

Effects of Monetary Policy Shocks on the Exchange Rate in the Republic of Korea: Capital Flows in Stock and Bond Markets

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Several studies have suggested that the prediction of standard theory on the effects of monetary policy on the exchange rate might not be applicable to or in the case of the Republic of Korea because participation of foreign investors is weak in the bond market but strong in the stock market. The current study examines the effects of monetary policy shocks on the exchange rate in the Republic of Korea by using structural vector autoregression models with sign restrictions. To determine the channels by which monetary policy shocks affect the exchange rate, I investigate the effects on various components of capital flows. The main empirical findings are as follows. First, a contractionary monetary policy shock, which increases the interest rate, appreciates the Korean won significantly in the short run as predicted by most theories. Second, contractionary monetary policy shocks increase capital inflows into the bond market consistent with the prediction of the uncovered interest parity condition. This seems to be the main channel by which contractionary monetary shocks appreciate the won. Finally, foreign investors tend to withdraw money from the domestic stock market in response to a monetary tightening, resulting in a decrease in capital inflows.

Keywords: monetary policy shocks, vector autoregression, sign restrictions, exchange rate, capital flows

JEL codes: F31, F32, F33, F36

I. Introduction

Since the 1990s, many emerging Asian economies have liberalized capital accounts and opened financial markets to foreign investors. Foreign investors to date own a huge amount of stocks in emerging markets. Thus, international capital flows into domestic stock markets have become important sources of exchange rate instability as evidenced by the recent global financial crisis. However, foreign ownership in some emerging Asian bond markets, for example, the Republic of Korea, is still negligible.

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In advanced countries, foreign investors actively participate in bond markets. In some countries, they even participate in bond markets more actively than they do in stock markets. For example, a huge amount of United States (US) debt securities (e.g., Treasury bills) is owned by foreigners. In contrast, foreign investor ownership is limited in the US stock market. Such a difference in foreign investor participation in stock and bond markets may generate an important difference in the transmission of structural shocks in emerging and advanced countries. The current study investigates one interesting aspect of structural shock transmission, that is, the effects of monetary policy shocks on the exchange rate of an emerging Asian country.

Most international monetary and macro models predict that a contractionary monetary policy shock, which increases the interest rate, leads to domestic currency appreciation, other things being equal. Traditional Mundell–Fleming–Dornbusch models and recent New Open Economy macroeconomic models incorporate a version of the interest parity condition. This implies that, other things being equal, an increase in the domestic interest rate leads to domestic currency appreciation because the expected return on domestic bonds (denominated in domestic currency) becomes relatively higher than the expected return on foreign bonds (denominated in foreign currency). Therefore, the relative demand between domestic and foreign currency increases net capital inflows into the domestic bond market and appreciates the domestic currency against the foreign currency.

A number of studies have empirically tested such a standard prediction for advanced countries (Eichenbaum and Evans 1995, Kim and Roubini 2000, Kim 2003, Faust and Rogers 2003, Kim 2005, Scholl and Uhlig 2009). These studies found that a contractionary monetary policy shock leads to domestic currency appreciation, a finding consistent with standard theory, although the shape of exchange rate responses does not perfectly match the standard theoretical predictions implied by the uncovered interest parity condition.

However, if the domestic bond market is not fully developed and foreign investors do not actively participate in the domestic bond market of emerging countries, the standard channel through the domestic bond market may not function well. An increase in the domestic interest rate may also lead to a depreciation of the domestic currency through the stock market channel. Foreign investors may withdraw money from the domestic stock market as contractionary monetary shocks have adverse effects on the domestic economy. Capital outflows in the stock market may lead to exchange rate depreciation. Several studies (Kim and Ryou 2001, Lee and Ryou 2006) examined a reduced form or a simple timing relation between the interest rate and the exchange rate in the Republic of Korea. The results suggest that a rise in the interest rate corresponds to Korean won depreciation or that interest rate appreciation does not significantly affect the exchange rate.¹

¹Several studies (Radelet and Sachs 1998; Stiglitz 1999; Wade 1998; Dekle, Hsiao, and Wang 2002; Ohno, Shirono, and Sisli 1999) suggested that a high interest rate policy increases the interest burden of highly leveraged

To clarify this issue, this study examines the effects of monetary policy shocks on the exchange rate in the Republic of Korea. Although previous studies have examined the reduced form or simple timing relation between the interest rate and exchange rate, a reduced form or a simple timing relation between the interest rate and exchange rate can be generated from structural shocks other than monetary policy shocks. The current study employs a structural vector autoregression (VAR) model with sign restrictions developed by Uhlig (2005) to identify exogenous shocks on monetary policy and examine the effects of identified shocks on the exchange rate. This study also examines the effects of monetary policy shocks on various components of capital flows, such as capital inflows (liabilities) and outflows (assets) in stock and bond markets, to determine the mechanism by which monetary policy shocks affect the exchange rate.²

The rest of the paper is organized as follows. Section II explains the empirical methodology. Section III provides the empirical results on the effects of monetary policy shocks on exchange rate. Section IV discusses the detailed transmission mechanism by examining the effects of monetary policy shocks on various components of capital flows. Section V concludes and presents a summary.

II. Empirical Method and Data

A. Structural Vector Autoregression Models with Sign Restrictions

To identify exogenous monetary policy shocks and examine the effects of the identified shocks on the exchange rate, structural vector autoregression (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 effective in identifying exogenous monetary policy shocks. By imposing proper sign restrictions, several puzzling responses (e.g., liquidity and price puzzles) can be eliminated.³ Given that puzzling responses are often regarded as failures in identifying proper monetary policy shocks, the identification strategy with sign restrictions is appealing. The methodology of the structural VAR model with sign restrictions is briefly described below.

firms and raises bankruptcy rates, thus worsening the economic environment and bringing about further depreciation during a financial crisis.

²See Kim (2013b) for more general results on emerging countries.

³An 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 (Kim 2013a).

A reduced form of the VAR model is considered:

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

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 a $l \times 1$ 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 previous studies, reduced-form residuals and elements of u_t are the linear combinations of structural shocks:

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

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 often 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 structural shock in particular, that is, monetary policy shocks, which amounts to identifying a single column $a \in R^m$ of the matrix A . Uhlig (2005) defines 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) shows 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 is expressed by the following: $r_a(k) = \sum_{j=1}^l \alpha_j r_j(k)$, where $r_j(k) \in R^l$ is the vector response at horizon k to the j th shock 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 10,000 such draws.

B. Empirical Model and Data

The estimation period is relatively short. Hence, only five endogenous variables are included in the baseline VAR model: the call rate (CR), the monetary base (MB), the consumer price index (CPI), industrial production (IP), and the

won-dollar exchange rate (ERA). The first four variables are key macro/monetary variables. These are included to identify monetary policy shocks. The last variable is the focus of this study.

Two variables are also included as exogenous variables in the baseline model: the federal funds rate (FFR) and a variable representing worldwide risk conditions. The FFR is included to control for US monetary policy, which is likely to affect the exchange rate. A variable representing worldwide risk conditions is included because it is also likely to affect the won-dollar exchange rate and capital inflows into and outflows from the Republic of Korea. Given that assets in emerging countries like the Republic of Korea are riskier than assets in the US, changes in worldwide risks are likely to affect the relative price of assets in emerging versus advanced countries (or the risk premium of the won relative to the dollar) and consequently capital flows and exchange rates. For example, an increase in uncertainty or credit risk in the world economy may prompt international investors to purchase assets in advanced countries, which are relatively safer, by selling assets in emerging countries, which are relatively riskier.

The FFR and worldwide risk conditions are assumed to be exogenous to domestic variables because the variables of a small open economy such as the Republic of Korea are not likely to affect US or worldwide variables. These exogenous variables are also not restricted in terms of their contemporaneous effect on endogenous variables in the model (Equation (1)).

The following sign restrictions on impulse responses are imposed to identify contractionary monetary policy shocks: (1) increased call rate, (2) decreased monetary base, and (3) decreased CPI. By imposing these restrictions, liquidity and price puzzles are avoided. Thus, the impulse responses of these basic macro variables to monetary policy shocks are consistent with conventional wisdom on the effects of monetary policy. The sign restrictions are imposed on the impulse responses for the first 12 months after a shock.⁴

Thereafter, various components of financial accounts (capital flows) are added one by one to infer the transmission mechanism in the baseline model. Given that the sign restrictions imposed in the baseline model can identify monetary policy shocks, no additional restrictions are imposed in the extended models.

Monthly data are used. A constant term and six lags are assumed. The estimation period is from January 1999 to June 2012. The sample starts from 1999 because monetary policy operating procedures in the Republic of Korea have changed substantially, with the capital account almost fully liberalized after the Asian financial crisis (Kim and Park 2006, Kim and Yang 2012). The CBOE DJIA Volatility Index (VIX) is used as the variable to represent worldwide risk. The difference between

⁴Following Scholl and Uhlig (2009), the restrictions are imposed for 12 months. The main results are still qualitatively similar even when the restrictions are imposed under different durations. Several results are reported in Section IV.C.

Table 1. **Participation Rate of Foreign Investors in Bond and Stock Markets in the Republic of Korea**

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Bonds	0.09	0.11	0.29	0.48	0.46	0.59	4.45	4.33	5.57	6.64	6.90
Stocks	32.80	36.30	41.20	40.50	37.20	35.10	32.70	27.20	30.50	31.20	30.60

Sources: Bank of Korea, Financial Supervisory Service, Korea Exchange.

the US Baa corporate bond yield (Moody's seasoned Baa corporate bond yield) and the 10-year US Treasury constant maturity rate, representing credit risks, is also used in the extended experiment. Korean data are obtained from the web page of the Bank of Korea. US data are obtained from the Macro Database of the Federal Reserve Bank of St. Louis.

Table 1 shows the participation rate of foreign investors in the stock and bond markets of the Republic of Korea in 2000. Foreign investors owned a substantial fraction of stocks (ranging from 27% to 42%) but only a small fraction of bonds (less than 10%). Before 2007, foreign investors owned less than 1% of bonds.

III. Empirical Results: Effects on Exchange Rate

A. Baseline Model

Figure 1 shows the impulse responses of the macro variables to monetary policy shocks in the baseline model with 68% probability bands for a 4-year horizon.⁵ The name of each variable is denoted at the top of each graph. By imposing the sign restrictions, the price and liquidity puzzles are avoided. In response to monetary policy shocks, the interest rate increases and the monetary base and price level decrease. These are likely responses under exogenous monetary contraction. Industrial production declines over time; the peak response is found to occur approximately 15 months to 20 months after the shock.

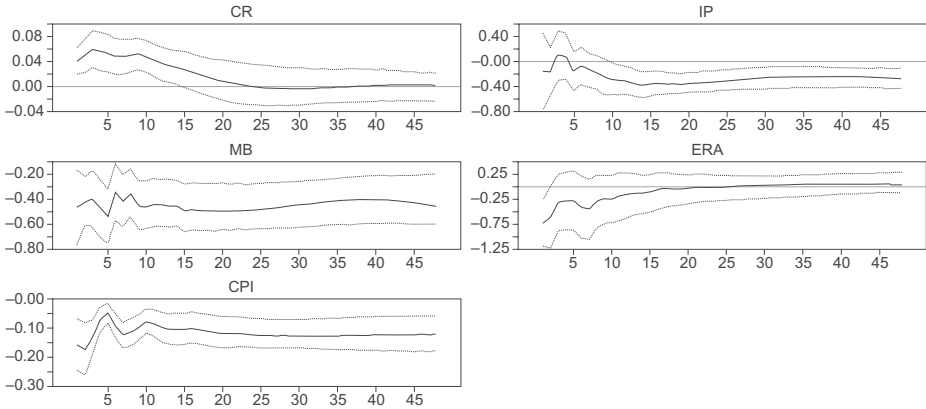
The domestic currency appreciates on impact and then depreciates back to the initial level approximately 20 months after the shock. The probability bands do not include the zero response in the short run. The standard theory suggests that, other things being equal, an exogenous monetary contraction, which increases the interest rate, will appreciate the domestic currency in the short-run. The empirical result matches the prediction.⁶

I then examine the nature and the size of monetary shocks and exchange rate responses more carefully. The interest rate increases by 0.04 percentage point on

⁵The number of estimated parameters is relatively large compared to the data point, hence a 68% probability band (or one-standard error band) is used for inference.

⁶The domestic currency depreciates back to the initial level in the long run. The long run effect is therefore close to zero. This finding is puzzling because the monetary base and price levels decline in the long run. A brief explanation is provided in Section IV.

Figure 1. Impulse Responses to Monetary Policy Shocks—Baseline Model



CPI = consumer price index, CR = call rate, ERA = won-dollar exchange rate, IP = industrial production, MB = monetary base.

Note: This figure shows the impulse responses to monetary policy shocks for a 4-year horizon in the baseline model. The solid line is the median response, while dotted lines are 68% probability bands. The name of each responding variable is denoted at the top of each graph.

Source: Author’s computations.

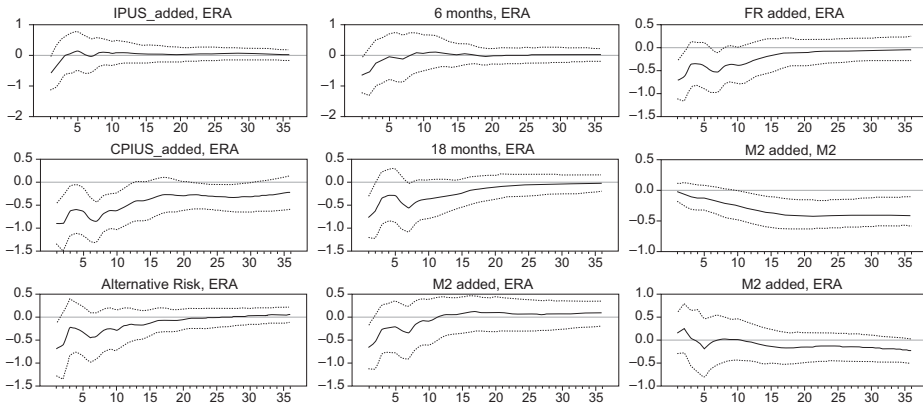
impact and stays 0.04–0.06 percentage point above the initial level for one year. The interest rate decreases back to the initial level in 20 months or so. In response to such monetary policy shocks, the exchange rate appreciates about 0.75% on impact, which is the maximum effect. The domestic currency depreciates back to the initial level in about 20 months or so.

B. Extended Experiments

To check the robustness of the results, several alternative specifications are investigated. First, industrial production and CPI of the US are added one by one as exogenous variables in the model (“CPI_US added” and “IP_US added” in Figure 2). Basic economic conditions in the US such as economic activity and the price level (represented by industrial production and CPI) may be important to explain exchange rate movements. Second, the difference between the US Baa corporate bond yield and the 10-year US Treasury constant maturity rate, which proxies for credit risk, is used instead of VIX (“VIX” in Figure 2).⁷ Third, the duration of the sign restrictions is changed to 6 and 18 months instead of 12 months (“6 months” and “18 months” in Figure 2). Fourth, M2 is added as an additional endogenous variable to check whether a broad monetary aggregate decreases in response to identified monetary policy shocks as expected in an actual exogenous monetary contraction (“M2_added” in Figure 2). Finally, foreign exchange reserves

⁷The correlation between the two variables for the sample period is 0.8.

Figure 2. Impulse Responses to Monetary Policy Shocks—Extended Models



6 months = sign restrictions imposed for 6 months, 18 months = sign restrictions imposed for 18 months, Alternative Risk = the difference between the US Baa corporate bond yield and the 10-year US Treasury constant maturity rate used instead of VIX, CPIUS_added = US consumer price index added to model, ERA = won-dollar exchange rate, FR = foreign exchange reserves, FR_added = foreign exchange reserves added to model, IPUS_added = US industrial production added to model, M2 = broad money measure, M2_added = broad money measure added to model.

Note: This figure shows the impulse responses to monetary policy shocks for a 3-year horizon in the extended model. The solid line is the median response, while dotted lines are 68% probability bands. The name of each model and each responding variable is denoted at the top of each graph.

Source: Author's computations.

(FR) is added as an additional endogenous variable to infer the foreign exchange intervention ("FR_added" in Figure 2).

The results are reported in Figure 2. The results of all models are not too different from those of the baseline model. The domestic currency appreciation is found as predicted by the standard theory predicts. The domestic currency appreciates on impact and then depreciates to the initial level over time. The error bands do not include zero responses in the short run. In the model where M2 is added, M2 decreases over time in response to a contractionary monetary policy shock. Such responses of M2 are expected in exogenous monetary contraction, a result that further supports the validity of the empirical model. Finally, foreign exchange reserves do not change significantly, which may imply that foreign exchange intervention is not clearly found after monetary policy shocks. This suggests that we do not need to pay too much attention to foreign exchange intervention when we examine the effects of Korean monetary policy shocks on exchange rate.

IV. Detailed Transmission Mechanism: Effects on Components of Capital Flows

A. Theory

To explore further the detailed channels through which monetary policy shocks affect the exchange rate, I examine the effects of these shocks on the various

components of capital flows. Theoretically, an exogenous monetary contraction that increases domestic interest rate affects the portfolio choice of foreign and domestic investors in the following ways. First, domestic bonds become more attractive because they offer higher interest rates. Second, domestic stocks become less attractive because monetary contraction is likely to have an adverse effect on the domestic economy and a substitution from domestic stocks to domestic bonds may transpire considering that domestic bonds offer better returns. Third, given that foreign bonds offer relatively less returns than domestic bonds, the former becomes less attractive. Fourth, the sale of domestic stocks (with a negative expectation on the domestic economy after monetary contraction) may lead to the purchase of foreign bonds. Fifth, foreign stocks become less attractive because a substitution from foreign stocks to domestic bonds may occur. Sixth, the sale of domestic stocks may lead to the purchase of foreign stocks.

These changes in portfolio choices are likely to affect various components of capital flows and exchange rates. First, foreign investors are likely to purchase domestic bonds because they offer higher returns, thus resulting in an increase in capital inflows for the bond market and appreciation of the domestic currency. Second, foreign investors are likely to sell domestic stocks because they become less attractive under a negative perspective on the domestic economy after monetary contraction. This condition is likely to result in a decrease in net capital inflow in the stock market and the depreciation of the domestic currency. Third, domestic investors are likely to sell foreign bonds to purchase domestic bonds, thus leading to a decrease in net capital outflow for the bond market and domestic currency appreciation. Fourth, domestic investors may purchase foreign bonds if they wish to substitute domestic stocks with foreign bonds, thus leading to an increase in net capital outflow for the bond market and depreciation of the domestic currency. Fifth, domestic investors may sell foreign stocks to purchase domestic bonds that offer higher returns, thus resulting in a decrease in net capital outflow for the stock market and appreciation of the domestic currency. Sixth, domestic investors may purchase foreign stocks if they would like to substitute domestic stocks with foreign stocks, thus leading to an increase in net capital outflow for stock market and depreciation of the domestic currency.⁸

The standard theory, which is based on a relation like the interest parity condition, suggests that the first and the third channels should work for domestic and foreign bond markets. Moreover, the domestic currency appreciates through the first, third, and fifth channels but depreciates through the second, fourth, and sixth channels. If foreign investors do not actively participate in the domestic bond market, the first channel may not work. If domestic investors are restricted from

⁸Foreign investors' buying and selling strategy may have an impact on domestic investor sentiment, which may amplify the effects of foreign investors' actions. On the other hand, domestic currency appreciation following monetary contraction worsens the trade balance and decreases output, which may make the negative effect on stock price stronger.

Table 2. **Basic Properties of the Components of Capital Flows**

	Mean	Standard Deviation
Bond, Asset (Net Outflows)	0.35	1.57
Bond, Liability (Net Inflows)	1.43	3.16
Stock, Asset (Net Outflows)	0.62	1.80
Stock, Liability (Net Inflows)	0.68	3.37
Loan, Asset (Net Outflows)	0.23	2.80
Loan, Liability (Net Inflows)	-0.06	5.50

Note: This table shows the mean and standard deviation of various types of capital flows (monthly frequency). Each variable is expressed as a percent of trend gross domestic product.

Sources: Bank of Korea

investing in foreign bond and stock markets, the last four channels may not work. If only the second channel works, then the domestic currency depreciates.

B. Empirical Results: Baseline Model

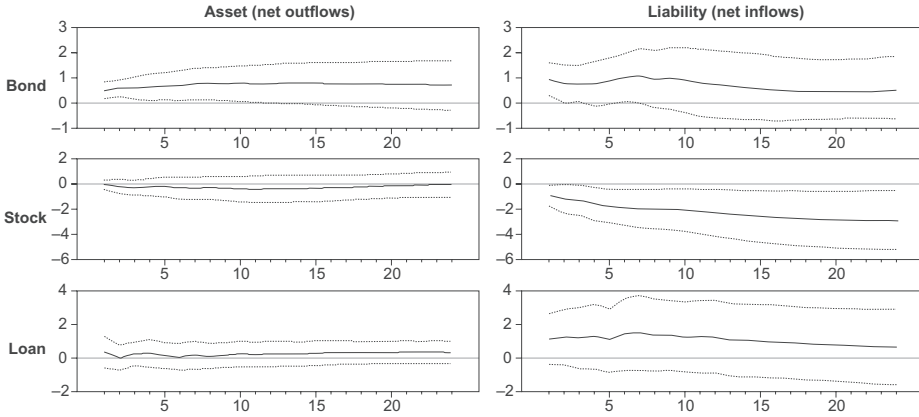
To explore whether each channel works, the effects of monetary policy shocks on various components of capital flows are examined by extending the baseline model (Section II.B). Capital flows are divided into two large categories: net capital inflows (net changes in liability flows) and net capital outflows (net changes in asset flows). Three types of net capital inflows and outflows are considered, namely, stocks, bonds, and loans. Although theoretical predictions on capital flows in loan markets are not discussed in Section IV.A, capital flows in loan markets are examined empirically because capital flows in loan and bond markets are likely to behave similarly in theory.

Each variable is stated in US dollar terms, divided by trend US dollar GDP for normalization, and then multiplied by 100. Therefore, each variable is expressed as a percentage of trend GDP.⁹ Table 2 shows the mean and standard deviation of each component. For each component, net inflows (liability) are more volatile than net outflows. The volatilities of stock and bond flows do not differ much, but the volatility of loan flows exceed the volatility of stock and bond flows.

Figure 3 shows the (cumulative) impulse responses of various components of capital flows for a 2-year horizon. Cumulative responses are reported to infer whether capital flows increase up to a certain time horizon after the shock. The graphs in the first and the second columns show the components of net capital outflows and inflows, respectively. The graphs in the first, second, and third rows show the capital flows in bonds, stocks, and loan markets, respectively. To aid comparison of the sizes of inflows and outflows for each market, scales of the graphs in the same row are identical by construction.

⁹A linear trend is used, but the results are similar when other trend types (e.g., a quadratic trend, the trend obtained using the HP filter) are used. GDP is calculated in monthly terms to be consistent with monthly capital flows.

Figure 3. Impulse Responses of Components of Capital Flows—Baseline Model



Note: This figure shows the (cumulative) impulse responses of various components of capital flows to monetary policy shocks for a 2-year horizon. The solid line is the median response while dotted lines are 68% probability bands. The graphs in the first and the second columns show the components of net capital outflows and inflows, respectively. The graphs in the first, second, and third rows show the capital flows in bonds, stocks, and loan markets, respectively.

Source: Author's computations.

First, capital inflows decrease sharply for the stock market in response to a contractionary monetary policy shock. The probability bands do not include zero responses. This finding implies that the second channel works strongly; that is, foreign investors withdraw money from the domestic stock market after domestic monetary tightening. However, capital outflows for the stock market do not change significantly.

Second, capital inflows for the bond market increase, a result consistent with the first channel. The short-run response is also significant. Coinciding with the prediction of standard theory, foreign investors purchase domestic bonds because of better returns. Capital inflows for the loan market also increase, although probability bands include the zero response.

Third, capital outflows for the bond market also increase significantly consistent with the fourth channel. This result suggests that domestic investors purchase foreign bonds after selling domestic stocks. In contrast, capital outflows for the loan market do not change significantly. Also note that the increase in capital inflows for bond and loan markets exceed that of capital outflows, indicating net capital inflows.

The standard bond market channel is therefore functional. Some of the past studies have questioned this channel because of the relatively weak participation of foreign investors in the Korean bond market. However, the empirical results show that foreigners invest more in domestic bonds after domestic monetary contraction.¹⁰

¹⁰The significant effect through the bond market may be related to the rising trend of foreign participation in the bond market from 0.48% in 2004 to 6.9% in 2011, as shown in Table 1. The increase in foreign participation may

On the contrary, the other side of the standard bond market channel does not seem to work well. Empirical results show that domestic investors purchase foreign bonds after a domestic monetary contraction. Domestic investors may end up purchasing foreign bonds after selling domestic stocks with negative prospects after monetary contraction. However, the increase in capital inflows for the bond market seems to be larger than that of capital outflows in the short run. In addition, capital inflows for the loan market increase (although not significantly), whereas capital outflows do not change substantially. These results suggest that capital flows in bond and loan markets lead to domestic currency appreciation in the short run.

Finally, similar to the claim of some past studies, foreign investors sell domestic stocks after monetary contraction. This finding is probably due to the negative perspective on the domestic economy after monetary contraction. This condition may lead to domestic currency depreciation, as suggested by previous studies. However, the increase in capital inflows for bond and loan markets is relatively stronger than the decrease in capital inflows for the stock market. Overall, the empirical result shows that the domestic currency appreciates.¹¹

C. Extended Experiments

To check the robustness of the results even further, effects of monetary policy shocks on the components of capital flows are examined based on the alternative models discussed in Section III.C. Similar to the baseline model, each component of capital flows is added to each alternative model without imposing any further restrictions. The results are reported in Figure 4. Each column of figures shows the results from each model, and each row of figures shows the results for each component of capital flows. To facilitate the comparison, the graphs in the first two, next two, and last two rows have the same scale.

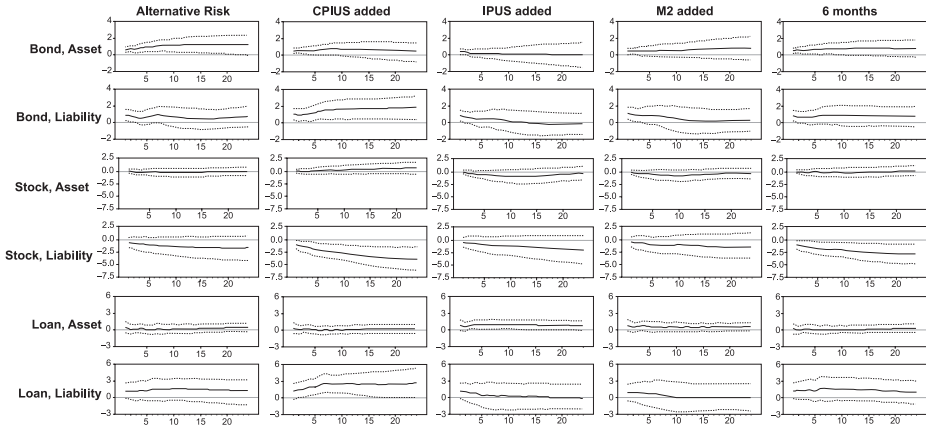
First, the short-term increase in capital inflows for the bond market is significant in all models. Capital outflows for the bond market also increase significantly; however, the increase in outflows tends to be smaller than the rise in inflows, particularly in the short run. These empirical findings on capital flows in the bond market are robust across different models.

Capital outflows for the stock market tend to decrease in all models. However, the decrease is not significant in some models. Changes in capital inflows for the stock market are relatively small compared with the changes in capital outflows. Capital inflows for the loan market increase in most models, significantly so in some

be related to various regional efforts on developing bond markets (e.g., the Asian Bond Market Initiative and Asian Bond Funds). Refer to Kim and Yang (2011) for Asian financial cooperation.

¹¹Note that the decrease in capital inflows to the stock market and the increase in capital outflows to the bond market are more persistent than the increase in capital inflows to bond and loan markets. This may explain why the domestic currency does not appreciate in the long term despite the long-term decrease in price levels and monetary base.

Figure 4. Impulse Responses of the Components of Capital Flows—Extended Experiments



6 months = sign restrictions imposed for 6 months, Alternative Risk = the difference between the US Baa corporate bond yield and the 10-year US Treasury constant maturity rate used instead of VIX, CPIUS_added = US consumer price index added to model, IPUS_added = US industrial production added to model, M2_added = broad money measure added to model.

Note: This figure shows the (cumulative) impulse responses of various components of capital flows to monetary policy shocks for a 2-year horizon in the extended models. The solid line is the median response while dotted lines are 68% probability bands. Each column of figures shows the results from each model, and each row of figures shows the results for each component of capital flows.

Source: Author's computations.

models. Capital outflows for the loan market also increase in some cases. However, the rise is insignificant and relatively small in most cases. To summarize, similar to the baseline model, capital inflows to the loan market tend to increase, whereas capital inflows for the stock market tend to decrease. Nevertheless, these results are not significant in some cases.

V. Conclusion

In contrast to the condition in advanced countries, foreign investors do not actively participate in the domestic bond market in the Republic of Korea. However, foreign investors actively participate in the domestic stock market. Based on this phenomenon, some past studies argue that a monetary contraction may depreciate the domestic currency when the standard bond market channel does not work. In addition, foreign investors may withdraw money from the domestic stock market after a monetary contraction. Against this backdrop, this study examined the effects of monetary policy shocks on the exchange rate in the Republic of Korea using structural VAR models with sign restrictions.

Empirical results show that a monetary contraction appreciates the exchange rate in the short run as predicted by standard theory. To explore the channels by

which monetary policy shocks affect exchange rates, the effects of these shocks on various components of capital flows were examined. Consistent with standard theory such as the uncovered interest parity condition, the study found a significant increase in capital inflows to the bond market. This seems to be the main channel by which monetary contraction appreciates the domestic currency. However, this result contradicts the argument that the bond market channel may not work because of weak participation of foreign investors in the domestic bond market. Empirical results also show that capital inflows tend to decrease in the stock market, which is similar to the claim of some past studies. However, the bond market channel seems to dominate the stock market channel because domestic currency appreciates under monetary contraction.

Since the Asian financial crisis in 1997, several policy makers and researchers have argued that emerging Asian economies suffer from the lack of strong monetary transmission mechanisms. They suggest that investors do not respond strongly to monetary expansion and the resulting decline in interest rates because firms have become conservative after experiencing the devastating financial crisis.

Even if the interest rate or investment channel does not work, the empirical results suggest that an alternative channel for monetary policy, that is, the exchange rate channel, is likely to work. Many Asian countries, including the Republic of Korea, adopted a regime with a more flexible exchange rate and a more open capital account. Under such an environment, the interest rate channel becomes weaker but the exchange rate channel becomes stronger.¹²

The policy environment of emerging economies will undergo rapid changes in the future. Emerging economies are likely to be more financially interconnected with the rest of the world as foreign investors participate more actively in the bond market and as domestic investors vigorously pursue outside opportunities. This environment will lead to another challenge for policy makers of emerging economies. Policy makers should be aware of the changes in policy environments and should have a clear understanding of the effects of changes in policies.

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¹²However, the exchange rate channel may not work for countries with a rigid exchange rate regime, while changes in credit availability following monetary policy may be important for countries where short-term and long-term interest rates are not closely tied together.

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