Net foreign debt
- Real exchange rate
- Capital price
- Net worth
- Inflation
- Nominal interest
- Foreign interest shock

Baseline
Impulse response to foreign interest rate shock

- **Net output**
- **Consumption**
- **Investment**
- **Export**
- **Import (log(\(\epsilon M\)))**
- **Net foreign debt**
- **Real exchange rate**
- **Capital price**
- **Net worth**
- **Inflation**
- **Nominal interest**

**Foreign interest shock**
Macro-prudential policy:

Tax on foreign currency borrowing $\tau^D_t$

Subsidy on net worth $\tau^N_t$ to balance the budget

$$\tau^N_t N_t = \tau^D_t \epsilon_t D^*_t$$

Cyclical macro-prudential policy

$$\tau^D_t = \omega_{\tau^D} \left( \ln K^b_{t-1} - \ln K^b \right)$$
Stand dev of \((\ln R_t^*, i_t, \ln A_t, \ln Y_t^*) = (2.0, 0.5, 1.3, 3.0)\)%

Fraction of non-price-adjusters is 0.1 in a quarter

| Welfare Effects: Flexible Price and Large \(\text{var}(R_t^*)\) |
|-----------------|-----------------|-----------------|
| \(\omega_\pi \setminus \omega_{D^*}\) | 0 | 0.01 | 0.02 |
| 1.25 | 0.06% | 0.13 | 0.19 |
| 1.5 | 0.00 | 0.10 | 0.18 |
| 2.0 | -0.06 | 0.07 | 0.17 |
Remark on Policy

Procyclical tax on bank foreign borrowing significantly improves welfare if external financial shocks are important and prices are flexible.

It allows monetary authority to pursue macroeconomic stability. Strict inflation targeting without macro-prudential policy can reduce welfare.

Topics for future research: home-currency denominated debt, currency hedging, foreign exchange intervention, gross financial flows and foreign direct investment.
Transmission of External Financial Shocks in Real Model

- Foreign interest rate rises $R^* \uparrow$
- Real exchange rate depreciates $\epsilon_t \uparrow$
- Value added productivity $\frac{A_t}{(\epsilon_t)^{\alpha_M}} \downarrow$
- Home real interest rate rises $R_t \uparrow$
- Capital price falls $Q_t \downarrow$
- Export increases $E_{Xt} \uparrow$
- Bank net worth decreases $N_t \downarrow$
- Capital investment decreases $I_t \downarrow$
- Output $Y_t \downarrow$
Effect of macroprudential policy to foreign interest rate shock

- net output
- consumption
- investment
- import (log(IM))
- net foreign debt
- real exchange rate
- capital price
- net worth
- inflation
- nominal interest
- foreign interest shock
- foreign debt tax

Lines represent: with policy, baseline
Foreign fund: $\mathcal{D}_t^* = \mathcal{D}_t + \mathcal{D}_t^* + \mathcal{N}_t$

Bank finance: $Q_t K_t^b = D_t + D_t^* + N_t$

Direct finance: $Q_t K_t^h$

EM Funds

Foreign debt: $\epsilon_t D_t^*$

Home Banks

Home deposit $D_t$

Deadweight Loss

Businesses

Households