FX intervention and monetary policy design: a market microestructure analysis

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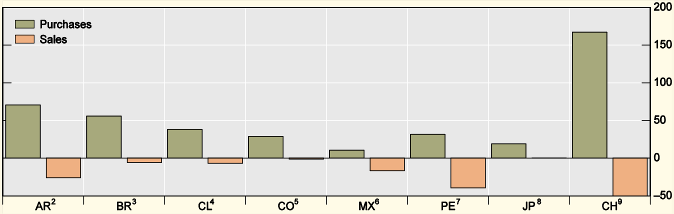
MOTIVATION

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

FX intervention : 2009 – March 2012



(as a % of average FX reserve minus gold)

MOTIVATION

Questions that need to be addressed

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

What other authors have done? (1)

- Messe & Rogoff (1983): randow walk predicts exchange rates better than macroeconomic models.
- Lyons (2001): "the exchange rate determination puzzle".
- **FX microestructure.** 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 (2010): extends Bacchetta & van Wincoop (2006) to introduce FX intervention. Show importance of both portafolio-balance/ signalling channels.

What do we do?

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

- A FX dealer market with heterogenous information.
- To analyse the interaction of FX intervention with Monetary Policy.

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

What do we find?

FX intervention...

- reduces the power of monetary policy (pass-through effect).
- under discretion can have larger effects in the exchange rate than under rules (surprise effect).
- ...but rules can make FX more effective as a stabilisation instrument (expectations channel).

The model (1)

Setup

FX dealers:

- receive savings from households and foreign investors,
- invest in both currencies,
- receive heterogeneus information with noise.

Households

- consume,
- save
- supply labour.

The model (2)

Firms:

- intermediate goods: use labour.
- final goods: domestic goods, exports, imports.
- monopolistic competition and nominal rigidities.
- export sector: price discrimination and price to market.
- import sector: incomplete pass-through.

Domestic small open economy

- size $\longrightarrow$ 0,
- subject to capital flows.

Central bank has two policy instruments:

- interest rate
- FX (sterilised) intervention.

Dealers (1)

- 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.

Dealers (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.

Dealers (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).

Dealers: 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.

Dealers: information structure (2)

- 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 $\int_0^1 v_t^d dd = i_{t+1}^*$.

Monetary authority (1)

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

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

- 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**

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

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:

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

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 polinomials in the lag operator L.

Computational Strategy (3)

Solving the second block

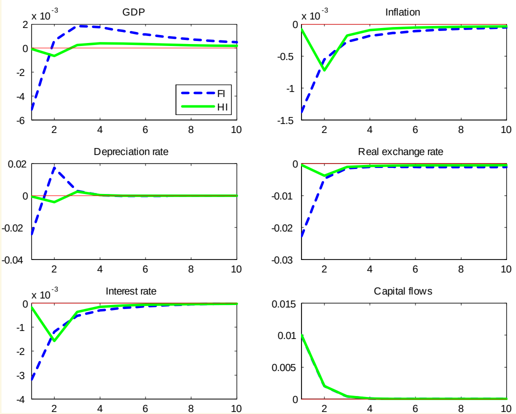
- We use the solution in the first block to find a $MA(\infty)$ representation of the endogenous variables (eg i_t, ϖ_t^{*cb}) as a function of the shocks and replace it in equation (1).
- **Signal extraction.** Dealers extract information from the observed depreciation rate (Δs_t) and signal (v_t^{d*})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

$$\begin{bmatrix} \Delta s_t^* \\ v_t^{d*} \end{bmatrix} = \begin{bmatrix} a_1 & b_1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} \varepsilon_{t+1}^{i^*} \\ \varepsilon_t^{\varpi^*} \end{bmatrix} + \begin{bmatrix} 0 \\ \varepsilon_t^{vd} \end{bmatrix}$$

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

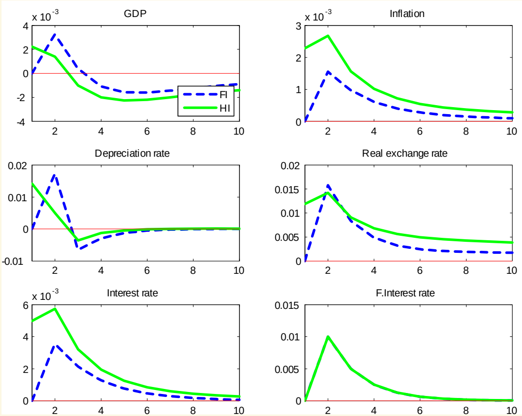
Results (1)

Disconection from fundamentals (IRFs capital inflows)



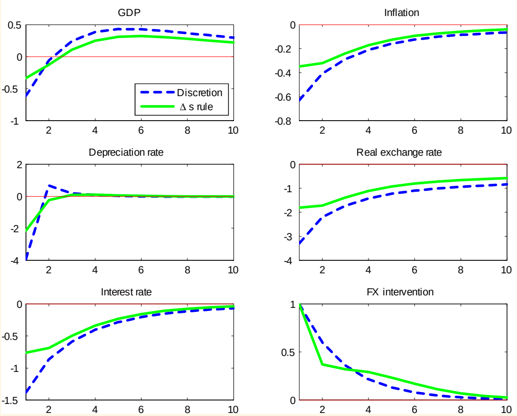
Results (2)

Anticipation effect (IRFs i^*_{t+1})



Results (3)

Intervention at work (discretion vs rule - HI)



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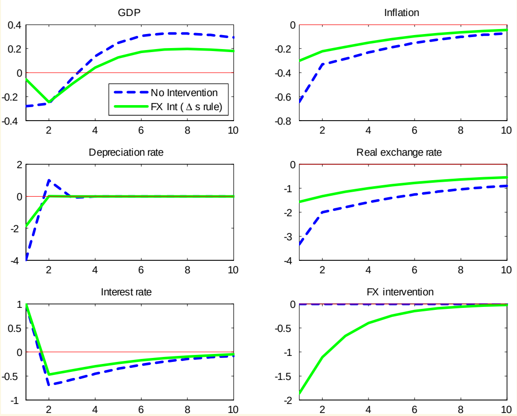
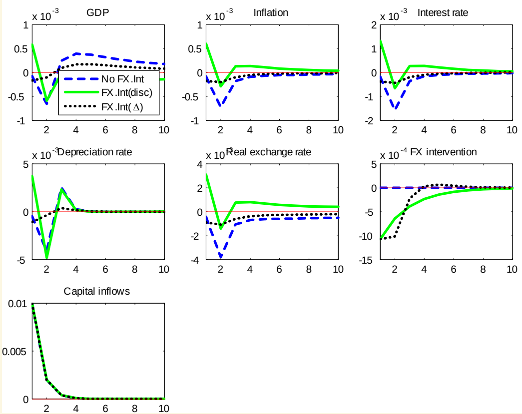
Results (4)

Intervention at work (MP effects)



Results (5)

Intervention at work (capital inflow 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).
- Some (preliminary) results of FX intervention in general equilibrium: reduces the power of monetary policy, relative benefits of rules in comparison with discretion.
- Additional excercises: test order flows (measured by the private information component of orders), welfare analysis (eg welfare frontiers for different rules), robustness excercises.