The effects of Forex intervention using intraday data: Evidence from Peru.[1]

Marylin Choy, Erick Lahura and Marco Vega*

Abstract

Using intra-day data for Peru for the period 2009-2011, this paper shows that central bank interventions in the foreign exchange market have a significant and asymmetric effect on interbank exchange rate. In particular, central bank intervention is more effective reducing the interbank exchange rate rather than raising it.

Key Words : *exchange rate, foreign exchange market, intervention*

JEL Classification : F31, G14, G15.

1 Introduction

The Central Bank of Peru adopted a managed floating exchange rate in August 1990. Since then, foreign exchange (FX) intervention have been done in a discretionary fashion and it has been usually done close to the closing time of the FX market. Currently, the daily interbank forex turnover is approximately. USD 0,7 billions.

Since 2002, monetary policy in Peru has been conducted under a Inflation Targeting regime. Between 1990 and 2001, monetary policy was implemented

[1]The views presented in this paper belong to the authors and do not necessarily represent those of any institution.

*Marylin Choy: Main Manager, Monetary Operations Division, Central Bank of Peru (e-mail:marylin.choy@bcrp.gob.pe). Erick Lahura: Head, Capital Markets Analysis and Financial Regulation, Central Bank of Peru. (e-mail:erick.lahura@bcrp.gob.pe). Marco Vega: Deputy Manager, Research Division, Central Bank of Peru (e-mail:marco.vega@bcrp.gob.pe)

under a monetary targeting regime, using as the intermediate target: (i) the gowth rate of base Money, (ii) a predetermined level of the commercial banks' current account at the central bank, and (iii) a corridor system for the interbank rate. Since 2003, the monetary policy instrument has been the reference rate for the interbank interest rate; in this context, FX operations in Peru are sterilized in order to meet the monthly interest rate target.

The Central Bank intervention in the FX market is done in order to reduce excessive volatility in the exchange rate at a daily frequency. The main idea is to avoid an negative balance-sheet effect that can be generated by drastic changes in the exchange rate, which result in high volatility. This negative effect can be very important due to the degree of dollarization of the financial assets in the Peruvian economy, which is currently around 43%.

In this paper, we try to measure the effectiveness of FX interventions through its temporary impact on the level of exchange rate. Given that the announced target has been to reduced drastic changes in the exchange rate on a daily basis, i.e. to reduce interday volatility, this goal cannot be achieved without having any impact on the daily level of exchange rate.

The empirical analysis is based on a vector autoregression (VAR) estimated using intraday data. Specifically, we use interbank exchange rate data collected every 5 minutes, from Monday to Friday between 9:20 am and 1:30pm, between January 5, 2009 and 27 April, 2011. In order to measure the effects of an exogenous change in forex intervention, we identify three structural shocks assuming long-run restrictions. In particular, under the view that the exchange rate is determined by its fundamentals in the long run, we use the identifying assumption that an exogenous change in FX intervention (either purchase or sell) has no long-run effect on the level of exchange rate. However, we allow for FX interventions to have transitory effects on the level of exchange rate.

The results show that central bank interventions in the foreign exchange market have a significant and asymmetric effect on interbank exchange rate. In particular, central bank intervention is more effective reducing the interbank exchange rate rather than raising it.

The paper is organised as follows. Section 2 presents a brief literature review of previous research on the effects of forex intervention. Section 3 provides a description of the Peruvian FX market. Section 4 presents standard statistical analysis of foreign exchange data. Section 5 describes the proposed methodology to analyse the effects of forex intervention, based on long-run restrictions. Section 6 presents and analyses the main estimation results. Finally, section 7 provides the main conclusions.

2 Brief literature review

The literature on measuring the effects of forex intervention is very broad. At first glance, many papers have used variants of Generalized Autoregressive Conditional Heteroscedasticity (GARCH) models. (To be completed . . .)

For the case of Peru, there are some papers that have tried to measure the effects of forex intervention using different econometric techniques and data. The main contribution of this paper is twofold: (i) it is the first one to use intra-day data (five-minutes data), and (ii) it proposes an alternative way to identify exogenous forex decisions based on long-run assumptions that can be tested.

3 FX market in Peru and the Central Bank

3.1 Features of Peruvian FX market

The interbank foreign exchange (FX) Peruvian market is a local market which is primarily based on spot transactions. Although there is a market of forwards and options, it is very small compared to the spot FX market.

Spot FX market transactions are traded primarily in a private electronic trading platform operated by the company DATATEC. This platform is based on a blind system in which the bidders are known only to those involved in the transaction and after the transaction is closed. It operates between 9am and 1:30 pm, Monday through Friday. The settlement of these transactions is done on the same day, under a real time gross settlement (RTGS) system in a payment vs payment platform through each bank's account held at the central bank

The participants of the FX market are commercial banks. However about five banks are the major players in terms of average amount traded. Currently, the average amount traded in the interbank spot FX market is around US700 million. The largest amount traded in one day was approximately US 1,700, almost 1 percent of GDP.

3.2 Central Bank intervention in the FX market

FX operations are part of open market operations to regulate daily liquidity. Both, FX operations and open market operations are decided everyday by a committee that meets roughly between 11:30 am and 1 pm. According to Rossini et al. (2011), the Central Bank of Peru performs FX operations without a pre-announcing the amount of operations, so that it does not signal any exchange rate path.

The Central Bank intervention in the FX market is done in order to reduce excessive volatility in the exchange rate at a daily frequency. The main idea is to

avoid an negative balance-sheet effect that can be generated by drastic changes in the exchange rate, which result in high volatility. This negative effect can be very important due to the degree of dollarization of the financial assets in the Peruvian economy, which is currently around 43%. The Central Bank considers that the level of the exchange rate is determined by fundamentals and therefore can not be altered permanently; therefore, the it does not have an exchange rate target.

The main type of FX intervention in Peru is through direct operations with commercial banks in the spot market at the prevailing exchange rate. Rarely, when forward trading volume causes pressure in the foreign exchange position of banks and thus in the spot exchange rate, the central bank intervenes through swap transactions, to buy or sell vacation dollars.

The interventions are sterilized in order to achieve the prevailing interest rate target. Sterilization of FX operations are made using two main instruments: Central Bank Securities (CDs- Central Bank Certificate of Deposits), and Treasury's deposits at the central bank

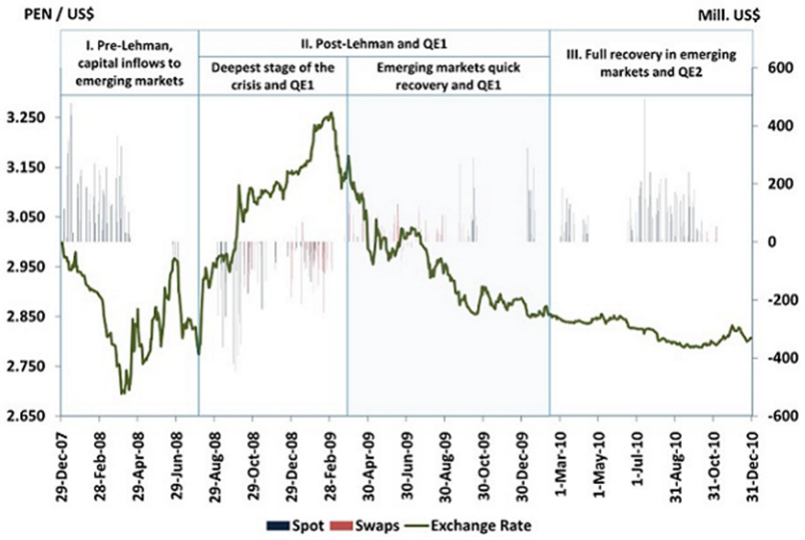
The Central Bank purchases and sales dollars in the interbank fx market through the system DATATEC. These operations are discretionary, do not obey to any pre-announced rule, they can be done any day and at any time while the fx market is in operation.

The Central Bank is one more participant in the trading system. Given that the FX market operates through a blind system, the other participants do not know the Central Bank's positions, and only after an operation has been closed they can identify it as counterpart. However, the Central Bank announces when it starts to intervine, so that all participants become aware of it even if they do not perform transactions with the Central Bank. The amount of intervention is published when the market closes.

4 Data analysis

We use intervention data at transaction level. The data is collected every 5 minutes, from Monday to Friday between 9:20 am and 1:30pm, between January 5, 2009 and 27 April, 2011. Figure 1 shows the evolution of interbank exchange rate and interventions:

Figure 1



Intervention data at transaction level is described in Table 1:

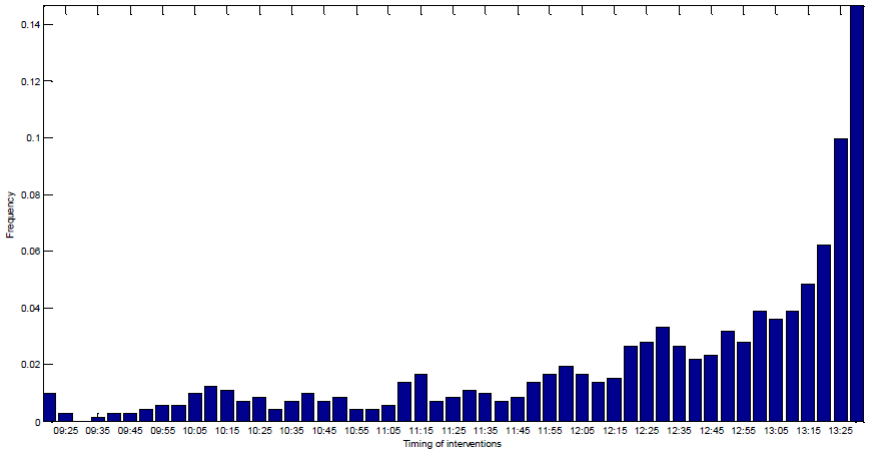
Table 1. *Size of Intervention Data. Sample period goes from January 5,2009 to April 27, 2011*

	2009	2010	2011[a/]
Number of transations	1933	5050	487
Number 5 min interval observations	181	505	38

a/ Intervention data up to 27 April

Foreign exchange (FX) intervention have been done in a discretionary fashion since 1990 and it has been usually done close to the closing time of the FX market, as it is shown in Figure 2

Figure 2. *Frequency distribution of intraday timing of interventions*



To be completed . . .

5 Measuring the effects of forex intervention

The empirical analysis is based on a VAR model estimated using intraday data. Specifically, data is collected every 5 minutes, from Monday to Friday between 9:20 am and 1:30pm. In order to measure the effects of an exogenous change in forex intervention, we identify three structural shocks assuming long-run restrictions. In particular, under the view that the exchange rate is determined by its fundamentals in the long run, we use the identifying assumption that an exogenous change in forex intervention (either purchase or sell) has no long-run effect on the level of exchange rate.

A structural VAR approach

Let E denote the log interbank exchange rate, so that $e_t \equiv E_t - E_{t-1}$ represents the rate of growth of the exchange rate; P_t is the amount of dollars purchased by the central bank in the foreign exchange market; and S_t the amount of dollars sold by the central bank. Under the assumption that e_t, P_t, and S_t are stationary time

series, and E_t is non-stationary, the vector moving average (VMA) representation for e_t, P_t, and S_t [2] in terms of fundamental innovations can be written as:

$$\begin{bmatrix} e_t \\ P_t \\ S_t \end{bmatrix} = \sum_{i=0}^{\infty} \begin{bmatrix} \phi_{11}(i) & \phi_{12}(i) & \phi_{13}(i) \\ \phi_{21}(i) & \phi_{22}(i) & \phi_{23}(i) \\ \phi_{31}(i) & \phi_{32}(i) & \phi_{33}(i) \end{bmatrix} \begin{bmatrix} \varepsilon^F_{t-i} \\ \varepsilon^P_{t-i} \\ \varepsilon^S_{t-i} \end{bmatrix} \tag{1}$$

where ε^F_t represents a shock to any fundamentals in the exchange rate; ε^P_t and ε^S_t represent exogenous decisions to purchase and sell dollars, respectively. Given that all three series are assumed to be stationary, then none of these disturbances will have permanent or long-run effects on them. However, these disturbances might have long-run effects on the log level of the exchange rate, E_t, given that it is assumed to be a unit root process.

Long-run identification of structural errors

In order to identify the structural errors of this VAR model, we follow the strategy suggested by Blanchard and Quah (1989) which is based on long-run restrictions. In particular, we assume that none of the disturbance terms ε^P_t and ε^S_t has any long-run effect on the log exchange rate. In terms of 1, this assumption implies that $\sum_{i=0}^{\infty} \phi_{12}(i) = 0$ and $\sum_{i=0}^{\infty} \phi_{13}(i) = 0$.

Given that we need at least one more zero restriction to achieve identification, it is also reasonable to assume that a sale innovation ε^S_{t-i} will have no long-run effect over dollar purchases, i.e. $\sum_{i=0}^{\infty} \phi_{23}(i) = 0$. By symmetry, it is also possible to assume that a purchase innovation ε^P_{t-i} will have no long-run effect on dollar sales, i.e. $\sum_{i=0}^{\infty} \phi_{32}(i) = 0$.

[2] Each variable in the VAR is expressed as deviations from its sample mean

6 Estimation results

The first step was to test for the presence of unit roots in the series. Using the DF-GLS efficient unit root test proposed by Elliot, Rothenberg and Stock (1996), we found that the unit root hypothesis cannot be rejected for E, whereas this hypothesis is rejected for P and S. Based on these results we proceed to estimate the long-run effects matrix under the assumptions: $\sum_{i=0}^{\infty} \phi_{12}(i) = 0$, $\sum_{i=0}^{\infty} \phi_{13}(i) = 0$, $\sum_{i=0}^{\infty} \phi_{23}(i) = 0$, and $\sum_{i=0}^{\infty} \phi_{32}(i) = 0$. Given that the model is over-identified, we also perform a test of overidentifying restrictions. The results are shown in Table 2:

Table 2. *Long-run effects and overidentifying restrictions.*

Structural VAR estimates (method of scoring)

	$\sum_{i=1}^{\infty} \phi_{11}(i)$	$\sum_{i=1}^{\infty} \phi_{21}(i)$	$\sum_{i=1}^{\infty} \phi_{22}(i)$	$\sum_{i=1}^{\infty} \phi_{31}(i)$	$\sum_{i=1}^{\infty} \phi_{33}(i)$
estimate	0.05	-0.35	0.87	3.86	7.16
prob.	0.00	0.00	0.00	0.00	0.00

LR test for over-identification

Chi-square(1)	1.63
Probability	0.20

The estimated coefficients have the expected signs; in particular, a positive structural exchange rate shock has a negative cumulative effect on dollar purchases and a positive cumulative effect on dollar sales. The test of over-identifying restrictions cannot be rejected and thus supports the joint validity of the proposed restrictions.

Figure 3 shows the response of interbank exchange rate to purchase and sale exogenous shocks. According to Figure 3, forex interventions have significant effects on exchange rates. Furthermore, forex interventions have a greater effect

reducing exchange rates (sales) than raising exchange rates (purchases).

Figure 3. *Accumulated responses of five-minutes changes in exchange rates*

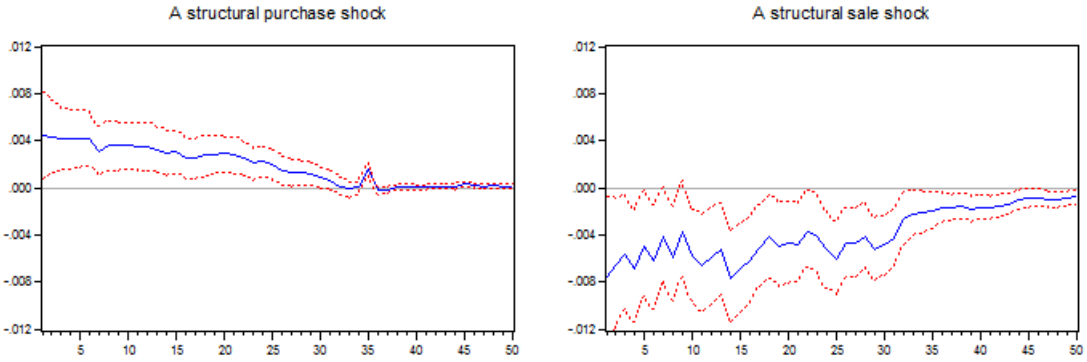
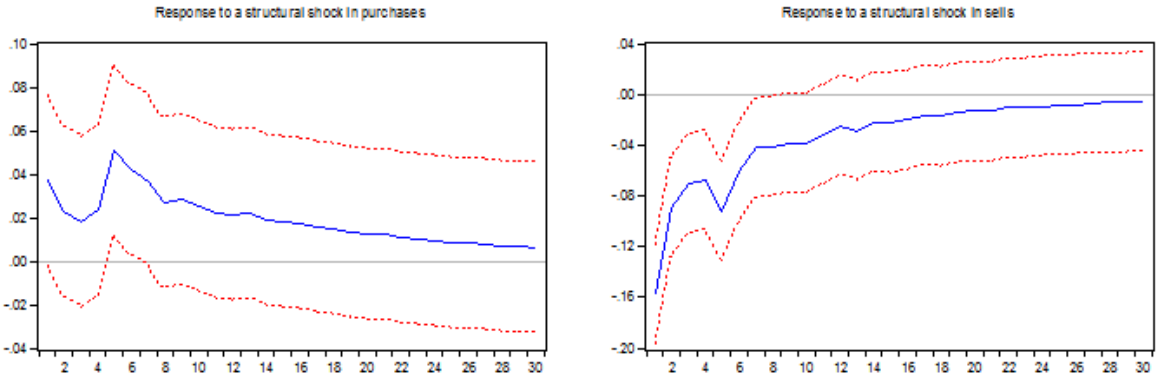


Figure 4 shows the response of interbank exchange rate (in logs) to purchase and sale exogenous shocks using daily data. Again, the results obtained with intra-day data are confirm.

Figure 4. *Response of log of exchange rates (daily data)*



7 Conclusions

Using intra-day data for Peru for the period 2009-2011, this paper shows that central bank interventions in the foreign exchange market have a significant and asymmetric effect on interbank exchange rate. In particular, central bank intervention is more effective reducing the interbank exchange rate rather than raising it.

References

Blanchard, O. and Quah, D. (1989), 'The Dynamic Effects of Aggregate Demand and Supply Disturbances', *American Economic Review*, Vol. 79, pp. 655-73.

Diebold, F. and R. Mariano (1995), 'Comparing Predictive Accuracy', *Journal of Business and Economic Statistics*, Vol. 13, pp. 253-263.

To be completed . . .

Appendix

A Data