Banking Limits on Foreign Holdings

Disentangling the Portfolio Balance Channel

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Research Objective

Analyze the effects of financial constraints on the exchange rate through the portfolio channel

- Construct a two-period model where constraints inhibit capital flows
  - Departures from UIP explain the effects of sterilized intervention

- Empirically test this channel by using a sharp policy discontinuity within Colombian regulatory banking limits
  - Effects of limits banking limits on foreign holdings

Findings: Effects on the exchange rate are short-lived, and significant only when: (a) constraints are binding and (b) in periods of Central Bank intervention

Motivation

- The "*corner* or *bipolar hypothesis*" began to lose popularity after the East Asia crises (1997-98) and the failure of Argentina's currency board (2001)

  -Eichengreen (1994), Obstfeld and Rogoff (1995)

- Since then, central banks have allegedly opted for monetary policy autonomy (but reluctant to relinquish control over currencies)

  - Concerted initiatives include: Smithsonian Agreement (1971), Plaza Accord (1985), Louvre Accord (1987), Chiang Mai Initiative (2000) and Pittsburg Agreement (2009)

Motivation

- The impossible trinity (*trilemma*) indicates that a country cannot
  - Allow for free capital flows
  - Have autonomous monetary policy
  - Adopt a fixed or managed exchange rate

Policymakers can only regain control of the exchange rate if they abandon monetary policy or enact capital controls

- In the empirical literature, there is a lack of consensus regarding the effectiveness of Central Bank intervention
  - Menkhoff (2013) and Villamizar and Perez (2015): 15/25 and 16/32 studies find significant FXI effects
  - Few studies center on the Portfolio Balance Channel: Dominguez and Frankel (1993), Dominguez (2003), Gabaix and Maggiori (2015), Kuersteiner et al. (2016)

Financial Rigidities

Financial Rigidities: Limits on foreign exposure

- Colombian Banks have limits on foreign holdings
  - *PPC -Assets minus Liabilities in USD relative to total capital (Jan 2004-Oct 2015)*
- Colombian Banks are key players in COP-USD market
- When limits bind, banks are no longer indifferent between holding different currency denominated assets

Model

Two-period Small Open Economy (exogenous r^*)

- Representative household (Banks)
  - Receive exogenous endowment (A_t) and government transfer (τ_t)
  - Choose whether to save in domestic or foreign assets
  - Face limits on the amount of foreign assets

- Government (Central Bank)
  - Issues domestic debt to buy foreign assets B^* (Sterilized FXI)

Findings

Multiple equilibria

- Constraints do not bind *-UIP holds*
  - Agents are indifferent between foreign and domestic assets
  - Exchange rate does not depend on foreign assets

- Constraints bind *-UIP does not hold*
  - Household wants to save in asset with higher return until limit binds
  - Exchange rate depends on
    - FX intervention
    - Regulatory limits
  - Intervention helps overcome wedge caused by departure from UIP

Maximization Problem

Households

$$\max_{c_0, c_1, B, B^*} \quad U(c_0, c_1) = \ln c_0 + \beta \ln c_1$$

$$\text{s. t.} \quad c_0 + B + e_0 B^* = A_0 + \tau_0$$

$$c_1 = (1+r)B + (1+r^*)e_1 B^* + A_1 + \tau_1$$

$$\underline{B} \leq \frac{e_0 B^*}{I} \leq \overline{B} \qquad \textit{where} \qquad I \equiv A_0 + \tau_0 + \frac{A_1 + \tau_1}{1+r}$$

Government

Budget is balanced through lump-sum transfers

$$\tau_0 \equiv B_G - e_0 B_G^*$$

$$\tau_1 \equiv -(1+r)B_G + (1+r^*)e_1 B_G^*$$

We can only pin down $\frac{e_1}{e_0}$, so we assume $e_0 = 1$

Maximization Problem

- From Household's maximization problem:

$$1 + r = e_1 (1 + r^*) - \frac{\overline{\lambda} - \underline{\lambda}}{\beta I} c_1$$

$\overline{\lambda}$ ($\underline{\lambda}$): Lagrange multiplier of upper (lower) bound on dollar exposure

- $1 + r < e_1 (1 + r^*) \iff \overline{\lambda} > 0$ and $\underline{\lambda} = 0$
- $1 + r > e_1 (1 + r^*) \iff \overline{\lambda} = 0$ and $\underline{\lambda} > 0$

Equilibrium

A competitive equilibrium in this economy consists of

- Prices $P = \{e_1, r\}$
- Allocations $X = \{c_0, c_1, B, B^*\}$
- Government policies $G = \{B_G, B_G^*\}$

such that

1. Given P, X is a solution to the household's problem
2. Markets clear

Proposition

- When constraints don't bind, e_1 does not depend on B_G^*

$$e_1 = \frac{1+r}{1+r^*} = \frac{A_1}{\beta A_0(1+r^*)}$$

- When constraints bind then FX intervention affects e_1

$$e_1 = \frac{1+r}{1+r^*}\left(1 \underbrace{- \frac{1}{\tilde{B}} - \frac{(1+\beta)A_0}{B_G^*}}_{\text{Wedge}}\right) \qquad \text{for } \tilde{B} \in \{\overline{B}, \underline{B}\}$$

Empirical methodology

- Conduct a sharp RDD to study the effects of banking limits
  - Causal effects are identified in episodes of central bank intervention and non-intervention

- Findings
  - Banking limits have a short-lived effect on the exchange rate
  - Effects are greater in episodes when the central bank intervened
  - Effects on portfolio are significant (loans and foreign exposure)

RDD

- Assignment of treatment:

$$D_t = \mathbf{1}\{X_t \geq x_0\}$$

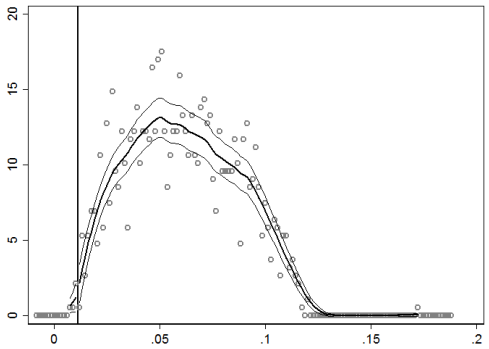
- Average Treatment Effect

$$\begin{aligned}
\text{ATE} =& E\left(Y_{1t} - Y_{0t} \mid X_t = x_0\right) \\
=& E\left(Y_{1t} \mid X_t = x_0\right) - E\left(Y_{0t} \mid X_t = x_0\right) \\
=& \lim_{\epsilon \downarrow 0} E\left(Y_t \mid X_t = x_0 + \epsilon\right) - \lim_{\epsilon \uparrow 0} E\left(Y_t \mid X_t = x_0 + \epsilon\right)
\end{aligned}$$

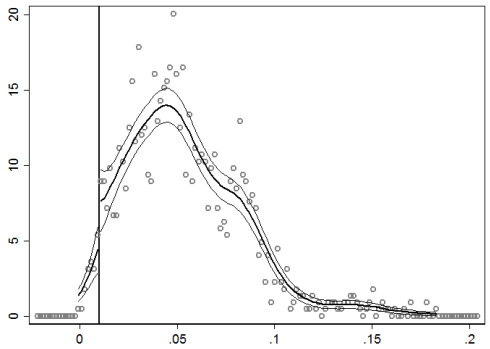
Last equality holds as long as conditional distribution of potential outcomes $\Pr\left(Y_{it} \leq y \mid X_t = x\right)$ is continuous at $X_t = x_0$, for $i \in \{0, 1\}$

No manipulation at cutoff

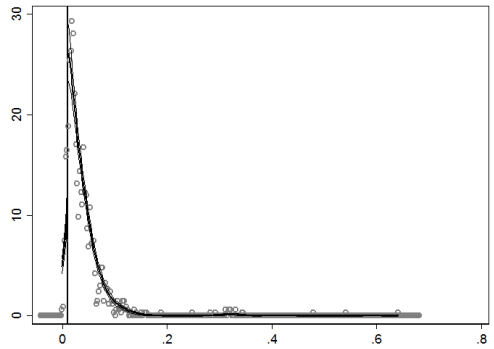
Figure: McCrary's (2008) Test



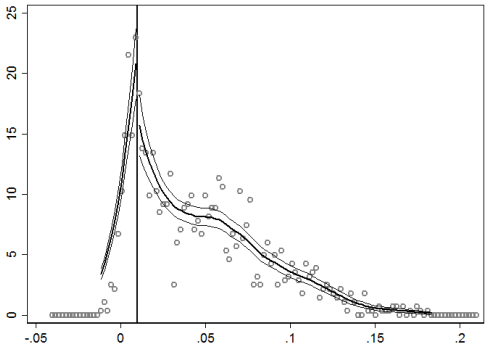
(a) Financial System



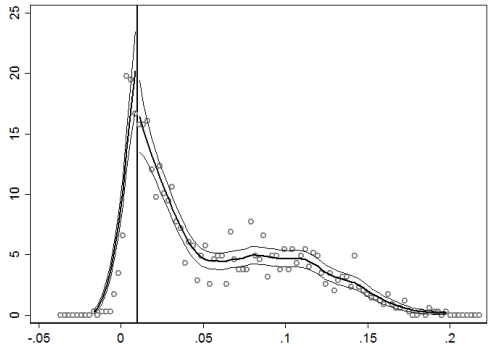
(b) Bank 1



(c) Bank 3



(d) Bank 4



(e) Bank 5

RDD

We estimate:

$$\left(\hat{a}, \hat{b}, \hat{\gamma}, \hat{\theta}\right) = \underset{a,b,\gamma,\theta}{\arg\min} \sum_{j=1}^{J} \sum_{t=2}^{T-J} \left(y_{t+j} - a_j - b_j \left(X_t - x_0\right) - \theta_j D_t - \gamma_j \left(X_t - x_0\right) D_t\right)^2 K\left(\frac{X_t - x_0}{h}\right)$$

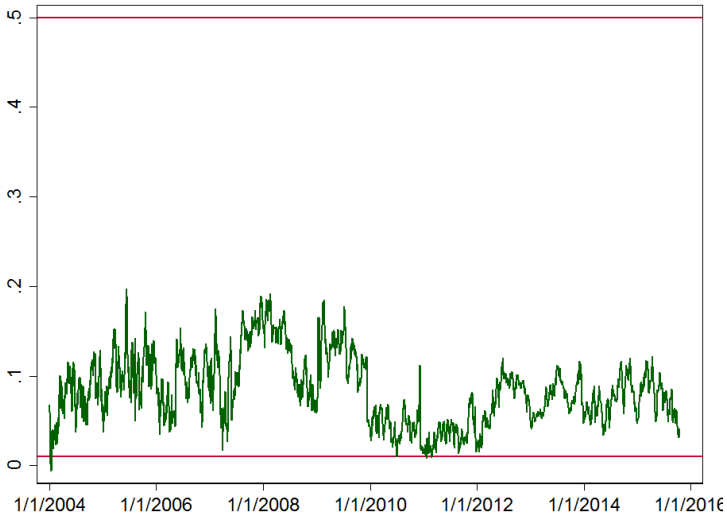
- $\theta = (\theta_1, ..., \theta_J)'$ are the impulse-response coefficients (Jorda (2005), Kuersteiner et al. (2016))
- $K(\cdot)$ is a kernel function
- h is the bandwidth
- b_j, γ_j are polynomials

Caveats

- As horizon expands, control days 'catch up' over time
- Continuity of potential outcomes cannot be fully tested -there are however, testable implications
- Results can depend on kernel/bandwidth
(Imbens and Kalyanaraman (2011), Calonico, Cattaneo, Titiunik (2014))

Data

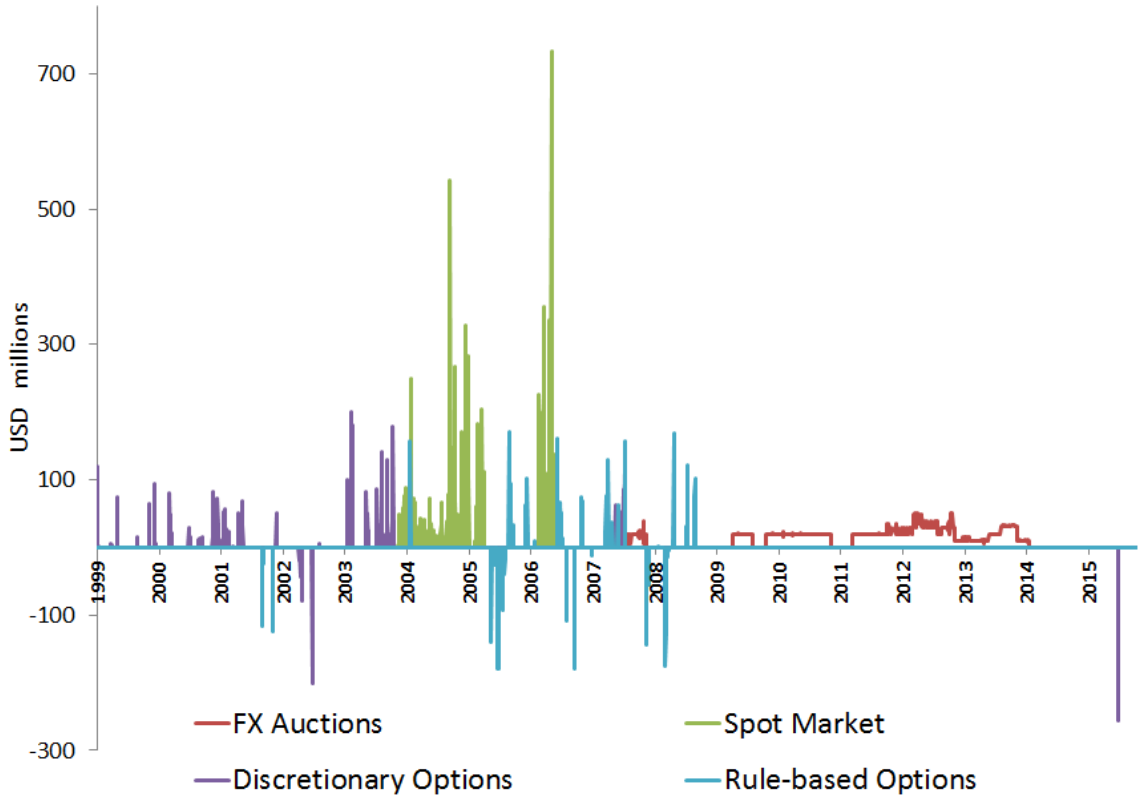
Figure: Financial System's Foreign Exposure as % of Equity



- Effective lower (1%) bound (Jan 23, 2004 - Oct 16, 2015)
- Total daily change in banks' foreign exposure (in terms of equity) was 1% between 2004-2015
- Running Variable: $\frac{1}{x_0} \frac{\textit{Net Short Term Assets (USD)}}{\textit{Capital}} < 1,$

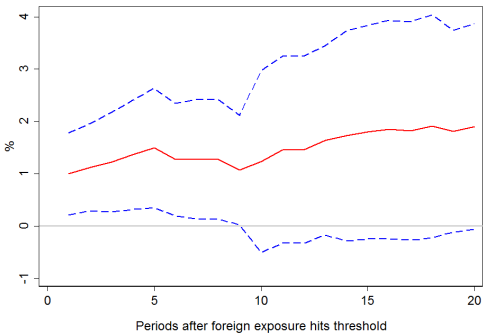
FX intervention

Figure: Official Foreign Exchange Intervention

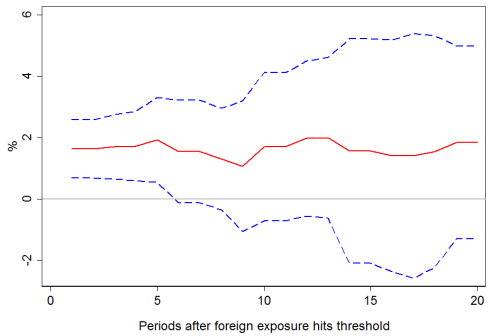


IRF's of Exchange rate (Δe_t)

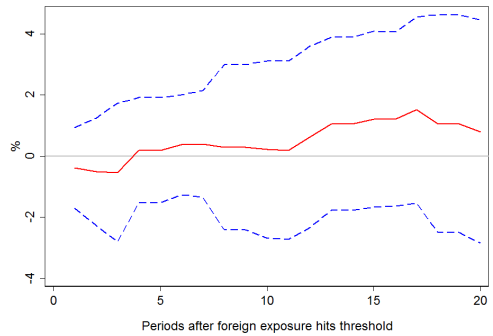
Figure: IRFs -Exchange rate changes



(a) Whole Sample



(b) Episodes of FXI



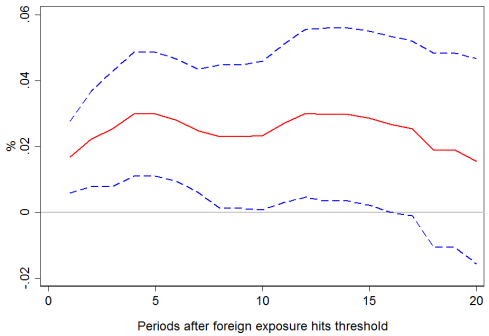
(c) Episodes of no FXI

Portfolio shifts

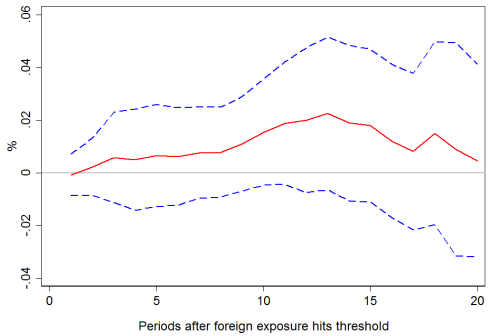
We consider effects of banking limits on portfolio balances of the five largest banks

- $\frac{(A_t^* - L_t^*)e_t}{A_t}$: Assets minus Liabilities as share of domestic assets
- $\frac{L_t^* e_t}{L_t}$: Loans (USD) as share of loans (COP)

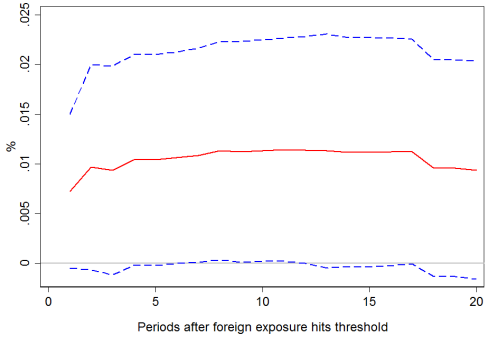
Portfolio shifts



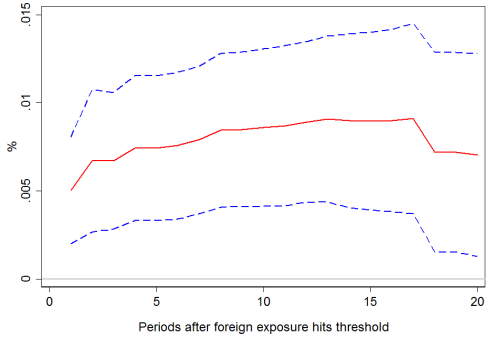
(d) $\frac{(A_t^* - L_t^*)e_t}{A_t}$ Poly



(e) $\frac{(A_t^* - L_t^*)e_t}{A_t}$ RDD



(f) $\frac{L_t^* e_t}{L_t}$ Poly



(g) $\frac{L_t^* e_t}{L_t}$ RDD

Conclusion

- Concluding remarks
  - 2-period tractable model: intervention has an effect on exchange rate when limits bind. Empirical exercise support this.
  - We find shifts in portfolio balances as a response to limits on foreign holdings.

- Ongoing Investigation
  - N-period model: Role of current account
  - Impact on capital flows, forward market