The impact of different forms of FX intervention

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Topics

- Introduction
- Colombian Foreign Exchange Intervention. Overview
- A Tobit- Garch model: US$ 20 million vs. Discretionary Interventions
- Event Study: Volatility Options vs. Other Type of Interventions
- Conclusions

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Fischer (2001)

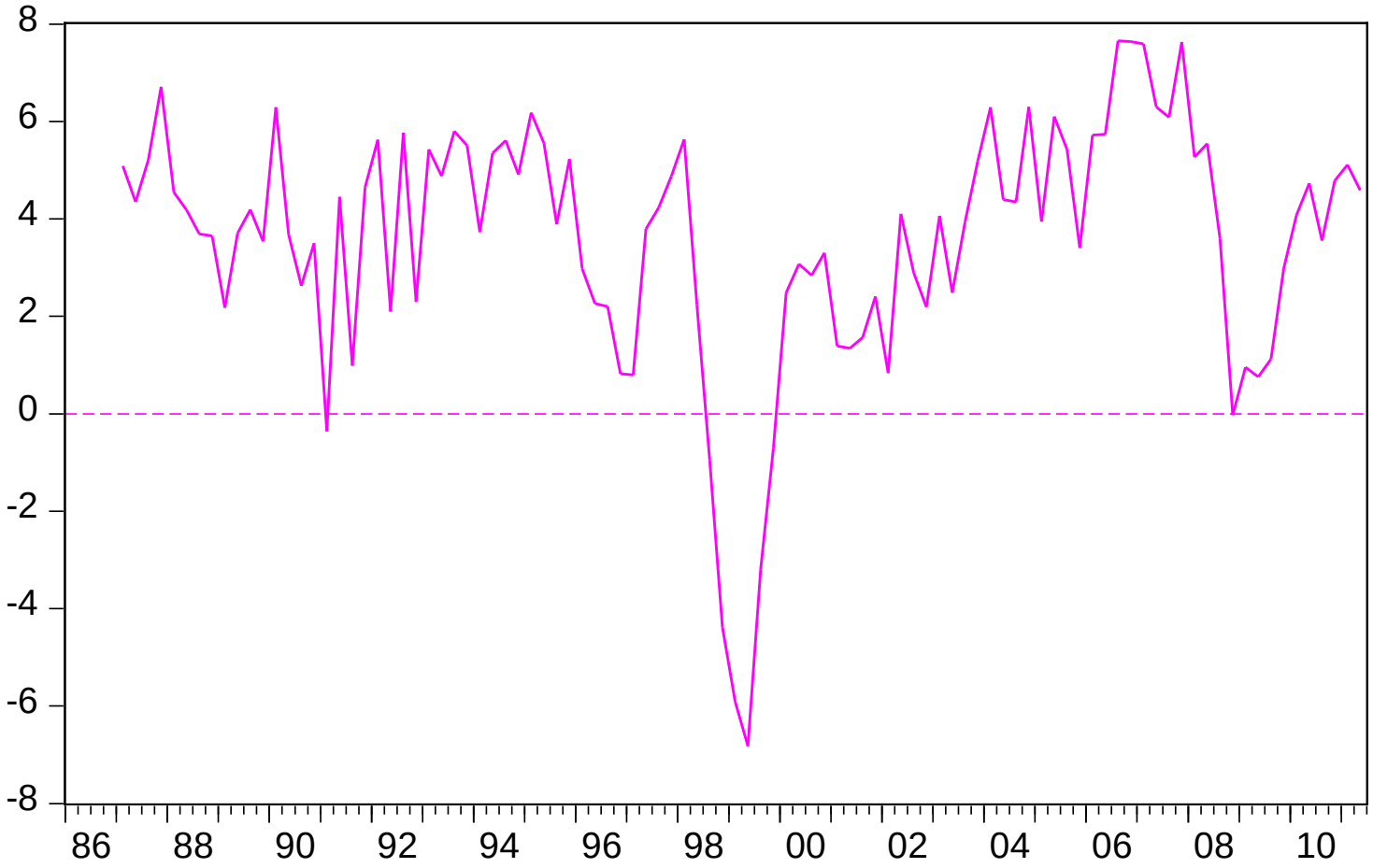
- **Each of the major international capital market-related crises since 1994 has in some way involved a fixed or pegged exchange rate regime**
  - **Mexico,in 1994, Thailand, Indonesia and Korea in 1997, Russia and Brazil in 1998, and Argentina and Turkey in 2000**
- **countries that did not, avoided crises of the type that afflicted emerging market countries with pegged rates**
  - **South Africa in 1998, Israel in 1998, Mexico in 1998, and Turkey in 1998**

- **Carvalho (2010) finds that those countries which adopted inflation targeting**
  - **handled the recent international crisis much better, partially because they float**
- **Kamil (2012) argues that currencies missmatches**
  - **are much marked under pegs**

- **Supporters of free floating in Colombia**
  - **contrast the deep crisis of 1999**
    - **partially caused by the implementation of an exchange rate band,**
  - **with the relatively successful recent experience under flexible rates**

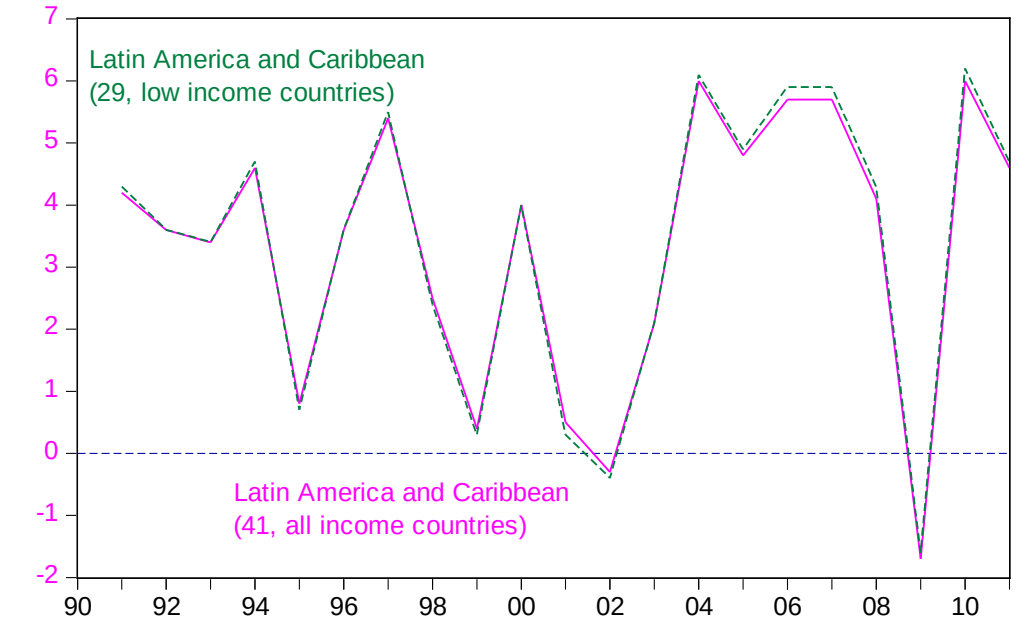
Colombian GDP

(y/y, %)



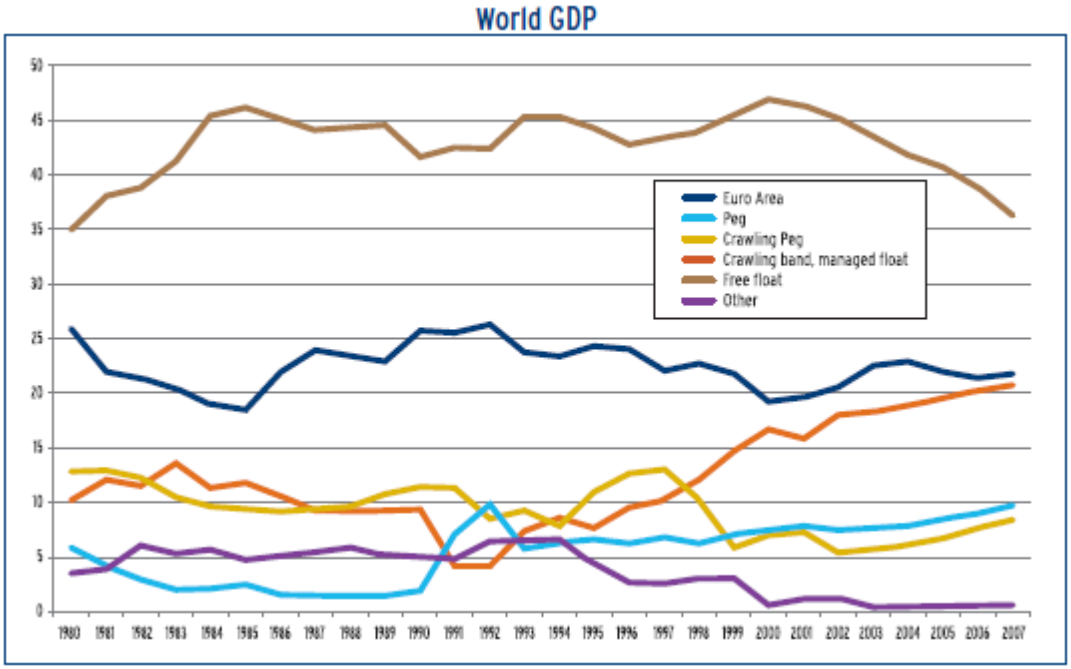
GDP

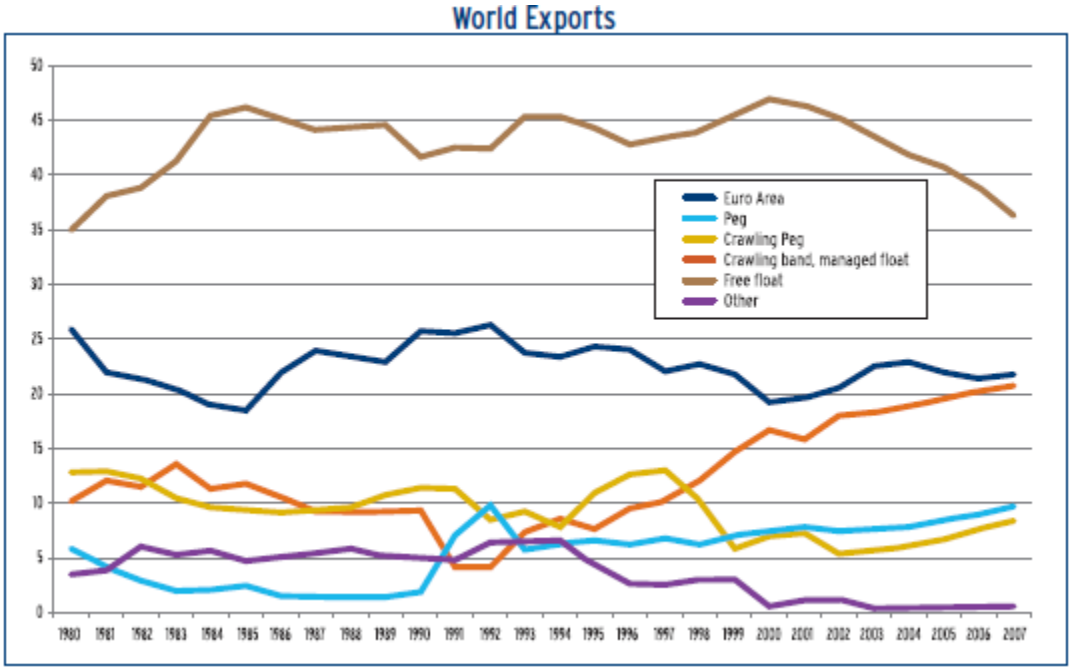
(y/y growth.%)



- **Razin and Rubinstein (2006): tensions with a fixed exchange rate regime**
  - **More investment and growth**
  - **More prone to macroeconomic crises**

Shares of countries under alternative exchange-rate regimes





Source: Eichengreen et.al (2011)

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Arguments for intervention

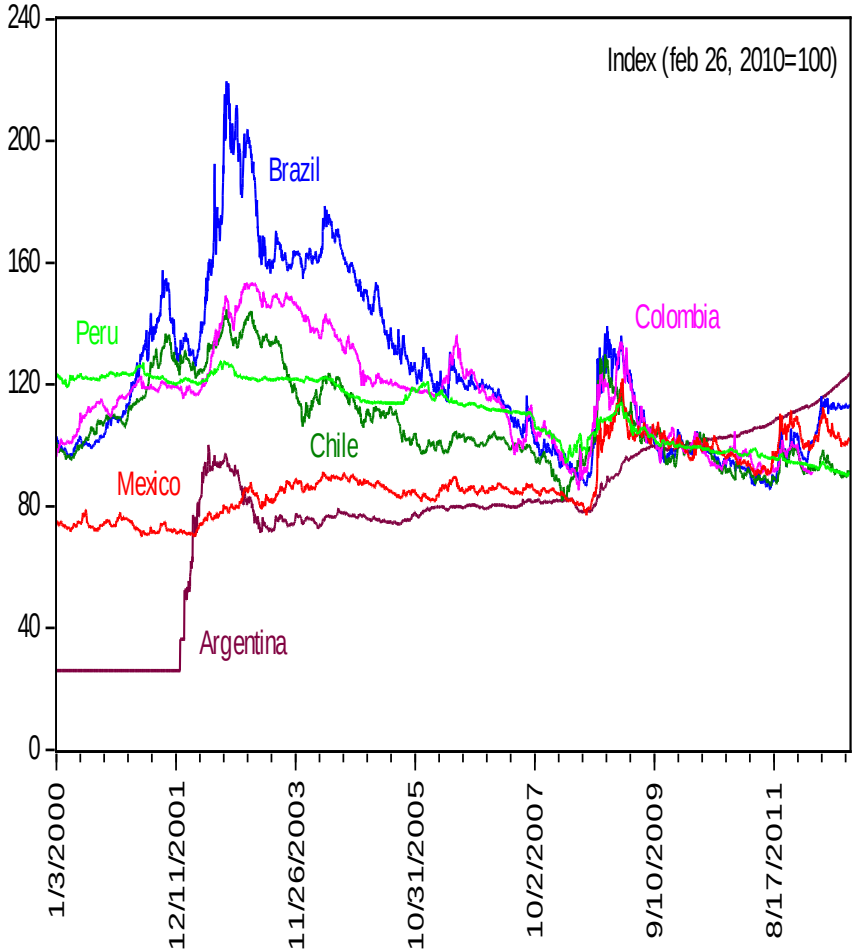
- International Reserves as shock absorbers, but…
  - flexible credit line with the IMF: 45% of the stock of international reserves in 2009, 13.9% in 2010, and 19.1% in 2012
  - The range of the “optimum” amount or reserves is very broad
- The desired level of the exchange rate differs from the observed level
- The volatility of the exchange rate is considered too high

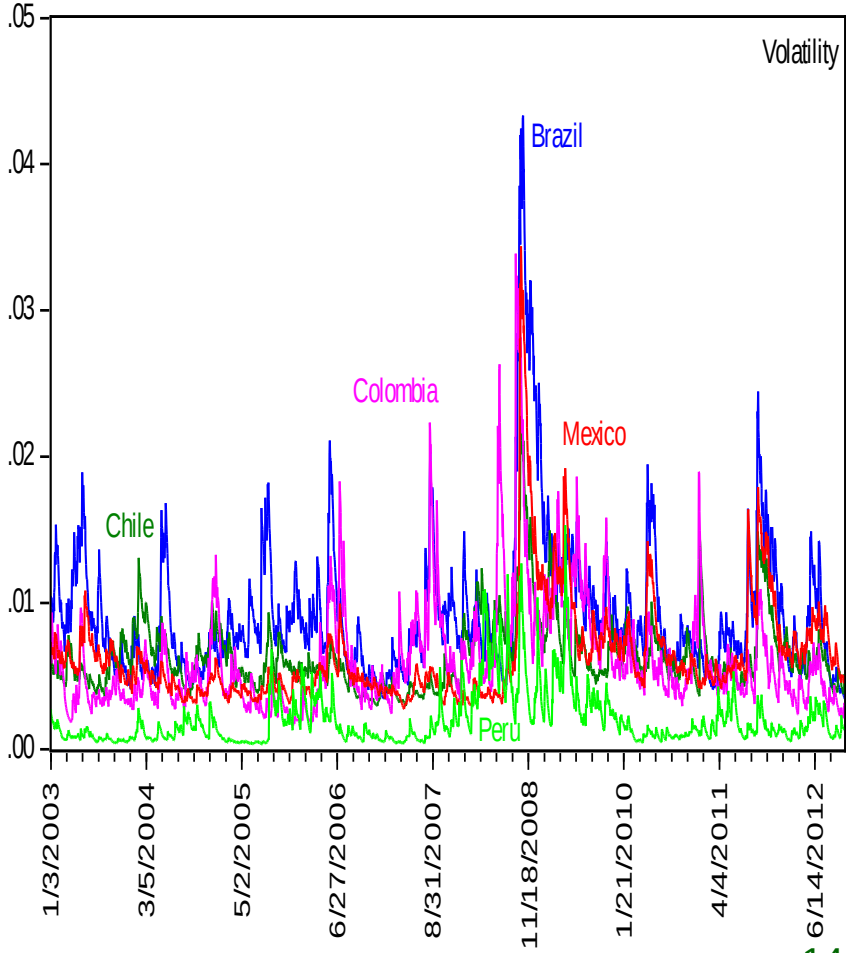
Reserve accumulation or volatility in the FX?

Source: Savastano (2011)

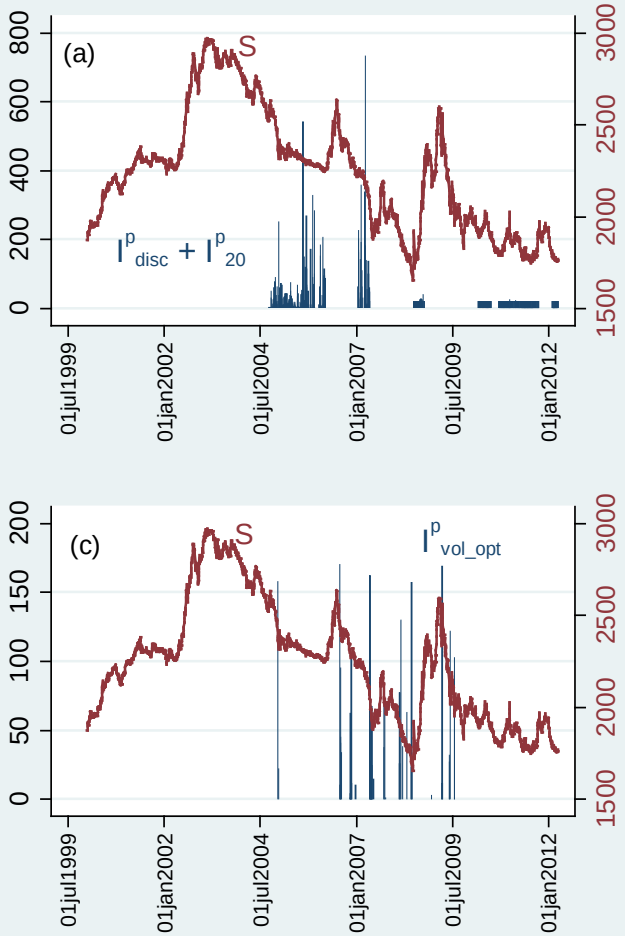
Nota: Promedios ponderados de 15 países de América Latina, y 10 países de Asia.
¹Índice, 2005=100.
²Reservas internacionales brutas como proporción del PIB promedio de 2006–08.

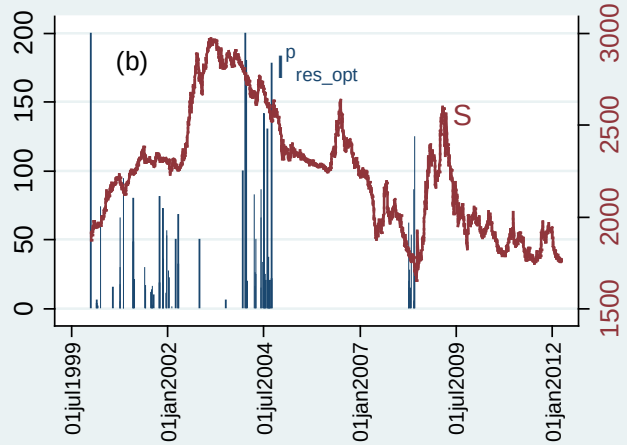
Level and volatility of the exchange rate





Colombian central bank intervention



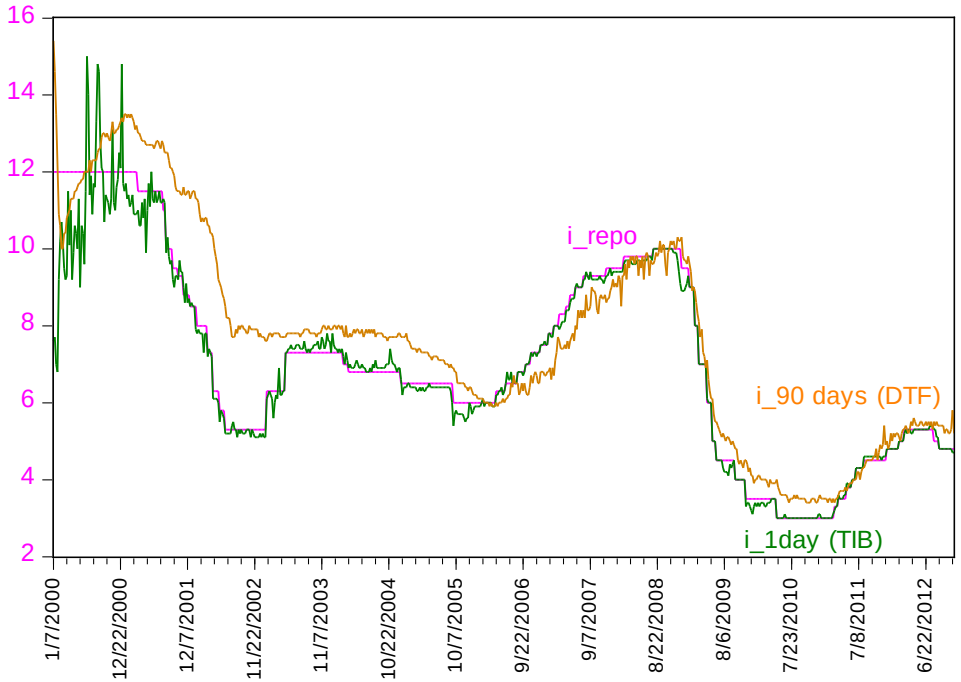


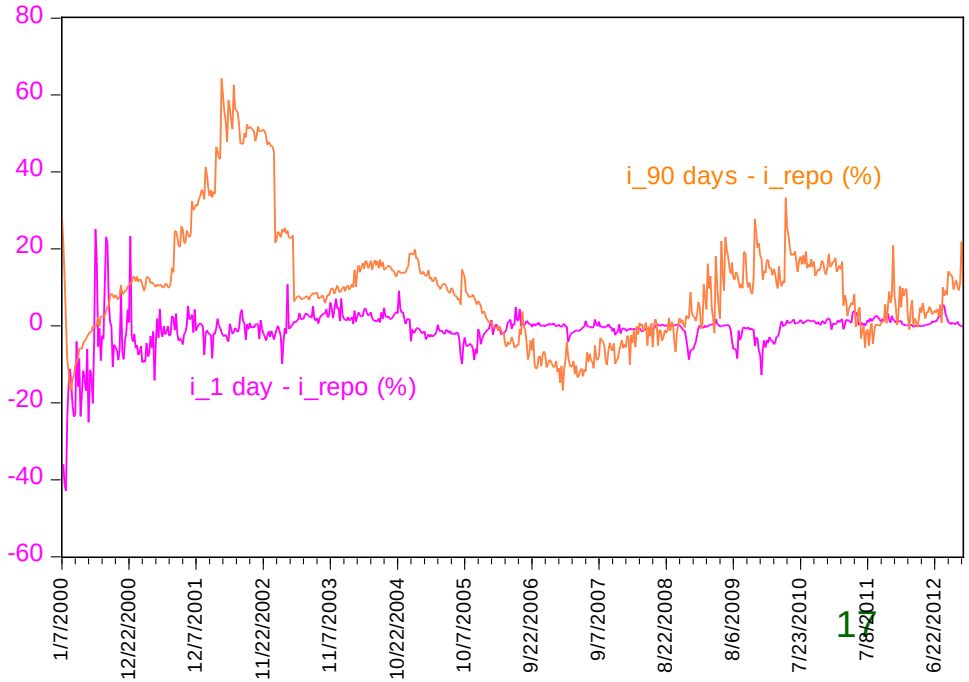
Colombian central bank intervention

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012*
Purchases (US$)	319	629	252	106	2,905	4,658	1,781	5,082	2,381	539	3,060	3,720	2,840
Participation (%)													
Options Put	100	100	100	100	54	0	33	11	41	100	0	0	0
International Reserve Accumulation	100	100	100	100	48	0	0	0	19	0	0	0	0
Volatility Options	0	0	0	0	6	0	33	11	22	100	0	0	0
$ 20 million/day aprox.	0	0	0	0	0	0	0	0	59	0	100	100	100
Discretional Intervention	0	0	0	0	46	100	67	89	0	0	0	0	0
Sales (US$)	0	0	414	345	500	3,250	1,944	369	235	369	0	0	0
Participation (%)													
Options Call			100	100	0	0	49	100	100	100			
International Reserve Reduction			0	100	0	0	0	0	0	0			
Volatility Options			100	0	0	0	49	100	100	100			
Sales to National Government			0	0	100	100	51	0	0	0			
Net Purchases	319	629	-163	-238	2,405	1,408	-164	4,713	2,147	171	3,060	3,720	2,840

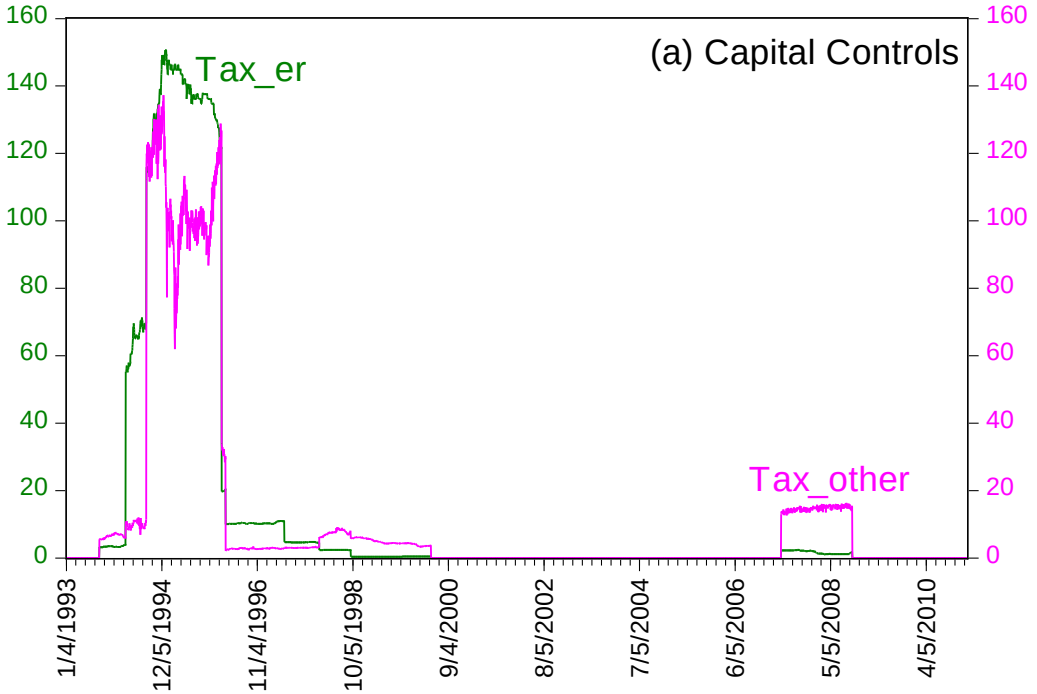
*: january - august

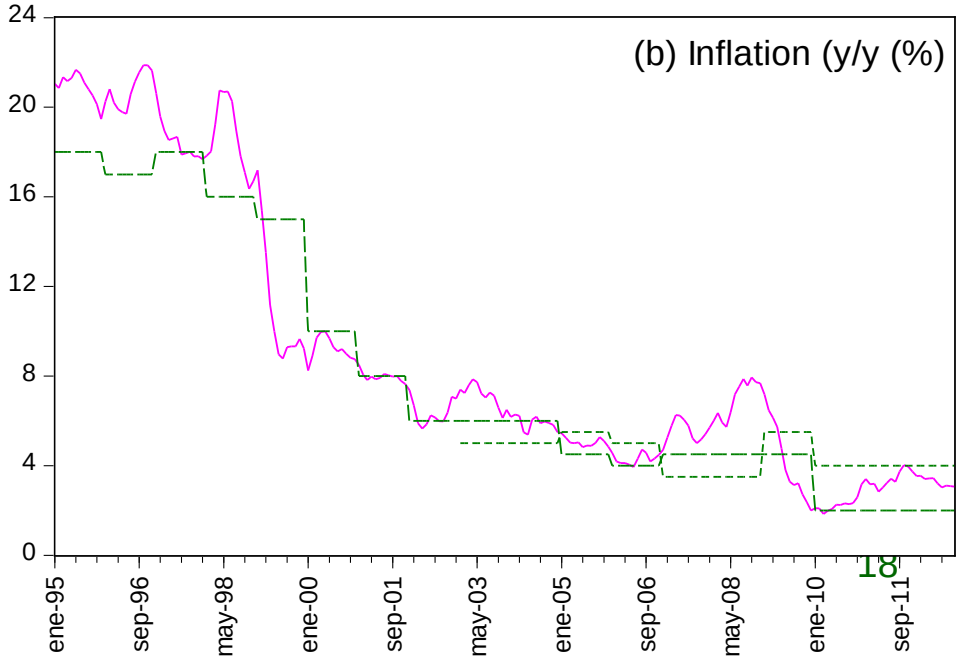
Are interventions sterilized?





Capital controls and Macro Prudentials (2007-2008)





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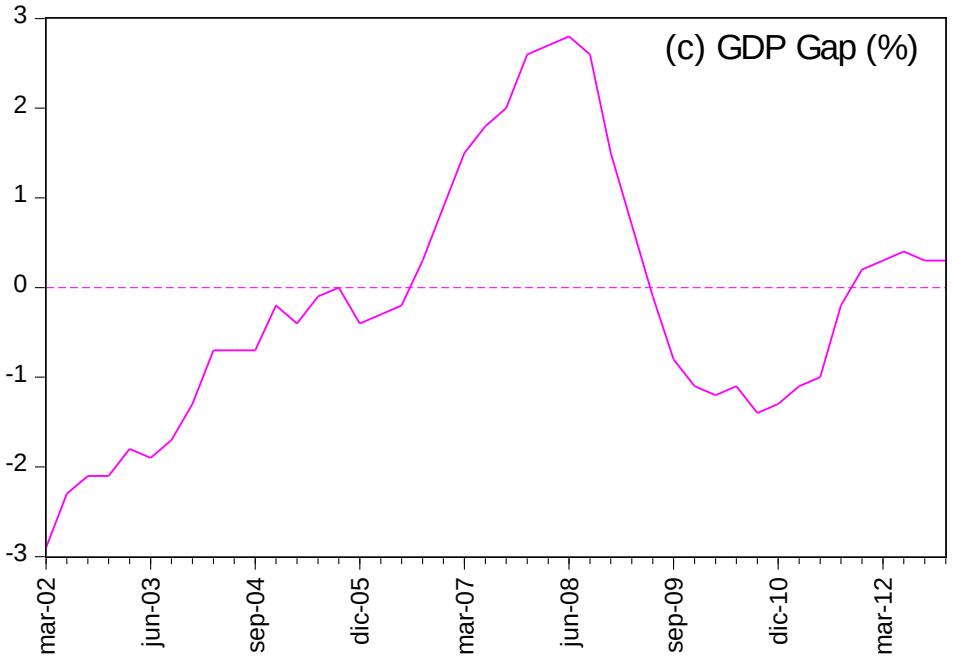

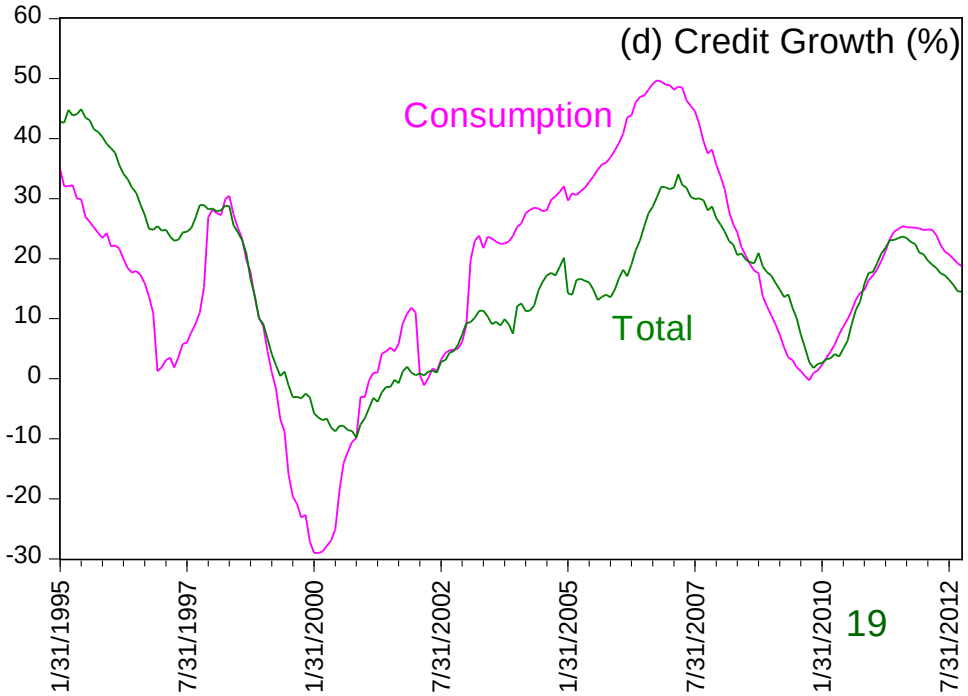

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The simultaneous equations GARCH model

$$I^{p}_{disc,t} = \gamma_0 + \gamma_1 I^{p}_{disc,t-1} - \gamma_2 \sum_{j=1}^{20} \Delta s_{t-j} - \gamma_3 \left(s_{t-1} - \overline{s}_{t-1} \right) - \gamma_4 D^{net}_{t} - \gamma_5 \left(\pi_t - \pi^{*} \right) + u_{1t}$$

$$\Delta s_t = \delta_0 + \delta_1 I^{p}_{disc,t} + \delta_2 I^{20}_{t-1} + \delta_3 \Delta \rho_{CDS,t} - \delta_4 (i_t - i^{å}_t) + \delta_5 \Delta s_{t-1} + \boldsymbol{\delta}' \mathbf{x}'_t + u_{2t}$$

$$u_{1t} = \sigma_{1t} \varepsilon_{1t} ; \;\; \sigma^2_{1t} = \alpha_{1,0} + \alpha_{1,1} u^2_{1t-1} + \beta_1 \sigma^2_{1t-1}$$

$$u_{2t} = \sigma_{2t} \varepsilon_{2t} ; \;\; \sigma^2_{2t} = \alpha_{2,0} + \alpha_{2,1} u^2_{2t-1} + \beta_2 \sigma^2_{2t-1}$$

With $\varepsilon_{1t} \overset{iid}{\sim} N(0,1)$, $\varepsilon_{2t} \overset{iid}{\sim} N(0,1)$, $\boldsymbol{x}_t = \left(\Delta q_t , \Delta tax_t , \Delta s^{bra}_{t-1} \right)'$

The reaction function

$I^{p}_{disc,t}$: discretionary interventions, purchases (+)

$\left(s_{t-1} - \overline{s}_{t-1}\right)$: missalingments of the FX (-)

D^{net}_{t} : Dummy, 1 if the central bank is a net debtor (lots of liquidity) (-)

$\left(\pi_t - \pi^*\right)$: inflation vs yearly target (-)

$$I^{p}_{disc,t} = \gamma_0 + \gamma_1 I^{p}_{disc,t-1} - \gamma_2 \sum_{j=1}^{20} \Delta s_{t-j} - \gamma_3 \left(s_{t-1} - \overline{s}_{t-1}\right) - \gamma_4 D^{net}_{t} - \gamma_5 \left(\pi_t - \pi^*\right) + u_{1t}$$

$I^{p}_{disc,t}$:	discretionary purchases	(+)
I^{20}_{t-1} :	*US*$20 million daily purchases	(+)
$\rho_{CDS,t}$:	risk, CDS Colombia, 5 years	(+)
$(i_t - i_t^{å})$:	1 day interest rates (treasuries)	(-)
x_t :		
q :	real exchange rate (real shocks)	(+)
s_{t-1} :	*AR*(1)	(+)
tax :	capital controls	(+)
s^{bra}_{t-1} :	nominal exchange rate Brazil	(+)

$$\Delta s_t = \delta_0 + \delta_1 I^{p}_{disc,t} + \delta_2 I^{20}_{t-1} + \delta_3 \Delta\rho_{CDS,t} - \delta_4 (i_t - i_t^{å}) + \delta_5 \Delta s_{t-1} + \boldsymbol{\delta}' \mathbf{x}'_t + u_{2t}$$

$$\boldsymbol{x}_t = \left(\Delta q_t , \Delta tax_t , \Delta s^{bra}_{t-1} \right)'$$

The reaction function

Method	Tobit - GARCH
Dep. Var:	$(I_p^{disc})_t$
Constant	32.8118 [4.9626]***
$(I_{disc}^{p})_{t-1}$	0.7136 [7,118]***
$\sum_{j=1}^{20} \Delta s_{t-j}$	-0.3958 [-1,7185]
$s_{t-1} - \bar{s}_{t-1}$	-833.8378 [-7,6926]***
D_{net_pos}	-23.5185 [-0,8154]
$\pi_t - \pi^*$	-62.8904 [-7,2246]***
Observations	1000

***, **, *: significant at 1%, 5% and 10%

Determi-nants

Method:	ous Equations - GARCH			
Dep. Var:	Δs_t	Δs_t	Δs_t	Δs_t
	(1)	(2)	(3)	(4)
Constant	-0.064	-0.0597	-0.0661	-0.0611
	[-1.818]*	[-1.701]*	[-1.881]*	[-1.738]*
$(\$I^{p}_{disc})_t$	0.0013	0.0014	0.0013	0.0013
	[1.777]*	[1.875]*	[1.805]*	[1.805]*
I^{20}_{t-1}	0.0044	0.0042	0.0046	0.0042
	[2.274]**	[2.168]**	[2.365]**	[2.149]**
$\Delta\rho_{CDS}$	0.0211	0.0203	0.0204	0.0205
	[15.743]***	[14.976]***	[15.072]***	[15.111]***
$i_t - i^*_t$	0.0007	0.00002	0.001	0.0004
	[0.101]	[0.003]	[0.018]	[0.053]
Δq	0.1135	0.1161		0.1159
	[4.677]***	[4.798]***		[4.782]***
Δs^{brasil}_t		0.0698	0.0649	0.0675
		[4.450]***	[4.141]***	[4.298]***
Δtax			0.0066	0.0059
			[2.775]***	[2.506]***
Observations:	2010	2010	2010	2010

***, **, *: significant at 1%, 5% and 10%

(an AR(1) term was also included; see equaition (2))

Determi-nants

Method:	Simultaneous Equations - GARCH			
Dep. Var:	Δs_t	Δs_t	Δs_t	Δs_t
	(1)	(2)	(3)	(4)
Constant	-0.0602	-0.0598	-0.0659	-0.0594
	[-3.186]***	[-3.171]***	[-3.502]***	-3.151]***
$(\$I^{p}_{disc})_t$	0.0012	0.0013	0.0013	0.0013
	[1.817]*	[1.946]*	[1.882]*	[1.926]*
I^{20}_{t-1}	0.0044	0.0042	0.0046	0.0041
	[2.273]**	[2.171]**	[2.384]**	[2.16]**
$\Delta\rho_{CDS_t}$	0.0209	0.0201	0.0202	0.0203
	[15.644]***	[14.868]***	[14.979]***	5.011]***
Δi_t	-0.00007	0.00003	-0.00008	0.00003
	[-0.104]	[0.051]	[-0.121]	[0.053]
Δi^*_t	0.0025	0.0024	0.002	0.0021
	[2.789]***	[2.739]***	[2.205]**	[2.306]***
Δq	0.1136	0.1165		0.116
	[4.699]***	[4.825]***		[4.807]***
Δs^{brasil}_t		0.0683	0.064	0.0667
		[4.378]***	[4.108]***	[4.269]***
Δtax_t			0.0061	0.0055
			[2.546]**	[2.291]***
Observations:	2010	2010	2010	2010

***, **, *: significant at 1%, 5% and 10%

(an AR(1) term was also included; see equaition (2))

Determinants (without correction of Tobit)

Method:	ARCH	ARCH	ARCH
Dep. Var:	Δs_t	Δs_t	Δs_t
Constant	0.0063	0.0166	0.0161
	[0.467]	[1.144]	[1.114]
$I^{c}_{t,tobit}$	-0.0002	-0.0004	-0.0004
	[-0.768]	[-1.269]	[-1.262]
I^{20}_{t-1}	0.0026	0.0024	0.0024
	[2.041]**	[1.879]*	[1.888]*
$\Delta\rho_{CDS}$	0.0138	0.0133	0.0134
	[14.207]***	[14.461]***	[14.531]***
$i_t - i^*_t$	-0.0103	-0.0116	-0.0117
	[-2.468]**	[-2.743]***	[-2.784]***
Δs^{brasil}_t		0.0471	0.0472
		[5.189]***	[5.217]***
Δtax			0.6201
			[1.911]*
Observations:	2010	2010	2010
R-squared:	0.1376	0.1434	0.1512

***, **, *: significant at 1%, 5% and 10%
p-arch, heteroskedasticity consistent (Bolleslev-Wooldridge)

- **The coefficients obtained in Table 3 suggest**
  - **that a 1 day change from US$20 million to US$ 40 million raises the Colombian exchange rate by approximately Col $ 2**

- **It means (with all caveats considered) that actual interventions of US$ 1000 million,**
  - **increase the exchange rate by 5.50% (approximately, using an exchange rate of $ 1,817 per dollar),**
  - **much higher than the 1.54% found by Fratzscher (2012) for actual interventions in the German – Euro area,**
  - **or the 0.06% for the US$ - Yen**
  - **no statistical relationship was found for the relation between the German mark and the dollar**

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Event studies

- **Fratzscher (2012):**
  - **we are not only interested on the *impact*, but also on *permanence***
    - **What is the cumulative impact of the intervention?**
- **We want to compare the cumulative effect of different types of intervention**
  - **Volatility options**
  - **Reserve accumulation options**
  - **Discretionary interventions**
  - **US$ 20 million (very few events)**

Econometric issues

- Clusters
- Permanence
  - Does impact diminish through time?
- What is the reaction function of automatic (established rule) volatility options?
- In the case of reserve accumulation options
  - Reserves are bought at low prices
    - Causality?

Different criteria

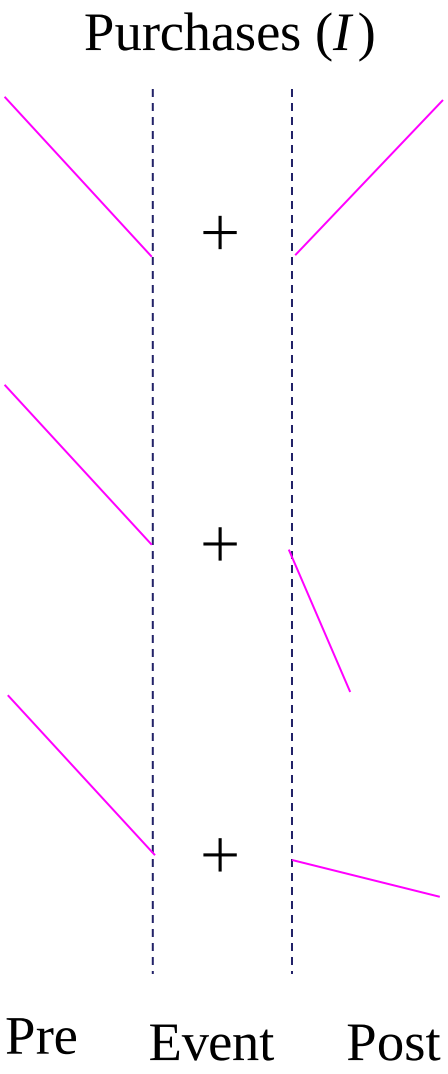
Direction: Success if $\cdot I_t^p > 0 \cap \Delta s_+ > 0$

Reversal: Success if $\Delta s_- < 0 \cap I_t^p > 0 \cap \Delta s_+ > 0$

Smoothing: Success if $\Delta s_- < 0 \cap I_t^p > 0 \cap \Delta s_+ > \Delta s_-$

Matching $\left(\text{see below}\right)$

Different criteria



	Direction	Reversal	Smoothing
	$I_t^p > 0 \cap \Delta s_+ > 0$	$\Delta s_- < 0 \cap I_t^p > 0 \cap \Delta s_+ > 0$	$\Delta s_- < 0 \cap I_t^p > 0 \cap \Delta s_+ > \Delta s_-$
+	Success	Success	Success
+	Failure	Failure	Failure
+	Failure	Failure	Success

Smoothing…5 days

Type of Intervention	Purchases/ sales	Window	Total Cases	Favourable Cases	% Success	Ho: p≤0.5 p-value	Ho: p≤0.6 p-value	Ho: p≤0.7 p-value	Ho: p≤0.8 p-value
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
A. Discretionary	Purchases	**5**	11	8	72.7	0.03	0.12	0.31	0.62
	Sales	**5**	**0**						
B.Options int. reserves	Purchases	**5**	19	12	63.2	0.08	0.31	0.67	0.93
	Sales	**5**	1	1	100.0	.	.	.	.
C.Options volatility	Purchases	**5**	11	10	90.9	0.00	0.00	0.02	0.09
	Sales	**5**	9	9	100.0	0.00	0.00	0.00	0.00
t2=(A)+(B)	Purchases	**5**	30	20	66.7	0.02	0.18	0.59	0.94
	Sales	**5**	1	1	100.0	.	.	.	.
t3=(A)+(B)+(C)	Purchases	**5**	38	28	73.7	0.00	0.03	0.26	0.78
	Sales	**5**	8	8	100.0	0.00	0.00	0.00	0.00

Event, Pre and Post windows: 5 days

Direction

Type of Intervention	Purchases/ sales	Window	Total Cases	Favourable Cases	% Success	Ho: p≤0.5 p-value
(1)	(2)	(3)	(4)	(5)	(6)	(7)
A. Discretionary	Purchases	5	11	6	54.5	0.27
	Sales	5	0	0	.	.
B.Options int. reserves	Purchases	5	19	11	57.9	0.18
	Sales	5	1	1	100.0	
C.Options volatility	Purchases	5	11	7	63.6	0.11
	Sales	5	9	7	77.8	0.02
t2=(A)+(B)	Purchases	5	30	17	56.7	0.18
	Sales	5	1	0	-	
t3=(A)+(B)+(C)	Purchases	5	38	23	60.5	0.07
	Sales	5	10	8	80.0	0.01

Event, Pre and Post windows: 5 days

Reversals

Type of Intervention	Purchases/Sales	Window	Total Cases	Favourable Cases	% Success	Ho: p≤0.5 p-value
(1)	(2)	(3)	(4)	(5)	(6)	(7)
A.Discretionary Intervention	Purchases	5	11	5	45.5	0.50
	Sales	5	0	0	.	.
B. Options Int.Reserves	Purchases	5	19	6	31.6	0.92
	Sales	5	1	0	-	.
c. Options volatility	Purchases	5	11	7	63.6	0.11
	Sales	5	9	7	77.8	0.02
t2=(A)+(B)	Purchases	5	30	11	36.7	0.90
	Sales	5	1	0	-	.
t3=(A)+(B)+(C)	Purchases	5	38	17	44.7	0.69
	Sales	5	10	8	80.0	0.01

Event, Pre and Post windows: 5 days

Matching

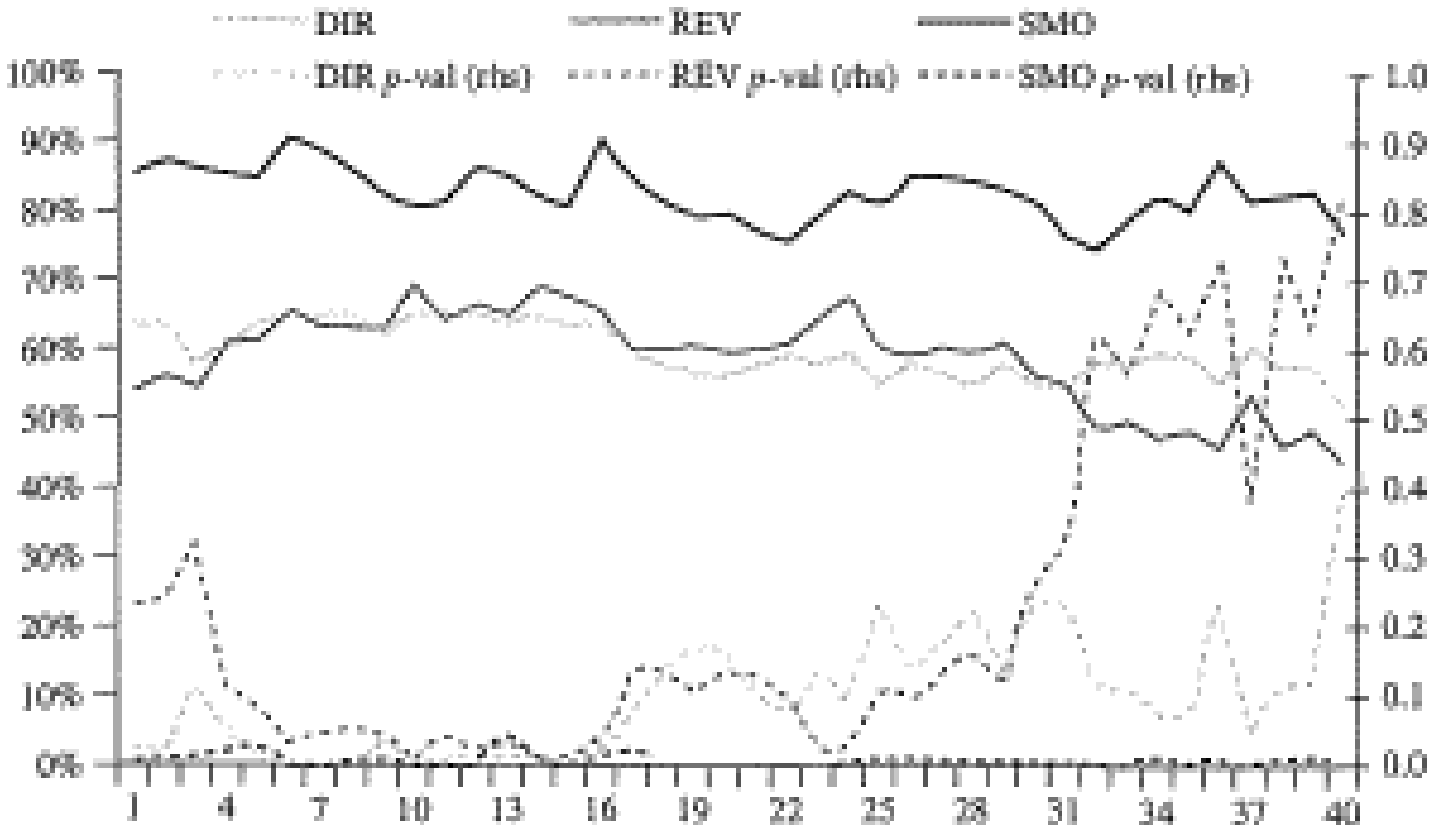
Type of Intervention (1)	Purchases/Sales (2)	Window (3)	Total Cases (4)	Average Difference (5)	P-value H0: D≤0 (6)
A.Discretionary intervention	Purchases	5	11	0.06	0.42
	Sales	5	0	.	.
B.Options int.reserves	Purchases	5	19	0.05	0.39
	Sales	5	1	-0.16	
C.Options volatility	Purchases	5	11	1.08	0.11
	Sales	5	9	-0.72	0.02
t2=(A)+(B)	Purchases	5	30	0.05	0.41
	Sales	5	1	-0.10	.
t3=(A)+(B)+(C)	Purchases	5	38	0.30	0.32
	Sales	5	10	-0.67	0.04

Event, Pre and Post windows: 5 days

Controls: results remain relatively solid

- The event is not successful if the exchange rate in Brazil behaves as in Colombia
  - Without intervention in Brazil
- What happened when the volatility options rule should (but was not) applied?

Evaluation of the success criteria over different post-event windows (G3 countries)



the success rate remains relatively stable and falls only moderarely when extending the time window

Source: Fratzscher(2012), pp.741

Permanence… (Fratzscher, 2012)

- **Japán, September 15, 2010: authorities purchased US$ 24 billion,**
  - **an amount larger than the total of all interventions conducted by the US Federal Reserve since 1990**
  - **and more than six times larger than US intervention in the entire year of 1985,**
    - **when the United States, Europe and Japan conducted concerted interventions to weaken the dollar**

Permanence…

- **The devaluation of the yen against the dollar was 3% (from 83 to 85 yen/dollar)**
  - **but the exchange rate returned to the pre-intervention level four weeks after the intervention**

Topics

- Introduction
- Colombian Foreign Exchange Intervention. Overview
- A Tobit- Garch model: US$ 20 million vs. Discretionary Interventions
- Event Study: Volatility Options vs. Other Type of Interventions
- **Conclusions**