Capital Controls and Optimal Chinese Monetary Policy[1]

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[1]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.

China's monetary policy constrained by its trade policy

- Existing trade policy regime:
  1. Nominal exchange rate pegs
  2. Closed capital account
- Undervalued currency $\Rightarrow$ persistent trade surpluses and foreign currency inflows.
- Capital controls $\Rightarrow$ rapid accumulation of foreign reserves on CB balance sheet.

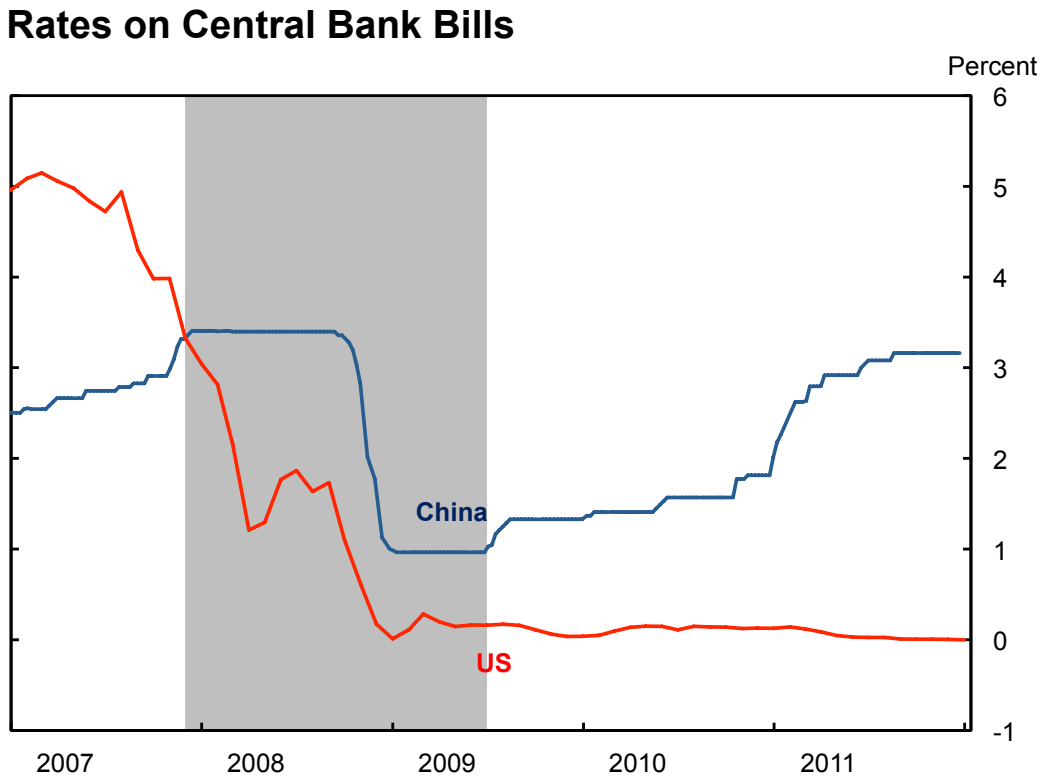
PBOC engages in extensive foreign asset sterilization

- Under capital controls, restrictions on Chinese holding foreign assets and foreign investors holding Chinese assets
  - China's international investment positions very small (Song, et al., 2013)
  - Significant deviations from CIP between 1999 and 2007 (Shu, et al., 2009)
- Exporters sell foreign-currency revenues to PBOC (China's CB) at prevailing exchange rate
- PBOC sterilizes purchases by selling domestic bonds (to avoid increases in money supply)
- Relative yields of foreign and domestic assets determine sterilization gains or losses.

Global financial crisis changed sterilization calculus

- Prior to crisis, Chinese rates lower $\Rightarrow$ fiscal benefits to sterilization [e.g. Prasad and Wei (2007)]
  - With crisis, large drops in global interest rates
- Positive spread in Chinese rates $\Rightarrow$ marginal fiscal costs of sterilization
- PBOC now faces tradeoff between costs of sterilization and inflation

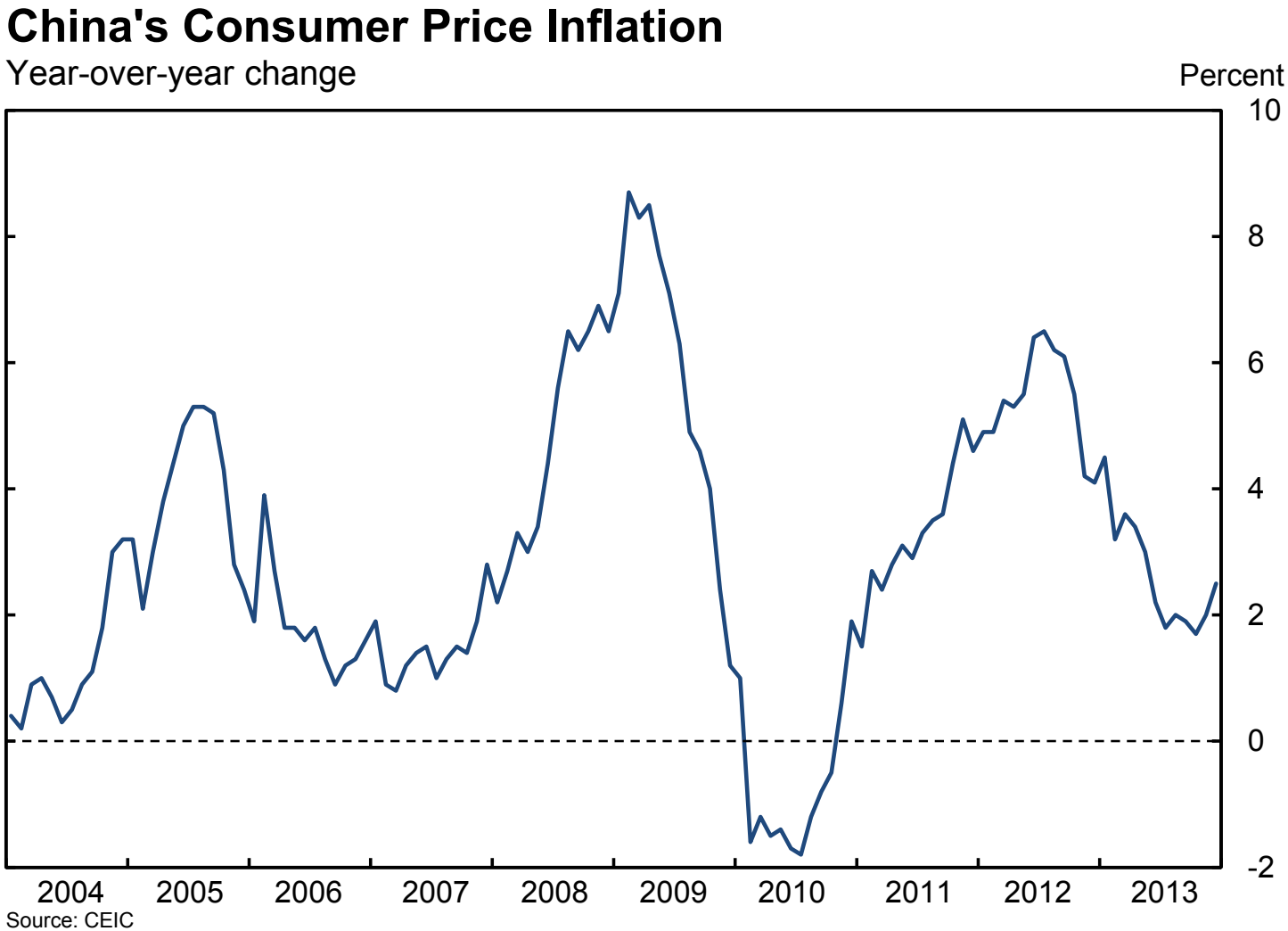
Global crisis and the "reversal of fortune" for PBOC



"This looks like a glaring violation of UIP" [Bob Hall, informal comments, 2014]

"The dollar is our currency, but your problem." [John Connally, U.S. Treasury Secretary, 1971]

Higher sterization cost accompanied by higher inflation



What we do in this paper

- Build a DSGE model with "Chinese characteristics"
  1. Capital controls
  2. Exchange rate pegs
  3. Sterilized interventions
- Examine optimal monetary policy responses to a persistent decline in foreign interest rate
  - Tradeoff between sterilization costs and inflation
- Study alternative liberalization of policies in a unified DSGE framework

Related literature

- Optimal monetary policy
  - Simple NK models: maintaining price stability closes output gap (Woodford, 2003)
  - Nominal rigidities: tradeoff can arise (Erceg, et al., 2000; Mankiw-Reis, 2004; Benigno, 2004; Huang-Liu, 2005)
- Capital controls
  - Jeanne and Korinek (2010) and Bianchi (2013): Time-varying borrowing tax stabilizes credit cycles, improves welfare
  - Farhi and Werning (2012): Capital controls mitigate effects of excessive capital movements
  - Song, Storesletten, and Zilibotti (2013): Capital controls exacerbate misallocation for China
- This paper: Capital controls imply a monetary policy tradeoff between sterilization costs and inflation stability

Model features

1. Capital market frictions:
   - Imperfect asset substitutability $\Rightarrow$ UIP wedge
   - Restricted private-sector access to foreign asset markets (capital controls)
   - Foreign investors not allowed to hold Chinese assets
2. Nominal rigidities
3. Pegged exchange rate and sterilization policy
   - CB targets pace of nominal exchange rate appreciation and purchases foreign assets at ongoing exchange rate
   - Financed by sterilization (domestic bonds) or increase in money supply

Model feature I: Imperfect asset substitutability

- Utility function

$$U = \mathrm{E}\sum_{t=0}^{\infty}\beta^t\left\{\ln C_t + \Phi_m \ln\frac{M_t}{P_t} - \Phi_l\frac{L_t^{1+\eta}}{1+\eta}\right\}$$

- Household faces budget constraints with quadratic portfolio adjustment costs

$$C_t + \frac{M_t}{P_t} + \frac{B_t + e_t B^*_{pt}}{P_t}\left[1 + \frac{\Omega_b}{2}\left(\frac{B_t}{B_t + e_t B^*_{pt}} - \bar{\psi}\right)^2\right] \leq w_t L_t + \frac{M_{t-1}}{P_t} + \frac{R_{t-1}B_{t-1} + e_t R^*_{t-1} B^*_{p,t-1}}{P_t} + \frac{D_t}{P_t},$$

- Ω_b reflects restricted access to foreign asset markets under capital controls, but allowing for "leakage"

Model feature I: Imperfect asset substitutability (cont'd)

- Portfolio adjustment costs $\Rightarrow$ UIP wedge:

$$\hat{R}_t - \hat{R}_t^* = \mathrm{E}_t \hat{\gamma}_{e,t+1} + \Omega_b \bar{\psi} \hat{\psi}_t,$$

  where ψ_t denotes portfolio share of domestic bond

- Presence of UIP wedge $\Rightarrow$ imperfect international risk sharing: inefficiency even without monopolistic distortions

Model feature II: Nominal rigidities

- Production function

$$Y_t(j) = \Gamma_t(j)^{\phi}(Z_t L_t(j))^{1-\phi}, \quad j \in [0,1]$$

  where Γ_t is a composite of domestic and imported intermediate goods

- Quadratic price adjustment costs

$$\frac{\Omega_p}{2}\left(\frac{P_{t+k}(j)}{\pi P_{t+k-1}(j)} - 1\right)^2 C_{t+k}$$

- Phillips curve with sticky prices $\Rightarrow$ monetary policy has real effects

Model feature III: Sterilization

- Foreign investors are not allowed to hold Chinese assets (part of capital controls)
- Flow of funds constraint for government

$$e_t(B^*_{gt} - R^*_{t-1}B^*_{g,t-1}) \leq B_t - R_{t-1}B_{t-1} + M^s_t - M^s_{t-1}$$

  - CB purchases foreign assets at the ongoing exchange rate, financed by domestic bond or money supply
  - Non-Ricardian feature: No lump-sum taxes/transfers $\Rightarrow$ CB portfolio compositions have real effects

External accounts

- Current account net exports plus earnings on foreign assets

$$ca_t = e_t \frac{B_t^* - B_{t-1}^*}{P_t} = X_t - q_t \Gamma_{ft} + \frac{e_t (R_{t-1}^* - 1) B_{t-1}^*}{P_t}$$

- Export demand taken as given

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

External shocks are persistent

- Interest rate shock

$$\ln R_t^* = (1-\rho_r)\ln R^* + \rho_r \ln R_{t-1}^* + \sigma_r \varepsilon_{rt}$$

- Export demand shock

$$\ln \tilde{X}_t^* = (1-\rho_x)\ln \tilde{X}^* + \rho_x \ln \tilde{X}_{t-1}^* + \sigma_x \varepsilon_{xt}$$

Optimal monetary policy

- Study Ramsey optimal policy under capital controls and exchange-rate pegs
- Ramsey planner maximizes representative household's welfare subject to private optimizing conditions
- Study macro responses to shocks to foreign interest rate and export demand under calibrated parameters
- Examine counterfactual policy reforms

Parameter calibration (highlights)

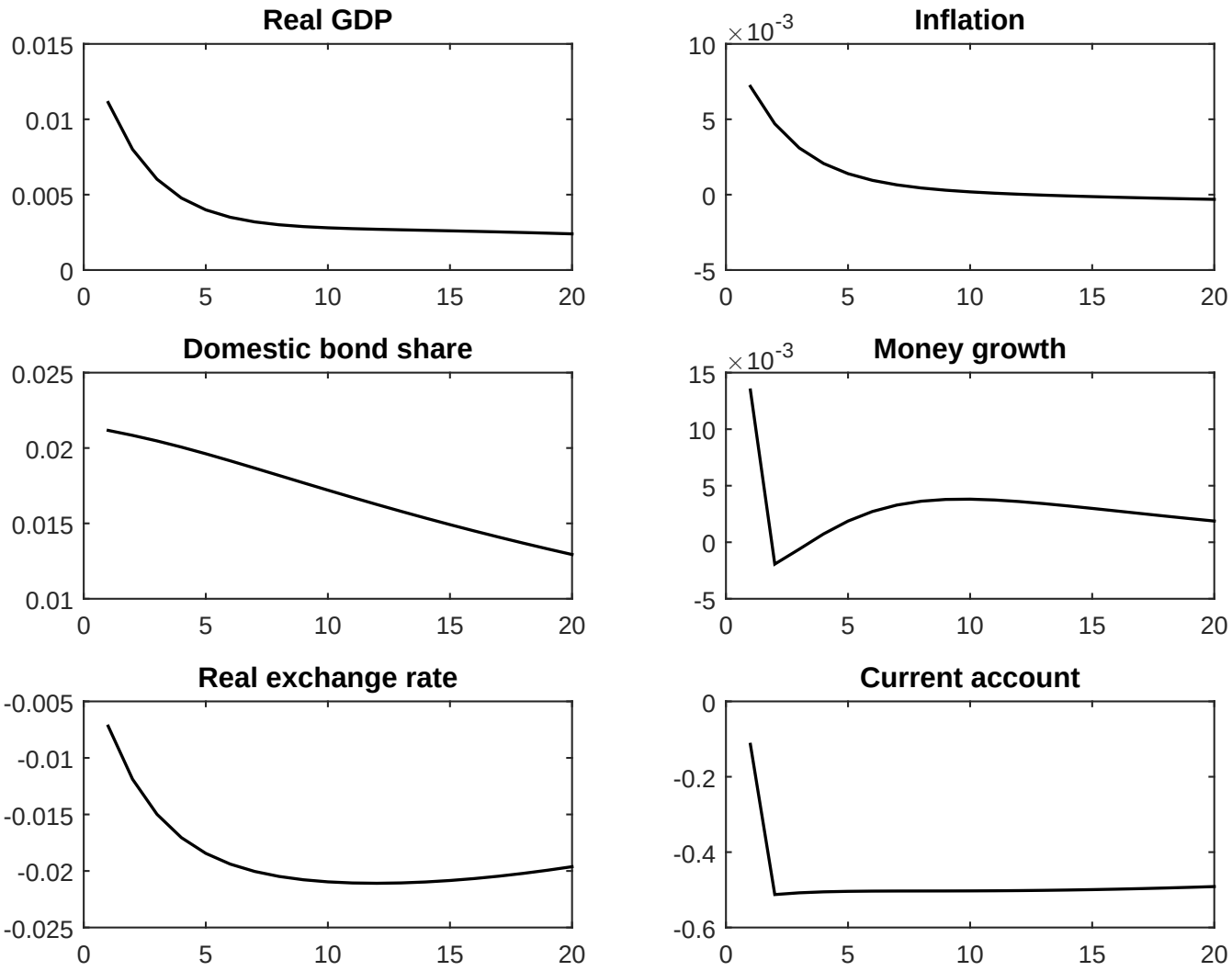
- Use Chinese data as much as possible, otherwise std US
- Average growth rate: 8 percent per year
- Price contract duration: 4 quarters
- Share of domestic intermediate input $\alpha = 0.756$ (matches int. input share of 0.5 and Import/GDP=0.2)
- Steady-state trade surplus 3% of GDP (average 90-09)
- Export demand elasticity $\theta = 1.5$ (Feenstra, et al., 2012)
- Estimate modified UIP condition from 22 EMEs (01-11)
  - Implies $\Omega_b = 0.22$.
  - Set $\Omega_b = 0.6$ for China to capture tighter K controls than other EMEs

▸ Calibration Details

Impact of negative foreign interest rate shock ($\rho_{r^*} = 0.98$)

1. $R^* \downarrow \Rightarrow$ sterilization cost $\uparrow \Rightarrow$ CB sterilizes less $\Rightarrow$ money supply $\uparrow$
2. Private portfolio rebalancing: relatively higher domestic rate $\Rightarrow$ higher share of private domestic bond holdings ($\psi \uparrow$)
3. Expansion in money supply raises AD $\Rightarrow$ y and π rise
4. Since e is fixed, rise in $\pi \Rightarrow$ real appreciation $\Rightarrow$ CA $\downarrow$
5. Lower R_t^* further reduces CA surplus
6. Net effects in calibrated model: decline in $R^* \Rightarrow$ short run increases in y and π

Effects of negative shock to foreign interest rate: Benchmark



Counterfactual liberalization of policy

1. Partially lifting capital controls while keeping ex. rate peg
   - Lower Ω_b from 0.6 to 0.3 (closer to other EMEs)
2. Floating exchange rate while maintaining capital controls
   - Nominal anchor provided by Taylor rule
3. Liberalizing controls on both K account and exchange rate

- Under each regime, study optimal monetary policy responses and welfare following external shocks

Macro stability and welfare under optimal policy

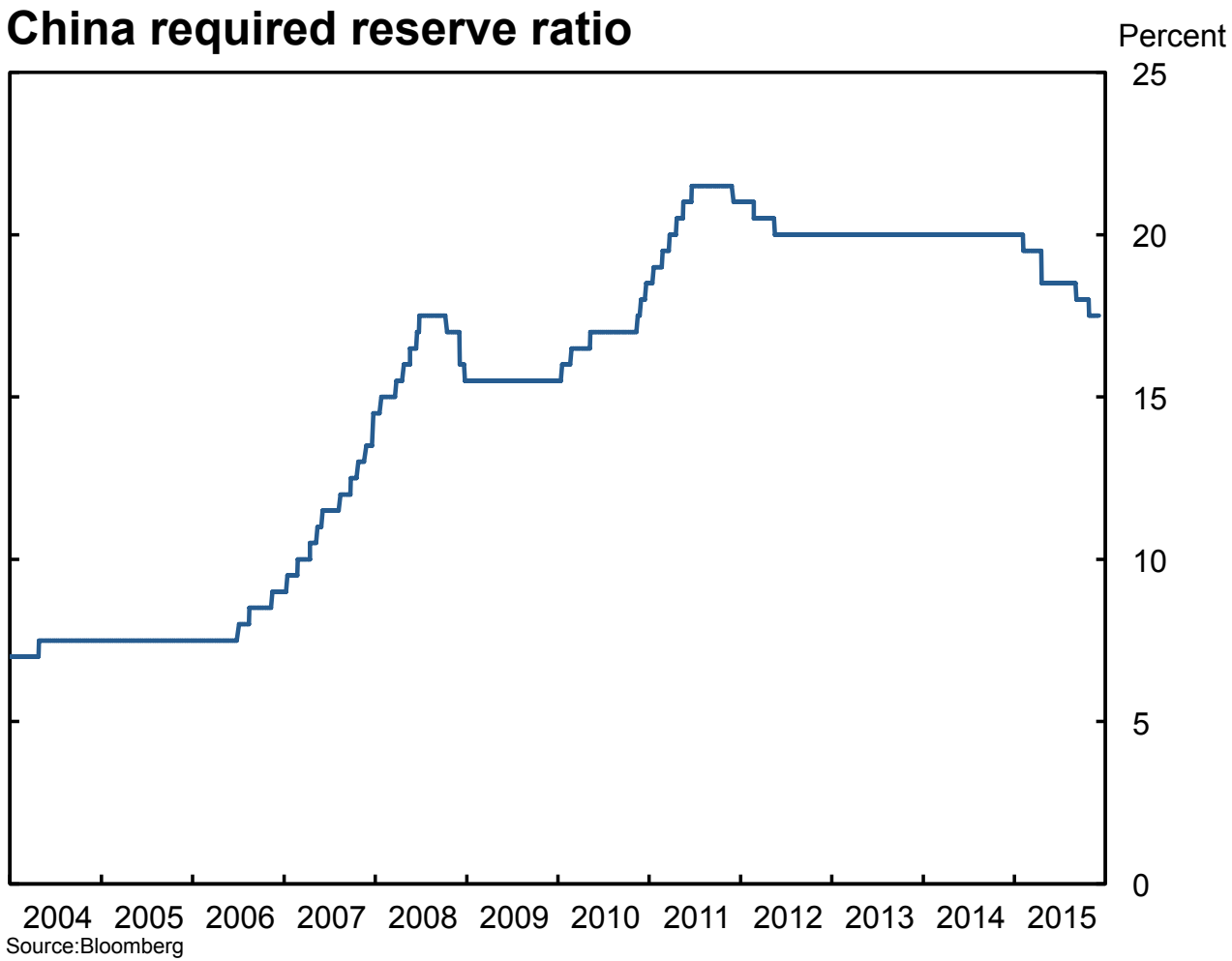
	Benchmark	Open capital account	Flex FX	Full reform
σ_y	0.0285	0.0296	0.0078	0.0068
σ_π	0.0106	0.0112	0.0056	0.0082
σ_L	0.0241	0.0239	0.0150	0.0174
σ_q	0.1899	0.1870	0.0926	0.1007
σ_{ca}	3.6873	3.5944	3.3412	3.2838
Welfare gains	–	0.0002	0.0103	0.0080

New CLSZ paper examines RR policy

- Under capital controls, RR helps mop up foreign exchange reserves (Ma, et al. (2013))
- Under certain circumstances,may be cheaper mechanism for alleviating inflation pressures
- But need to consider allocative effects
- ↑ RR reallocates investment away from SOEs

Chang, Liu, Spiegel, and Zhang, 2016. "Reserve Requirements and Optimal Chinese Stabilization Policy"

PBOC frequently adjusts reserve requirements



- Since 2006, adjusted RR 40 times
- Between 2006 and 2011, RR rose from 8.5% to 21.5%

What we do

- Build a DSGE model with financial frictions and Chinese characteristics to study
  1. implications of RR policy for allocation efficiency, aggregate productivity, and social welfare
  2. role of RR policy in stabilizing business cycle fluctuations
  3. optimal RR policy and its interactions with interest-rate policy

Main finding: Interest rate and RR complementary policy instruments

- Interest-rate rule effective for stabilizing inflation and output
- RR rule helpful for reallocating resources between sectors
- Greater welfare gains when both instruments used together

Setup

- Generalize BGG (1999) to capture Chinese characteristics
  - Two sectors: SOEs and POEs, with identical technology, but POE TFP higher
  - Two types of financial intermediaries and segmented credit markets
    - Commercial banks (lend to SOEs)
    - Shadow banks (lend to POEs)
  - Government guarantees SOE debt
    - Commercial banks subject to reserve requirements

Compare macro stability and welfare under 4 alternative policy rules

Variables	Benchmark	Optimal τ rule	Optimal R rule	Jointly optimal rule
Policy rule coefficients				
ψ_{rp}	1.50	1.50	1.93	1.51
ψ_{ry}	0.50	0.50	0.32	-0.14
$\psi_{\tau p}$	0.00	374	0.00	232
$\psi_{\tau y}$	0.00	417	0.00	-913
Volatility				
GDP	5.351%	5.375%	5.321%	5.325%
π	0.617%	0.598%	0.381%	0.398%
C	4.956%	4.954%	4.926%	4.925%
H	0.749%	0.723%	0.792%	0.855%
R	0.525%	0.511%	0.475%	0.724%
Y_s	5.374%	5.412%	5.363%	6.887%
Y_p	5.468%	5.534%	5.493%	5.438%
Welfare				
Welfare gains	—	0.019%	0.023%	0.493%

Changes in RR reveal tradeoff between allocation efficiency and bankruptcy costs

- RR and interest rates are complementary policy instruments
  - Interest rate effective for macro stabilization
  - RR more useful for improving allocation efficiency and welfare
- Jointly optimal policies appear to rely on much larger RR and interest rate adjustments than either individual rule
- May not see these policies in practice for reasons outside our model

Conclusion

- Examine capital controls and RR policies in DSGE model with Chinese characteristics
  - Large welfare gains under jointly optimal rule imply complementarity of policies
- Caveats:
  - Results are "second-best"
  - Policy changes may markedly change tradeoffs
- Capital controls and RR considered independently, but commonly used together
  - Synthesis would be welcome, but numerically challenging
  - On list for future work

Parameter calibration

Parameter	Description	value
	Preferences	
β	Subjective discount factor	0.995
Φ_m	Utility weight on money balances	0.06
η	Inverse Frisch elasticity	2
	Technologies	
ϕ	Cost share of intermediate goods	0.50
$\bar{\lambda}_z$	Mean productivity growth rate	1.02
	Nominal rigidities	
θ_p	Elasticity of substitution	10
Ω_p	Price adjustment cost	60
	Portfolio adjustment	
Ω_b	Portfolio adjustment cost parameter	0.6
$\bar{\psi}$	Average portfolio share of domestic bonds	0.9
	International trade	
α	Share of domestic intermediate goods	0.7556
θ	Export demand elasticity	1.5
	Shock processes	
ρ_r	Persistence of foreign interest rate shock	0.98
ρ_x	Persistence of export demand shock	0.95
σ_r	Standard deviation of foreign interest rate shock	0.01
σ_x	Standard deviation of export demand shock	0.01

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