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ON EXCHANGE RATE IN EMERGING
COUNTRIES**

Soyoung Kim and Kuntae Lim

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Effects of Monetary Policy Shocks on Exchange Rate in Emerging Countries⁺

Soyoung Kim^{*}

Department of Economics
Seoul National University

and

Kuntae Lim^{**}

Bank of Korea

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Abstract

This study empirically investigates the effects of monetary policy shocks on the exchange rate in six emerging countries (Korea, Thailand, the Philippines, Mexico, Brazil, and Colombia). VAR models are used, wherein sign restrictions on impulse responses are imposed to identify monetary policy shocks. The empirical model reflects the small open emerging economy features. The estimation period is the recent period in which these countries adopted inflation targeting and more flexible exchange rate regimes based on the experience of advanced countries. The main findings are as follows. First, various puzzles such as the “exchange rate puzzle,” “delayed overshooting puzzle,” and “forward discount bias puzzle” are frequently found in these countries. Second, more severe puzzles are found in these emerging countries than in small open advanced countries.

Keywords: VAR, Monetary Policy Shocks, Exchange Rate, UIP Condition, Delayed Overshooting
JEL Classifications: F3, E5

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^{*} Department of Economics, Seoul National University, San 56-1, Sillim-Dong, Gwanak-Gu, Seoul 151-746, Korea. Tel.: +82-2-880-2689, E-mail: soyoungkim@snu.ac.kr.

^{**} Monetary Policy Department, Bank of Korea, 39, Namdaemun-ro, Jung-gu, Seoul 100-794, Korea. Tel.: +82-10-3885-0254, E-mail: ktl@bok.or.kr.

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1. Introduction

The effects of monetary policy shocks on the exchange rate have always been controversial. Initial studies documented various puzzling responses that contrast with what theories have predicted. By employing recursive vector autoregression (VAR) models with US data, Eichenbaum and Evans (1995) documented that the maximum response of the exchange rate to monetary policy shocks has a substantial delay of 2–4 years, which is different from the prediction of popular “overshooting” theories such as that of Dornbusch (1976). This is called the “delayed overshooting” puzzle. Eichenbaum and Evan (1995) also reported huge, persistent, and significant deviations from the UIP condition, conditional on monetary policy shocks. This can be regarded as the “forward discount bias” puzzle, conditional on monetary policy shocks. Using a recursive VAR model for non-US G-7 countries (against the US), Grilli and Roubini (1995) documented even more puzzling responses: contractionary monetary policy shocks result in an exchange rate depreciation (instead of an exchange rate appreciation), which is inconsistent with most theories. This is called the “exchange rate” puzzle.

However, subsequent studies argued that the results are “less puzzling” than those initially found in the aforementioned studies, and that the empirical evidence is often broadly consistent with the existing theory. In particular, the “exchange rate” puzzle is not found and the delay in overshooting is relatively slight or less certain. Kim and Roubini (2000) and Faust and Rogers (2003), and Bjorland (2009) found such results using the alternative identification methods that allow a contemporaneous feedback relation between monetary policy and the exchange rate, which was not the case in Eichenbaum and Evans (1995) and Grilli and Roubini (1995). On the other hand, Scholl and Uhlig (2008) employed a relatively recent identification method that imposes sign restrictions on the impulse responses and documented a long delay in overshooting even after allowing such feedback relation. However, Kim et al. (2015) and Kim and Lim (2015) further found that the delay for the US and for the UK, Australia, Sweden, and Canada,

respectively, is relatively slight when the sample period is restricted to the period of homogeneous monetary policy regime.

Most past studies investigated the effects in advanced countries, but studies on the effects in a group of emerging countries are scarce. Thus, this study investigates the effects in emerging countries. What is the effect of monetary policy shocks on exchange rates in emerging countries? Are the effects similar to those of advanced countries? Do we find more puzzles in emerging countries? The issue can be especially interesting for the emerging countries that recently adopted new monetary policies and/or exchange rate regimes by following advanced countries. After experiencing the currency crisis in the 90s, many emerging countries began to use the interest rate as a monetary policy instrument. Moreover, they adopted inflation targeting and more flexible exchange rate regimes. In terms of monetary and exchange rate regimes, these countries may not be significantly different from advanced countries. With the adoption of monetary and exchange rate regimes that are similar to those of advanced countries, are the effects of monetary policy on the exchange rate in these emerging countries similar to those in advanced countries? Are the effects in emerging countries broadly consistent with the theory, similar to those in advanced countries as they recently adopt similar policy regimes?

This study investigates six emerging countries (Korea, Thailand, the Philippines, Mexico, Brazil, and Colombia) with the inflation-targeting period as the sample period. We use the empirical model utilized by Uhlig (2005) and Scholl and Uhlig (2008). The model imposes sign restrictions on impulse responses to identify monetary policy shocks. However, different from Scholl and Uhlig (2008) who investigated the US, we use the model to study small open economy features, which is similar to that of Kim and Lim (2015) because these emerging countries are regarded as small open economies. Kim and Lim (2015) investigated advanced countries; thus, the comparison between advanced and emerging countries is facilitated by using a similar model for emerging countries. In the model, we consider various variables that are important to determine

the exchange rate in emerging countries, such as foreign exchange reserves, VIX, and spread, to check the robustness of the main results.

In Section 2, we explain the empirical method and the empirical model. In Section 3, we present the empirical results from the baseline and the extended models. In Section 4, we compare the results with those of advanced countries. In Section 5, we conclude based on the summary of the results.

2. Methodology and Data

2.1. Structural VAR Model with Sign Restrictions

To identify exogenous monetary policy shocks and examine the effects of the identified shocks on the exchange rate, structural VAR models with sign restrictions (Uhlig 2005) are used. Past studies on the effects of monetary policy have frequently used structural VAR models, which are useful in identifying exogenous monetary policy shocks. By imposing proper sign restrictions, several puzzling responses (e.g., liquidity and price puzzles) can be eliminated.¹ The identification strategy that uses sign restrictions on impulse responses is appealing because puzzling responses are often regarded as failures in identifying proper monetary policy shocks. The methodology of the structural VAR model with sign restrictions is briefly described below.

A reduced form of the VAR model is considered:

$$Y_t = B(L)Y_{t-1} + C(L)X_t + u_t, \quad (1)$$

¹ An exogenous monetary expansion (contraction) is supposed to increase (decrease) monetary aggregates and price levels and decrease (increase) interest rates. However, in a model that uses innovations in broad monetary aggregates as monetary policy shocks, both monetary aggregates and interest rates increase. This phenomenon is called the “liquidity puzzle.” On the other hand, in a model that uses innovations in interest rates as monetary policy shocks, both interest rates and price levels increase. This phenomenon is called the “price puzzle.” These puzzles are often regarded as indications that exogenous shocks to monetary policy are not properly identified in the model. Sims (1992), Christiano, Eichenbaum, and Evans (1999), and Kim (2013) have provided a survey of the literature.

where Y_t is an $l \times 1$ vector of endogenous variables, X_t is an $m \times 1$ vector of exogenous variables, u_t is an $l \times 1$ residual vector, $E(u_t) = 0$, $E(u_t u_t') = \Sigma$, and $B(L)$ and $C(L)$ are $l \times l$ and $l \times m$ matrix polynomials in lag operator L .

In general, reduced-form residuals (elements of u_t) can be written as the linear combinations of structural shocks (elements of v_t) as follows:

$$u_t = Av_t, \quad (2)$$

where A is an $l \times l$ matrix, v_t is an $l \times 1$ vector of structural shocks, $E(v_t) = 0$, and $E(v_t v_t') = 1$.

Previous studies recovered orthogonal structural shocks from reduced-form residuals by determining A . For example, the recursive identification strategy developed by Sims (1980) recovers A as a lower triangular matrix by applying Cholesky decomposition on Σ .

Uhlig (2005) has identified structural shocks by imposing sign restrictions on impulse responses. The study has identified only one type of structural shock in particular, that is, monetary policy shock, which amounts to identifying a single column $a \in R^m$ of the matrix A . Uhlig (2005) has defined the impulse vector as follows.

Definition 1. The vector $a \in R^m$ is called an impulse vector if matrix A exists; thus, $AA' = \Sigma$ and a is a column of A .

Uhlig (2005) has shown that any impulse vector a can be characterized by $a = \tilde{A}\alpha$, where $\tilde{A}\tilde{A}' = \Sigma$ is a Cholesky decomposition of Σ and α is an l -dimensional vector of unit length.

Thereafter, the vector impulse response $r_a(k)$ for a can be expressed by the following:

$$r_a(k) = \sum_{j=1}^l \alpha_j r_j(k), \text{ where } r_j(k) \in R^l \text{ is the vector response at horizon } k \text{ to the } j\text{th variable in a}$$

Cholesky decomposition of Σ . A list of inequality restrictions on the entries of the vector impulse response $r_a(k)$ at various horizons k is then imposed.

Following the pure sign restriction approach by Uhlig (2005), a Bayesian prior for the VAR parameters (B , Σ) and an independent uniform prior for α are assumed. Only the draws that satisfy the inequality restrictions are retained in the simulation exercise. The probability bands are calculated based on 5,000 of such draws.

2.2. Empirical Model and Data

The model developed in this study aims to identify monetary policy shocks in small open economies. In particular, the model is different from that of Scholl and Uhlig (2008), who have identified monetary policy shocks for the US, a country regarded as a large open economy. Different from Scholl and Uhlig (2008), we include US or the world variables as exogenous variables, to model the small open economy features of those countries. In addition, some variables, such as foreign exchange reserves, are included to consider foreign exchange intervention and reserve accumulations that are likely to have impact effects on exchange rate, especially in these emerging economies.

Six endogenous variables are included in the baseline VAR model: the call rate, monetary base, consumer price index, industrial production, exchange rate of domestic currency against the US dollar, and foreign exchange reserves. The first four variables are key macro/monetary variables. These are included to identify monetary policy shocks. The exchange rate is the focus of this study. We also include foreign exchange reserves because exchange rate may critically depend

on foreign exchange rate intervention and/or accumulation of foreign exchange reserves. In addition, omitting foreign exchange reserves in the model may lead to mismeasurement of the effect in these economies.²

Three variables are also included as exogenous variables in the baseline model: the federal funds rate (FFR), industrial production of the US, and consumer price index of the US. The FFR is included to control for US monetary policy, which is likely to affect the exchange rate and/or monetary policy in each country. Industrial production and the consumer price index of the US are included because these macro fundamentals for the US could be important in determining the exchange rate against US dollars in each country. These exogenous variables are not restricted in terms of their contemporaneous effect on endogenous variables in the model [see Equation (1)].

The following sign restrictions on impulse responses are imposed to identify contractionary monetary policy shocks: (1) call rate increases, (2) monetary base decreases, and (3) CPI decreases. By imposing these restrictions, the liquidity and price puzzles are avoided by construction. Thus, the impulse responses of these basic macro variables to monetary policy shocks are consistent with conventional wisdom on the effects of monetary policy. These types of restrictions are imposed by Uhlig (2005) and frequently used in past studies, such as Scholl and Uhlig (2008) and Kim and Lim (2015). The sign restrictions are imposed on the impulse responses for the first 12 months after a shock, following Scholl and Uhlig (2008) and Kim and Lim (2015).

We consider three largest (in terms of GDP) Asian emerging countries (Korea, Thailand, and the Philippines) and three largest Latin American emerging countries (Mexico, Brazil, and Colombia) that have adopted inflation targeting in recent years. Monthly data are used. Six lags for endogenous variables are assumed. To save the degree of freedom, no lags are assumed for

² Kim (2005) has suggested that delayed overshooting can be related to foreign exchange intervention.

exogenous variables in the baseline model; however, some lags are allowed in the extended models (in Section 3.2) to check the robustness of the results. For each country, we consider the sample period during which inflation targeting is adopted. The estimation periods are 1998:1–2014:9, 2000:4–2014:9, 2002:1–2014:9, 1999:1–2014:9, 1999:6–2014:9, and 1999:9–2014:9, for Korea, Thailand, the Philippines, Mexico, Brazil, and Colombia, respectively.

3. Empirical Results

3.1. Baseline Model

Figure 1 reports the (median) impulse responses to monetary policy shocks with 68% probability bands for each country. The interest rate increases in the short run, monetary base decreases, and CPI declines in all countries. The price and the liquidity puzzles are not found by construction because of the imposition of sign restrictions on the impulse responses of these variables. The effects on IP are negative with more than 84% probability in Korea, Thailand, Brazil, and the Philippines.

The exchange rate responses in many countries are puzzling. The most puzzling responses are found in Brazil. In this country, the exchange rate depreciates, which is different from zero with 84% probability. Thus, the “exchange rate” puzzle is clearly identified. In Mexico, Thailand, and Colombia, the exchange rate responses are insignificant; the 68% probability bands include zero responses at all horizons. In the Philippines, short-run appreciation is found; however, the response is different from zero with 84% probability only at the eighth month horizon. In addition, a delayed overshooting is found; the appreciation of the exchange rate is not immediate, but gradual and the maximum appreciation occurs only in eight months. Korea is the only country in which exchange rate responses are broadly consistent with theory. The exchange rate appreciation is significant at some short-run horizons. In addition, the exchange rate appreciates

on impact, which is close to the maximum effect found in the next month. Thus, an almost immediate overshooting is found.³

Figure 2 reports the responses of the accumulated risk premium. Following many past studies, such as Eichenbaum and Evans (1995), the risk premium or the deviation from UIP condition at t is calculated as follows:

$$\rho_t = (i_t - i_t^*)/12 + S_t - S_{t+1}, \quad (1)$$

where i , i^* , and S are the domestic interest rate, foreign interest rate, and the exchange rate, respectively. We accumulate the risk premium over time based on impulse responses

Except for Colombia and Thailand, the accumulated risk premium of the countries is significantly different from zero at some horizons based on 68% probability bands. In Korea, the accumulated risk premium is significantly different from zero at medium- and long-run horizons. In the Philippines and Mexico, the accumulated risk premium is significantly different from zero at some short horizons. In Brazil, the accumulated risk premium is significantly different from zero at medium-run horizons.

3.2. Extended Models for Robustness

The baseline model is extended in various ways to check the robustness of the results. First, in the baseline model, lags of exogenous variables are not included to save the degree of the freedom. Now six lags of exogenous variables are included. Second, VIX and the spread of the US are additionally included as exogenous variables, individually. VIX represents worldwide risk condition, which may affect the capital flows and the exchange rate in these emerging countries. The spread of the US represents the unconventional monetary policy conducted in the country

³ In Korea, a LR depreciation is found in this baseline model. However, such a puzzling LR depreciation in Korea is not robust finding because it is not found in some extended models reported in Section 3.2.

after the global financial crisis. Past studies, such as Baumeister and Benati (2013) and Kapetanios et al. (2012) have used the term spread to represent the unconventional monetary policy actions. Third, restrictions on impulse responses are imposed up to the 12-month horizons in the baseline model, but now imposed up to the 6-month horizons. Fourth, we include a dummy variable for the global financial crisis (2008:7–2008:12) because the exchange rate may show abnormal behavior during the global financial crisis.

Figure 3 presents the responses of the exchange rate and risk premium in each case. The results are qualitatively similar to those of the baseline model in most cases. The “exchange rate puzzle” is found in Brazil. The exchange rate responses in Thailand, Mexico, Colombia, and the Philippines are mostly insignificant. In Korea, significant short-run exchange rate appreciation and only one-month delay in overshooting are found. The accumulated excess return is significantly different from zero at some horizons in most cases, which is similar to that in the baseline model.⁴

4. Comparison with Advanced Countries

We compare the results of emerging countries with those of advanced countries. Figure 4 reports the results for the UK, Canada, Sweden, and Australia. The empirical model is the same as the baseline model. Also for advanced countries, the sample period includes only inflation targeting period: 1992:10–2014:9, 1991:2–2014:9, 1993:1–2014:9, and 1993:3–2014:9 for the UK, Canada, Sweden, and Australia, respectively.⁵

The exchange rate puzzle is not found in any of the advanced countries; that is, the exchange rate appreciates, which is different from zero with an 84% probability at some horizons. In

⁴ The accumulated excess return is significant in the baseline model of Korea. However, the accumulated excess return becomes smaller and insignificant when six lags are allowed for the exogenous variables and when the global financial crisis dummy is included. This result, together with impulse responses of the exchange rate, may suggest that overall puzzles are weak in Korea.

⁵ Refer to Kim and Lim (2015) for detailed analysis on these advanced countries.

addition, only a slight delay in overshooting is found. The delay is less than six months in all countries. Overall, the results of advanced countries are different from those of emerging countries. More severe puzzles are found in emerging countries than in advanced countries.

On the other hand, the accumulated excess return is significantly different from zero at some horizons even in advanced countries. This is not surprising because past studies have found the significant forward discount bias puzzle in most countries. The results may suggest that different sources can explain the forward discount bias puzzle (conditional on monetary policy shocks) and other puzzling responses (such as the exchange rate and delayed overshooting puzzles).

We also consider the sample periods from 1999 for advanced countries. In the baseline estimation, the sample periods of advanced countries are from early 1990s but the sample periods of emerging countries are from late 1990s and early 2000s. We would like to check whether the difference in the results comes from the difference in the sample periods. In Figure 5, the results are similar to those when the full sample is used. This suggests that the difference in sample periods does not explain the difference of the results between advanced and emerging countries.

Emerging countries have recently adopted inflation targeting with more flexible exchange rate regimes, following the action of advanced countries. However, emerging countries are still different from advanced countries in various aspects, which may explain the difference in the results on the exchange rate responses. We discuss some economic features of emerging and advanced countries to determine the potential factors that can explain the different results.

First, the degree of capital mobility may differ between emerging and advanced countries. When capital mobility is strongly restricted, the changes in the interest rate may not affect capital flows and exchange rate in the standard way. For example, under capital account restrictions on capital inflows, the interest rate rise may not induce capital inflows and appreciate the exchange rate. As

another example, the interest parity condition does not hold and exchange rate responses may be different from those predicted by the standard theory based on the assumption of perfect capital mobility. In this regard, we report a measure of capital control restrictions for the sample countries in Table 1. We use the measure developed by Schindler et al. (2015) who have developed such measure by assessing the capital control restrictions on both inflows and outflows of 10 categories of assets for 100 countries from 1995 to 2013 based on Schindler (2009) and the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions. A higher number shows a stronger degree of capital control. In Table 1, we report the numbers based on overall (comprising both inflow and outflow), overall inflow, and overall outflow indices. We calculate the average for the estimation period of each country.⁶

Table 1 shows that stronger degrees of capital controls are imposed in emerging countries than in advanced countries. In four advanced countries, the numbers based on overall index range from 0.003 to 0.286. By contrast, in five emerging countries (excluding Korea), the numbers are far higher, ranging from 0.533 to 0.875. Different from the five emerging countries, Korea shows a low number, 0.289, which is similar to that of Australia. Interestingly, Korea is the only emerging country in which severe puzzles are not found. The results are similar when we use the overall inflow index or overall outflow index. These results suggest that strong degrees of capital controls imposed in the five emerging countries may explain the puzzling exchange rate responses found in those countries. Interestingly, Kim (2015) has empirically shown that the degree of capital controls explain the cross-country differences in the effects of government consumption shocks on real exchange rate. Although we examine the effects of monetary policy shocks, the degree of capital controls may also play an important role in the transmission of monetary policy shocks to exchange rate.

In theory, relatively more rigid exchange rate system in emerging countries may result in more puzzling behaviors of exchange rates in emerging countries. However, the degree of exchange

⁶ The earliest year is 1995 and the latest year is 2013 because only the data from 1995 to 2013 are available.

rate flexibility between emerging and advanced countries does not seem to explain the difference between emerging and advanced countries. In Table 2, we report the measure of exchange rate flexibility. First, we report the measure based on exchange rate classification of Reinhart and Rogoff (2004). A higher number shows a more flexible exchange rate regime. We calculate the average for the estimation period of each country.⁷ Second, we also report the exchange rate flexibility index based on Calvo and Reinhart (2002). A higher number shows a more flexible exchange rate regime.⁸

Table 2 shows the degree of exchange rate flexibility across countries in our sample. Finding a clear difference between advanced and emerging countries is not easy. Regarding the first measure, Australia has the highest number, 4. The UK and Sweden are 3. Canada is 2.69. Five emerging countries (excluding the Philippines) range from 3.0 to 3.17, which is not much different from the numbers of advanced countries. The Philippines has a relatively small number, 2.33. Regarding the second measure, two advanced countries (Australia and Sweden) have the highest numbers (0.0201 and 0.0140, respectively). However, the other two advanced countries (the U.K. and Canada) have even lower numbers than three emerging countries (Thailand, the Philippines, and Brazil).

Overall, these results suggest that the degree of exchange rate flexibility does not explain the differences in the exchange rate responses between advanced and emerging countries.

In addition, we don't find any direct evidence that foreign exchange intervention plays some role in generating the exchange rate puzzle in emerging countries. We found the exchange rate puzzle in Thailand and Brazil, but foreign exchange intervention does not help generate the puzzle. In Figure 1, foreign exchange reserve falls in Thailand and Brazil, which, if any, would lead to an appreciation of exchange rate.

⁷ The latest year is 2010 because only the data until 2010 are available.

⁸ To construct the measure, the variance of exchange rate is divided by the sum of the variance of foreign exchange reserves and the variance of the interest rate. Monthly data is used.

Finally, we examine the degree of financial market development in these countries. When the financial market is less developed, the standard monetary policy transmission mechanism may not work well. For example, when the bond market is less developed, an interest rate increase may not induce capital inflows into the bond market, and have a limited effect on exchange rate, differently from the prediction of the standard theory.

Table 3 reports two general measures of the financial market development, namely, private credit by deposit money banks to GDP and liquid liabilities to GDP.⁹ We also report three measures for the bond market development, namely, gross portfolio debt liabilities to GDP, gross portfolio debt assets to GDP, and corporate bond issuance volume to GDP.

Two measures of financial market development suggest that the financial market tends to be more developed in advanced countries and Korea than in the other emerging countries. However, in terms of both measures, Thailand has a higher number than Sweden, the UK, Canada, and Korea. Further, in terms of the liquid liabilities to GDP, Brazil and the Philippines have higher numbers than Sweden. Then, the gross portfolio debt liabilities to GDP and gross portfolio debt assets to GDP tend to be higher in advanced countries than in emerging countries. However, the number for Korea is considerably smaller than those of advanced countries, and smaller than those of some emerging countries. Corporate bond issuance volume to GDP tends to be higher in advanced countries and Korea than in the other emerging countries. However, Thailand has a higher number than Australia. Overall, these measures tend to be higher in advanced countries and Korea than in the other emerging countries but some exceptions exist. It is not so easy to draw a clear conclusion, but the degree of financial market development does not seem to fully explain the difference in the effects of monetary policy on exchange rate. Therefore, the results do not clearly support the important role of financial market development.

⁹ These measures have been frequently used in the past studies on financial development, such as the studies on financial development and income inequality. Levine (2005) has provided a survey on the studies on financial development and income inequality.

5. Conclusion

This study empirically investigates the effects of monetary policy shocks on exchange rates in emerging countries by using VAR models in which sign restrictions are imposed on the impulse responses to identify monetary policy shocks. The empirical model reflects the small open emerging economy features. The estimation period is the recent inflation-targeting period in which these countries adopted new monetary policy regime and a more flexible exchange rate regime based on the experience of advanced countries.

The empirical results show the following. First, various puzzles, such as the “exchange rate,” “delayed overshooting,” and “forward discount bias” puzzles, are frequently found in these countries. Second, more severe puzzles are found in the emerging countries (except for Korea) than in small open advanced countries, when the same empirical model is applied.

The results suggest that differences exist in the transmission of monetary policy between emerging and advanced countries despite the recent adoption by the emerging countries of a new monetary and exchange rate policy regime which is similar to that of advanced countries. Further investigation suggests that the high degree of capital control imposed in emerging countries may explain the difference. Future studies should analyze more detailed transmission mechanisms of the monetary policy of emerging and advanced countries to explain why more puzzles are found in emerging countries.

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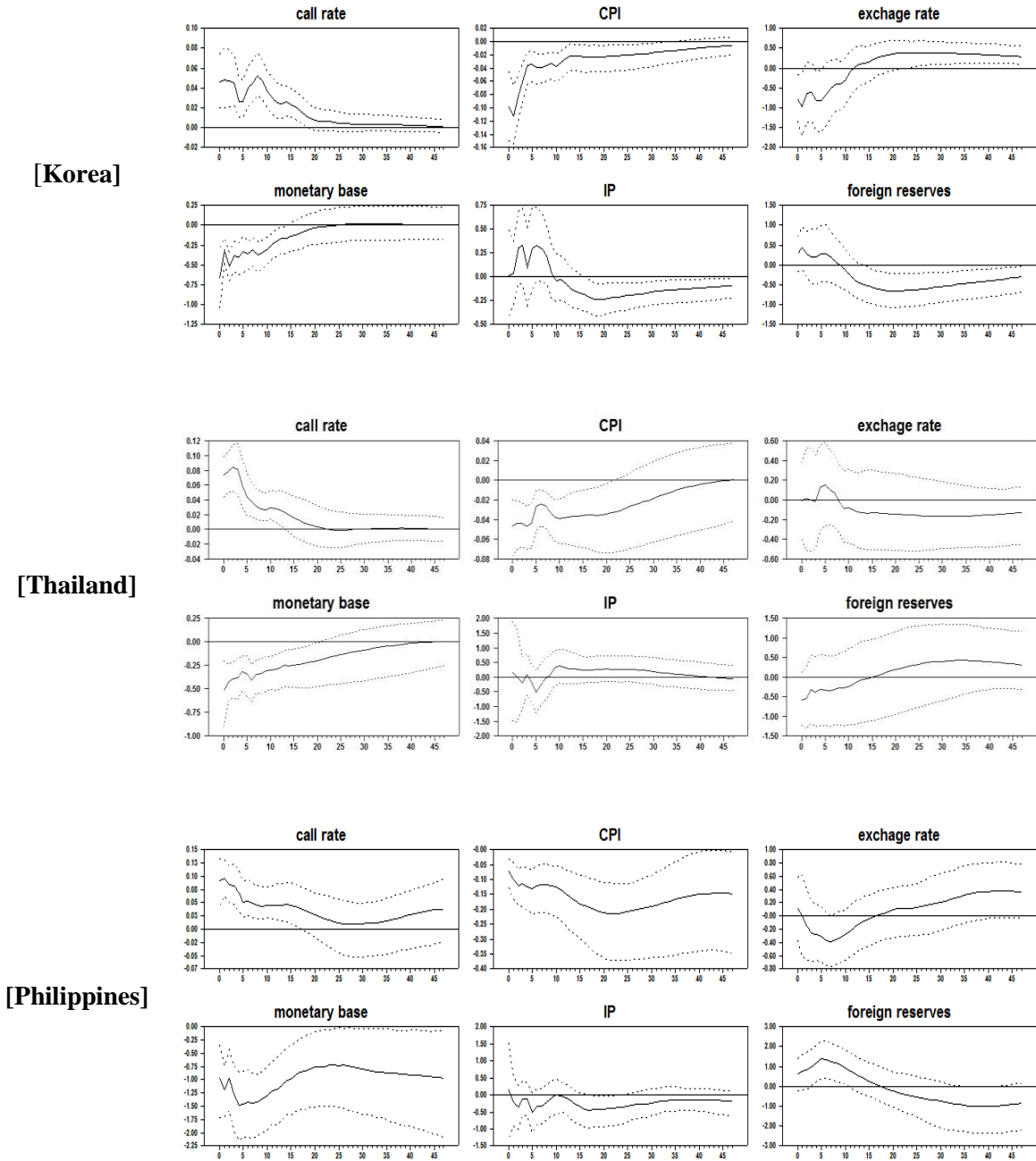
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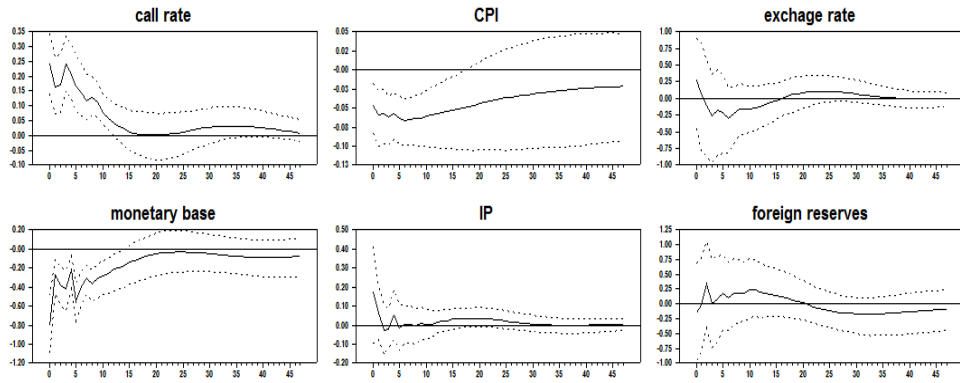
Appendix. Data Sources

Variable	Description	Sources and Notes
CR	Money market rate	<i>International Financial Statistics</i>
MB	Monetary base, seasonally adjusted (Thailand: narrow money)	<i>International Financial Statistics</i> (Korea: Korea's central bank)
CPI	Consumer price index, seasonally adjusted (Thailand: core consumer price index)	<i>International Financial Statistics</i> (Thailand and Colombia: each country's central bank)
IP	Industrial production index, seasonally adjusted	<i>International Financial Statistics</i> (Thailand and Colombia: each country's central bank)
ERA	Exchange rate of domestic currency per US dollars (period average)	<i>International Financial Statistics</i>
FR	Foreign exchange reserve (Total reserves minus gold)	<i>International Financial Statistics</i>
FFR	Federal funds rate	<i>International Financial Statistics</i>
USCPI	US Consumer price index, seasonally adjusted	<i>International Financial Statistics</i>
USIP	US Industrial production index, seasonally adjusted	<i>International Financial Statistics</i>
VIX	CBOE volatility index	Federal Reserve Bank of St. Louis Macro Database
SPREAD	Moody's seasoned Baa corporate minus 10-year US Treasury constant maturity rate	Federal Reserve Bank of St. Louis Macro Database

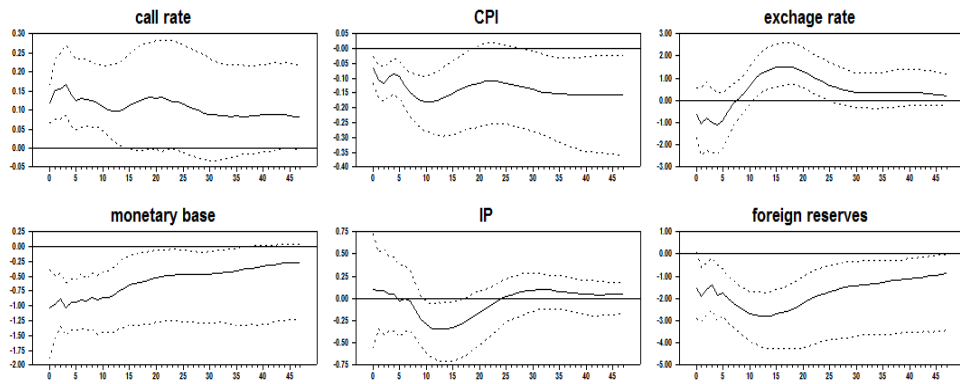
Figure 1. Impulse Responses to Contractionary Monetary Policy Shocks



[Mexico]



[Brazil]



[Colombia]

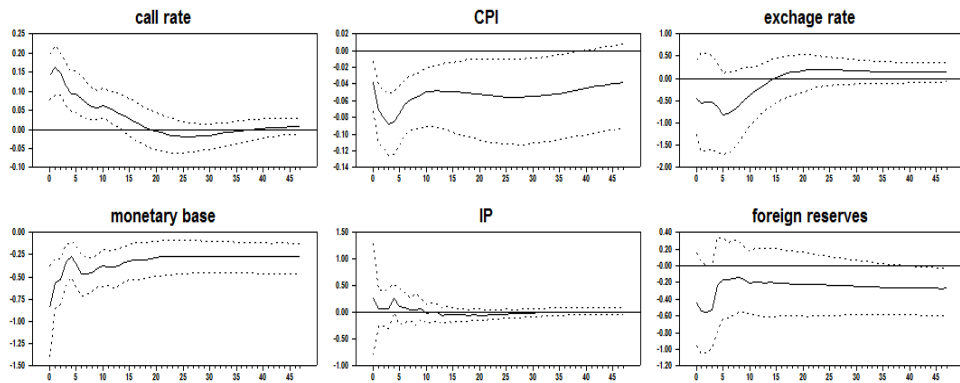


Figure 2. Accumulated Risk Premium Conditional on Monetary Policy Shocks

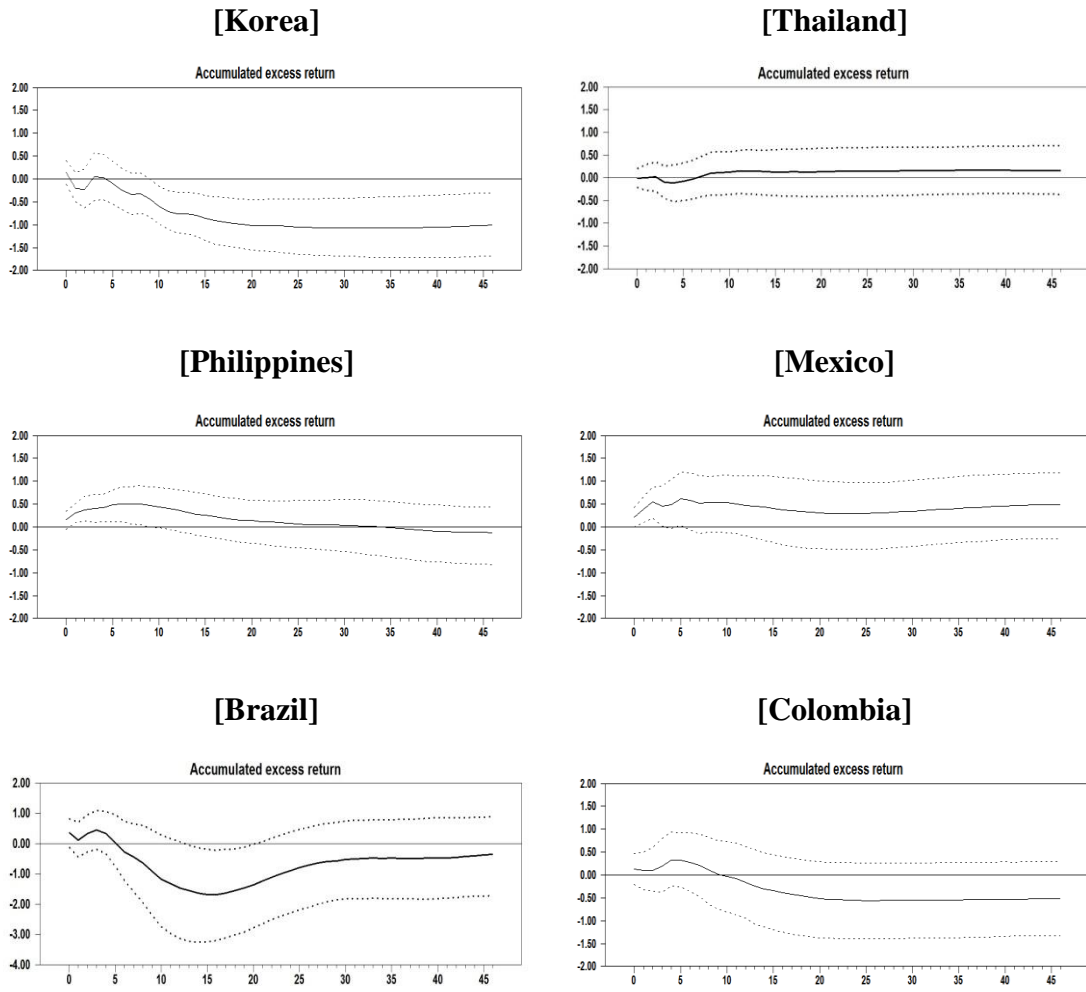
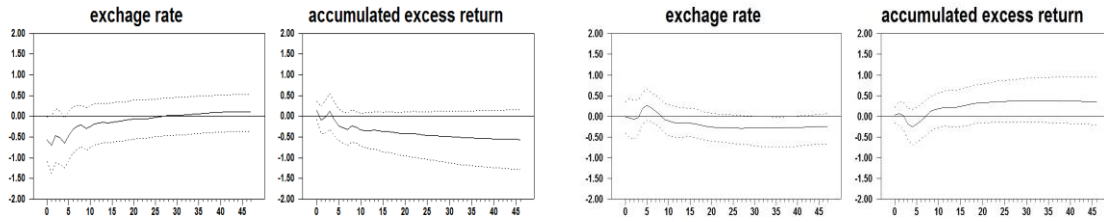


Figure 3. Robustness

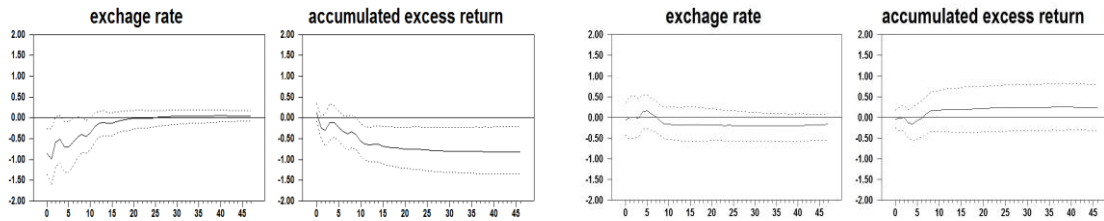
[Korea]

[Thailand]

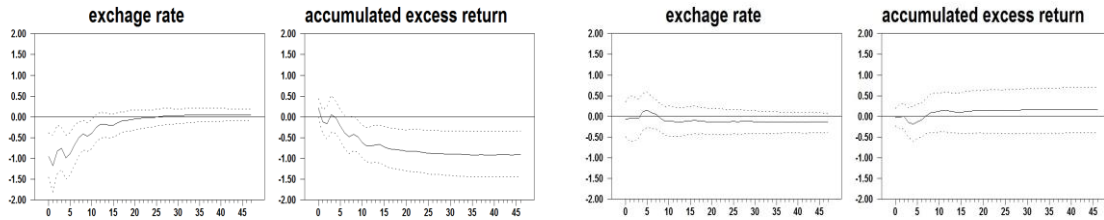
Six Lags for Exogenous Variables



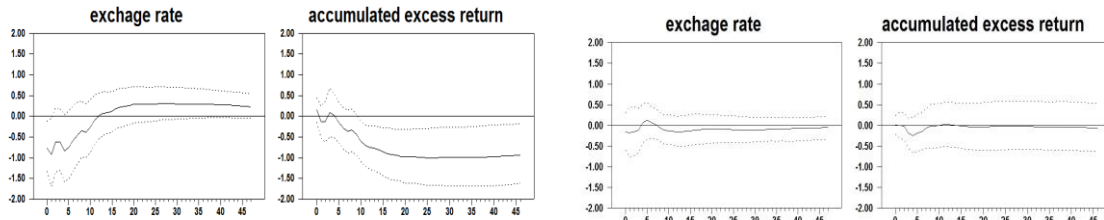
Adding VIX as an Exogenous Variable



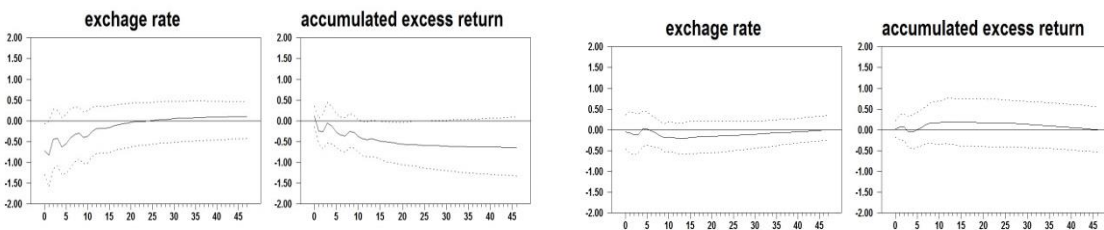
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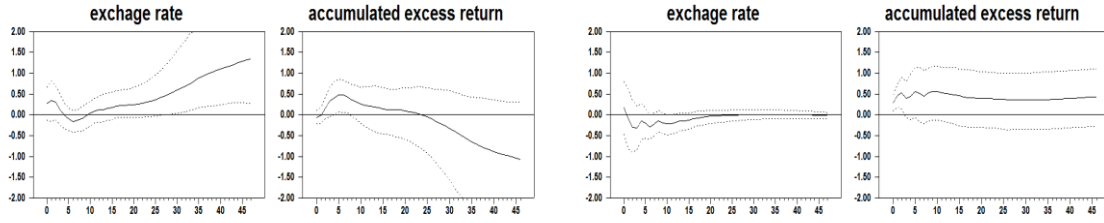
Six Month Sign Restrictions



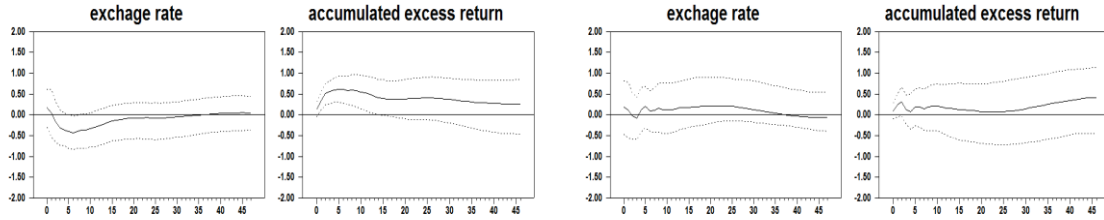
Global Financial Crisis Dummy (08.7–08.12)



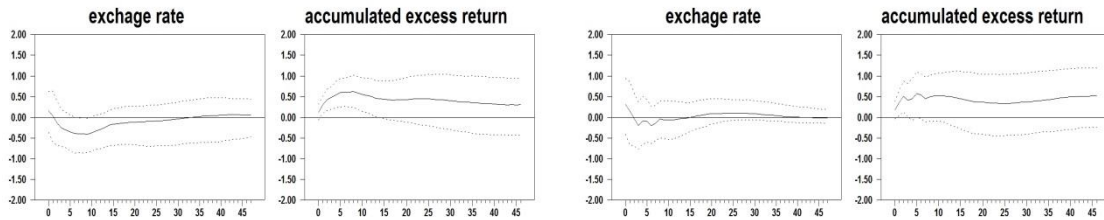
[Philippines] [Mexico]
Six Lags for Exogenous Variables



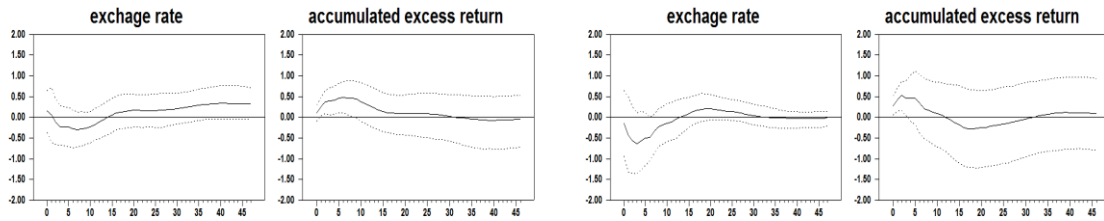
Adding VIX as an Exogenous Variable



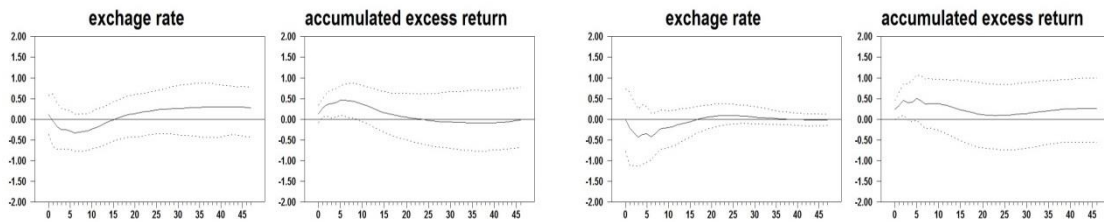
Adding Spread as an Exogenous Variable



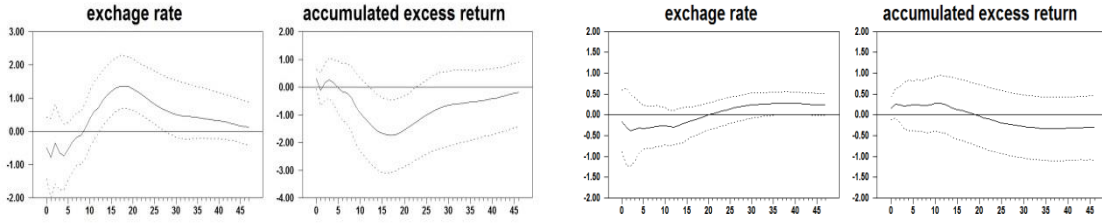
Six Month Sign Restrictions



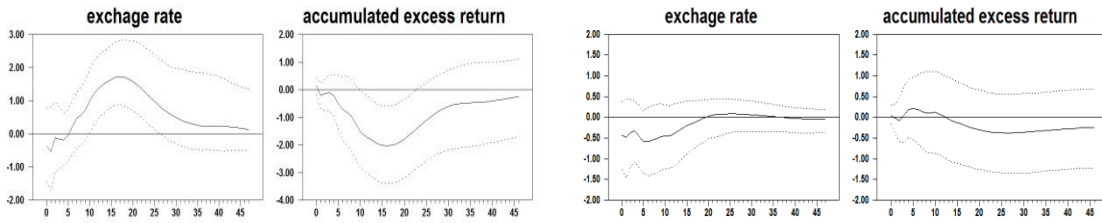
Global Financial Crisis Dummy (08.7–08.12)



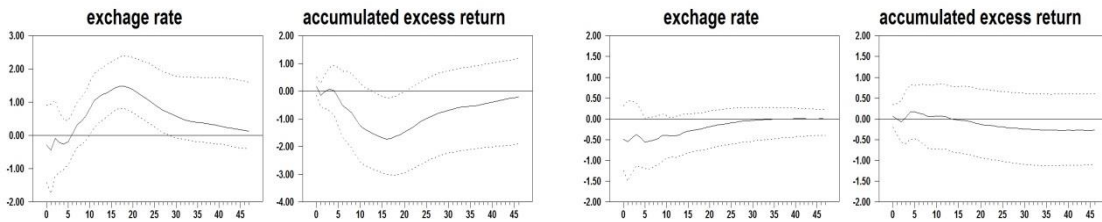
[Brazil] **[Colombia]**
Six Lags for Exogenous Variables



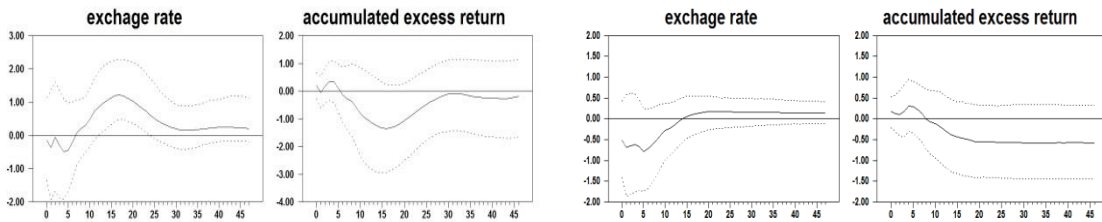
Adding VIX as an Exogenous Variable



Adding Spread as an Exogenous Variable



Six Month Sign Restrictions



Global Financial Crisis Dummy (08.7–08.12)

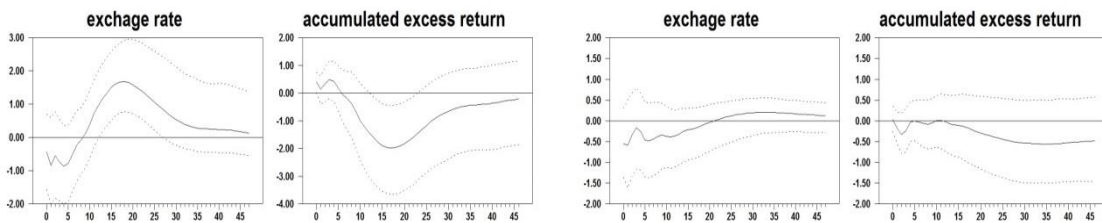


Figure 4. Impulse Responses to Contractionary Monetary Policy Shocks in Advanced Countries

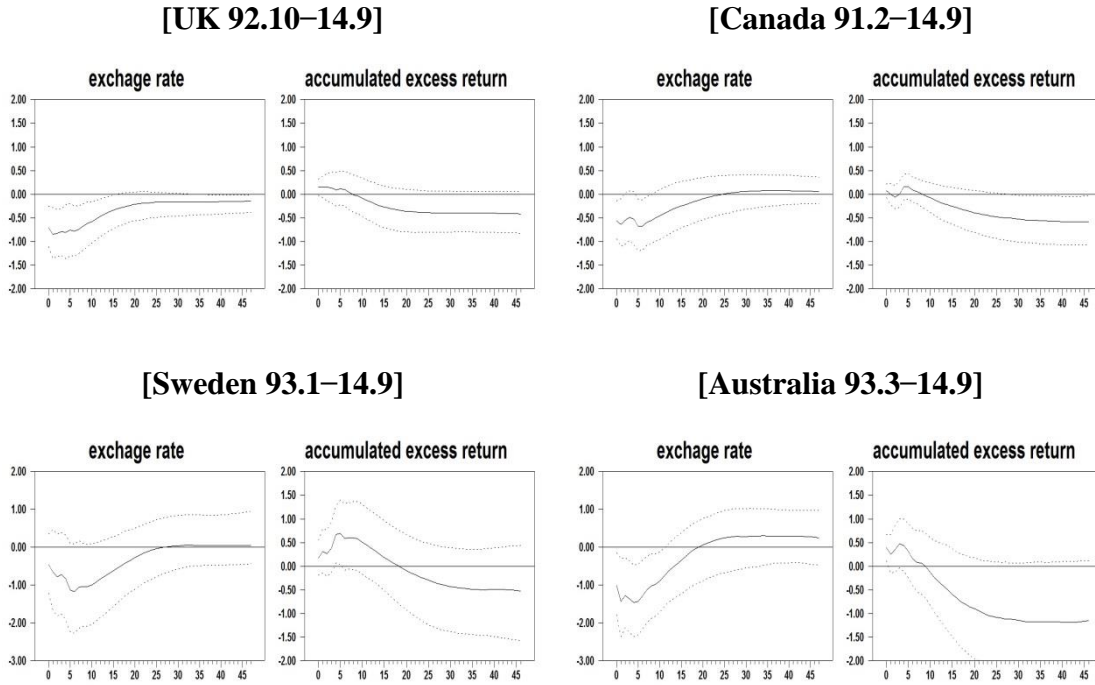


Figure 5. Impulse Responses to Contractionary Monetary Policy Shocks in Advanced Countries: Sample Period from 1999

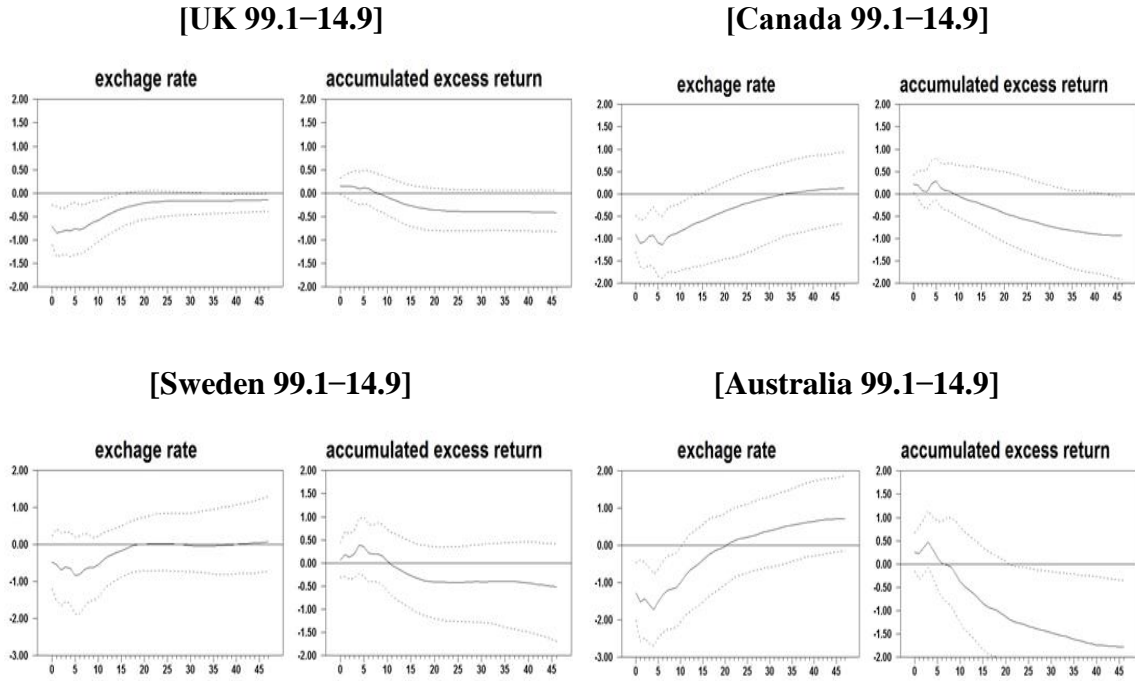


Table 1. Capital Control Measures by Schindler et al. (2015)

	Overall index	Overall inflow index	Overall outflow index
UK	0.003	0.005	0
Canada	0.051	0.101	0
Sweden	0.053	0.091	0.016
Australia	0.286	0.276	0.296
Korea	0.289	0.244	0.334
Thailand	0.771	0.668	0.875
Philippines	0.875	0.767	0.983
Mexico	0.543	0.530	0.557
Brazil	0.533	0.487	0.580
Colombia	0.624	0.716	0.531

Notes: The numbers show the annual averages. In all countries, the sample period ends in 2013. The sample period starts from the first year of the inflation-targeting period in all countries, except for the UK, Canada, Sweden, and Australia in which the sample period starts from 1995.

Table 2. Exchange Rate Flexibility Measures

	Reinhart and Rogoff (2004)¹⁾	Calvo and Reinhart (2002)²⁾
UK	3.00	0.0016
Canada	2.69	0.0026
Sweden	3.00	0.0201
Australia	4.00	0.0140
Korea	3.15	0.0025
Thailand	3.00	0.0055
Philippines	2.33	0.0043
Mexico	3.00	0.0008
Brazil	3.17	0.0035
Colombia	3.00	0.0025

Notes:

¹⁾ The numbers show the annual averages. In all countries, the sample period ends in 2010. The sample period starts from the first year of the estimation period (inflation-targeting period) in all countries, except for the UK, Canada, Sweden, and Australia in which the sample period starts from 1998.

²⁾ The sample period is the inflation-targeting period for each country. Monthly data is used.

Table 3. Financial Market Development Measures

	Private credit by deposit money banks to GDP (%) ¹⁾	Liquid liabilities to GDP (%) ¹⁾	Gross portfolio debt liabilities to GDP (%) ²⁾	Gross portfolio debt assets to GDP (%) ³⁾	Corporate bond issuance volume to GDP (%) ⁴⁾
UK	136.4	109.1	69.2	65.0	3.3
Canada	96.3	96.3	35.8	6.7	2.3
Sweden	65.9	51.9	68.6	25.3	2.4
Australia	92.5	75.2	50.5	8.9	1.7
Korea	82.9	64.4	11.6	3.2	3.9
Thailand	99.9	104.9	4.2	2.7	2.1
Philippines	27.8	54.8	16.5	4.7	1.2
Mexico	16.4	25.6	14.0	3.9	1.6
Brazil	39.1	55.4	13.6	0.7	1.4
Colombia	27.7	19.2	9.8	7.5	0.9

Data Source: World Bank, Global Financial Development Database

Notes: The numbers show the annual averages.

¹⁾The inflation-targeting periods, up to 2013

²⁾UK, Sweden, Columbia: 1999–2013, Australia, Thailand: 1999–2010, Korea, Mexico, Brazil: 2001–2013, Canada: 1999–2011, Philippines: 2001–2011

³⁾UK, Sweden, Columbia: 1999–2013, Korea, Mexico, Brazil: 200–2013, Canada: 1999–2011, Australia: 1999–2010, Thailand: 2000–2010, Philippines: 2001–2011

⁴⁾2000–2013 (except for Columbia, 2005–2013)