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Abstract

This paper examines the currency manipulation policy in the foreign exchange markets of thirteen emerging countries using a structural vector autoregressive (SVAR) framework to link the dynamics of real exchange rates and foreign reserves. It is found that for Korea, Singapore, and Taiwan, exchange rate shocks are the main source of fluctuations in foreign reserves over all time horizons. Empirical evidence suggests that these countries intervene substantially in the foreign exchange markets in order to promote export competitiveness.

Keywords: Official Intervention, Foreign Reserves

JEL Classification: F31, E58

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1 Introduction

As international capital markets become more integrated, a currently fashionable view of the choice of exchange rate regime is that countries must choose between one of two extremes, either a free-floating or a firmly fixed regime. This bipolar proposition is referred to as *the vanishing intermediate regime*, or *the missing middle*. It is argued that the 1997 Asian currency crisis supported this proposition, since most Asian countries that suffered from the currency crisis adopted either a free-floating regime (e.g., Indonesia, Korea, the Philippines, and Thailand) or a hard peg (Malaysia) following the crisis. However, some observers have noted that many countries that say that they allow their exchange rate to float do not. For instance, Calvo and Reinhart (2002) find that the average for countries claiming an independently floating system lies far from the benchmark and is very close to the average for managed-float countries. They refer to these findings as a "fear of floating."

Exchange rate stability is still a major policy concern because of the high pass-through from exchange rate movements to domestic inflation in developing countries (see Calvo and Reinhart (2002)). Moreover, since developing countries rely heavily on primary commodity exports, it is not surprising that most developing countries may adopt a managed-floating exchange rate regime. Particularly, in order to prevent their competitiveness from deteriorating, some emerging market economies have intervened in foreign exchange markets to prevent or slow the appreciation of their currencies. It is now referred as "currency manipulation" (see Neely (2011)), which intends to gain an advantage in trade, and has raised hot debate among international policymakers and analysts. Just before the G20 Seoul meeting in September 2010, Brazilian finance minister Guido Mantega spoke of an "international currency war" where devaluing currencies artificially has become a global strategy.

As a result of frequent and intensive interventions, many developing countries built up substantial foreign reserves. In a recent speech, Bernanke (2010) uses the annual percent change in the real effective exchange rate (REER) as well as the accumulation of foreign exchange reserves as a share of GDP over the same period to measure the degree of intervention. He notices that:

> "[t]he relationship evident in the graph suggests that the economies that have most heavily intervened in foreign exchange markets have succeeded in limiting the appreciation of their currencies. The graph also illustrates that some emerging market economies have intervened at very high levels and others relatively little."

In particular, the chart (Figure 8) in Bernanke (2010) pinpoints Taiwan, Singapore and Thailand as aggressively trying to hold their currencies down, while India, Chile and Turkey are not.

The Central Bank of Taiwan have immediately delivered a press briefing to reject the implication of currency undervaluation in the chart. Officials from Taiwan's central bank have argued that the calculation of the percentage change in the REER could vary substantially because of different comparison based periods. Moreover, they also argue that REER is not a good measure of undervaluation. Finally, they claim that the changes in foreign reserves are not necessary caused by official intervention. Taiwan's central bank concludes in the press release that

> [a] better clue to whether a country has intervened in the foreign exchange market can be found by looking at the growth rate of foreign exchange reserves. Taiwan's FX reserves grew by only 0.8% month-on-month in October

> 2010, and by a somewhat higher rate of 2.27% in September 2010. These changes can be mainly explained by the appreciation of the Euro and other reserve currencies against the U.S. dollar. The data show that Taiwan did not intervene in the foreign exchange market to prevent appreciation of the NT dollar.[1]

Indeed, simple descriptive statistics are not up to the task of sorting out the degree of official intervention, but data unavailability makes it difficult for researchers to investigate official intervention in the foreign exchange market. Weymark (1995, 1997) proposed an alternative approach to measurement of the degree of exchange market intervention in a small open economy. By constructing an index of intervention activity that is based on observed data, Weymark (1995, 1997) used the index to measure bilateral and multilateral interventions for Canada over the period 1975–1990. However, Chen and Taketa (2007) use Japanese intervention data to show that the correlation between the Weymark index and Japanese intervention activity is negative, which casts a doubt on the usefulness of the Weymark index.

In this paper, we take a further step to investigate and measure the degree of central bank intervention in the foreign exchange market using a structural vector autoregressive (SVAR) framework linking the dynamics of exchange rates and foreign reserves. The SVAR approach has been employed in Kim (2003); however, the goal of Kim (2003) is to analyze the effects of foreign exchange intervention and monetary policy on the exchange rate movements, while the current paper aims at examining how the exchange rate movements affect the changes in foreign reserves, and measuring the degree of foreign exchange intervention. Moreover, a closely related paper by Kim et al. (2009) uses a bivariate SVAR model with sign restrictions to examine the *de facto* exchange rate ar-

[1] See the Cental Bank's Press Release No. 227 on November 20, 2010.

rangement in eight East Asian countries, and evaluate the "fear of floating" hypothesis in the aftermath of the Asian crisis. Using dynamic policy reaction functions, they measure the degree of exchange rate stabilization by computing the percentage decrease of foreign exchange reserves in reaction to an 1% currency depreciation. That is, Kim et al. (2009) focus on how the exchange rate movements "pass-through" into foreign reserve changes (conditional on exchange rate shocks) using impulse response functions. In the current paper, we use variance decomposition as an alternative strategy to measure the degree of central bank intervention.

Using structural VAR models, we compute the proportional contribution of exchange rate shocks to the forecast error variance of foreign reserves. Given that central bank actively intervene the foreign exchange market, the exchange rate movements would be small, whereas the changes in foreign exchange reserves would be large. If the exogenous exchange rate shock is able to explain a large portion of the movements in foreign reserves, the evidence would suggest a high degree of official intervention.

The paper is structured as follows. Section 2 presents the empirical strategy. Section 3 describes the data and preliminary test results, and Section 4 reports the key empirical results with robustness checks. Finally, concluding remarks are offered in Section 6.

2 Empirical Strategy

We consider the following trivariate VAR model including output growth, $\Delta\log(y_t)$, changes in real exchange rates, $\Delta\log(EX_t)$, and changes in foreign reserves, $\Delta\log(FR_t)$:

$$\Phi(L)x_t = \varepsilon_t, \tag{1}$$

where x_t is:

$$x_t = \begin{bmatrix} \Delta \log(y_t) \\ \Delta \log(EX_t) \\ \Delta \log(FR_t) \end{bmatrix}, \tag{2}$$

$\Phi(L) = I - \Phi_1 L - \Phi_2 L^2 - \cdots - \Phi_p L^p$ is the lag polynomial.

To measure the degree of central bank intervention in the foreign exchange market, we perform the variance decomposition by the following identification:

$$\begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \end{bmatrix} = \begin{bmatrix} a_{11} & 0 & 0 \\ a_{21} & a_{22} & a_{23} \\ 0 & a_{32} & a_{33} \end{bmatrix} \begin{bmatrix} e_t^A \\ e_t^{EX} \\ e_t^{FR} \end{bmatrix}, \tag{3}$$

where ε_{jt} denote the reduced-form VAR innovations. The structural shocks are identified as the output shock, e_t^A, the exchange rate shock, e_t^{EX}, and the foreign reserve shock, e_t^{FR}. The identification suggests that in order to stabilize the exchange rate, a shock to exchange rates affects foreign reserves since central bank would buy and sell foreign exchange reserves in foreign exchange market in response to exchange rate movements. Moreover, a shock to foreign reserves shifts demand and supply in the foreign exchange market, which would affect the exchange rate. Clearly, the identification scheme allows exchange rates and foreign reserves to be determined simultaneously. Finally, it is assumed that the output shocks (including demand and supply shocks) move the exchange rate via adjustments in current account. It is worthy noting that the the foreign exchange reserve included in the SVAR system is not served as a proxy of foreign exchange market intervention, and thus it is not the focus of the current paper to examine how the exchange rate changes in response to official intervention activities. By contrast, if the evidence shows that a large portion of variance in foreign exchange reserves is attributed to exchange rate shocks, we interpret it as evidence of currency manipulation.

We will employ variance decompositions, which help us to investigate the sources of foreign exchange reserve fluctuations and, in particular, the roles of exchange rate shocks. Hence, the degree of intervention can be measured through the portion of the movements in foreign reserves that can be explained by the exchange rate shocks.

3 Data and Preliminary Tests

We investigate monthly data from 1999:M1 to 2010:M9 for emerging countries examined in Bernanke (2010) : Brazil, Chile, India, Indonesia, Korea, Mexico, Philippines, Poland, Russia, Singapore, Thailand, Taiwan, and Turkey.[2] The sample period is chosen to be the aftermath of the Asia 1997 currency crisis. We use the growth rate of the industrial production as the measure of real output growth. Data for the U.S. dollar nominal exchange rate, foreign exchange reserve and consumer price indices are from the International Financial Statistics (IFS) published by the International Monetary Fund. Industrial production for most countries is also from the IFS. Due to missing data problem in IFS, the industrial production for Indonesia, Russia, and Thailand is obtained from Datastream. Finally, data for Taiwan are obtained from Taiwan Economic Data Center (TEDC). Country real exchange rates are constructed by multiplying the U.S. dollar nominal exchange rate by the ratio of foreign to U.S. consumer price indices.

Unit root tests are used to examine whether the series for real exchange rate changes, foreign reserve changes and real output growth are stationary. We apply conventional unit root tests, including the Augmented Dickey–Fuller (ADF) test, and the Phillips–

[2]China and Malaysia are excluded in our study because these countries peg their currency to the U.S. dollar during most of the sample period. Because of unavailability of manufacturing production data in monthly frequency, Hong Kong is also excluded.

Perron (PP) test. The results from unit root tests incorporating an intercept in Table 1 suggest that a unit root process is rejected for each series in first difference: $\Delta \log(EX)$, $\Delta \log(FR)$ and $\Delta \log(IP)$.

4 Empirical Results

We use variance decomposition to measure the degree of central bank intervention in the foreign exchange market. The idea is simple and intuitive: if the central bank intervenes the exchange market to stabilize its currency, the exchange rate shock should explain a large portion of the foreign reserve movements. However, if foreign exchange reserves do not change much, a high contribution of exchange rate shocks does not imply a huge manipulation. The data for percentage changes in foreign reserves month to month are plotted in Figure 1. It is clear that the foreign reserves fluctuate considerably for emerging countries examined in this paper.

In order to investigate how much fluctuations in the foreign reserves are due to different structural shocks, we calculate variance decompositions of the change in foreign reserves, $\Delta \log(FR)$, and report the results in Tables 2 and 3. Each column represents how much of the h-step ahead forecast error variance of the change in foreign reserves can be explained by the productivity shock (e^A), the exchange rate shock (e^{EX}), and the foreign reserve shock (e^{FR}) for one month, two months, half year, one year, and two years ($h = 1, 2, 6, 12$, and 24). It is worth noting that for five of thirteen emerging countries, exchange rate shocks are the main source of fluctuations in foreign reserves over all time horizons. These highly intervened countries are India (79.72–83.94%), Indonesia (40.57–40.82%), Korea (43.97–54.66%), Philippines (45.14–47.94%), Singapore (74.79–80.83%), and Taiwan (47.86–54.70%). By contrast, the degree of intervention is relatively lower for countries with the smaller contribution of the exchange rate shock: Brazil (0.43–5.85%), Chile (0.79–0.80%), Mexico (0.28–0.92%), and Russia (0.01–0.26%).

5 Robustness

To check the robustness of the empirical results, we first use an alternative measure of real exchange rates. The real effective exchange rate indices for a total of 58 economies are obtained from the Bank for International Settlements (BIS). The results in Tables 4 and 5 are consistent with our main findings.

We then examine different VAR identification schemes. The first alternative identification scheme is

$$\begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \end{bmatrix} = \begin{bmatrix} a_{11} & 0 & 0 \\ 0 & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix} \begin{bmatrix} e_t^A \\ e_t^{EX} \\ e_t^{FR} \end{bmatrix}. \tag{4}$$

That is, it is assumed that a shock to productivity causes changes in foreign reserves since the reserves may vary over the economic fluctuations. To be more precise, a positive productivity shock raises output and export growth, and thus induces an accumulation of foreign reserve. Moreover, we consider a simple Choleski decomposition as follows:

$$\begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \end{bmatrix} = \begin{bmatrix} a_{11} & 0 & 0 \\ a_{21} & a_{22} & 0 \\ a_{31} & a_{32} & a_{33} \end{bmatrix} \begin{bmatrix} e_t^A \\ e_t^{EX} \\ e_t^{FR} \end{bmatrix}. \tag{5}$$

The results for equation (4) are reported in Tables 6 and 7 whereas results for equation (5) are reported in Tables 8 and 9. We can see that Korea, Singapore, and Taiwan remain the countries with relatively higher degree of official intervention while lower degree of intervention is still found in countries such as Brazil, Chile, India, Mexico, and Russia.

6 Conclusion

Due to the lack of appropriate data on official intervention in the foreign exchange markets, it is a difficult task for both academic researchers and policy makers to verify whether countries let their exchange rate adjust freely as they claimed. The controversy is apparent particularly for emerging market countries since it is believed in general that in order to prevent their competitiveness from deteriorating, emerging market countries tend to frequently and substantially intervene in foreign exchange markets to prevent or slow the appreciation of their currencies. However, simple descriptive statistics such as the rate of depreciation in real effective exchange rate or growth rate of foreign reserve accumulation may fail to capture the whole dynamic picture of official intervention.

In this paper, we examine the degree of central bank intervention in the foreign exchange markets of thirteen emerging countries using a structural vector autoregressive (SVAR) framework to link the dynamics of exchange rates and foreign reserves. It is found that for Korea, Philippines, Poland, Singapore, and Taiwan, exchange rate shocks play an important role to explain the fluctuations in foreign reserves over all time horizons. Empirical evidence suggests that these countries intervene substantially in the foreign exchange markets.

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Table 1: Unit Root Tests

	ADF Test			PP Test		
	$\Delta \log(EX)$	$\Delta \log(FR)$	$\Delta \log(IP)$	$\Delta \log(EX)$	$\Delta \log(FR)$	$\Delta \log(IP)$
Brazil	-5.83	-3.09	-10.46	-12.09	-12.45	-10.50
Chile	-8.55	-6.43	-12.63	-9.98	-13.65	-21.66
India	-3.43	-4.58	-18.53	-10.31	-8.70	-18.60
Indonesia	-3.29	-7.70	-4.64	-12.24	-11.02	-29.92
Korea	-12.24	-3.41	-10.95	-12.34	-7.25	-11.03
Mexico	-10.97	-11.79	-12.47	-11.03	-11.88	-12.56
Philippines	-11.16	-6.07	-16.24	-11.29	-10.76	-17.46
Poland	-10.19	-4.94	-3.00	-10.26	-12.15	-24.20
Russia	-4.49	-3.89	-13.19	-8.61	-6.37	-13.21
Singapore	-11.80	-5.65	-14.46	-11.89	-11.07	-22.08
Taiwan	-8.60	-6.16	-17.94	-10.61	-6.23	-17.53
Thailand	-2.91	-2.44	-5.38	-10.81	-9.52	-13.75
Turkey	-10.44	-4.88	-4.30	-10.47	-12.90	-21.94

Note: ADF and PP are Augmented Dickey–Fuller and Phillips–Perron test statistics, respectively. In each test, the null hypothesis is that the series has a unit root. Test critical values for ADF and PP are -3.44 (1%), -2.87 (5%) and -2.57 (10%). Lags in ADF tests are chosen by Akaike Information Criterion. The variables EX, FR, and IP represent real exchange rates, foreign reserves, and industrial production, respectively.

Table 2: Variance Decompositions (Identification in Equation (3))

	Brazil			Chile			India		
Horizon	e^A	e^{EX}	e^{FR}	e^A	e^{EX}	e^{FR}	e^A	e^{EX}	e^{FR}
1	0.00	0.43	99.58	0.00	0.79	99.21	0.00	83.94	16.06
2	0.00	5.82	94.19	0.04	0.80	99.16	0.06	80.43	19.51
6	0.02	5.85	94.13	0.06	0.80	99.13	0.10	79.72	20.18
12	0.02	5.85	94.13	0.06	0.80	99.13	0.10	79.72	20.18
24	0.02	5.85	94.13	0.06	0.80	99.13	0.10	79.72	20.18

	Indonesia			Korea			Mexico		
Horizon	e^A	e^{EX}	e^{FR}	e^A	e^{EX}	e^{FR}	e^A	e^{EX}	e^{FR}
1	0.00	40.57	59.43	0.00	43.97	56.03	0.00	0.28	99.72
2	0.22	40.82	58.96	0.57	54.66	44.77	0.00	0.92	99.08
6	0.31	40.82	58.87	3.02	51.97	45.01	0.04	0.92	99.04
12	0.32	40.82	58.87	3.11	51.41	45.48	0.04	0.92	99.04
24	0.32	40.82	58.87	3.11	51.39	45.50	0.04	0.92	99.04

	Philippines			Poland			Russia		
Horizon	e^A	e^{EX}	e^{FR}	e^A	e^{EX}	e^{FR}	e^A	e^{EX}	e^{FR}
1	0.00	45.14	54.86	0.00	17.84	82.16	0.00	0.01	99.99
2	0.06	47.85	52.09	0.10	19.13	80.77	0.29	0.11	99.60
6	0.06	47.94	52.00	2.29	20.06	77.65	0.35	0.26	99.39
12	0.06	47.94	52.00	3.34	19.86	76.80	0.35	0.26	99.39
24	0.06	47.94	52.00	3.37	19.86	76.77	0.35	0.26	99.39

Table 3: Variance Decompositions (Identification in Equation (3))

	Singapore			Taiwan		
Horizon	e^A	e^{EX}	e^{FR}	e^A	e^{EX}	e^{FR}
1	0.00	80.83	19.17	0.00	54.70	45.30
2	0.24	80.59	19.17	0.00	54.53	45.47
6	0.24	74.79	24.97	1.06	48.08	50.85
12	0.24	74.79	24.97	1.06	47.87	51.07
24	0.24	74.79	24.97	1.06	47.86	51.08
	Thailand			**Turkey**		
Horizon	e^A	e^{EX}	e^{FR}	e^A	e^{EX}	e^{FR}
1	0.00	25.57	74.43	0.00	49.70	50.31
2	0.76	29.37	69.87	0.92	44.95	54.14
6	0.78	29.83	69.40	0.95	43.19	55.86
12	0.78	29.83	69.40	0.95	43.18	55.87
24	0.78	29.83	69.40	0.95	43.18	55.87

Table 4: Variance Decompositions (BIS effective exchange rate indices)

	Brazil			Chile			India		
Horizon	e^A	e^{EX}	e^{FR}	e^A	e^{EX}	e^{FR}	e^A	e^{EX}	e^{FR}
1	0.00	0.00	100.00	0.00	92.19	7.81	0.00	36.16	63.84
2	0.00	0.42	99.58	0.10	92.21	7.69	0.07	41.89	58.04
6	0.00	0.43	99.57	0.31	91.71	7.98	0.07	42.56	57.36
12	0.00	0.43	99.57	0.31	91.71	7.98	0.07	42.56	57.36
24	0.00	0.43	99.57	0.31	91.71	7.98	0.07	42.56	57.36

	Indonesia			Korea			Mexico		
Horizon	e^A	e^{EX}	e^{FR}	e^A	e^{EX}	e^{FR}	e^A	e^{EX}	e^{FR}
1	0.00	96.41	3.59	0.00	71.04	28.97	0.00	30.13	69.87
2	0.25	96.18	3.57	0.38	62.24	37.38	0.00	30.14	69.86
6	0.35	96.06	3.59	4.01	62.40	33.59	0.00	30.14	69.86
12	0.36	96.06	3.59	3.99	62.73	33.28	0.00	30.14	69.86
24	0.36	96.06	3.59	4.00	62.72	33.28	0.00	30.14	69.86

	Philippines			Poland			Russia		
Horizon	e^A	e^{EX}	e^{FR}	e^A	e^{EX}	e^{FR}	e^A	e^{EX}	e^{FR}
1	0.00	14.27	85.73	0.00	5.86	94.14	0.00	3.26	96.75
2	0.19	15.50	84.30	0.04	6.74	93.23	0.23	2.45	97.32
6	0.53	17.02	82.45	2.43	6.50	91.07	0.30	2.42	97.29
12	0.53	17.02	82.45	3.07	6.46	90.46	0.30	2.42	97.29
24	0.53	17.02	82.45	3.11	6.46	90.43	0.30	2.42	97.29

Table 5: Variance Decompositions (BIS effective exchange rate indices)

	Singapore			Taiwan		
Horizon	e^A	e^{EX}	e^{FR}	e^A	e^{EX}	e^{FR}
1	0.00	93.67	6.34	0.00	38.78	61.22
2	0.16	92.41	7.43	0.01	39.49	60.50
6	0.18	91.54	8.29	1.11	47.59	51.30
12	0.18	91.53	8.30	1.12	47.72	51.16
24	0.18	91.53	8.30	1.12	47.72	51.16

	Thailand			Turkey		
Horizon	e^A	e^{EX}	e^{FR}	e^A	e^{EX}	e^{FR}
1	0.00	43.95	56.05	0.00	5.66	94.34
2	0.72	43.39	55.89	0.70	5.56	93.74
6	0.72	43.24	56.04	0.76	5.49	93.76
12	0.72	43.24	56.04	0.76	5.49	93.75
24	0.72	43.24	56.04	0.76	5.49	93.75

Table 6: Variance Decompositions (Identification in Equation (4))

	Brazil			Chile			India		
Horizon	e^A	e^{EX}	e^{FR}	e^A	e^{EX}	e^{FR}	e^A	e^{EX}	e^{FR}
1	0.05	8.00	91.95	0.21	11.68	88.11	0.51	14.38	85.11
2	0.08	13.14	86.78	0.27	11.68	88.05	0.65	12.79	86.57
6	0.12	13.16	86.72	0.29	11.68	88.03	0.72	12.75	86.54
12	0.12	13.16	86.72	0.29	11.68	88.03	0.72	12.75	86.54
24	0.12	13.16	86.72	0.29	11.68	88.03	0.72	12.75	86.54

	Indonesia			Korea			Mexico		
Horizon	e^A	e^{EX}	e^{FR}	e^A	e^{EX}	e^{FR}	e^A	e^{EX}	e^{FR}
1	0.25	8.43	91.33	4.14	48.05	47.81	0.48	0.47	99.05
2	0.51	8.76	90.73	3.26	58.55	38.20	0.48	0.79	98.73
6	0.62	8.77	90.62	7.65	52.82	39.53	0.50	0.80	98.70
12	0.62	8.77	90.61	7.52	52.22	40.26	0.50	0.80	98.70
24	0.62	8.77	90.61	7.52	52.20	40.28	0.50	0.80	98.70

	Philippines			Poland			Russia		
Horizon	e^A	e^{EX}	e^{FR}	e^A	e^{EX}	e^{FR}	e^A	e^{EX}	e^{FR}
1	1.18	7.92	90.90	4.77	24.59	70.65	0.62	4.05	95.33
2	1.20	9.41	89.39	4.62	25.46	69.92	1.32	3.96	94.72
6	1.20	9.41	89.39	6.54	25.76	67.71	1.43	4.08	94.49
12	1.20	9.41	89.39	7.52	25.50	66.99	1.44	4.08	94.49
24	1.20	9.41	89.39	7.55	25.49	66.96	1.44	4.08	94.49

Table 7: Variance Decompositions (Identification in Equation (4))

	Singapore			Taiwan		
Horizon	e^{A}	e^{EX}	e^{FR}	e^{A}	e^{EX}	e^{FR}
1	2.85	41.44	55.71	0.11	10.40	89.49
2	3.07	41.19	55.74	0.22	9.65	90.13
6	3.01	39.70	57.30	1.84	10.15	88.00
12	3.01	39.70	57.29	1.86	10.25	87.89
24	3.01	39.70	57.29	1.86	10.25	87.89

	Thailand			Turkey		
Horizon	e^{A}	e^{EX}	e^{FR}	e^{A}	e^{EX}	e^{FR}
1	0.56	0.01	99.43	0.52	0.03	99.46
2	0.99	1.54	97.48	0.70	8.74	90.57
6	0.99	1.77	97.23	0.65	9.35	90.00
12	0.99	1.77	97.23	0.65	9.35	90.00
24	0.99	1.77	97.23	0.65	9.35	90.00

Table 8: Variance Decompositions (Identification in Equation (5))

	Brazil			Chile			India		
Horizon	e^{A}	e^{EX}	e^{FR}	e^{A}	e^{EX}	e^{FR}	e^{A}	e^{EX}	e^{FR}
1	0.02	0.00	99.98	0.30	1.61	98.09	0.79	4.35	94.86
2	0.02	5.29	94.69	0.36	1.63	98.01	0.98	6.94	92.08
6	0.04	5.33	94.63	0.39	1.63	97.99	1.04	7.53	91.43
12	0.04	5.33	94.63	0.39	1.63	97.99	1.04	7.53	91.43
24	0.04	5.33	94.63	0.39	1.63	97.99	1.04	7.53	91.43
	Indonesia			Korea			Mexico		
Horizon	e^{A}	e^{EX}	e^{FR}	e^{A}	e^{EX}	e^{FR}	e^{A}	e^{EX}	e^{FR}
1	0.12	12.20	87.68	3.44	17.59	78.98	0.43	5.87	93.70
2	0.36	12.52	87.12	2.69	29.93	67.38	0.42	6.41	93.17
6	0.46	12.54	87.00	6.75	27.97	65.28	0.46	6.41	93.13
12	0.46	12.54	87.00	6.65	27.60	65.74	0.46	6.41	93.13
24	0.46	12.54	87.00	6.65	27.59	65.76	0.46	6.41	93.13
	Philippines			Poland			Russia		
Horizon	e^{A}	e^{EX}	e^{FR}	e^{A}	e^{EX}	e^{FR}	e^{A}	e^{EX}	e^{FR}
1	1.23	3.80	94.97	4.20	16.02	79.78	0.05	12.12	87.83
2	1.32	7.65	91.04	4.08	17.46	78.45	0.45	11.29	88.26
6	1.32	7.75	90.93	6.00	18.52	75.49	0.54	10.78	88.68
12	1.32	7.75	90.93	6.99	18.34	74.67	0.54	10.77	88.69
24	1.32	7.75	90.93	7.02	18.34	74.64	0.54	10.77	88.69

Table 9: Variance Decompositions (Identification in Equation (5))

	Singapore			Taiwan		
Horizon	e^A	e^{EX}	e^{FR}	e^A	e^{EX}	e^{FR}
1	3.10	44.92	51.97	0.05	16.12	83.83
2	3.41	45.22	51.37	0.05	16.00	83.96
6	3.22	43.69	53.09	1.20	13.47	85.33
12	3.22	43.69	53.09	1.20	13.37	85.44
24	3.22	43.69	53.09	1.20	13.37	85.44
	Thailand			**Turkey**		
Horizon	e^A	e^{EX}	e^{FR}	e^A	e^{EX}	e^{FR}
1	0.71	23.39	75.90	0.97	1.50	97.53
2	1.07	27.29	71.64	1.51	7.64	90.85
6	1.06	27.76	71.18	1.46	7.49	91.05
12	1.06	27.76	71.18	1.46	7.49	91.05
24	1.06	27.76	71.18	1.46	7.49	91.05

Figure 1: Percentage Changes in Foreign Reserves