FX INTERVENTIONS IN BRAZIL: A SYNTHETIC CONTROL APPROACH *

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The views expressed in this presentation are those of the presenter and do not necessarily represent those of the IMF or IMF policy.
Cumulative Interventions and the Exchange Rate

- **Cumulative Swap Interventions**
- **Cumulative Credit Lines Interventions**
- **Exchange Rate (BRL/USD)**

**Source:** AC Pastor and BCB
FX Intervention Program

- On August 22, 2013 the central bank announced a major program of FX intervention:
  - Daily sales of US$ 500 million worth of currency forwards
  - US$ 1 billion spot every Friday through repurchase agreements
  - Program to last until at least the end of the year

- On December 18, 2013 program extended:
  - Daily sales reduced to US$ 200 million
  - Spot interventions if liquidity needed
  - Program to last until at least mid-2014.

- On June 2014 program extended to end-2014
FX Intervention Program

- FX Interventions through swaps
  - Settle in BRL.
  - Provide investors the same returns from buying spot dollars, holding them to the maturity of the swap, and converting back to BRL.

- Program was large:
  - Announcement implied ~ USD $50 billion.
  - Eventual stock reached ~ USD $110 billion. This is about 1/3 of the stock of reserves.
Literature on Intervention

- Not much theoretical literature
  - UIP has been a fixture in most open economy models since Mundell-Flemming-Dornbusch
  - A few recent papers try to model portfolio effects (e.g. Benes et al. 2012 and Ghosh et al. 2015).

- There is a very large empirical literature on FX Intervention:
  - Sarno and Taylor (2001) survey early literature (mainly advanced economies); evidence not supportive (intervention tiny compared to size of bond markets)
  - Menkhoff (2013) provides a more recent survey covering Emerging Markets, where evidence is more supportive (intervention can be sizable relative to domestic bond markets)
In the Brazilian context, a number of papers of intervention, including:

- Andrade and Kohlscheen (2014) estimates a 0.3% movement after announcement of a swap auction.
- Barroso (2014) estimates a 0.5% effect for a US$ 1 billion intervention.
- Werther (2010) estimates effect of US$ 1 billion intervention to be 0.10-1.14% (with low duration).
- Broadly speaking, estimates in the range of 0.1-0.5 percent for a US$ 1 billion intervention.
Estimating the Effect

- We use a synthetic control approach (Abadie et al. 2010; Carvalho et al. 2015) to estimate the effect of the program on the exchange rate and its volatility.
  - In a nutshell it consists of using data from other countries to construct a synthetic Brazil, to estimate a counterfactual.
- Estimates involve a good amount of noise.
- But errors are orthogonal to the endogeneity problems that plague the literature on FX intervention (central bank buys dollars because it wants to contain appreciation and vice-versa).
Estimating the Effect

- Synthetic control not suitable for studying small frequent interventions, but suitable for large event
- Results also complemented with a standard event-study regression
Synthetic Controls

- We estimate weights for different countries that can explain the behavior of the exchange rate in Brazil prior to the program announcement, following Abadie et al. (2010).

- Log change in the counterfactual exchange rate will be given by weighted average of the log change in the exchange rate for the other countries.

- Weights minimize the mean square error (in the pre-program period) of the change in the exchange rate, its volatility, asset prices and portfolio flows.
Synthetic Controls

- We also estimate synthetic controls using a method proposed by Carvalho et al. (2015), which allows for negative weights, univariate estimation, and statistical inference.
Data

- We use weekly data for:
  - Log Change in the Exchange Rate
  - Log Change in the Volatility
  - Change in Equity Index
  - Change in Bond Index
  - Portfolio Flows (EPFR) scaled by 2012 GDP

- Our sample consists of 16 countries (mostly emerging markets)
Effect of Program Announcement on the Exchange Rate
Effect of Program Announcement on the Exchange Rate

![Graph showing the effect of program announcement on exchange rate]

- The graph displays the percentage points change in the exchange rate over time.
- The x-axis represents dates from June 1, 2013, to December 1, 2013.
- The y-axis shows the percentage points change, ranging from -20 to 5.
- The graph highlights a significant drop in percentage points after an announcement on October 1, 2013.
Effect of Program Announcement on the Exchange Rate
Effect of Program Announcement on Option-Implied Volatility
Effect of Program Announcement on Option-Implied Volatility
Effect of Program Announcement on Option-Implied Volatility

Date

Percentage Points

01jun2013 01aug2013 01oct2013 01dec2013
Effect of Program Announcement on Risk Reversal
Effect of December 2013 Announcement on Exchange Rate
Effect of December 2013 Announcement on Volatility
Effect of December 2013 Announcement on Risk Reversal
Effect of June 2014 Announcement on Exchange Rate
Effect of December 2014 Announcement on Exchange Rate
We use daily data to estimate a regression of the change in the log of the exchange rate on:

- Change in interest rate differential
- Change in log(VIX)
- Change in log CRB commodity prices
- Change in log of a Dollar Index relative to AE; relative to Latin American (excluding Brazil); and relative to Asian currencies

Regression estimated using data from January 2013 until 20 days prior to August announcement.

Results used to compute changes in exchange rate beyond those implied by fitted model (analogous to Cumulative Abnormal Returns in finance)
Volatility

Aug 22 2013

Dec 18 2013
Risk Reversal

Aug 22 2013

Dec 18 2013
Conclusion

- Estimates point to a large effect of the program announcement on the exchange rate (10%+)
- Some estimates point to a decline in option-implied volatility, but results not as stark/robust as for the level
- Second announcement had a smaller effect on the exchange rate (0-5%)
  - Effect likely priced-in before by the market
- Third and fourth announcements had virtually no effect