Monetary Policy Regimes and Capital Account Restrictions in a Small Open Economy[1]

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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

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

- Ω_b represents cost of portfolio adjustment

1. Imperfect asset substitutability (cont'd)

- Let ψ_t denote the domestic bond share:

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

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

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

- If $\Omega_b = 0$, reduces to the standard UIP condition.
- Foreign demand for domestic bonds

$$\frac{B_{ft}}{Z_t^p P_t} = f\left(\mathrm{E}_t (1 - \tau_t) R_t \frac{e_t}{e_{t+1}} - R_t^* \right),$$

where $f'(\cdot) > 0$ and τ_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 Ω_p represents price adjustment costs

- Phillips curve relation:

$$v_t = \frac{\epsilon - 1}{\epsilon} + \frac{\Omega_p}{\epsilon} \frac{C_t}{Y_t} \left[\left(\frac{\pi_t}{\pi} - 1 \right) \frac{\pi_t}{\pi} - \beta \mathrm{E}_t \left(\frac{\pi_{t+1}}{\pi} - 1 \right) \frac{\pi_{t+1}}{\pi} \right]$$

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

$$
\begin{array}{rcl}
\ln \tilde{R}_t^* &=& (1 - \rho_r) \ln \tilde{R}^* + \rho_r \ln \tilde{R}_{t-1}^* + \sigma_r \varepsilon_{rt} \\
\ln \tilde{X}_t^* &=& (1 - \rho_x) \ln \tilde{X}^* + \rho_x \ln \tilde{X}_{t-1}^* + \sigma_x \varepsilon_{xt}
\end{array}
$$

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

$$\mathcal{L} = \sum_t^\infty L_t, \quad L_t = \lambda_\pi \hat{\pi}_t^2 + \lambda_y g \hat{dp}_t^2 + \lambda_b \hat{b}_{yt}^2 + \lambda_q \hat{q}_t^2,$$

where b_{yt} represents ratio of foreign-held bonds to GDP, and λ_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

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

- Welfare defined as

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

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

- We evaluate household welfare in terms $var(\hat{L})$

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%

Optimal time-varying capital account restrictions

- First consider optimal time path for tax (τ_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 τ_t

Optimal tax on foreign-held bonds following foreign interest rate shock

Optimal tax rate following a negative foreign interest rate shock
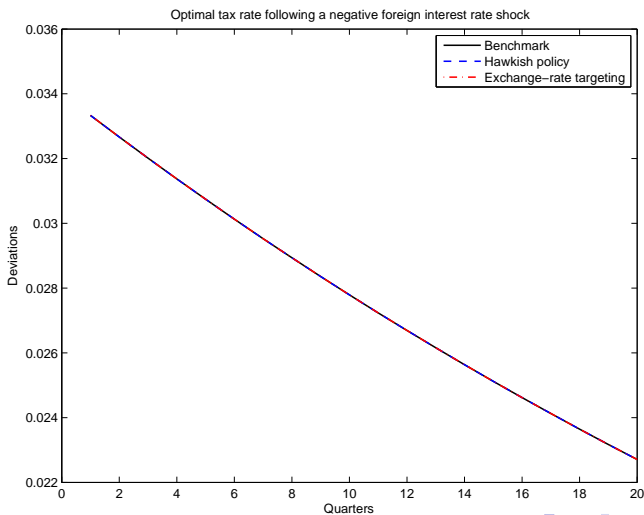
Optimal tax on foreign-held bonds following export demand shock

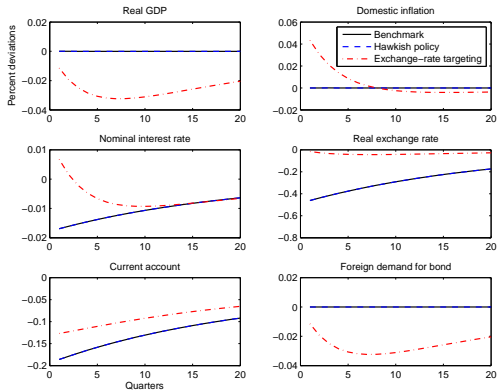Optimal tax rate following a negative export demand shock
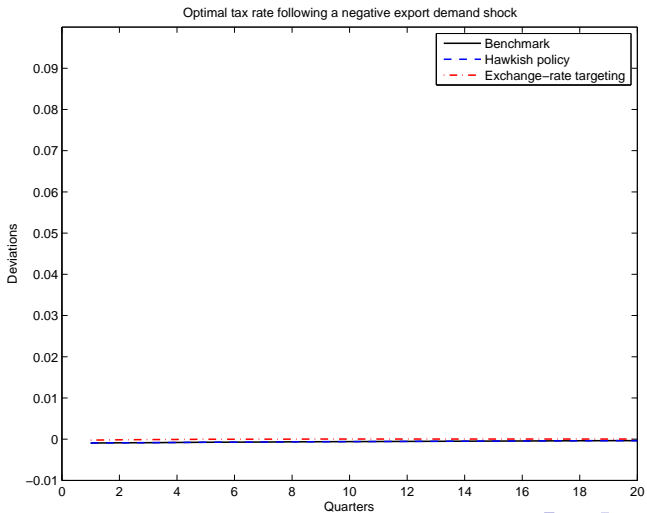
Optimal tax responds to R^* shock but not to X^* shock

- Tax rate increases in response to declines in R^*

  - R^* shock raises spread between domestic and foreign rates

  - Adjusting τ mitigates the spread, insulating domestic economy from shock

  - Responses do not depend on monetary regime (irfs not shown to save space)

- Changes in τ do not stabilize against foreign demand shock

  - Optimal policy calls for very small change in τ_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

Export demand shock: Exchange rate stabilizing, optimal policy

- Exchange-rate targeting central bank has different dynamics
  - Real GDP falls → central bank eases to smooth output
  - Inflation picks up, offset by temporary nominal depreciation in exchange rate
  - Foreign agents' holdings of domestic bonds fall ↑ domestic rates ↑
  - 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 τ 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 $\downarrow$ and output $\uparrow$ and current account deficit $\uparrow$
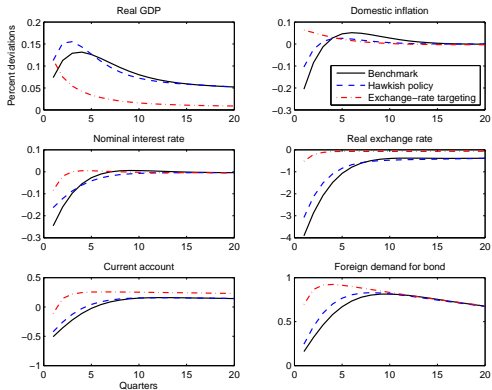
Foreign interest shock and simple tax: Alternative monetary regimes

- 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 ↑ and output ↓
    - Monetary policy eases by lowering domestic nominal rates
    - Foreign demand for domestic bonds ↓
    - Lowers output, inflation stabilizes

- Inflation stabilizing case quite similar
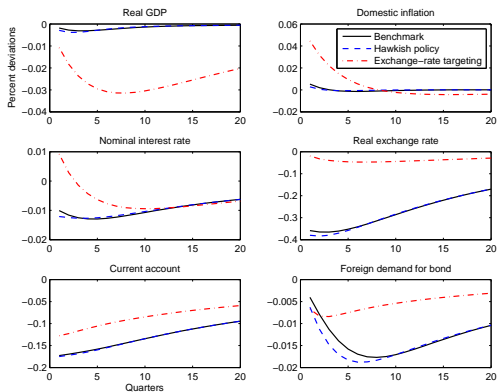
Export demand shock: Real exchange rate targeting, simple controls

- 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

	Optimal capital controls			Simple capital controls		
	Benchmark	Hawkish	ER-targeting	Benchmark	Hawkish	ER-targeting
Welfare	-0.35	-0.35	-0.10	-3.21	-1.83	-0.11
σ_π	0	0	0.0006	0.0025	0.0012	0.0012
σ_y	0	0	0.0014	0.0047	0.0049	0.0022
σ_{ca}	0.0077	0.0077	0.0055	0.0163	0.0161	0.0224
σ_{b_f}	0	0	0.0014	0.0456	0.0464	0.0493
σ_l	0.0036	0.0036	0.0019	0.0109	0.0082	0.0020

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