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Monetary and Macroprudential Policies to Manage Capital Flows

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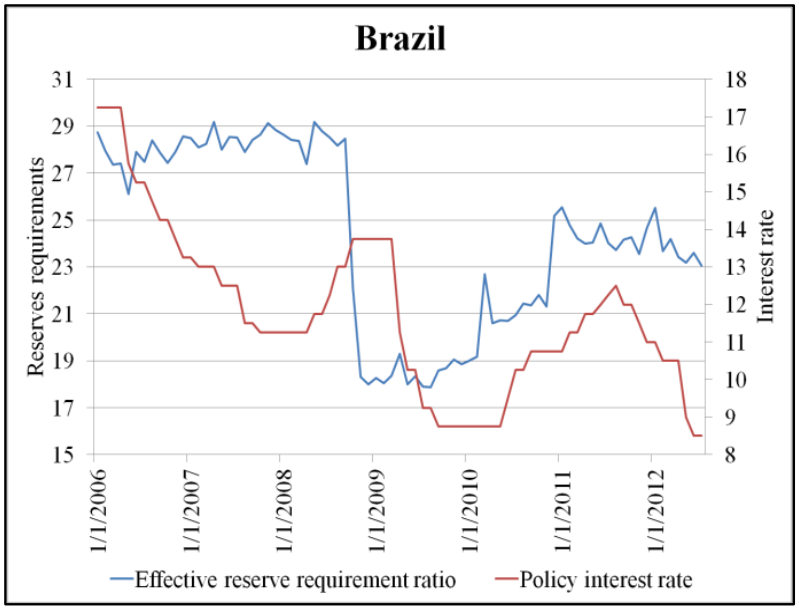
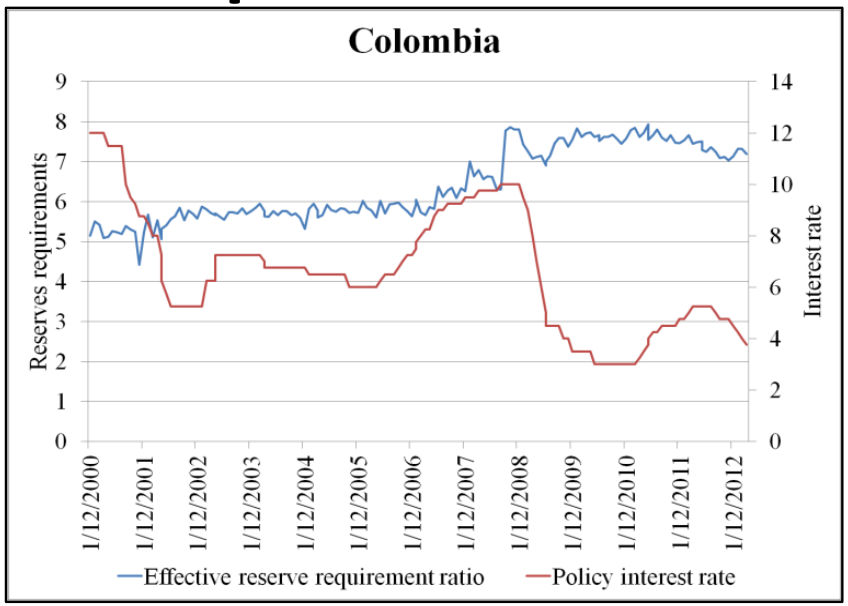
The views expressed herein are those of the authors and should not be attributed to the IMF, its Executive Board, or its management.

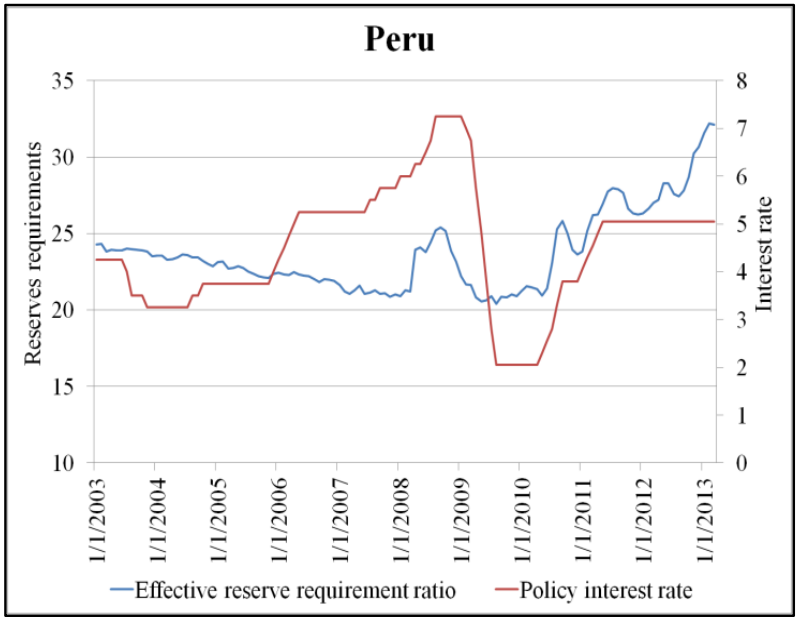
Motivation

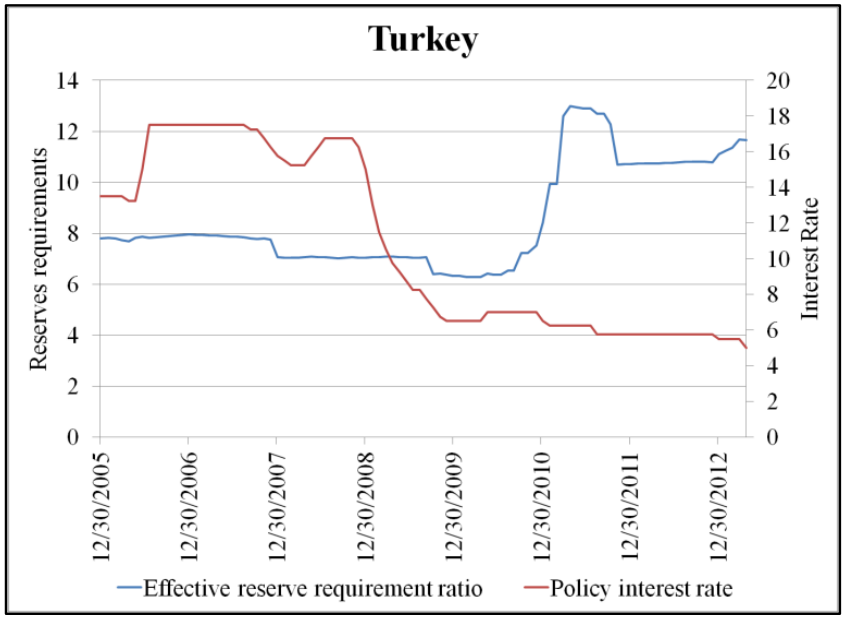
- The use of Macroprudential policies (**MaPP**) has been a legacy of the recent financial crisis
  - Cyclical dimension
  - Cross-section (systemic) dimension
- How **MaPP** interact with Monetary Policy (**MP**)?
  - Two (extreme) views
  - Follow up on messages from IMF (2013)
- Several EM countries have adjusted reserve requirements in the recent years as a **MaPP** tool.

MP Rate and Reserve Requirements









A few analytical papers on the use of Reserve Requirements as a MaPP tool

- Several studies in closed economy
  - Exceptions: Glocker-Towbin (2012); Unsal (2013)
- This paper innovates in three margins:
  1. Nominal and financial frictions from microeconomic principles
  2. Welfare-based measure to rank alternatives policies
  3. Shock to the world interest rate (UMP and "normalization")

Macro policy faces two type of frictions: Nominal and Financial

- Nominal friction calls for **inflation stabilization**.

- **Financial accelerator-cum-fire sale** mechanism calls for the a stabilization of the **deadweight losses of the financial frictions**.

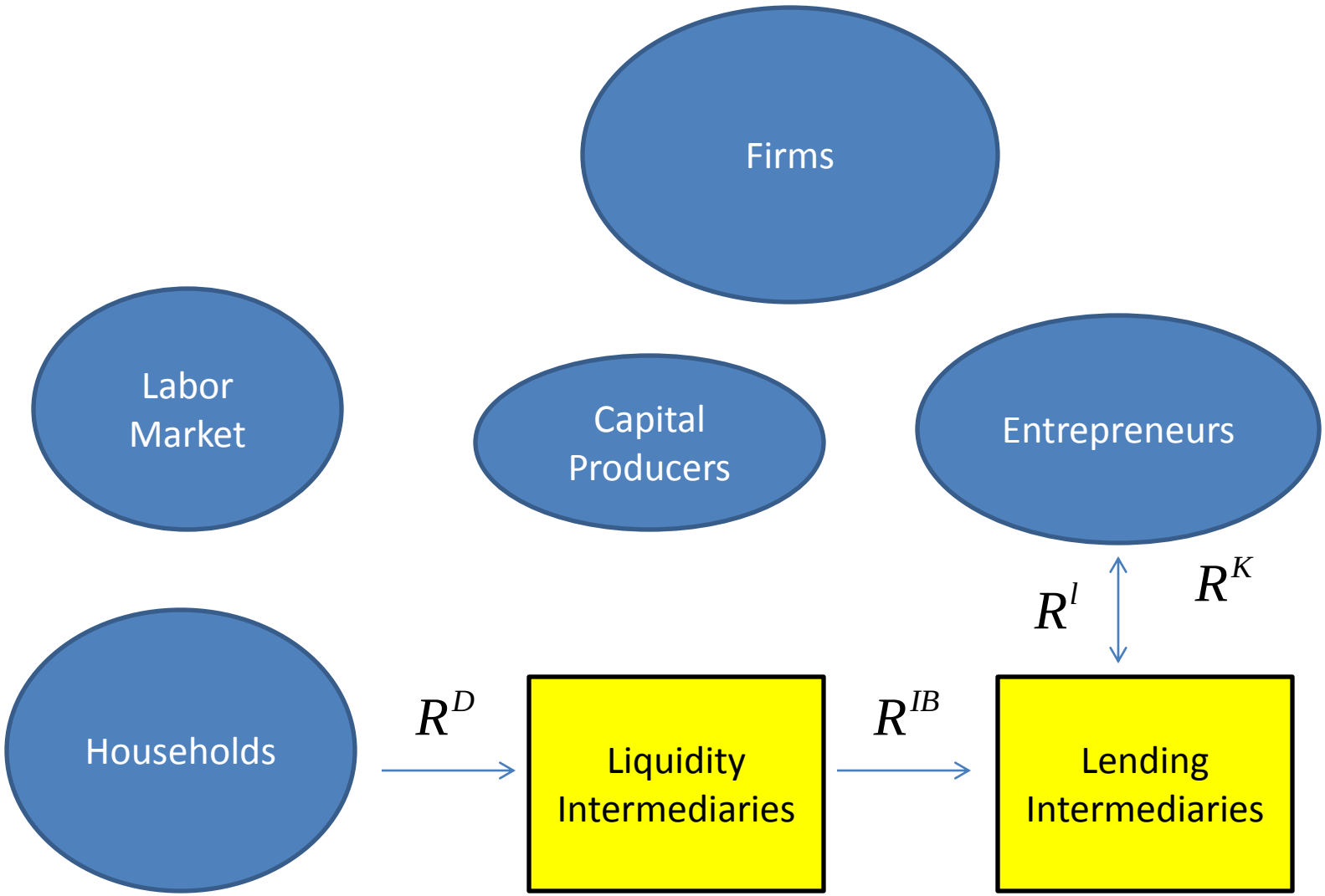
Preview of main results

In standard SOE model with **nominal rigidities** + **financial accelerator-cum-fire sales,** fluctuations in the world interest rate (capital flows)**:**

- IT regime dominates standard Taylor rule
- Augmenting the Taylor rule with credit growth stabilization may not be effective policy response
- Use of a countercyclical macro-prudential instrument, in combination with the MP rate, improves welfare substantially
- Need to coordinate MP rate with MaPP instrument

Overview of the Model

- Small open economy
- Two differentiated tradable goods: Home and Foreign
- *Nominal friction:* price rigidity a-la-Calvo (1983)
- *Financial friction:* financial accelerator plus a fire-sales amplification mechanism
  - Solvency: loans' *default* (Bernanke, Gertler and Gilchrist, BGG, 1999)
  - *Liquidity*: real and financial resources are needed to liquidate distressed assets (extension of Choi-Cook, 2012)


Firms
Labor Market
Capital Producers
Entrepreneurs
R^l
R^K
Households
R^D
Liquidity Intermediaries
R^{IB}
Lending Intermediaries

$$R^K > R^l > R^{IB} > R^D$$

Production, Consumption and Capital Goods

- Production function and consumption are standard
- Capital good are obtained:
  1. Buying final goods; install new capital goods
  2. Buying old and undepreciated capital
  3. Buying liquidated and re-structured capital
- Then evolution of capital is given by:

$$k_{t+1} = (1-\delta)\left(k_t - k_{D,t}^{new}\right) + \left(1 - \Delta\left(\frac{inv_t}{inv_{t-1}}\right)\right) inv_t + \eta_k (1-\delta) k_{D,t}$$

Credit Intermediary (1)

- Provides loans to entrepreneurs under a "BGG" contract that solves the agency problem
- The average return to capital for the entrepreneurs is capital is:

$$R_{t+1}^{K} = \frac{VMPK_{t+1} + (1-\delta)Q_{t+1}}{Q_t}; \quad \text{where } VMPK_{t+1} \text{ is the rental rate}$$

and Q_t the price of capital

Credit Intermediary (2)

- Threshold condition for lending rate:

$$R^k_{t+1}\bar{\omega}_{t+1}K_{t+1}Q_t = R^l_{t+1}B_t, \quad \text{where } R^l_{t+1} \text{ is loan rate and}$$

$$B_t \text{ is the loan}$$

- Zero profit condition for credit intermediary:

$$\underbrace{[1-\Phi(\bar{\omega}_{t+1})]R^l_{t+1}B_t}_{\text{Revenue if loan repaid}} + \underbrace{\left(VMPK_{t+1} + (1-\delta)FS_{t+1}\right)k_{t+1}\int_0^{\bar{\omega}_{t+1}} \omega d\Phi(\omega;\ \sigma_\omega)}_{\text{Revenue if default}} = \underbrace{R^{IB}_{t+1}B_t}_{\text{Cost of Funds}} \quad ,$$

where $\Phi(\bar{\omega}_{t+1})$ is the probability of default and

FS_{t+1} is the fire-sale price of the defaulted capital

Credit Intermediary (3)

- Define:

$$\mu_{t+1} = \frac{(Q_{t+1} - FS_{t+1})(1-\delta)}{VMPK_{t+1} + (1-\delta)Q_{t+1}},$$

- Then, zero profit condition for credit intermediary is:

$$\underbrace{[1-\Phi(\bar{\omega}_{t+1})]R^{l}_{t+1}B_t}_{\text{Revenue if loan repaid}} + \underbrace{(1-\mu_{t+1})R^{k}_{t+1}Q_t k_{t+1}\int_0^{\bar{\omega}_{t+1}} \omega d\Phi(\omega;\ \sigma_\omega)}_{\text{Revenue if default}} = \underbrace{R^{IB}_{t+1}B_t}_{\text{Cost of Funds}},$$

- In contrast to BGG, cost of default is endogenous (and countercyclical); in boom (recession):
  - Default decreases (increases)
  - Recovery rates rises (falls)

Liquidity Intermediary (1)

- Demand for liquidity services:

$$lq_t = \upsilon k_{D,t}, \quad \text{where } lq_t \text{ are liquidity services}$$

- To provide liquidity services, LI requires *real* and *financial* ("excess reserves") resources

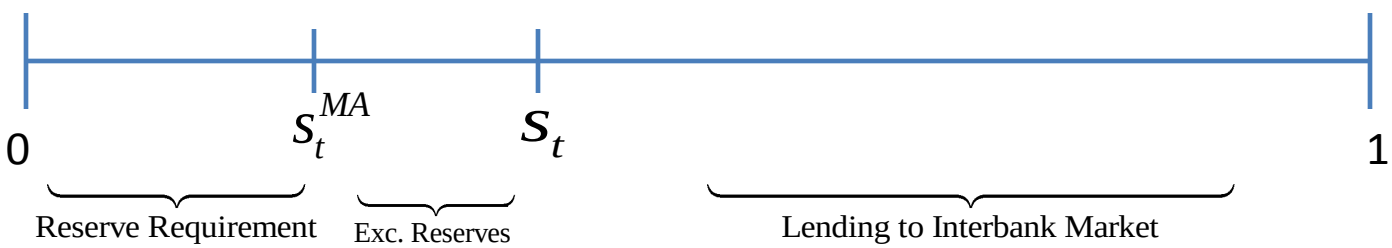
$$lq_t = \min[n_t^{1-\alpha_{lq}};\ \ xr_t^{1-\alpha_{xr}}], \quad \text{where } n \text{ is in units of final goods,}$$
$$\text{and } xr \text{ is "excess reserves"}$$

Liquidity Intermediary (2)

- Maximize benefits derived from the use of deposits:

$$\max_{n,s,(D/P)} \left\{ \left[(1-s_t) R_t^{IB} + s_t^{MA} R_t^{RE} - R_t^D \right] \frac{D_t}{R_t^D} - P_t n_t \right\}$$

- Allocation of funds:



Liquidity Intermediary (3)

- Optimal condition for liquidity intermediary:

$$R_t^{IB} = g_t \frac{(1-\alpha_{lq})lq_t}{xr_t} R_t^D$$

$$R_t^{IB} = (1-s_t^{MA})^{-1}[R_t^D - s_t^{MA}]$$

- Fire sale (or "*cash-in-the-market*") price:

$$FS_t = \eta_k Q_t - \upsilon(f_t + g_t) + (1-\eta_k)(1-\delta)E_t[sd_{t+1}FS_{t+1}]$$

- Equilibrium in the interbank market:

$$B_t = (1-s_t)D_t$$

Nominal friction

- Wholesale producers sell differentiated goods, a composite of domestic and imported goods
- Set sticky prices a-la-Calvo →Phillips curve:

$$\log(1+\pi_t) = \frac{\beta}{1+\beta\chi_p} E_t[\log(1+\pi_{t+1})] + \frac{\chi_p}{1+\beta\chi_p}\log(1+\pi_{t-1})$$

$$+ \frac{(1-\phi_p)(1-\beta\phi_p)}{\phi_p(1+\beta\chi_p)}\log\left(\frac{mgcr_t}{mgc_{ss}}\right), \qquad \text{where}$$

marginal cost is: $$mgcr_t = \left[(1-\alpha_d)\left(\frac{P_{y,t}}{P_t}\right)^{1-\theta_d} + \alpha_d\left(\frac{e_t P_t^*}{P_t}\right)^{1-\theta_d}\right]^{\frac{1}{1-\theta_d}}$$

Aggregate Equilibrium

- Aggregate (domestic) demand is given by

$$da_t = c_t + c_{k,t} + inv_t + n_t$$

- And is equal to the supply of final goods (adjusted by the price distortion or nominal friction "*disp*")

$$da_t = (disp_t)^{-1} y_{s,t}$$

Welfare

- We will analyze alternatives policies (**MP** and **MaPP**) to mitigate the impact of these distortions
- We rank them according to their impact on this welfare measure:

$$\sum_{t=1}^{T} \beta^t \ln\left(\left(1+\varsigma_i\right) c_{ss} - \gamma_h \frac{(h_{ss})^{1+\sigma_L}}{1+\sigma_L} \right) - W_{nat} = W_{nat} - W(i)$$

Calibration

- *Macro-parameters*: standard
- *Financial system parameters:*

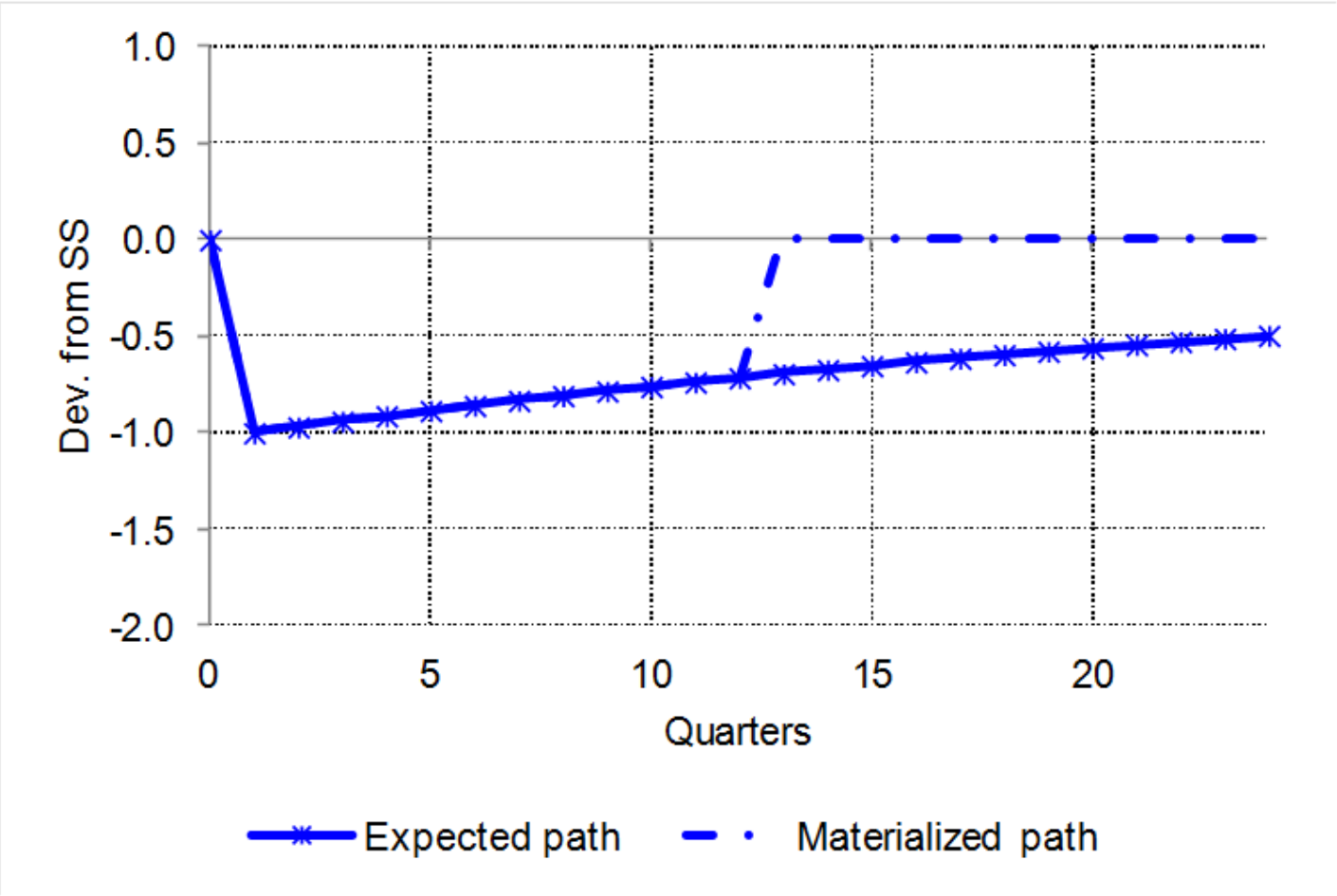
  (i) annual default rate of 3 percent (in line with BGG);

  (ii) a leverage ratio of 40 percent (mid-point between BGG and estimate from Gonzalez-Miranda (2012));

  (iii) an average cost of liquidation (μ) of 60 percent

  (iv) excess reserves of 0.25 percent of deposits
- These parameter values imply:
  - $\mathrm{R}^K = 13.7\% > R^l = 6.4\%, R^{IB} = 4.5\%, R^D = 4\%$ (in annual basis)
  - a recovery rate of around 36 percent
  - entrepreneurs' debt/credit is 55 percent of annual GDP
  - deposits, as percentage of annual GDP, is 61 percent

Shock to the World Interest Rate



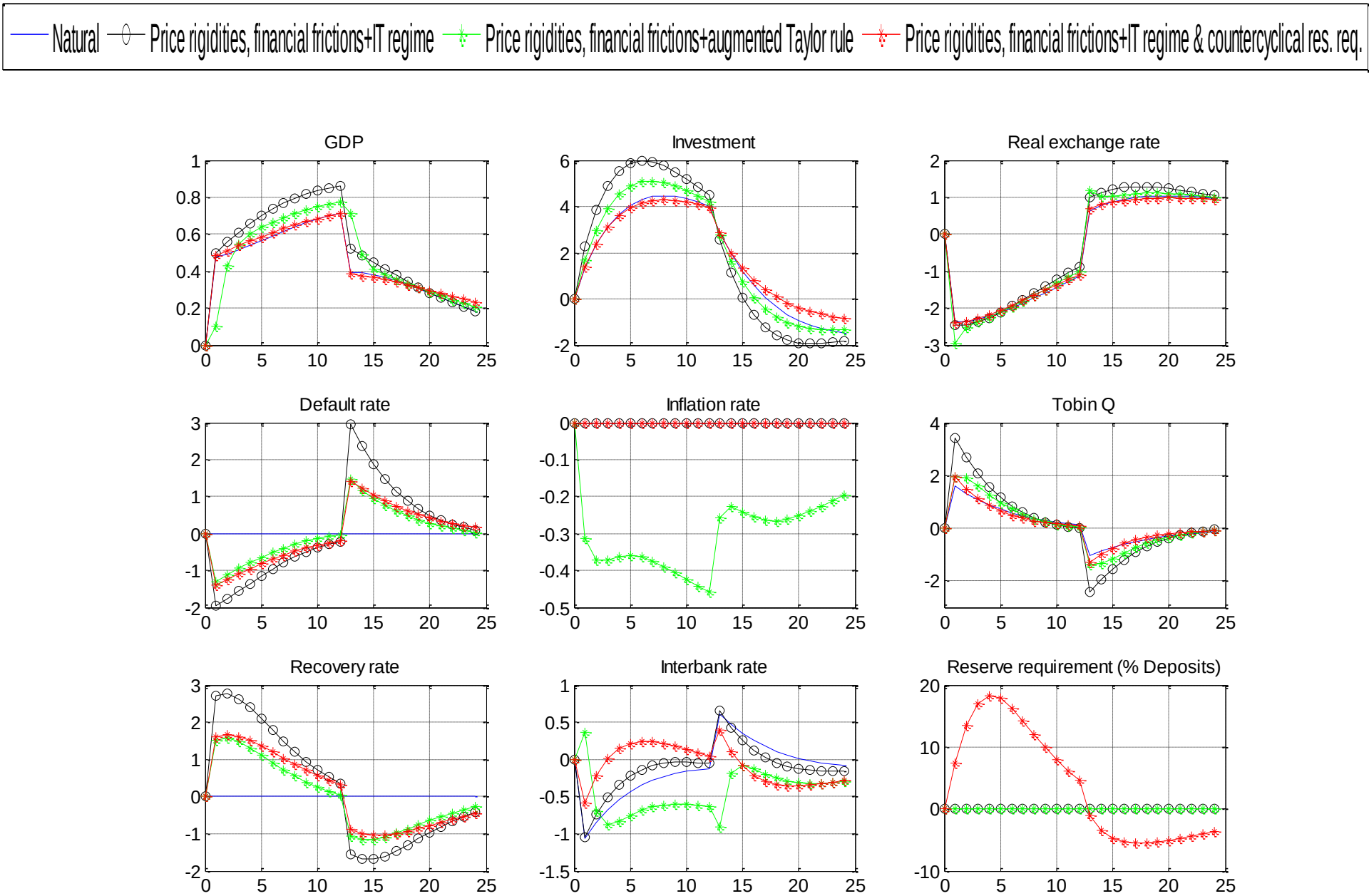
Alternative Policies

- We consider four alternative "regimes"
  1. Standard Taylor rule and **constant** reserve requirement (**RR**)
  2. Inflation Targeting and **constant RR**
  3. Augmented Taylor rule and **constant RR**

$$\log\left(\frac{R_t^{IB}}{1+r}\right) = \psi_\pi \log(1+\pi_t) + \psi_y \log(y_t) + \psi_b \log(b_t)$$

  4. Inflation Targeting and **countercyclical RR**

$$\log\left(\frac{s_t^{MA}}{s^{MA}}\right) = -\phi_{xr} \log\left(\frac{xr_t}{xr}\right)$$

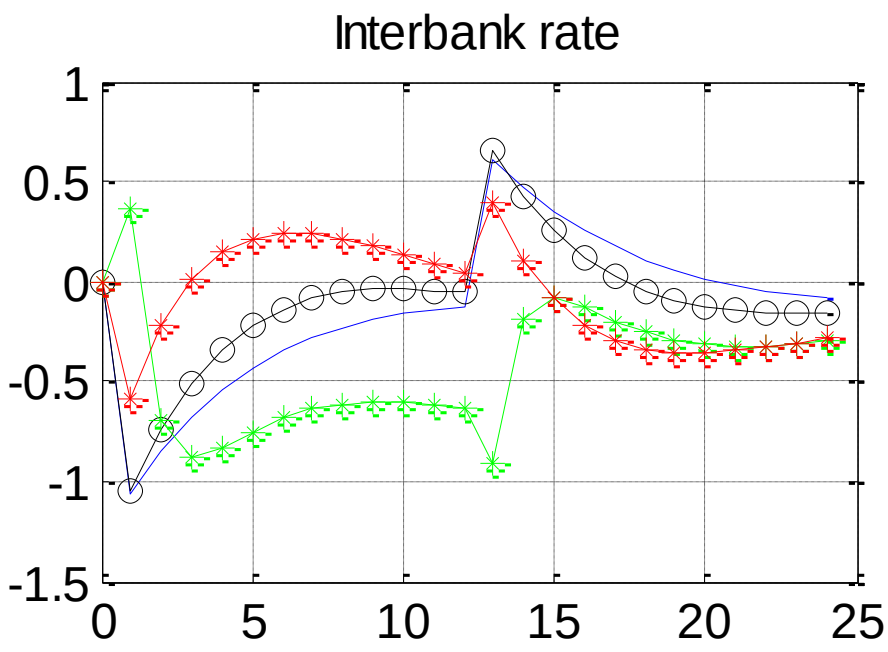

Natural
Price rigidities, financial frictions+IT regime
Price rigidities, financial frictions+augmented Taylor rule
Price rigidities, financial frictions+IT regime & countercyclical res. req.
GDP
Investment
Real exchange rate
Default rate
Inflation rate
Tobin Q
Recovery rate
Interbank rate
Reserve requirement (% Deposits)

Higher Welfare with Countercyclical RR

	Policy Framework	Welfare	Losses expressed relative to the Natural EQ welfare in terms of SS consumption
1	Standard Taylor rule	-17.1602	11.27%
2	IT Regime	-16.9999	11.15%
3	Augmented Taylor rule	-17.0887	11.22%
4	IT regime and Countercyclical RR	-15.4649	10.00%

MP rate: coordinate with Macroprudential tool

- Tinbergen, Mundell principles
- MP rate has to follow the “natural” rate and be adjusted by the RR



Robustness: Direct foreign borrowing financial sector

- Include foreign debt (denominated in dollars) for entrepreneurs and credit intermediaries
- More financial volatility, but same policy ranking

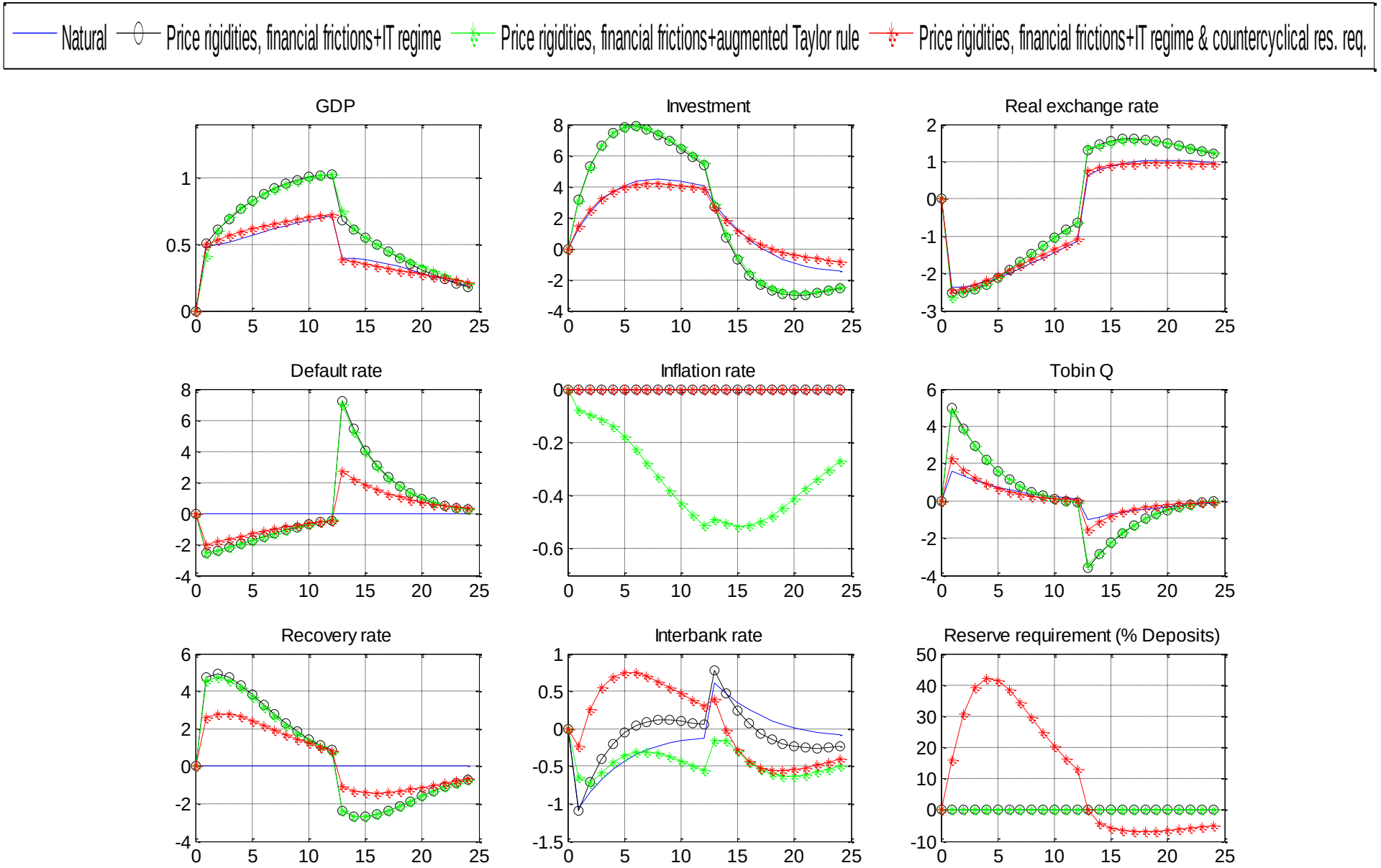
	Policy Framework	Welfare	Losses expressed relative to the Natural EQ welfare in terms of SS consumption
1	Standard Taylor rule	-16.9037	10.85%
2	IT Regime	-16.7712	10.75%
3	Augmented Taylor rule	-16.8059	10.78%
4	IT regime and Countercyclical RR	-14.1297	8.79%

Robustness: Dollarization

- Loans to entrepreneurs are denominated in dollars. This also rises the volatility
- Taylor rules "dominate" IT, **MaPP** improves the welfare even more.

	Policy Framework	Welfare	Losses expressed relative to the Natural EQ welfare in terms of SS consumption
1	Standard Taylor rule	-17.1063	10.65%
2	IT Regime	-16.8577	10.58%
3	Augmented Taylor rule	-16.7650	10.56%
4	IT regime and Countercyclical RR	-10.8573	6.27%

Dollarization



Robustness: Wage rigidities

- Only a fraction of workers adjust their wages to labor market condition every period (Blanchard-Galí, 2007)
- This increases the responses of asset prices and defaults. Still **same ranking of policies**.

	Policy Framework	Welfare	Losses (+) expressed relative to the Natural EQ welfare in terms of SS consumption
1	Standard Taylor rule	-17.6437	13.17%
2	IT Regime	-16.9368	12.63%
3	Augmented Taylor rule	-17.3656	12.96%
4	IT regime and Countercyclical RR	-14.3495	10.65%

Conclusions

- A countercyclical macroprudential policy is better suited to manage the volatility of world interest rates/capital flows
- Conclusion is robust to different combinations of nominal and financial frictions
- Inflation Targeting continues to be the main monetary policy objective, but MP rate must accommodate moves in the “natural” interest rate and reserve requirements

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