Monetary Policy Regimes and Capital Account Restrictions in a Small Open Economy

Zheng Liu and Mark M. Spiegel

\textsuperscript{a}Federal Reserve Bank of San Francisco

BOK IMF Conference on Asia Challenges of Stability and Growth Seoul, Korea September 26, 2013

\footnote{The views expressed herein are those of the authors and do not necessarily reflect the views of the Federal Reserve Bank of San Francisco or the Federal Reserve System.}
Low global rates following crisis encouraged EME inflows

- Relatively higher yields, combined with superior growth prospects
- Concerns expressed by EME policy makers about capital inflows
  - Western central banks maintained policies appropriate
  - Also important for EMEs to ensure Western recovery [e.g. Bernanke (2012)]
- Surges led to reconsideration of capital flow restrictions and other policies aimed at stemming inflows [Ostry, et al (2010)]
  - Mitigate excessive booms and exposure to sudden stops
- When possible, central banks also engaged in sterilization to mitigate real impact of inflows
In low interest rate environments, sterilization can be costly

- Policy problems faced by PBOC [Chang, Liu, and Spiegel (2012)]
  - To maintain closed capital account, PBOC purchased export proceeds with domestic assets
  - Profitable when foreign interest rates were high
  - Sterilization costly when global rates are low

- Many parallels for Asian small open economies
  - Pressures from low global rates through capital inflow surges
  - Under imperfect asset substitutability, central bank can sterilize inflows
  - But likely to be costly

- Costly sterilization $\Rightarrow$ tradeoff between stabilizing inflation and capital account
We consider 2 types of capital account restrictions and 3 alternative monetary regimes

- Capital account restrictions
  1. Optimal time-varying tax rate on capital inflows
  2. Simple constant tax on capital inflows

- Monetary policy regimes
  1. Standard loss function
  2. Inflation-stabilizing central banker
  3. Exchange-rate stabilizing central banker
Implications of capital account restrictions

- Two types of capital controls
  - Time-varying tax: Set optimally over cycle [e.g. Jeanne and Korinek (2010)]
  - Simple tax: Constant positive tax rate
    - Infrequently adjusted in practice [Chinn Ito (2002)]

- Compare welfare outcomes under these alternative capital control regimes

- Time-varying policy
  - Very effective in smoothing foreign interest rate shocks
  - Less effective for foreign demand shocks

- Simple policy leaves room for further stabilization through monetary policy
Implications of alternative monetary policy regimes

- Examine outcomes under each regime with simple and optimal capital controls
- “Standard” policy regime places equal weights on inflation and output and also stabilizes household portfolio compositions
- Inflation-stabilizing central banker places higher weight on inflation
  - Improves outcomes under simple controls, but provides no improvement under optimal controls
- Exchange-rate stabilizing central bank places higher weight on real exchange rate
  - Improves outcome under both capital account policies
Related Literature

- Many papers have found potential role for capital account restrictions
  - Jeanne and Korinek (2010): Time-varying Pigouvian tax on borrowing can internalize externalities associated with international borrowing
  - Korinek (2013): Taxes can substitute for global policy coordination
  - Bianchi (2011): Under financial frictions, capital controls can recover constrained-efficient allocations
  - Farhi and Werning (2012): Mitigate effects of excessive capital movements

- This paper first to analyze capital account restrictions in a monetary model
  - Needed for assessing implications of sterilization
  - Important component of monetary response to capital inflows
Key features of model

- Build on NK small open-economy model
  
  1. Imperfect international asset substitutability
  2. Sticky prices
  3. Sterilization policy
1. Imperfect asset substitutability

- Household maximize utility function subject to

\[
C_t + \frac{M_t}{P_t} + \frac{B_{ht} + e_t B_{ht}^*}{P_t} \left[ 1 + \frac{\Omega_b}{2} \left( \frac{B_{ht}}{B_{ht} + e_t B_{ht}^*} - \bar{\psi} \right)^2 \right] \\
\leq w_t L_t + \frac{M_{t-1}}{P_t} + \frac{R_{t-1} B_{h,t-1} + e_t R_{t-1} B_{h,t-1}^*}{P_t} + d_t,
\]

- \(\Omega_b\) represents cost of portfolio adjustment
1. Imperfect asset substitutability (cont’d)

- Let $\psi_t$ denote the domestic bond share:

$$
\psi_t = \frac{B_{ht}}{B_{ht} + e_t B_{ht}^*}
$$

- Optimal choices of $B_{ht}$ and $B_{ht}^*$ satisfy

$$
\Omega_b (1 + \psi_t) (\psi_t - \bar{\psi}) = E_t \frac{\beta \Lambda_{t+1}}{\Lambda_t} \frac{1}{\pi_{t+1}} \left[ R_t - R_t^* \frac{e_{t+1}}{e_t} \right],
$$

- If $\Omega_b = 0$, reduces to the standard UIP condition.

- Foreign demand for domestic bonds

$$
\frac{B_{ft}}{Z^p_t P_t} = f \left( E_t (1 - \tau_t) R_t \frac{e_t}{e_{t+1}} - R_t^* \right),
$$

where $f'(\cdot) > 0$ and $\tau_t$ represents taxes on foreign-held bonds.
2. Sticky prices

- Monopolistic competition in product markets
- Quadratic price adjustment costs (Rotemberg, 1982)

\[ \frac{\Omega_p}{2} \left( \frac{P_t(j)}{\pi P_{t-1}(j)} - 1 \right)^2 C_t, \]

where \( \Omega_p \) represents price adjustment costs

- Phillips curve relation:

\[ \nu_t = \frac{\epsilon - 1}{\epsilon} + \frac{\Omega_p}{\epsilon} \frac{C_t}{Y_t} \left[ \left( \frac{\pi t}{\pi} - 1 \right) \frac{\pi t}{\pi} - \beta E_t \left( \frac{\pi t+1}{\pi} - 1 \right) \frac{\pi t+1}{\pi} \right] \]
3. Sterilization policy

- Foreign capital flows

\[ ca_t = e_t \frac{B_t^* - B_{t-1}^*}{P_t} - \frac{B_{ft} - B_{f,t-1}}{P_t} \]

- Government flow-of-funds constraint

\[ e_t(B_{gt}^* - R_{t-1}^* B_{g,t-1}^*) \leq B_t - R_{t-1} B_{t-1} + M_t^s - M_{t-1}^s + \tau_t R_t B_{ft}, \]

where \( B_{gt}^* \) denotes central bank holdings of foreign bond
External shocks

- Export demand schedule

\[
X_t = \left( \frac{P_t}{e_t P_t^*} \right)^{-\theta} \tilde{X}_t^* Z_t^P = q_t^\theta \tilde{X}_t^* Z_t^P,
\]

where \( Z_t^P \) allows for balanced growth.

- Foreign interest rate and aggregate demand are exogenous

\[
\begin{align*}
\ln \tilde{R}_t^* &= (1 - \rho_r) \ln \tilde{R}_t^* + \rho_r \ln \tilde{R}_{t-1}^* + \sigma_r \varepsilon_{rt} \\
\ln \tilde{X}_t^* &= (1 - \rho_x) \ln \tilde{X}_t^* + \rho_x \ln \tilde{X}_{t-1}^* + \sigma_x \varepsilon_{xt}
\end{align*}
\]
Optimal policy

- Two inefficiency sources: nominal rigidities and imperfect asset substitutability

- Imperfect asset substitutability implies imperfect risk sharing
  - Inefficient even if monopolistic distortions removed [Corsetti, Dedola, and Leduc (2012)]

- Monetary policy alone cannot restore efficient allocations
Policy objective

- Loss function nests 3 alternative monetary regimes

\[ \mathcal{L} = \sum_{t} L_t, \quad L_t = \lambda_\pi \hat{\pi}_t^2 + \lambda_y \hat{gdp}_t^2 + \lambda_b \hat{b}_{yt}^2 + \lambda_q \hat{q}_t^2, \]

where \( b_{yt} \) represents ratio of foreign-held bonds to GDP, and \( \lambda_b \) captures desire for financial stability.

- Monetary policy regimes:
  1. Standard policy sets \( \lambda_y = 1, \lambda_\pi = 1, \lambda_b = 0.1, \) and \( \lambda_q = 0 \)
  2. Inflation-stabilizing regime: same as standard except \( \lambda_\pi = 3 \)
  3. Exchange-rate stabilizing regime: same as standard except \( \lambda_q = 0.1 \)
Welfare measure

- Second-order approximation to household period utility function

\[ U_t = \hat{C}_t + \Phi_m \hat{m}_t - \Phi_l \left( L^\eta \hat{L}_t + \frac{\eta}{2} L^\eta L^{-1} \hat{L}_t^2 \right). \]

- Welfare defined as

\[ (1 - \beta) V = (1 - \beta) E \sum_{t=0}^{\infty} \beta^t U_t = -\Phi_l \frac{\eta}{2} L^{\eta-1} \text{var}(\hat{L}), \]

where \( \text{var}(\hat{L}) \) denotes the unconditional variance of labor hours

- We evaluate household welfare in terms \( \text{var}(\hat{L}) \)
Calibration highlights

- **Non-standard parameters**
  - Portfolio adjustment cost $\Omega_b = 0.117$ [Chang, et al (2012)]
  - SS dom bond share $\bar{\psi} = 0.9$ [Coeurdacier and Rey (2011)]
  - Price adjustment cost $\Omega_p = 30$ (3 qtr contracts [Nakamura (2008)])
  - Average tax rate on capital inflows $\tau = 0.3$
  - Persistence of external shocks $\rho_r = 0.98$ and $\rho_x = 0.95$

- **Standard parameters**
  - Discount factor $\beta = 0.998$
  - Technology growth rate $\bar{\lambda}_z = 1.01$
  - Set $\Phi_m = 0.06$ [Chari, et al (2000)]
  - $\eta = 2$, so Frisch elasticity of labor supply is 0.5
  - Cost share of intermediate goods $\phi = 0.5$
  - Elasticity substitution $\theta = 1.5$ [Feenstra (2012)]
  - $\alpha = 0.756$, implies 20% steady state import-to-GDP ratio
  - Set $\epsilon = 10$ so steady-state markup is 11%
First consider optimal time path for tax ($\tau_t$) on capital inflows

- Given imperfect capital mobility, optimal monetary policy alone cannot achieve first-best
- Evaluate implications of capital account restrictions for macro and financial stability

Solve the Ramsey optimal policy problem for each monetary regime

- Planner chooses all endogenous variables, including $\tau_t$
Optimal tax on foreign-held bonds following foreign interest rate shock

![Optimal tax rate following a negative foreign interest rate shock](image.png)
Optimal tax on foreign-held bonds following export demand shock

![Optimal tax rate following a negative export demand shock](image-url)
Optimal tax responds to $R^*$ shock but not to $X^*$ shock

- Tax rate increases in response to declines in $R^*$
  - $R^*$ shock raises spread between domestic and foreign rates
  - Adjusting $\tau$ mitigates the spread, insulating domestic economy from shock
  - Responses do not depend on monetary regime (irfs not shown to save space)

- Changes in $\tau$ do not stabilize against foreign demand shock
  - Optimal policy calls for very small change in $\tau_t$
  - Results in interesting dynamics
Export demand shock: Standard case, optimal capital account policy

- Current account goes into deficit
- Monetary authority lowers interest rate
- Surprisingly, real exchange rate appreciates
  - Central bank stabilizes capital account by buying domestic bonds from domestic citizens (foreign holdings unchanged)
  - With less domestic assets, modified UIP condition allows for real exchange rate appreciation
- Real appreciation $\rightarrow$ marginal cost $\downarrow$ and markup $\uparrow$ $\rightarrow$ employment declines
- Optimal policy insulates inflation and GDP from shock, but decline in employment leads to welfare losses
Impulse responses negative demand shock, optimal policy
Export demand shock: Exchange rate stabilizing, optimal policy

- Exchange-rate targeting central bank has different dynamics
  - Real GDP falls $\rightarrow$ central bank eases to smooth output
  - Inflation picks up, offset by temporary nominal depreciation in exchange rate
  - Foreign agents’ holdings of domestic bonds fall $\uparrow$ domestic rates $\uparrow$
  - Real exchange rate stabilized

- Overall, exchange-rate targeting regime yields smaller fluctuations than standard case
Simple capital account restrictions

- In practice, do not observe time-varying (and state-contingent) tax policies
  - Examine macroeconomic implications of constant $\tau$ subject to the two types of external shocks
- Standard case with decline in foreign interest rate
  - Increased foreign demand for domestic bonds $\rightarrow$ domestic rate falls and real exchange rate appreciates
  - Terms of trade improve $\rightarrow$ inflation ↓ and output ↑ and current account deficit ↑
Impulse responses foreign interest rate shock, simple tax
Foreign interest shock and simple tax: Alternative monetary regimes

- **Inflation stabilization policy**
  - Central banker does not intervene as aggressively
  - More capital inflows $\rightarrow$ bigger boom
  - Results in higher GDP and less deflation than standard case

- **Exchange-rate targeting policy**
  - To mitigate real exchange rate appreciation, central bank sells domestic bonds
  - Foreign bond holdings rise more rapidly
  - Less of a decline in domestic interest rates
Export demand shock under simple controls

- **Standard case**
  - Current account deficit $\uparrow$ and output $\downarrow$
  - Monetary policy eases by lowering domestic nominal rates
  - Foreign demand for domestic bonds $\downarrow$
  - Lowers output, inflation stabilizes

- Inflation stabilizing case quite similar
Impulse responses to negative export demand shock under simple controls

- Real GDP
- Domestic inflation
- Nominal interest rate
- Real exchange rate
- Current account
- Foreign demand for bond
Export demand shock: Real exchange rate targeting, simple controls

- With real exchange rate stabilized don’t get expected depreciation that prevailed in standard case
- Foreign bond holdings do not decline as much, and terms of trade improvement is not as large, as standard case
- Inflation is higher, nominal rates rise
- GDP falls more steeply
Both shocks

- **Optimal capital account policy**
  - Optimal policies very effective at stabilizing external shocks
  - Inflation and output almost completely stabilized
  - Welfare losses 1/3 percent of steady-state consumption
  - Little consequence of moving to inflation-stabilizing regime
  - However, smaller losses under exchange rate stabilizing regime

- **Simple capital account policy**
  - Under simple capital account policy, the monetary regime matters more for welfare
  - Inflation stabilizing regime a substantive improvement over standard policy
  - Exchange rate stabilizing does even better; almost as well as under optimal policy
Welfare and macroeconomic volatilities under alternative policy regimes

<table>
<thead>
<tr>
<th></th>
<th>Optimal capital controls</th>
<th>Simple capital controls</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Benchmark</td>
<td>Hawkish</td>
</tr>
<tr>
<td>Welfare</td>
<td>-0.35</td>
<td>-0.35</td>
</tr>
<tr>
<td>$\sigma_\pi$</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>$\sigma_y$</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>$\sigma_{ca}$</td>
<td>0.0077</td>
<td>0.0077</td>
</tr>
<tr>
<td>$\sigma_{bf}$</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>$\sigma_l$</td>
<td>0.0036</td>
<td>0.0036</td>
</tr>
</tbody>
</table>
Conclusion

- Compare effectiveness of monetary policy and capital controls in smoothing external shocks
  - As environment is one of imperfect risk sharing, potential for policies to improve welfare
  - Consistent model with comparable steady states allows for coherent welfare comparisons
  - To our knowledge, paper is first to examine issues in full monetary model that allows for sterilization

- Optimal capital control policies smooth external shocks well
- However, as complicated policies not observed in practice, also examine simple capital controls
  - Simple controls allow monetary policy to improve welfare
  - Welfare substantively improved by inflation stabilizing regime
  - Real exchange rate stabilizing regime best: Little enhancement from optimal capital policies