Impact of foreign exchange interventions on exchange rate expectations

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Abstract

Using monthly data for four selected emerging economies, we find that sterilised central bank foreign exchange intervention has little systematic influence on near-term nominal exchange rate expectations in the direction intended by the central banks. In other words, central bank dollar purchases to stem exchange rate appreciation or related exchange rate volatility are not associated with an adjustment of near-term exchange rate forecasts in the direction of depreciation, and vice versa. This suggests that intervention may not change near-term exchange rate expectations. Moreover, intervention may have unintended effects in the sense that it can lead to undesired volatility in the exchange rate, which is consistent with previous studies.

Keywords: exchange rate expectation, foreign exchange intervention

JEL classification: D84, E58, F31

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Introduction

Has sterilised intervention in emerging market economies (EMEs) had an impact on exchange rate expectations? The question arises because "in the era of flexible exchange rates, relative currency prices are clearly expectations driven" (Dominguez (1986)). If expectations remain unchanged, any impact on the spot exchange rate could be short-lived. If interventions are believed to help guide the exchange rate towards values more consistent with fundamentals, such policy actions probably change exchange rate expectations to the direction desired by the central bank. This will be welfare-enhancing to the extent that a persistent deviation of the exchange rate from levels consistent with fundamentals creates welfare losses.

In what follows, this note will first motivate the question by reviewing findings in previous studies. Then it will present a simple model and econometrically estimate the impact of central bank interventions on exchange rate expectations using monthly data from Consensus Economics and for a panel of four EMEs (Brazil and Peru in Latin America, and Malaysia and Korea in Asia) over the period of 2004–12. Finally, we discuss the findings and policy implications.

1. Findings in previous studies

The bulk of the literature on the effectiveness of central bank interventions has focused on their impact on the spot exchange rate, and the evidence in EMEs is mixed. Reviews by Menkhoff (2012) and Ostry et al (2012) suggest that interventions in some cases have a systematic impact on the rate of change in exchange rates, while in other cases they have been able to reduce exchange rate volatility. Intervention appears to be more effective when it is consistent with monetary policy (Amato et al (2005), Kamil (2008)). Thus results vary depending on the intervention episode and instrument.

Of course, the effectiveness of central bank intervention needs to be evaluated against its policy goal. However, meeting discussion highlighted that the assessment of intervention effectiveness can be complicated. Intervention may be considered as effective if it promotes external price competitiveness and increases capacity to insure themselves against external shocks, thereby reducing external funding cost and promoting long-term economic growth. But these benefits, and thus the associated effectiveness of intervention, are extremely difficult to measure. Intervention may be considered effective if "orderly market conditions" have been maintained. But efforts to reduce currency volatility today may also reduce incentive for the private sector to develop mechanism to manage exchange rate risk, increasing currency volatility down the road.

Recent research papers by central banks in Latin America using intraday data found that intervention has a small but transitory effect on exchange rate movements (see Box). The impact of discretionary intervention tends to be larger than the impact of non-discretionary intervention. The majority of meeting participants believed that intervention can influence exchange rates temporarily at best.

Effects of foreign exchange intervention in Latin America

Takeaways from the BIS Consultative Council for the Americas Research Network

During 2012, the BIS Consultative Council for the Americas (CCA) sponsored a research network on the effects of foreign exchange market operations in Latin America. The central banks of Brazil, Chile, Colombia, Mexico and Peru participated. The goal of the project was to understand the impact that foreign exchange interventions conducted by these central banks has on the exchange rate.

Several key findings emerged from the contributions to the meeting. Moreno et al (2013) find that foreign exchange intervention can affect exchange rate returns and volatility, although the effects may be transitory. Echavarría et al (2013) find that, in Colombia, the exchange rate responds differently to discretionary intervention and intervention following preannounced rules. In the context of Peru, Lahura and Vega (2013) find that central bank sales of foreign exchange have a larger impact on the exchange rate than purchases. Kohlscheen (2013) argues that, in Brazil, foreign exchange intervention reduces the impact of order flows on exchange rate returns. According to Pincheira (2013), intervention in Chile used to have a substantial (but transitory) impact on inflation expectations but not any longer. In the case of Mexico, García-Verdú and Zerecero (2013) find that the impact of foreign exchange auctions on market liquidity and conditions depends on the procedure of these auctions.

The view taken in the literature is that central bank foreign exchange interventions may have a larger effect in EMEs than in advanced economies. The portfolio balance channel tends to be stronger in EMEs because the degree of substitutability between domestic and foreign assets is considered to be lower. In addition, central banks in EMEs may have an information advantage over market participants because of their informational and regulatory power (Canales-Kriljenko (2003)). Finally, non-sterilisation of intervention can strengthen the impact of intervention, as discussed by Sarno and Taylor (2001) and Menkhoff (2012). The signalling or expectations channel, through which sterilised intervention affects market expectations about future fundamentals, is likely to be weaker in EMEs because policy credibility may be lower.

The BIS survey summarized by Berger and Mohanty for this meeting reveals that central banks in EMEs believe the signalling channel is the most prominent channel of effectiveness. Meeting participants had mixed views about the effectiveness through the portfolio balance channel, as greater financial market integration has probably made EM assets more substitutable.[2]

Despite the literature's strong focus on the effectiveness of central bank intervention on spot exchange rates, the response of exchange rate expectations could be of greater importance for policymakers. This is particularly so to the extent that interventions in EMEs have become more persistent, with potential implications for market views about future exchange rates. To have a durable effect on the spot exchange rate, central bank intervention probably needs to alter market expectations about the currency's future path. Therefore a direct way to measure

[2] An increasing number of capital flow management measures in EMEs were cited as evidence that assets in EMEs have become more substitutable with those in advanced economies. As these measures should reduce substitutability of assets in EMEs, the effectiveness of the portfolio channels depends on country circumstances.

the effect on spot exchange rate may be to look at the changes in exchange rate forecasts.

A large body of literature has exploited data on exchange rate expectations for advanced markets. This literature examines the characteristics of survey-based exchange rate forecasts: formation process, predictive power and heterogeneity across individual forecasters (Dominguez (1986), Frankel and Froot (1987), Ito (1990), Elliott and Ito (1999), Bénassy-Quéré et al (2003), Frenkel et al (2009)).

One interesting question is whether central bank intervention can provide guidance to market participants about the central banks' desire about exchange rate movement. A study by Rülke and Yoshida (2009) for Japan provides tentative evidence about the potential role of learning, whereby interventions, under certain conditions, lead market participants to learn the central bank's reaction function and its desired exchange rate path. These authors find that, in some cases, dollar purchases by the Bank of Japan can lead to an adjustment of three-month dollar/yen monthly forecasts to the direction of a weaker yen. For this to happen, the intervention needs to be able to influence the spot exchange rate to the same direction. In addition, it needs to be followed by a period of no intervention, which is considered to allow forecasters to evaluate and learn the effect of the intervention.

However, Beine et al (2007) suggest that intervention can unanchor exchange rate expectations. The authors find that interventions can increase the heterogeneity of individual forecasts, measures by the coefficient of variation across the individual forecasts, for euro/dollar and yen/dollar crosses.[3] In other words, intervention seems to increase uncertainty around the trajectory of exchange rates. This is consistent with the finding in the many studies on advanced economies surveyed by Neely (2008) that central bank intervention can increase the volatility of spot exchange rates. One meeting participant warned that discretionary intervention can adversely affect exchange rates by increasing uncertainty and risk premia.

So far, little work has been done to provide guidance on the impact of central bank intervention on exchange rate expectations in EMEs. Among the few related works, Disyatat and Galati (2007) use market-based option prices as measures of expectations for the Czech Republic and find some impact of intervention. Thus, this study attempts to help shed some light on the impact of central bank intervention on near-term exchange rate expectations.

2. Our approach

This section discusses a theoretical model and an econometric approach to estimate the impact of central bank intervention on exchange rate forecasts.

Model

A key determinant of exchange rates is interest rate differentials. The theory of uncovered interest parity predicts that higher domestic interest rates (relative to US

[3] In the euro/dollar (and earlier the mark/dollar) markets, unexpected interventions tend to increase the heterogeneity of forecasts. In contrast, in the dollar/yen markets, expected intervention increases the heterogeneity of forecasts.

interest rates) should weaken EMEs' exchange rates. This is because the gains from earning higher interest rates should be counterbalanced by weaker exchange rates later once opportunities to make profits have been arbitraged away. We thus start from uncovered interest rate parity conditions to relate domestic and foreign nominal interest rates, *r* and *r**, with the expected rate of exchange rate depreciation.

$$(1 + r_t^*)\frac{E_t[s_{t+1}]}{s_t} = (1 + r_t)$$

$E_t[s_{t+1}]$ is exchange rate forecasts for time *t+1* made at time *t*, and s_t is the spot exchange rate at time *t*. Another key determinant of EM exchange rates is perceived country risk. History has shown that EM exchange rates can sometimes depreciate sharply as country risk deteriorates. With high currency mismatches, EMEs were often forced to tighten policies to help stem currency depreciation, adversely affecting domestic activity and country risk. However, the vicious circle has weakened since EMEs have reduced their currency mismatches (Miyajima et al (2012)). Following Bacchetta and van Wincoop (2006), our model is extended with a risk premium *Z*. After log-linearising,

$$E_t[s_{t+1}] = s_t + r_t - r_t^* + Z_t$$

One important implication of the augmented model is that, despite domestic interest rates being higher, EM currencies can appreciate because the risk premium can change. Given our objective, the model is further extended to include intervention, measured in terms of central bank net dollar purchases. Sterilised intervention does not change the domestic interest rate, but it can affect exchange rate forecasts by either changing the risk premium (the portfolio channel) or expectations of future interest rates (the signalling channel). When included in the model, intervention I is lagged by one period to account for the endogeneity of movements in exchange rate forecasts and central bank intervention. Using contemporaneous values for both of them can bias the results because exchange rate movements can affect intervention decisions. Finally, the spot exchange rate s_t is dropped from the model as it can be correlated with lagged intervention I_{t-1}.

$$E_t[s_{t+1}] = I_{t-1} + r_t - r_t^* + Z_t$$

Therefore, our regression model will relate exchange rate forecasts with intervention, domestic and foreign interest rates and country risk.

Regression model

Based on the theoretical model, we estimate a behavioural equation linking movements in exchange rate forecasts to central bank interventions for a panel of EMEs. Our specification includes a number of controls while allowing for country-specific effects in some of them:

$$dlog\left(s_{i,t}^f\right) = a_i + b * I_{i,t-1} + c * \left(r_{i,t} - r_{i,t}^*\right) + d * Z_{i,t} + +v_{i,t}$$

where $s_{i,t}^f$ is exchange rate forecasts made for country *i* at time *t* (a higher value signifies a weaker EM currency), and *v* is an error term. We are primarily interested in the sign and statistical significance of the term *b*. The sign will be positive if central bank intervention guides exchange rate expectations to the "right" direction

– forecasters expect a weaker EM exchange rate in response to central bank dollar purchases to help weaken the spot exchange rate, and vice versa.

Data

Before discussing estimation results, we summarise the data in four categories: country and estimation period, exchange rates, intervention and other determinants. Graph A1 in the Appendix provides a graphical overview of the data, except for control variables.

Country and estimation period

We focus on a few EMEs with floating exchange rates that typically conduct discretionary intervention. These EMEs are selected from Asia and Latin America, two regions that have probably been more active in intervention in recent years due to strong foreign capital inflows. In order to add a degree of heterogeneity, we selected economies that are perceived to have different degrees of capital openness. Accordingly, we chose Brazil, Peru, Korea and Malaysia.[4]

Guided partly by data availability, we focused on the period spanning June 2004–August 2012 (for Malaysia, mid-2005 onwards, to focus on the period of a flexible exchange rate regime). To prevent exceptionally disorderly market conditions around the Lehman bankruptcy from affecting the results, we excluded the period July 2008–March 2009 from the estimation.[5]

Exchange rates

Three-month exchange rate forecasts are taken from Consensus Economics. For many EMEs, a number of market participants report their exchange rate forecasts during the month and the data provider takes the median of the reported figures.

The exchange rate data have a few distinct characteristics. First, forecasts tend to follow closely the current spot exchange rates but with lower volatility. The left-hand panel of Graph 1 shows that the average monthly returns are similar across spot exchange rates (red bars) and exchange rate forecasts (blue bars). However, the right-hand panel shows that volatility is greater for spot exchange rates. This is consistent with the pattern reported in the literature for advanced market exchange rate crosses (Takagi (1991)).

Second, since the onset of the global financial crisis in 2008, the pace of appreciation in both spot and forecast exchange rates moderated somewhat, shown by the shorter bars for the second subperiod in the left-hand panel of Graph 1.

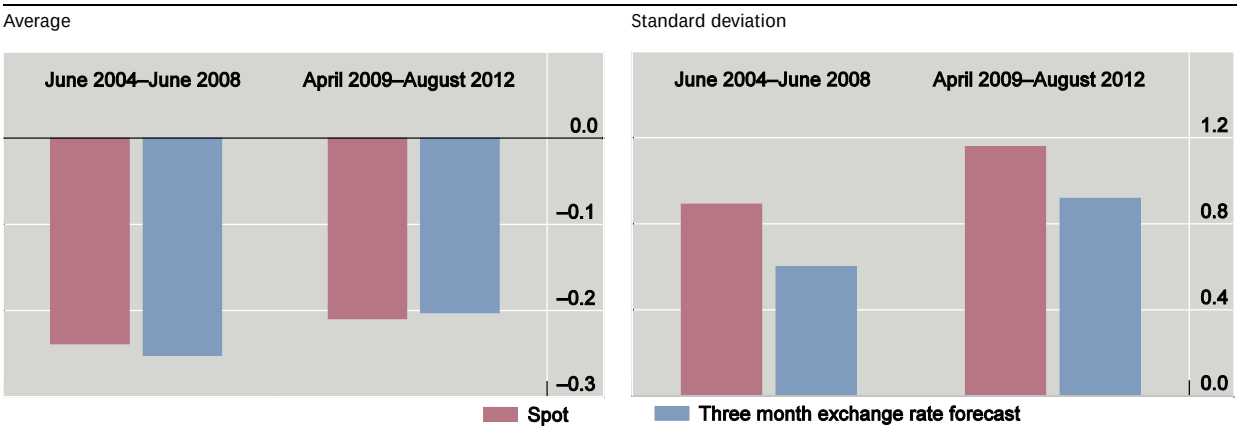
[4] According to the commonly used Chinn-Ito Index of capital account openness, over the past decade Peru has consistently kept its capital account open during the estimation period, while Brazil has been more restrictive, particularly reflecting measures to cope with the impact of strong capital inflows. Capital account openness has gradually increased in Korea, but has decreased in Malaysia.

[5] Several studies focusing on the effectiveness of central bank intervention on spot exchange rate movements exclude times of extreme stress. For instance, Adler and Tovar (2011) exclude September 2008–June 2009. Naturally this removes episodes of very large dollar sales.

Moreover, the volatility of exchange rates increased markedly, as indicated by the higher bars for the second subperiod in the right-hand panel.

Monthly change in spot exchange rate and three-month exchange rate forecast[1]

In per cent — Graph 1



[1] Using pooled data for Brazil, Peru, Korea and Malaysia. Exchange rate is against the US dollar; a negative change represents appreciation of the local currency.

Sources: © Consensus Economics; BIS staff calculations.

Intervention

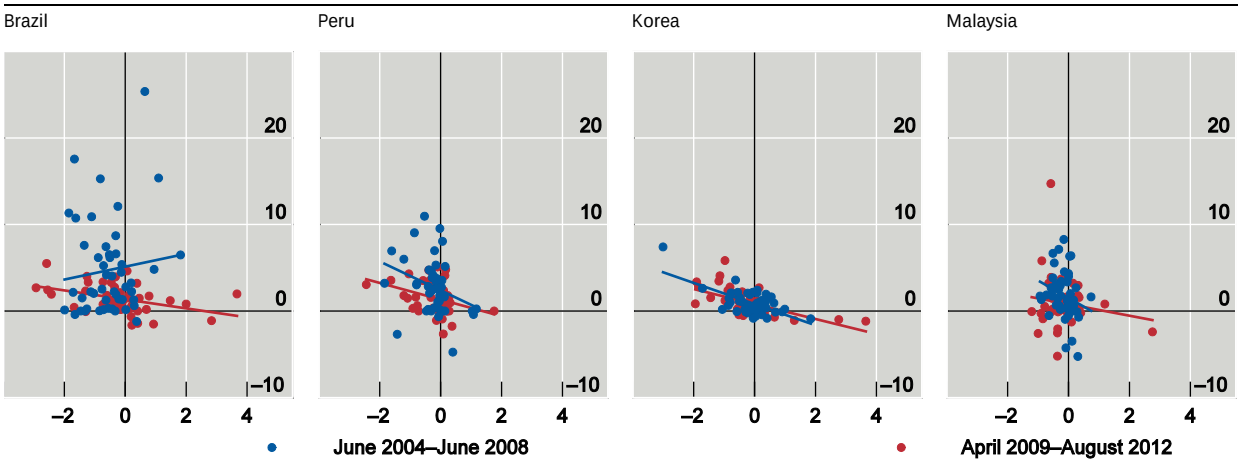
Measuring central bank foreign exchange intervention is a key hurdle in assessing its impact. Many EMEs in Latin America make the intervention data publicly available by instrument (spot, forward, swaps etc), including Brazil and Peru. For the sake of simplicity, we aggregate intervention data across different instruments, assuming their impact on exchange rates is broadly similar. In Asia, as intervention data are in most cases not made public, we proxy intervention with monthly changes in central bank official reserves, further adjusted for changes in the exchange rates based on the assumed currency composition guided by the IMF's Currency Composition of Official Foreign Exchange Reserves (COFER) data.

Graph 2 plots monthly net intervention in terms of dollar purchases as a percentage of official reserves on the y-axis and the monthly change in three-month exchange rate forecasts on the x-axis. Intervention data are lagged by one month. The blue dots are for the first subperiod (June 2004–June 2008) and the red dots for the second (April 2009–August 2012). The scatter plot reveals common patterns of intervention across the four EMEs and the correlation of lagged monthly intervention and the monthly change in three-month exchange rate forecasts.

A number of aspects stand out from Graph 2. First, the four EM central banks have leaned more heavily towards US dollar purchases than dollar sales, as the dots in Graph 2 in most cases take positive values. The intervention data are further summarised in Table A1 of the Appendix, which shows that the four EM central banks bought an average of 1.3–2.5% of official reserves per month, and, in many cases, the largest size of monthly intervention exceeded 10% of official reserves when central banks were net buyers of dollars. There were episodes of outsized intervention, when, for instance, the Central Bank of Brazil was a net buyer of dollars

for up to 25% of official reserves. In contrast, the four EM central banks typically sold much smaller amounts of dollars when they were net sellers of dollars.

Foreign exchange intervention and change in exchange forecasts[1] Graph 2



[1] Y-axis: monthly net intervention in terms of dollar purchases as a percentage of the stock of official reserves. X-axis: monthly percentage change in three-month exchange rate forecasts.

Sources: IMF; © Consensus Economics; Datastream; national sources; BIS staff calculations.

Second, it is also clear from Graph 2 that the four EMEs have reduced their intervention to stem currency appreciation since the onset of the global financial crisis in 2008. The values of the red dots appear to be often smaller than those of the blue dots, which could be due to lower appreciation pressure, greater tolerance for appreciation or higher costs of intervention. Appendix Table A1 confirms this observation. The average size of intervention fell from 2.5% of official reserves during the first subperiod to 1.3% of official reserves during the second subperiod. Similarly, the number of months during which the four EM central banks were net buyers of dollars declined in relative terms.

Finally, there is evidence that central bank dollar purchases are not necessarily accompanied by expectations of future depreciation. The trend lines relating the x- and y-axes are in many cases downward sloping, suggesting that positive intervention (net dollar purchases) is accompanied by a negative change in three-month exchange rate forecasts (appreciation), and vice versa. Note, however, that other key determinants of exchange rates are omitted from the analysis, so the bivariate correlations are insufficient to reach definite conclusions.

Other determinants

To allow for the influence of other determinants on the exchange rate, we included a number of control variables in a regression. The first control variable is the differential between the home and foreign country interest rates. Interest rate differentials are represented by the three-month interest rates and the slope of the yield curve, both relative to the United States. The former represent expectations of future short rates. The latter is the EM international credit risk represented by the change in the premium on international sovereign bonds, or credit default swaps when that is unavailable.

3. Results

When interventions are successful in moving the exchange rate in the desired direction, net dollar purchases by the central bank should prompt forecasters to adjust their exchange rate expectations to the direction of depreciation. Similarly, net dollar sales should be associated with an adjustment of exchange rate expectations to the direction of appreciation. Hence, the coefficient on the intervention variable should be positive. In contrast, if intervention is followed by forecast revisions to the direction opposite from what is desired by the central bank, the coefficient on intervention would be negative.

Fixed-effect panel model of impact of intervention on exchange rate forecasts[1] Table 1

Period	June 2004–August 2012			
	1	2	3	4
Intervention	–0.027*	–0.026	–0.029*	–0.029*
	(2.556)	(2.320)	(2.769)	(2.763)
Interest rate diff (3m)		–0.003		0.007
		(0.170)		(0.434)
Yield curve (12m less 3m)		0.050		–0.001
		(1.877)		(0.022)
Change in EMBI spread			0.013**	0.013**
			(4.089)	(4.015)
Adjusted R-squared	0.017	0.013	0.122	0.118

[1] Dependent variable is monthly difference of the log of three-month exchange rate forecasts. *, ** and *** signify statistical significance at the 10%, 5% and 1% levels, respectively. *t* values in parentheses are based on standard errors using the Huber-White sandwich estimator (Huber (1967), White (1980)).

Sources: BIS staff calculations.

An important finding from the estimated results shown in Table 1 is that interventions do not seem to have the intended effects on exchange rate expectations. The first row of the table shows intervention coefficients corresponding to four different specifications, with different control variables. The coefficient on intervention is consistently negative. In other words, central bank intervention to weaken (or strengthen) the exchange rate typically leads to an adjustment of exchange rate forecasts to the direction of appreciation (depreciation). Other than intervention, the country risk premium seems to be important for exchange rate determination.

To check for the robustness of the intervention coefficient we included a number of other control variables in the regression. These are changes in energy prices (higher oil prices leading to expectations of higher interest rates and probably stronger exchange rates); foreign portfolio inflows, which have surged following recent improvements in EMEs' growth and fiscal prospects; and news

about the US economy, which can have significant effects on EM exchange rates vis-à-vis the US dollar.[6]

Models 5 through 8 in Table A2 in the Appendix suggest that our main finding is unchanged: interventions do not prompt an adjustment of exchange rate expectations to the direction desired by the central bank. The coefficients on intervention remain around –0.03 and mostly significant at the 10% level. Moreover, the coefficients on the EMBI spread remain little changed. Among the new control variables, foreign bond inflows have a significant impact on exchange rate expectations with the expected sign. The coefficients of –0.05 in models 6 and 8 imply that an increase in such inflows equivalent to 1 percentage point of assets under management (AUM) leads to a 5 basis point appreciation of forecasts. To put this into context, the average monthly net inflows to Asia ex-Japan bond funds surged from 1% of AUM in 2007 to 5.8% of AUM in 2010, but moderated to 0.6% of AUM in 2012.

One issue is whether the result is influenced by specific period or development in our sample. The most important event is the global financial crisis that started in 2008, which has been accompanied by significant changes in foreign capital flows and investors' behaviour. Therefore, we re-estimated the model for two subperiods: June 2004–June 2008 and April 2009–August 2012 (models 9 and 10 in Table A1 in the Appendix).

The results show that the intervention coefficient is close to zero and statistically insignificant during the first subperiod, that is, the period preceding the global financial crisis. This suggests that, during this period, intervention had little effect on three month exchange rate forecasts.

In contrast, the intervention coefficient becomes significant and increases in size during the period starting 2009.[7] This suggests that the impact of intervention has changed following the onset of the global financial crisis. The coefficient of –0.09 and the average size of monthly intervention equivalent to 1.3% of reserves during the second subperiod (Table A1) together suggest that three-month exchange rate forecasts "appreciated" by 0.12% per month following intervention to purchase US dollars. This represents about one half of the average rate of appreciation of 0.2% per month during April 2009–August 2012 (Graph 1, left-hand panel). Moreover, the coefficients on foreign bond inflows and energy price inflation become more significant, with expected signs.

4. Concluding discussion

This note highlighted that central bank intervention to guide movements of spot exchange rates does not seem to have a major influence on near-term exchange

[6] Surprise indices represent the difference between expectation and outturn for purchasing managers' index, retail sales and non-farm payroll. Different US data surprises were also included but did not change the main results.

[7] When model 10 was re-estimated for the four individual countries separately, the coefficients on intervention all remained negative, but significant for Brazil and Peru. Those on country risk were all positive, but significant for Brazil and Korea. The coefficients on foreign bond inflows were all negative, but significant only for Malaysia.

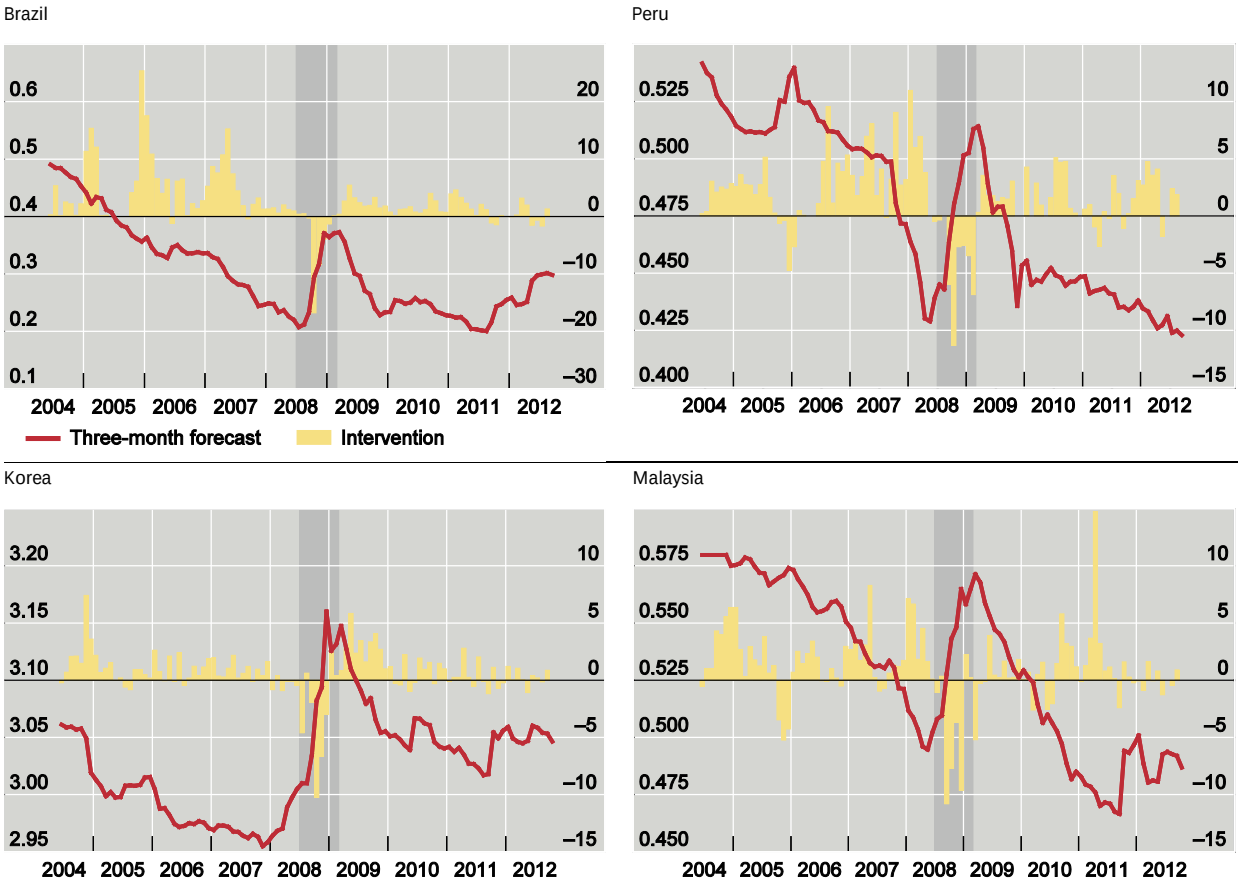
rate expectations. Moreover, during the period starting from 2009, intervention may have had unintended effects on exchange rate expectations. Note that, our findings do not rule out effects to the desired direction during a shorter period. Indeed, an accompanying chapter titled “Capital flow dynamics and FX intervention” finds that central bank intervention helps curb the momentum effect between exchange rate and capital inflows in the short run.

One interpretation of the result is that intervention does not change the near-term exchange rate expectations as they are dictated primarily by fundamentals. A second interpretation is that dollar purchases can increase appreciation pressure because a larger stock of official reserves reduces external credit spreads and attracts more foreign inflows. Similarly, a decline in official reserves reduces investor confidence, and increase both capital outflows and depreciation pressure. Indeed, this “fundamentals” channel may have prompted exchange rate forecasts to adjust to the “wrong” direction in reaction to foreign exchange intervention since 2009.

Appendix

Central bank foreign exchange intervention and three-month exchange rate forecast[1]

Graph A1



[1] Right-hand scale: intervention as a percentage of the stock of official reserves. Left-hand scale: three-month exchange rate forecast in log. Shaded area (July 2008–March 2009) dropped from regression.

Sources: IMF; © Consensus Economist; Datastream; national sources; BIS staff calculations.

Characteristics of central bank foreign exchange intervention

Table A1

	Average	Min	Max	St dev	Frequency[1]		
					Net sale	Net purchase	Zero
	(% of official reserves)				(% of total number of months)		
	June 2004–June 2008						
BR	4.6	–1.2	25.4	5.5	4.1	91.8	4.1
PE	2.7	–4.7	11.0	3.0	12.2	83.7	4.1
KR	0.9	–0.9	7.4	1.4	26.5	73.5	0.0
MY	1.8	–5.2	8.3	2.7	18.4	81.6	0.0
Average	**2.5**	**–3.0**	**13.0**	**3.2**	**15.3**	**82.7**	**2.0**
Median	**2.3**	**–3.0**	**9.6**	**2.9**	**15.3**	**82.7**	**2.0**
	April 2009–August 2012						
BR	1.5	–1.6	5.5	1.7	14.6	82.9	2.4
PE	1.6	–2.7	5.1	1.9	12.2	73.2	14.6
KR	1.0	–1.2	5.8	1.5	31.7	68.3	0.0
MY	1.0	–2.6	14.7	2.8	34.1	65.9	0.0
Average	**1.3**	**–2.0**	**7.8**	**2.0**	**23.2**	**72.6**	**4.3**
Median	**1.3**	**–2.1**	**5.7**	**1.8**	**23.2**	**70.7**	**1.2**

BR = Brazil; KR = Korea; MY = Malaysia; PE = Peru.

[1] Purchase and sale of foreign currency.

Sources: IMF; © Consensus Economics; Datastream; national sources; BIS staff calculations.

Fixed-effect panel model of impact of intervention on exchange rate forecasts[1]

Table A2

Period	June 2004–August 2012								Jun 04–Jun 08	Apr 09–Aug 12
	1	2	3	4	5	6	7	8	9	10
Intervention	–0.027*	–0.026	–0.029*	–0.029*	–0.027	–0.030*	–0.029*	–0.029*	–0.002	–0.087*
	(2.556)	(2.320)	(2.769)	(2.763)	(2.297)	(3.149)	(3.069)	(2.825)	(0.103)	(2.780)
Interest rate diff (3m)		–0.003		0.007	0.008	0.016	0.004	0.014	0.009	–0.036
		(0.170)		(0.434)	(0.498)	(0.815)	(0.257)	(0.625)	(0.353)	(1.298)
Yield curve (12m less 3m)		0.050		–0.001	0.016	0.003	–0.015	0.006	0.081	0.034
		(1.877)		(0.022)	(0.311)	(0.044)	(0.423)	(0.116)	(0.385)	(0.246)
Change in EMBI spread			0.013**	0.013**	0.012**	0.014**	0.013**	0.012**	0.004	0.014
			(4.089)	(4.015)	(3.820)	(4.135)	(4.218)	(4.140)	(2.055)	(2.084)
Energy price inflation					–0.040			–0.040	0.000	–0.077***
					(1.658)			(1.716)	(0.002)	(6.198)
Foreign bond inflows						–0.049**		–0.049**	–0.057**	–0.080***
						(4.651)		(3.805)	(3.988)	(12.603)
US data surprise A[2]							0.008	0.007	0.011	0.009
							(0.321)	(0.311)	(0.272)	(0.279)
US data surprise B[3]							0.008	0.011	–0.115	0.159
							(0.339)	(0.493)	(1.641)	(1.908)
US data surprise C[4]							–0.001	–0.001	0.000	–0.001
							(1.051)	(1.070)	(0.484)	(1.168)
N	363	363	363	363	363	363	363	363	196	166
Adjusted R-squared	0.017	0.013	0.122	0.118	0.131	0.142	0.117	0.155	0.029	0.298

[1] The dependent variable is monthly difference of the log of three-month exchange rate forecasts. Models 1–4 are shown in Table 1. *, ** and *** signify statistical significance at the 10%, 5% and 1% levels, respectively. The numbers in parentheses are *t* values calculated based on standard errors using the Huber-White sandwich estimator (Huber (1967), White (1980)). [2] PMI. [3] Retail sales. [4] Non-farm payroll.

Sources: BIS staff calculations.

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