FX intervention and monetary policy design: a market microestructure analysis

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All views expressed in this presentation are those of the author and do not necessarily represent the views of the Central Reserve Bank of Peru.

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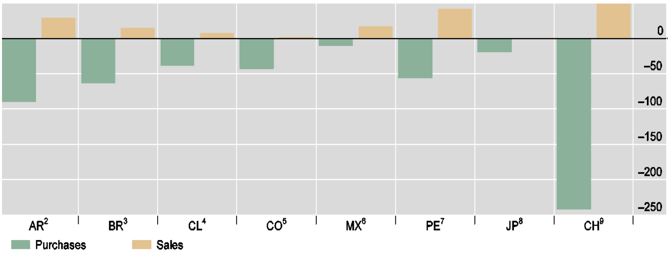
MOTIVATION

- Many central banks (EMEs/AEs) have reacted with FX (sterilised) interventions to capital inflows.

FX intervention : 2009 - 2012

(As a percentage of average foreign exchange reserve minus gold)



AR = Argentina; BR = Brazil; CH = Switzerland; CL = Chile; CO = Colombia; JP = Japan; MX = Mexico; PE = Peru.

Sources: National data; BIS calculations.

MOTIVATION

Questions that need to be addressed

- How sterilised intervention affects the transmission mechanism of monetary policy?
- Which channels are at work (portfolio/signaling channel)?
- Are there benefits for intervention rules?
- What should be the optimal monetary policy design?

What other authors have done? (1)

- Messe & Rogoff (1983): random walk predicts exchange rates better than macroeconomic models.
- Lyons (2001): ”the exchange rate determination puzzle”.
- **FX microstructure.** Evans & Lyons (2002) and others: short-run exchange rate volatility is related to order flow.
- **Information heterogeneity.** Bacchetta & van Wincoop (2006): exchange rates in the short run closely related to order flow (little with fundamental).
- Vitale (2011): extends Bacchetta & van Wincoop (2006) to introduce FX intervention. Show importance of both portfolio-balance/ signaling channels.
- FX interventions in a NK-DSGE setup: Benes et al. (2013), Vargas et al. (2013), Escudé (2012).

What do we do?

1) **We extend an SOE New Keynesian model, including:**

- A market of risk averse FX dealers.
- An explicit role for exchange rate volatility.
- the interaction of FX intervention with monetary policy.
- Extension: information heterogeneity across FX dealers.

2) We extend Townsend (1983) / Bacchetta & van Wincoop (2006) method to solve a DSGE model with heterogeneous information.

What do we find?

FX intervention...

- strong interactions between FX intervention and monetary policy,
- the source of exchange rate movements matters for the effectiveness of interventions,
- rules can make FX interventions more effective as a stabilisation instrument (expectations channel),
- overall, the control over the exchange rate variance reduces the importance of non-fundamental shocks in the economy,
- this results are still valid under heterogeneous information, where interventions can restore the connection with observed fundamentals.

The model (1)

- Standard NK-SOE DSGE model with an FX market run by risk averse dealers.
- Each dealer d receive FX market orders from households, foreign investors and the central bank.
- Dealers are short-sighted and maximise:

$$\max -E_t^d e^{-\gamma \Omega_{t+1}^d}$$

where $\Omega_{t+1}^d = (1 + i_t) B_t^d + (1 + i_t^*) S_{t+1} B_t^{d*}$ is total investment after returns.

The model (2)

- The demand for foreign bonds by dealer d:

$$B_t^{d*} = \frac{i_t^* - i_t + E_t^d s_{t+1} - s_t}{\gamma \sigma^2}$$

where $\sigma^2 = var_t\left(\Delta s_{t+1}\right)$ is the time-invariant variance of the depreciation rate.

The model (3)

- Aggregating over dealers: modified UIP (similar to B&vW 2006)

$$\overline{E}_t s_{t+1} - s_t = i_t - i_t^* + \gamma \sigma^2 (\varpi_t^* + \varpi_t^{*,cb})$$

$\overline{E}_t$: **average** rational expectation across all dealers.
ϖ_t^* : capital inflows
$\varpi_t^{*,cb}$: CB intervention (FX sales).

- In our baseline case, under perfect information, $E_t(x) = \overline{E}_t(x)$.

Monetary authority (1)

- Central bank implements monetary policy by setting the nominal interest rate according a Taylor rule:

$$\hat{\imath}_t = \varphi_\pi(\pi_t) + \varepsilon_t^{int}$$

- Three different strategies of FX intervention
  - Pure discretional intervention:

$$\varpi_t^{*cb} = \varepsilon_t^{cb1}$$

  - Exchange rate rule:

$$\varpi_t^{*cb} = \phi_{\Delta s} \Delta s_t + \varepsilon_t^{cb2}$$

  - Real exchange rate misalignments rule:

$$\varpi_t^{*cb} = \phi_{rer} rer_t + \varepsilon_t^{cb3}$$

Other equations of interest

- **Aggregate demand**

$$y_t = \phi_C(c_t) + \phi_X(x_t) - \phi_M(m_t)$$

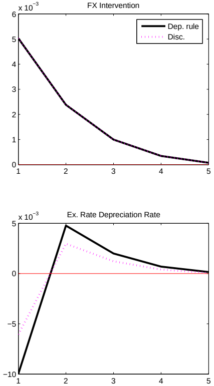
- **Aggregate supply**

$$\begin{aligned} \pi_t &= \psi\pi_t^H + (1-\psi)\,\pi_t^M \\ \pi_t^H &= \kappa_H mc_t + \beta E_t \pi_{t+1}^H \end{aligned}$$

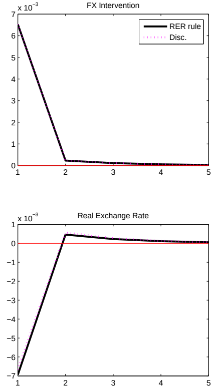
- **Current account**

$$\phi_\varpi\left(b_t - \beta^{-1} b_{t-1}\right) = t_t^{def} + y_t - \phi_C c_t + \phi_\varpi/\beta\left(i_{t-1} - \pi_t\right)$$

Perfect Information: Results (1) - Rules vs. Discretion



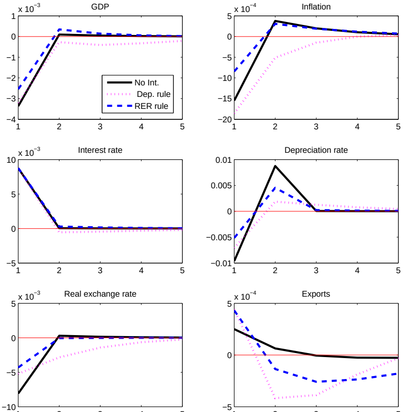
(a) Int. Rule 1



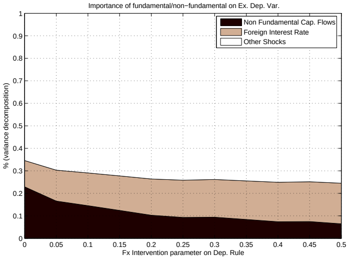
(b) Int. Rule 2

Results (2) - Interaction with Monetary Policy

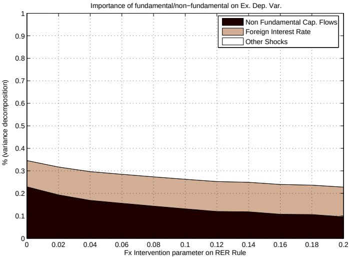
Figure: Reaction to a 1% Monetary Policy Shock - Rules vs. No Intervention



Results (3) - Contribution of Shocks under FX Intervention



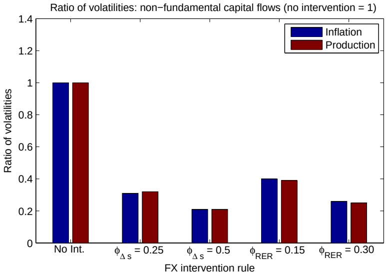
(a) Δs rule



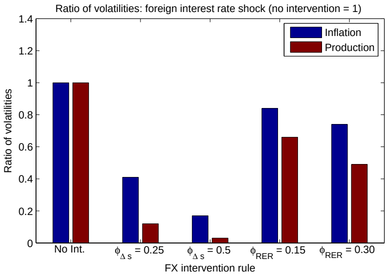
(b) RER rule

Figure: Variance Decomposition

Results (4) - Effect of FX Intervention Rules

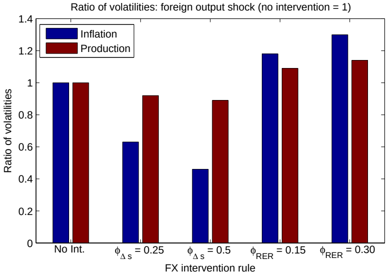


(a) ω^* shock

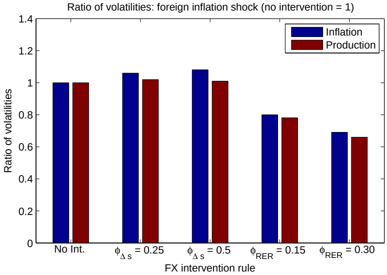


(b) i^* shock

Results (5) - Effect of FX Intervention Rules (2)



(c) y^* shock



(d) π^* shock

Heterogeneous information structure (1)

- Foreign investor exposure equals average + idiosyncratic term:

$$\varpi_t^{d*} = \varpi_t^* + \varepsilon_t^d$$

- ϖ_t^* is unobservable and follows an AR(1) process

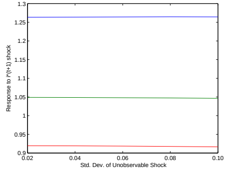
$$\varpi_t^* = \rho_\varpi \varpi_{t-1}^* + \varepsilon_t^{\varpi^*}$$

where $\varepsilon_t^{\varpi^*} \sim N\left(0, \sigma_{\varpi^*}^2\right)$. The assumed autoregressive process is known by all agents.

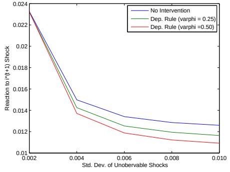
Heterogeneous information structure (2)

- Now dealers observe past and current fundamental shocks, while also receive private signals about some future shocks.
- At time t dealer d receive a signal about the foreign interest rate one period ahead:
$$v_t^d = i_{t+1}^* + \varepsilon_t^{vd}$$
where $\varepsilon_t^{vd} \sim N\left(0, \sigma_{vd}^2\right)$ is independent from i_{t+1}^* and other agent's signals. We also assume that the average signal received by investors is i_{t+1}^*, that is $\int_0^1 v_t^d dd = i_{t+1}^*$.
- For the solution we extend Townsend (1983) and Bacchetta and van Wincoop (2006) to a DSGE model. here.

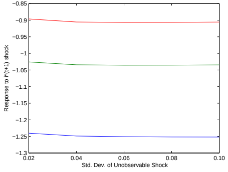
Results (6) - The Effects of HI



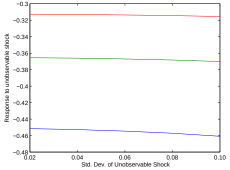
(e) Reaction to a i^*_{t+1} - CK



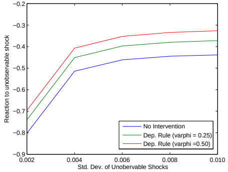
(f) Reaction to a i^*_{t+1} - HI



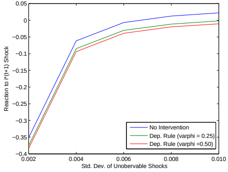
(g) Difference (HI-CK)



(h) Reaction to a ω^*_t - CK

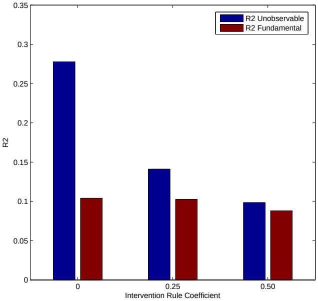


(i) Reaction to a ω^*_t - HI

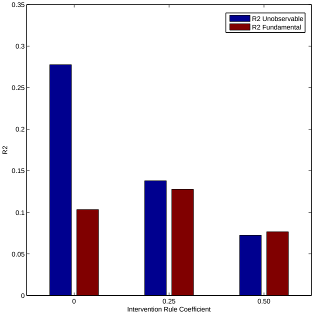


(j) Magnification (HI-CK)

Results (7) - FX Intervention under HI



(k) Δs rule



(l) RER rule

Figure: Regression of Δs_t on unobservable and fundamental shocks

Conclusions

- We present an alternative model of exchange rate determination in general equilibrium that can be useful:
  - to explain puzzles in the new international economy literature.
  - for policy analysis (central banks).
- Our results of FX intervention in general equilibrium:
  - Effective as an instrument in face of financial shocks, but not so much in face of real shocks or nominal external shocks;
  - FX intervention rules can have stronger stabilisation power than discretion as they exploit the expectations channel;
  - with heterogeneous information, FX intervention can help restore connection between exchange rate and fundamentals.
- Additional exercises: welfare analysis (eg welfare frontiers for different rules), robustness exercises, informative content in interventions, interventions under noisy/imperfect information.

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Computational Strategy (1)

We divide the system of log-linearised equations in 2 blocks.

Solving the first block

- We take into account all the equations, except the modified UIP condition.
- We solve this system of equations by the perturbation method, taking the depreciation rate (Δs_t) as an exogenous variable.
- The system of log-linear equations become:

$$A_0 \begin{bmatrix} X_t \\ E_t Y_{t+1} \end{bmatrix} = A_1 \begin{bmatrix} X_{t-1} \\ Y_t \end{bmatrix} + A_2 \Delta s_t + B_0 \epsilon_t$$

Back to main.

Computational Strategy (2)

Solving the second block

- The second block corresponds to the modified UIP condition:

$$\overline{E}_t \Delta s_{t+1} = i_t - i_t^* + \gamma \sigma^2 (\varpi_t^* + \varpi_t^{*,cb}) \tag{1}$$

- Based on Townsend (1983) and Bacchetta and van Wincoop (2006), we adopt a method of undetermined coefficients conjecturing the following equilibrium equation for Δs_t:

$$\Delta s_t = A(L)\varepsilon_{t+1}^{i^*} + B(L)\varepsilon_t^{\varpi^*} + D(L)\zeta_t' \tag{2}$$

where $A(L)$, $B(L)$ and $D(L)$ are infinite order polynomials in the lag operator L.

Back to main.

Computational Strategy (3)

Solving the second block

- We use the solution in the first block to find a $MA\left(\infty\right)$ representation of the endogenous variables (eg i_t, ϖ_t^{*cb}) as a function of the shocks and replace it in equation (1).
- **Signal extraction.** Dealers extract information from the observed depreciation rate $\left(\Delta s_t\right)$ and signal (Δv_t^{d*}) to infer the unobservable shocks $\left(\varepsilon_{t+1}^{i^*}, \varepsilon_t^{\varpi^*}\right)$:

$$\left[\begin{array}{c} \Delta s_t^* \\ \Delta v_t^{d*} \end{array}\right] = \left[\begin{array}{cc} a_1 & b_1 \\ 1 & 0 \end{array}\right] \left[\begin{array}{c} \varepsilon_{t+1}^{i^*} \\ \varepsilon_t^{\varpi^*} \end{array}\right] + \left[\begin{array}{c} 0 \\ \varepsilon_t^{vd} \end{array}\right]$$

- **Undetermined coefficients:** the coefficients in the conjectured equation (2) need to solve the modified UIP condition (1).

Back to main.