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## Article

# Does the effectiveness of monetary policy depend on the choice of policy instrument? Empirical evidence from South Korea

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## **Does the Effectiveness of Monetary Policy Depend on the Choice of Policy Instrument? Empirical Evidence from South Korea**

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**Abstract:** This study provides robust evidence on how the choice of the policy instrument for monetary policy influences its impact on economic activity. We study the case of South Korea for the period 1980-2017. We use FAVAR models that allow a comprehensive exploration of different areas of economic activity by overcoming limitations on a number of variables that can be included in the analysis in a traditional VAR model. Following the actual use of instruments, we test the effectiveness of monetary policy in two separate periods: 1980-1999, when the Bank of Korea mostly used M2 as the policy instrument; and then 2000-2017, when interest rate was the policy instrument. Our results show that monetary policy that uses interest rate as the policy instrument is markedly more effective in economic activity than M2. This is observable in the reaction from prices as well as variables that measure industrial production. In contrast, the impact of M2 mostly occurs in prices and it is short lived. We use robustness checks that switch the use of instrument for each subperiod and also test the use of each policy instrument for the entire period of analysis. The results hold, interest rates as policy instrument of monetary policy are more effective than M2.

**Keywords:** monetary policy, policy instrument, VAR, FAVAR, impulse response function.

**JEL classification:** C55, E52, E58.

## 1. Introduction

Understanding the impact of monetary policy actions in a domestic economy is essential for all economic agents, not just policy makers. Clarida, Galí and Gertler (1999) and Güler (2021) stressed the importance of gaining a better understanding on how monetary policy operates and that in considering open economies, the role of exchange rate regime and consumer prices becomes particularly relevant.

Over time, countries have adopted different targets for monetary policy. Bernanke and Mishkin (1997) explain how during the 1970s countries used policies with money-growth targets, while starting in the 1980s, central banks began to switch to policies that reduced inflation, which led to some countries adopting the now well-known inflation-targeting regimes. However, not all regimes were successful; Canada, for instance, switched to inflation targeting after unsuccessfully pursuing a money growth-targeting regime (Bernanke and Mishkin, 1997).

South Korea makes an interesting case of study for monetary policy actions. The fourth largest economy of Asia (after China, India and Japan), with a success story as one of the Asian tigers but also greatly impacted during the 1997 Asian crisis, later engaged in implementing macroeconomic reforms that would provide more stability to the economy. The Bank of Korea, its central bank, explicitly regards price stability as the central objective of monetary policy in its mandate (Bank of Korea, 2002) with the ultimate goal of sustainable economic growth.

The Bank of Korea Act of April 1998 stipulates that the bank should set an annual inflation target that must be achieved. For instance, the inflation target for 2002 was 3.1% (Bank of Korea, 2002) while it had a target around 2% in 2017 (Bank of Korea, 2017). Inflation in South Korea has fluctuated over time. Rapid economic growth and an average inflation of 14% occurred in the 1970s. The implementation of stabilization policies in the 1980s and 1990s reduced inflation to single digits, except in 1998, after the Asian financial crises (Bank of Korea, 2002).

While M1 growth was the main indicator during the 1970s, the lack of success on reaching its target led the central bank to switch, starting in 1979, to the use of M2 as the leading monetary indicator. During the 1980s and most of the 1990s, this monetary targeting regime continued even when other economies were abandoning it as a disconnection between monetary aggregates and inflation became apparent. The annual target for money growth declined from 20-25% in 1980 to 11.5-15% in 1996 (Bank of Korea, 2002).

An inflation targeting regime started in South Korea after 1998. Obstfeld (2014) indicates that it was with the IMF encouragement that South Korea introduced inflation targeting and that in addition to this new regime, institutional reforms were adopted and gave the central bank more independence and transparency. Targets for CPI inflation rates started to be announced after the adoption of inflation targeting. Because South Korea adopted the inflation-targeting regime in the aftermath of the 1997 Asian currency crisis, the first year of the regime inflation was higher than in the pre-regime (Aleem and Lahiani, 2014). After the initial adoption, however, comparisons with actual values showed a strong performance close to the targets, which points out the success of monetary policy actions (Obstfeld, 2014). Importantly, with the revised act, the central bank abandoned a dual mandate of stability of money and soundness of the banking system and focused on price stability as the main goal for monetary policy (Hoffmaister, 2001 and Krušković, 2022).

During the 1997 financial crisis, monetary policy was not very effective. Rousseau and Kim (2017) investigated the role of monetary shocks in the transmission of the crisis to the economy. The findings led to the conclusion that the ratio of commercial bills dishonored with respect to the total value of bills better explains the decline in industrial production than the central bank's decreases in the real stock of money. They attribute the more accurate role of dishonored bills ratio to the proxy, and this variable represents, for the cost of credit and the consequent effect on small and medium enterprises, a very important component of the economy of the country. It also suggests the presence of a credit channel, where the real sector was more affected by the rise in the costs of financial intermediation than by the decline in the supply of money.

In the same line, Oh (1999), discusses how the results of impulse response functions analysis indicate that the increases in the policy rate reduce consumer prices and that such effect persists in the long run. The effects of the shock to the policy rate on consumer prices, real exchange rate and industrial production are stronger than those coming from changes in money. Thus, due to financial innovation and liberalization, there has been a decrease in the effectiveness of the monetary channel, while the interest channel has increased in relevance. This, the author mentions, is key to the 1998 decision of the Central Bank to switch to inflation targeting regime.

After the crisis and with the adoption of inflation targeting, the effectiveness of monetary policy appears to have improved. Lim (2003) indicates that since its adoption in 1998, the inflation targeting regime that works in the country by adjusting interest rates has been successful in the control of the variability of

inflation and output. On the other hand, Kim and Park (2005) show that after the adoption of the new regime the country has experienced a declining trend in the deviation of inflation from its target as well as a slowdown in output growth. Though inflation targeting has helped the reduction of inflation volatility, “the decrease in the size of the standard deviation of inflation due to the propagation of inflation shocks is larger than that of inflation shocks itself. This finding suggests that the reduction in inflation volatility is not mainly due to the decrease in shocks to inflation” (p. 147).

Kim, Kim and Suh (2009) explain that after the Asian crisis of 1997, South Korea switched exchange rate regimes, going from a managed system towards a free-floating regime with the elimination of bands and expanding capital liberalization. Reforms following the crisis include the introduction of prudential regulation and supervision, improvement of corporate governance, and the adoption of inflation targeting regime, that is seen as a landmark of a proper-functioning financial system.

According to Han, Lee and Yun (2014), after the financial crisis, the response of bank lending rates to policy rate changes has expanded, which has been magnified by the changes in the lending market conditions. The only exception is household lending rates, where the transmission appears reduced. Overall, more response in bank lending rates is found under expansionary policy (lowering policy rates) than under contractionary policy (cuts in policy rates).

Analyzing the impact of monetary policy on the stock market, Sohn and Eom (2007) show that the response is immediate and stronger just after a policy shock, which is attributed to the efficiency of the stock market in incorporating and adjusting expectations and transaction behavior. Thus, stock market volatility can decrease with regular announcements such as those on the inflation targeting regime. Contrary to these findings, Sohn, Sung and Kwon (2006) find that monetary policy signals or announcements increase the volatility in financial variables with little impact on their levels, which the authors assess as an inability of monetary authorities to minimize the instability of the financial system. The latter is explained as a result of the difficulty in using past announcements and information from financial variables in forecasting future performance.

On comparing the effects of a given variable on two periods of time, Kim (2007) investigates the changes in the cost of capital as a channel for monetary transmission by comparing the high inflation period of the country (1988-1998) with the low inflation period that followed the adoption of inflation targeting (1999-2004). Using a cost elasticities approach, the author finds that the long run user cost

elasticity fell dramatically in the low inflation period, which reflects for firms that investment has become less sensitive to the changes in cost. Moreover, an increase in interest rates results in more modest decline in the low inflation period than in the previous high inflation period, implying a more weakened interest rate channel in the low inflation period mostly due to the fall in user cost elasticity.

Relating to costs, Yie (2008) investigates the existence of a cost channel in the transmission process in South Korea. The author finds the relevance of this channel after contractionary monetary policy before the 1997 crisis, but a dramatic decline after 1997. This change is accredited to the longer adjustment on output prices and the decline in the cost of capital adjustment after the crisis. When the banking sector is efficient in loan provision, monetary policy impacts the economy through changes in the aggregate demand (Demirbas and Can, 2022).

The recent history of monetary policy in South Korea, relevant to this paper, starts in the late 1970s. As explained by the Bank of Korea (2002), from initially using M1 as the policy instrument, instability of this tool moved the bank to replace it with the use M2 in 1979, which also signaled a full focus on monetary targeting by the bank. This targeting persisted until the 1990s, even as more developed countries started to switch to interest rate-based policy instruments, because interest rates were regulated in Korea during those years. There were several episodes when targets were not reached due to oil shocks as well as current account surpluses. The money targets were based on the economic conditions that included the rate of economic growth, price fluctuation and money velocity. A significant increase in money in trust accounts in commercial banks were used for short-term financial transactions and were not subjected to reserve requirements generated instability in M2 as monetary indicator. Changes in regulation of the trust accounts by the Bank of Korea in efforts to control the instability resulted in money flowing from the trust accounts to commercial banks' time and savings deposits, which in turn, increase the rate of growth of M2 from mid-1995 to mid-1996. This prompted the bank to adopt, in mid-1996, an additional policy instrument, MCT made of M2, certificates of deposit (CDs) and money-in-trust while also keeping M2. MCT was considered the main policy instrument; however, a 2% reserve requirement on CDs, imposed in 1997, significantly affected the growth of MCT as well as its usefulness as a policy instrument, prompting the Bank of Korea to consider the validity of maintaining money as its main instrument in the conduction of monetary policy. The bank decided to adopt inflation targeting in April 1998; it used M3 as a transitory policy instrument and received initial advice in the process from the IMF. September 1998 marked the first time the bank used interest rates as an operating target with an official announcement of using them as target in May 1999. Interest rates remain the policy instrument

for monetary policy in South Korea. For the purposes of our study, we divide the period of policy instruments in two, the first from 1980 to 1999 where money was the main target, and we choose M2 as the instrument as per the discussion above since it was the main instrument during the period. The second period of analysis is 2000-2017 with interest rates as the policy instrument.

Overall, studies about the effects of monetary policy in South Korea tend to focus on a specific channel (e.g., cost channel, exchange rate channel) or a specific variable (e.g., inflation) and with the use of structural VARs. The contribution of our paper in this area is a more comprehensive study about the effectiveness of monetary policy in economic activity by 1) investigating comparatively two different regimes: money target versus interest rate target; 2) analyzing the impact of policy actions in a wider set of macroeconomic variables by using the methodology that permits this analysis, FAVAR; and 3) by analyzing a longer period, 1980-2017. To the best of our knowledge, this is the first paper that combinedly works on these aspects for South Korea.

## 2. The Model

The Vector Autoregressive (VAR) model was developed by Sims (1980). It did not take much time for those simple and elegant VAR models to replace the cumbersome macro-econometric models, which were used as a standard in analyzing monetary policy or forecasting macroeconomic activities. The VAR models suffer from limited information set since they cannot typically handle more than four to eight variables, while monetary authorities throughout the world analyze literally hundreds of variables in making policy decisions. Consequently, as time continued, the limitations of the VAR models became apparent.

During the same time frame, dynamic factor models were also introduced and gained popularity (Sargent and Sims, 1977; Geweke, 1977). Those models were used to condense or summarize information from large data sets into few variables, known as factors. Bernanke, Boivin and Elias (2005) have successfully combined factor models with VAR to develop what is called the Factor-Augmented Vector Autoregressive (FAVAR) models. In doing so, they managed to incorporate any number of macroeconomic variables into the VAR models, thereby solving its major drawback of limited information set.

According to Bernanke et al. (2005), there are at least three potential problems associated with VAR models that could be solved by FAVAR models. First, policy makers have made information sets (by analyzing hundreds of variables) as op-

posed to the few variables included by the standard VAR models. It follows that the impulse response functions we generate from VAR models could be contaminated. This could be solved by incorporating potentially all relevant macroeconomic variables analyzed by policy makers into our models, i.e., FAVAR models. Second, the Standard VAR requires us to represent economic activity by a single variable such as the gross domestic product, industrial production, or unemployment rate. However, with FAVAR models, it is possible to represent economic activity as an unobserved variable determined by many observed variables. For example, we can construct an “economic activity” factor from numerous macroeconomic variables that constitute economic activity. Finally, with FAVAR models, we can generate impulse response functions for all of the variables included in the model (no matter how many), as opposed to the four to eight variables of the VAR models.

The underlying assumption with the FAVAR models is that the economy is driven by few factors that could be generated from numerous macroeconomic variables and idiosyncratic errors (Favero, Marcellino and Neglia, 2005). Following Bernanke et al. (2005), Stock and Watson (2005), Senbet (2008) and Zuniga (2011), we developed the FAVAR model as follows. Assume that  $Y_t$  is a dynamic factor model expressed as a distributed lag of a small number of unobserved factors and idiosyncratic disturbances that are assumed to be serially correlated.

$$Y_t = \lambda(L)F_t + u_t \quad (1)$$

$$u_t = \delta(L)u_{t-1} + v_t \quad (2)$$

Where  $F_t$  is a  $(K \times 1)$  vector of unobserved dynamic factors,

$\lambda(L)$  is an  $(M \times K)$  dynamic factor loadings and  $v_t$  is white noise.

Also assume that factors and disturbances are not correlated.

From equation (2),

$u_t = [I - \delta(L)L]^{-1}v_t$  and hence (1) becomes

$$Y_t = \Lambda(L)F_t + \delta(L)Y_{t-1} + v_t \quad (3)$$

Where  $\Lambda(L) = [I - \delta(L)L]\lambda(L)$

Define the evolution of factors as

$$F_t = \Phi(L)F_{t-1} + \eta_t \quad (4)$$



Where  $\eta_t$  is a  $(K \times 1)$  disturbance vector.

Substituting (4) into (3) and rearranging

$$Y_t = \Lambda(L)\Phi(L)F_{t-1} + \delta(L)Y_{t-1} + \omega_t \quad (5)$$

Where  $\omega_t = \Lambda(L)\eta_t + v_t$

Combining equation (5) with the factor evolution equation (4) yields the FAVAR model:

$$\begin{bmatrix} F_t \\ Y_t \end{bmatrix} = \begin{bmatrix} \Phi(L) & 0 \\ \Lambda(L)\Phi(L) & \delta(L) \end{bmatrix} \begin{bmatrix} F_{t-1} \\ Y_{t-1} \end{bmatrix} + \begin{bmatrix} \eta_t \\ \omega_t \end{bmatrix} \quad (6)$$

The VAR model is a special case of the FAVAR model expressed above. If we assume the terms in  $\Phi(L)$  are all zero, the system boils down to  $Y_t = \delta(L)Y_{t-1} + \omega_t$  which is exactly the VAR model.

However, since the factors are not observed, it is not possible to directly estimate the FAVAR model given in equation 6. Bernanke et al. (2005) solve that problem by assuming that the factors  $F_t$  can be inferred from the many observable macroeconomic variables (“informational” variables) analyzed by policy makers. Assume that the “informational” time series variables, observed by policy makers, are given by  $(N \times 1)$  vector  $X_t$ . The number of informational variables should be greater than the number of factors ( $K$ ) and the number of policy variables ( $M$ ) in other words,  $N \gg (K + M)$ . The assumption by Bernanke et al. (2005) that factors  $F_t$  can be inferred from  $X_t$  leads to the following equation:

$$X_t = \Pi^f F_t + \Pi^y Y_t + \varepsilon_t \quad (7)$$

Where  $\Pi^f$  is  $(N \times K)$  and  $\Pi^y$  is  $(N \times M)$ . It is also easy to see that  $F_t$  is  $(K \times 1)$  vector of factors,  $Y_t$  is  $(M \times 1)$  vector of policy instruments and  $\varepsilon_t$  is  $(N \times 1)$  vector of error terms with zero mean and no serial correlation. For our study, since we use one policy instrument at a time, this means  $M = 1$ .

Our next task is to estimate the unknown factors using the principal component analysis (Bernanke et al., 2005). First, we estimate the factors using all variables in  $X_t$  denoted by  $\hat{C}(F_t, Y_t)$ . However, the space covered by  $\hat{C}(F_t, Y_t)$  could overlap with that of  $Y_t$ , and this must be corrected to create independence between the two. We do that by dividing the dataset into fast-moving variables and slow-moving variables. The fast-moving variables are assumed to be highly sensitive (contemporaneously responsive) to policy shocks, such as bond prices, exchange

rates, interest rates or stock prices. The slow-moving variables are assumed to be contemporaneously unresponsive. Those variables include IP, GDP, unemployment rate, new orders, and prices. After dividing the variables into the two categories using the principal component analysis, we estimate factors solely based on slow-moving variables, denoted by  $\hat{C}(F)$ . Finally, we run the regression given below:

$$\hat{C}(F_t, Y_t) = \theta^f \hat{C}(F) + \theta^y Y_t + e_t \quad (8)$$

Where the estimated factors are given by

$$\hat{F}_t = \hat{C}(F_t, Y_t) - \theta^y Y_t \quad (9)$$

In step two, we estimate the VAR model incorporating the  $(K \times 1)$  factors,  $\hat{F}_t$  representing information set from the variables in  $(N \times 1)$  vector  $X_t$  as well as our policy variable(s) represented by  $Y_t$ .

### 3. Data

The data for this study are obtained from DataStream database and the Bank of Korea website. Seventy monthly times series variables are included in our dataset. The selections of the variables are based on availability of data. However, we made sure to include the most commonly analyzed variables, such as industrial production, new orders, monetary aggregates, interest rates, financial assets, exchange rates, prices, and expectations.

The FAVAR model assumes that all variables are stationary. Therefore, we tested every variable in our data set for unit roots using Augmented Dickey-Fuller test. When unit root was found, we made transformations until stationarity was attained (see Appendix for details). Finally, all variables are standardized – to have a mean of zero and a standard deviation of one.<sup>1</sup>

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<sup>1</sup> The principal component analysis is affected by the unit of measurement and the range.

## 4. Empirical Analysis

### 4.1. Impact of Monetary Policy During 1980-1999 Period

During this period, the Bank of Korea was using money supply M2 as monetary policy instrument. The impulse response functions to a one standard deviation positive shock to M2 (expansionary monetary policy) is given in Figure 1. The dotted lines are the 95 percent bootstrap confidence interval (developed by Kilian, 1998). We have selected 11 variables to analyze their responses to the monetary policy shock.<sup>2</sup> Those variables are IP total, IP manufacturing, producers inventory, producers' shipments, new orders – government, new orders – private, bank deposits, stock price index, real effective exchange rate, producer price index (PPI) and core consumer price index (CPI).

As indicated in the first row of Figure 1, a positive shock in M2 did not have much impact on IP or manufacturing.<sup>3</sup> We observed a slight positive response initially; however, the 95% confidence interval includes the zero baseline for almost all of the 24 months period, following the M2 shock. In the second row, we have responses of producers' inventory, producers' shipments and new orders by the government. Producers' inventory showed a slight decline between three and six months after the shock and stayed relatively low until about twelve to fifteen months. However, we do not see meaningful changes when it comes to producers' shipments or new orders by the government. The third row shows some significant and instantaneous positive responses to favorable monetary policy shock that lasted about three months. However, the bank deposits and stock prices did not exhibit significant change. In the last row, we displayed the responses of real effective exchange rate, PPI and core CPI. Of the three variables, it looks like CPI responded positively, as expected – higher money supply growth leading to higher inflation. The high inflation has been persistent for almost a year following the shock. There is also a sign of depreciation in real effective exchange rate (as expected) around nine to twelve months following the shock.

<sup>2</sup> It is possible to display the impulse response functions for the entire seventy variables we have selected for our analysis. We thought those sample variables displayed here are fairly representatives. However, the impulse response functions for any or all of the variables are available upon request.

<sup>3</sup> Running a positive shock (expansionary policy for M2 and contractionary policy the base rate) or running a negative shock (contractionary policy for M2 and expansionary policy for base rate) are the same in magnitude, except the results are reversed (or opposite in direction). We decided to run a positive shock for both policy instrument options.

From the discussion above, we observe that the biggest impact to a shock in M2 is the CPI inflation. Although there is favorable response from private new orders at impact, we cannot say that the M2 shock has significant impact on the rest of the economic activities. During this period, we argue that monetary policy (using M2 as instrument) did not seem effective on impacting the majority of the real economic activity variables.

## 4.2. Impact of Monetary Policy During 2000-2017 Period

The second period of this study evaluates monetary policy between the period of 2000 and 2017, where the Bank of Korea shifted its monetary policy instrument to interest rates (Bank of Korea's base rate)<sup>4</sup>. For the sake of consistency, we will display the impulse responses of the same variables listed above to a shock in the interest rate. Also, note that a positive shock in the interest rate is contractionary monetary policy. The impulse response functions to a positive shock in the Bank of Korea's base rate is displayed in Figure 2. Similarly, the dotted lines are the 95% confidence intervals around the impulse response functions.

The first row in Figure 2 depicts a one standard deviation positive shock to the base rate (contractionary monetary policy), and the responses of IP total and IP manufacturing to the policy shock. As expected, both responded similarly declining, starting at about the third month until about the ninth month. This was also supported by instantaneous rise in producers' inventory and a decline in shipments. In addition, private new orders decline on impact, bank deposits become mostly negative during the first three to four months and stock prices are mostly negative during the first nine months following the contractionary monetary policy shock. Finally, as shown in the last row, real exchange rate increases (appreciation) on impact and core CPI declines during the first six months. The only variable that does not show any significant responses is the government new orders and the PPI. The case of the PPI could be because, unlike the CPI, producers negotiate prices early and unexpected changes in policy might have lower impact in the short run.

Comparing the two periods and the choices of monetary policy instruments, we can note that monetary policy during the interest rate regime (2000-2017 period) has more impact on macroeconomic variables than the money supply regime (1980-1999). Our findings show that the Bank of Korea made a correct call in shifting from M2 to using interest rate as policy instrument. In order to test this

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<sup>4</sup> Before 2008, the base rate was called the overnight call rate.

claim, and since money and interest rate are closely related, we have also considered “what if” scenarios as robustness checks. The first considerations are using interest rate policy instrument during our first period (1980-1999) and M2 policy instrument during our second period (2000-2017).

### 4.3. Robustness Checks

#### 4.3.1. Hypothetical Policy Shocks During Each Period

In this section, we show “what if” scenarios that assume interest rate was used as monetary instrument during the first period and M2 was used as monetary instrument during the second period. We are aware that the policy makers were not employing those variables as monetary policy instruments during those specific periods. However, it would offer valuable insights to test them as potential instruments as money supply and interest are related to each other. It is safe to assume that targeting one variable could affect the other. Those hypothetical scenarios are given in Figures 3 and 4.

Figure 3 shows impulse response functions to a one standard deviation hypothetical shock in interest rate by monetary authorities during the 1980-1999 period. Again, the dotted lines are the 95% confidence intervals around the impulse response functions. Following a contractionary monetary policy (using interest rate as policy instrument), IP total and IP manufacturing declined, and the response seems persistent for about nine months. In addition, producers’ inventory, producers’ shipments, new orders by private sector, as well as bank deposits have declined within the nine-month period following the shock. Real effective exchange rate declined (appreciated) as well. The variables that did not respond significantly are government new orders, stock price index, PPI and core CPI. Despite this, it is clear to see that the hypothetical interest rate shock has bigger impact than the actual policy instrument (M2) used during this period.

In Figure 4, we presented another hypothetical scenario of using M2 as monetary instrument instead of the interest rate during the 2000-2017 period. As can be seen in the first row, we run a one standard deviation positive shock to M2 (expansionary monetary policy). Following the shock, producers inventory responded negatively on impact which then quickly became insignificant. Similarly, there are short-lived slight responses to the M2 shock from bank deposits (increase), real effective exchange rate (depreciates), PPI (increases) and Core CPI (increases). However, it is important to note that although those variables have responded in theoretically expected directions, none of them showed any

significance past the three-month mark following the hypothetical shock. On the other hand, we do not see any significant response from IP total, IP manufacturing, producers' shipments, new orders – both by the government and private sectors and stock price index. Comparing this hypothetical scenario to the actual monetary policy instrument of the interest rate shock during this period (Figure 2), we clearly see that the actual policy scenario (interest rate shock) has produced better results in impacting real economic activities. The two exercises we conducted seem to support the notion that interest does have higher impact than money growth as policy instrument. It is especially evident that the macro-variables responded better to the hypothetical interest rate shock than the actual M2 shock during the first period of this study (1980-1999). This could present a question on why the Bank of Korea did not switch earlier than 2000 to interest rate as the policy instrument.

#### 4.3.2. Hypothetical Policy Shocks During the Entire Period

In this section, we continue with our robustness check by combining the two periods and running monetary policy shocks using M2 and interest rate as policy instruments. In effect, these exercises assume “what if” scenarios that the Bank of Korea first started using M2 as policy instruments and kept that policy for the entire period under this study (1980-2017). Second, we repeat the same exercise using interest rate as policy instrument for the entire period. The results from those hypothetical assumptions are given in Figures 5 and 6.

Figure 5 depicts the impulse responses to M2 shock for the entire period (1980-2017). The first impression is that the results seem less volatile and more robust because the longer period gives us more data points.<sup>5</sup> We analyze the effect of a one standard deviation positive shock to the M2. We can see that following this expansionary policy shock, the stock price and core CPI responded positively and significantly for almost the entire 24-month period. There are also less significant responses (but in the expected directions) from new orders by private sector (positively), real effective exchange rate (depreciation) and PPI. However, those responses are extremely short lived (three months or less) and become insignificant very quickly. The set of variables that did not respond significantly include IP total and IP manufacturing, producers' inventory, producers' shipments and new orders by the government. There is also a counterintuitive negative response from bank deposits around the three-month mark. However, other than that sin-

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<sup>5</sup> For the entire period there are 442 observations. For the first period (1980-1999), there are 237 observations and for the second period (2000-2017), there are 205 observations.

gle incident, bank deposits remained insignificant for most of the time frame following the shock. Again, the responses to M2 shocks are not too impressive, just like in our previous exercises.

Finally, in Figure 6 we show the same hypothetical scenario for the entire period (as in Figure 5), but this time using interest rate as policy shock instead of M2. It is evident that the responses to interest rate shocks are more significant than the responses to M2 shocks. Following a one standard deviation positive shock to the Bank of Korea's base rate (contractionary monetary policy), IP total declined, IP manufacturing declined, producers' inventory initially increased (and declined thereafter), producer shipments declined, new orders by the private sector declined, bank deposits declined, stock price index declined, real effective exchange rate declined (appreciated), PPI declined (starting around eight months mark), and core CPI declined. The only variable that did not respond significantly is the new orders by the government. However, this variable was not significant in all scenarios we have considered, which implies that the government does not respond to a change in monetary policy by changing its purchase plans. These results offer strong support for the usefulness of interest rate as policy instrument.

To summarize, our results show that the effectiveness of monetary policy depends on the policy instrument choice. During the 1980-1999 period, the Bank of Korea pursued its monetary policy using M2 as an instrument. By late 1990s, it changed that stance to pursue its policy actions using interest rate (the base rate) as a policy instrument. Our study provides evidence that the interest rate instrument is more effective than the money growth rate (M2) instrument. We analyzed the impact of monetary policy using the actual policy instruments during the period under investigation. In this case, we used M2 as a policy instrument during our first period of study (1980-1999) and the interest rate (base rate) during the second period of our study (2000-2017). The results show that monetary policy using interest rate instrument was far more effective in impacting the real economic activity in the second period than the first period of this study. We argue this because interest rate is a better monetary policy instrument than money growth. To further investigate this claim, we run two robustness checks.

The first was to analyze a hypothetical scenario where we assume interest rate is a policy instrument during the first period (1980-1999) and M2 growth is a policy instrument in the second period (2000-2017). It turns out, during the first period, the interest rate shock (the hypothetical monetary policy instrument) has more impact on economic activity than M2 shock (actual monetary policy instrument). On the other hand, during the second period, the M2 shock (the hy-

pothetical monetary policy instrument) has far less impact on economic activity than the interest rate shock (actual monetary policy instrument).

The second robustness check was to combine the entire period (1980-2017) and analyze the impacts of the shocks to money (M2) growth, as well as the shocks to the interest rate. In effect, we are presenting the scenario where the Bank of Korea starts using M2 (or interest rate) as policy instrument and sticks to it throughout the entire period. Again, the results clearly show that interest rate as policy instrument was by far more effective than M2.

It is important to note that had the Bank of Korea actually used M2 (or the interest rate) as policy instrument during this entire period (1980-2017), the impulse response functions might have looked different. However, our objective here is to show the relative effectiveness of the two policy instruments under similar assumptions. In that, we have achieved our objective of showing that the interest rate is far more effective compared to money growth as policy instrument in South Korea. We agree that the Bank of Korea made a correct policy call by switching its instrument from M2 growth rate to the base rate by late 1990s. In doing so, monetary policy became more effective in influencing the macroeconomic variables of the country.



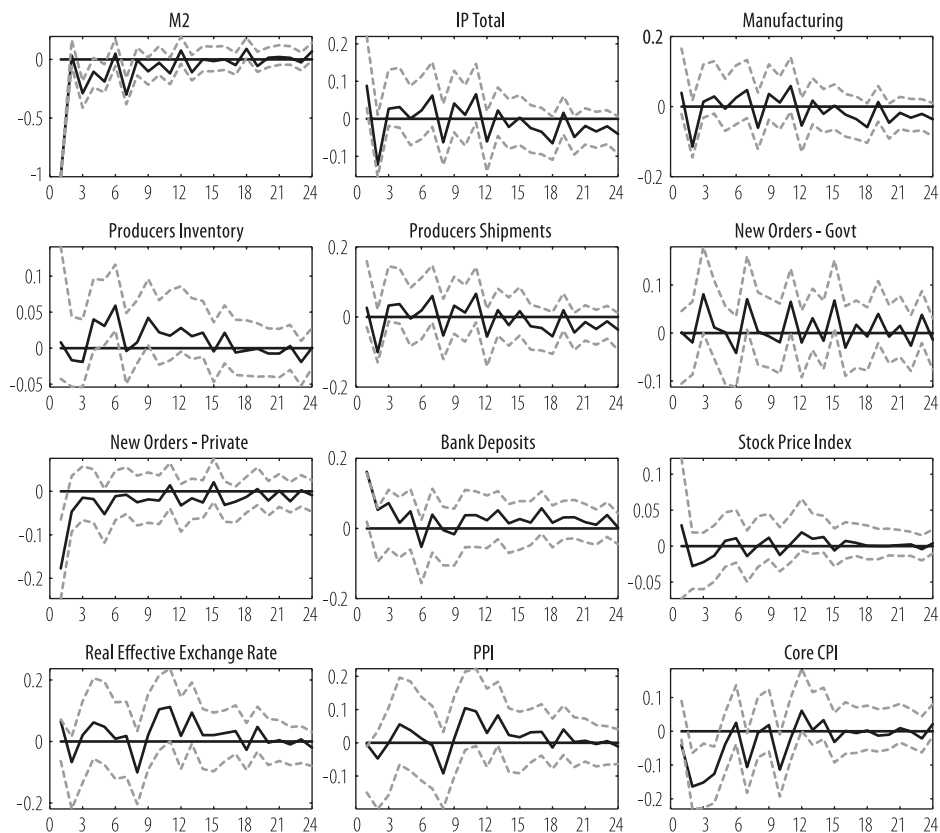
## 5. Conclusions

In this study, we assess the effect that choosing a policy instrument has on the impact of monetary policy on economic activity. We focus on two instruments in South Korea for the period 1980-2017, money as measured by M2 and interest rate. The Bank of Korea had used M2 as its instrument until 1999, and then switched to interest rate. Considering this timeframe in mind and with the use of the FAVAR model, we explore the impact of monetary policy shocks on economic activity and compare the effectiveness by looking at the reaction from impulse responses of variables of interest. Considering economy-specific estimates, we document the stronger impact on economic activity from using interest rate as the policy instrument for monetary policy, in contrast to a quite minimal response of using money as the instrument. In the latter case, there are short-lived responses mostly on variables representing prices. In the former, responses in real economic activity can be identified.

We further test the robustness of these findings by switching the instruments and exploring the effect of interest rates in the first period, 1980-1999, while using money as the policy instrument for the second period of analysis, 2000-2017. The results are consistent with the previous findings: shocks to interest rates have a larger impact on economic activity than the responses found in shocks to M2. Extending the robustness checks, we test the use of each policy instrument, M2 or interest rate, for the entire period of analysis of 1980-2017. Consistently, we find monetary policy is more effective when interest rate is the policy instrument. Particularly, the effects on real economic activity appear mainly when interest rates are used, not in the adoption of M2. This means that the reaction to monetary policy shocks is not irrespective of the policy instrument.

In short, our results suggest that interest rates as the monetary policy instrument do have a significant impact on economic activity in emerging markets such as South Korea. Our empirical results also provide no support for the argument that money is likely to be a successful instrument for monetary policy. This is relevant for many emerging and developing economies that still use money -in different measures- as their policy instrument.

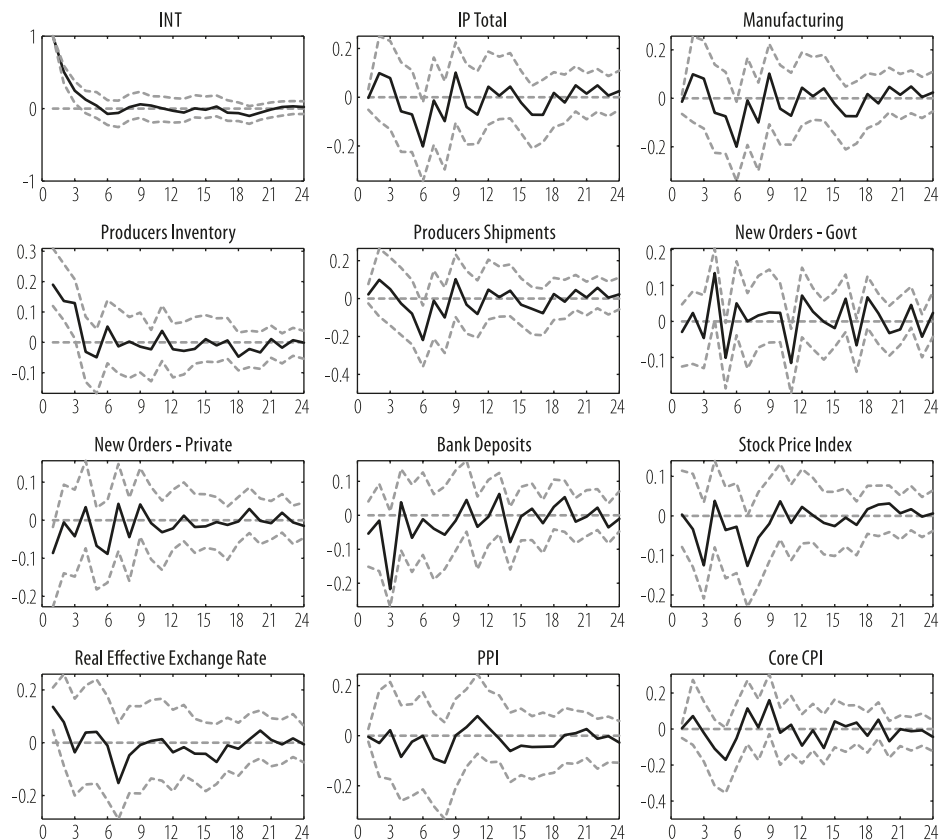
**Figure 1. Impulse responses to a shock in M2 for the period of 1980-1998, generated from FAVAR model ( $Y = M2$ , Five Factors).**



Note: The dotted lines represent a 95% confidence band around the impulse response functions.

Source: Authors' calculations

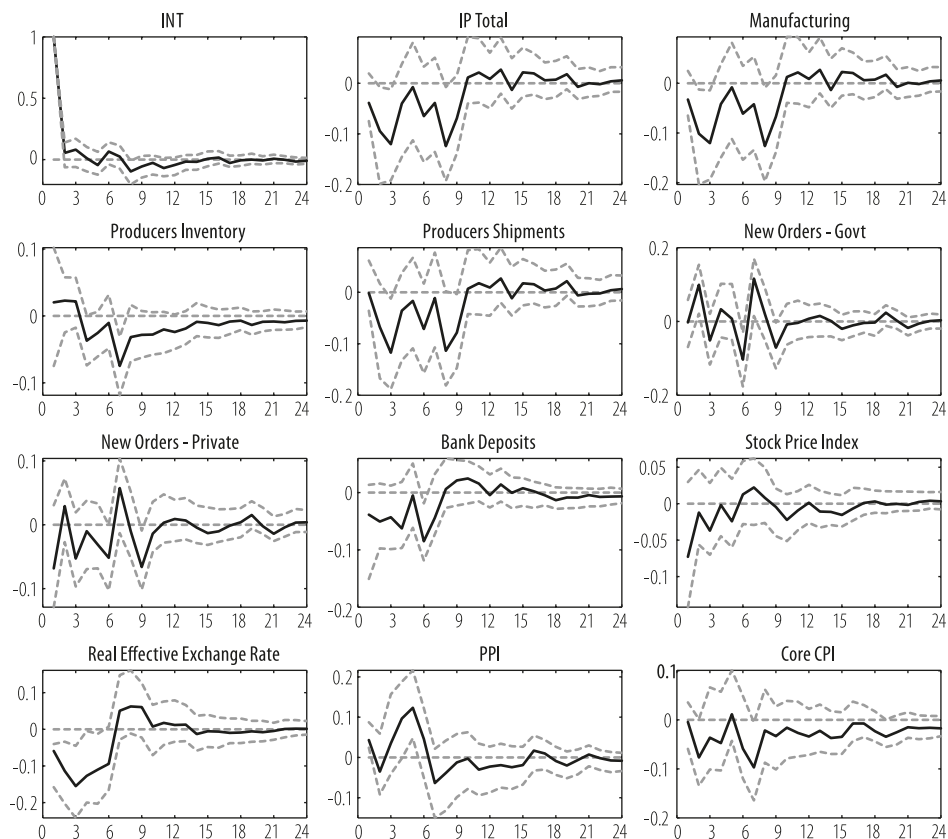
**Figure 2. Impulse responses to a shock in the base rate for the period of 1999-2017, generated from FAVAR model ( $Y$  = base rate, Eleven Factors).**



Note: The dotted lines represent a 95% confidence band around the impulse response functions.

Source: Authors' calculations

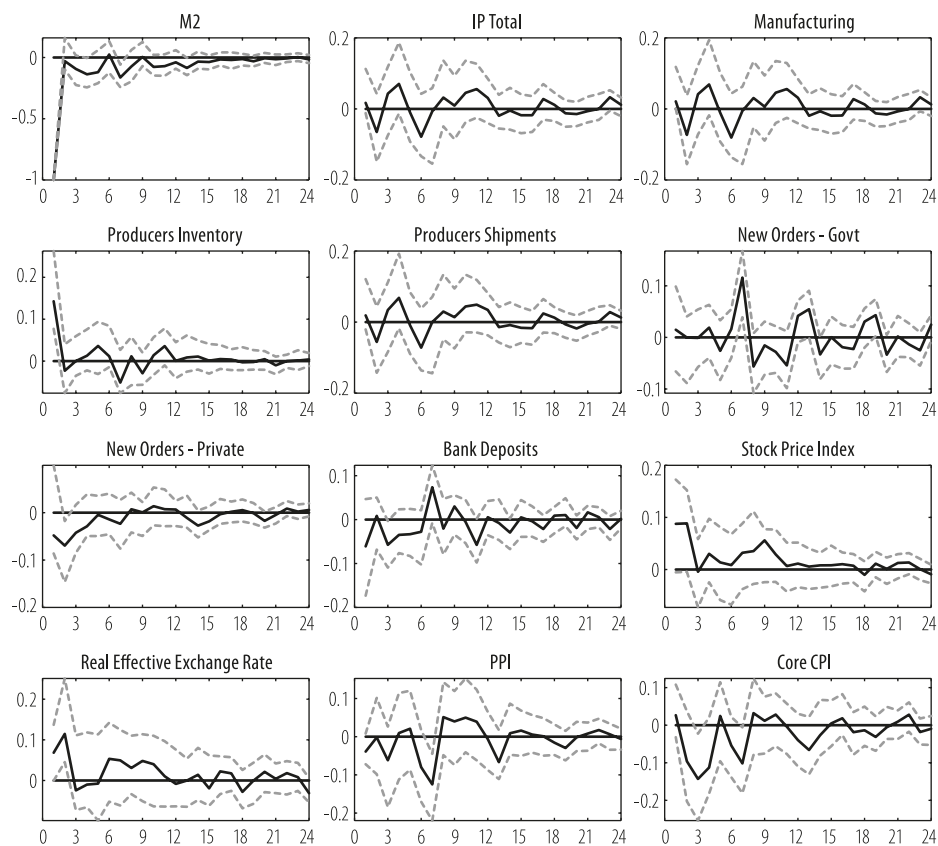
**Figure 3. Impulse responses to a shock in the base rate for the period of 1980-1998, generated from FAVAR model (Y = base rate, Seven Factors).**



Note: The dotted lines represent a 95% confidence band around the impulse response functions.

Source: Authors' calculations

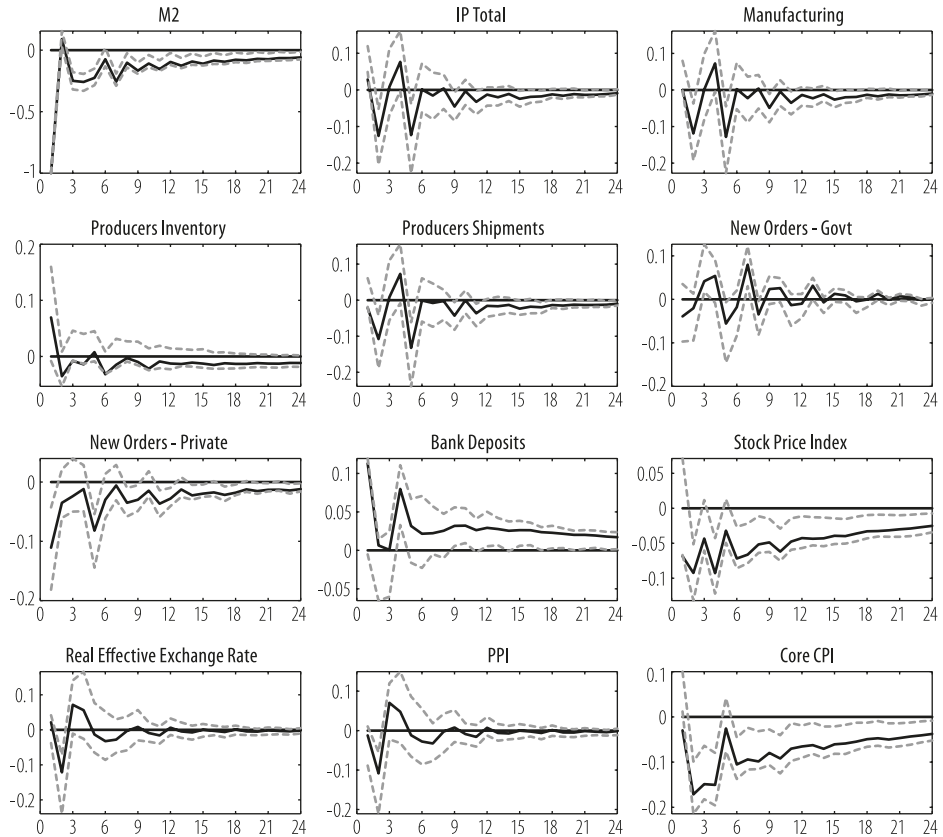
**Figure 4. Impulse responses to a shock in M2 for the period of 1999-2017, generated from FAVAR model ( $Y = M2$ , Seven Factors).**



Note: The dotted lines represent a 95% confidence band around the impulse response functions.

Source: Authors' calculations

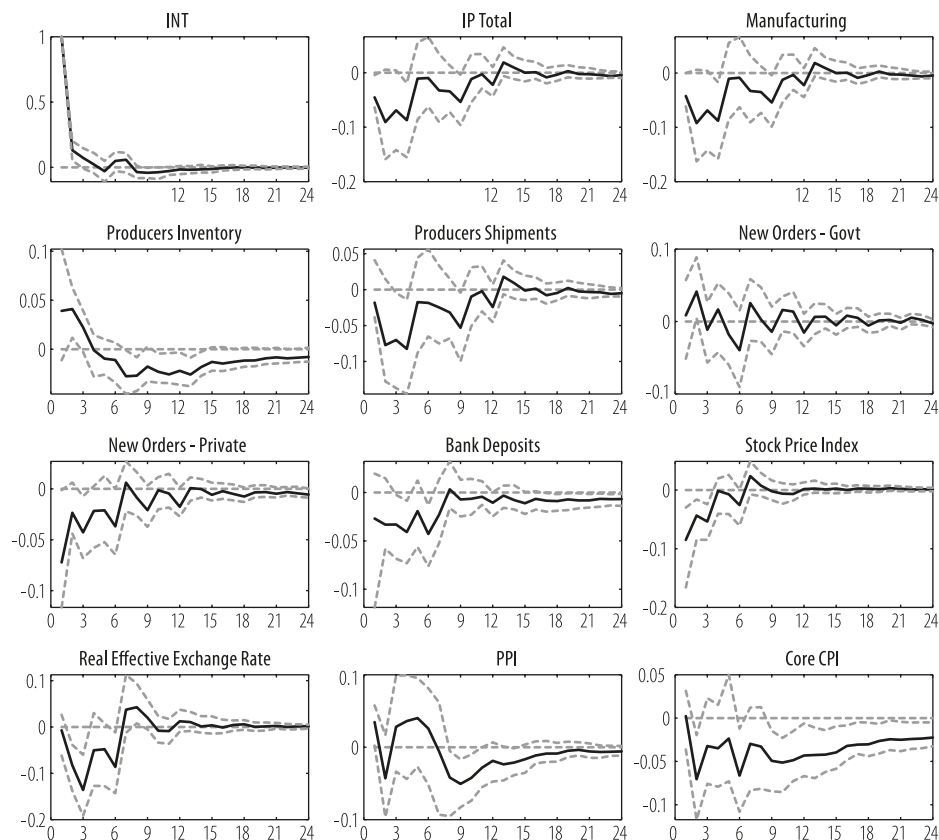
**Figure 5. Impulse responses to a shock in M2 for the period of 1980-2017, generated from FAVAR model ( $Y = M2$ , Seven Factors).**



Note: The dotted lines represent a 95% confidence band around the impulse response functions.

Source: Authors' calculations

**Figure 6. Impulse responses to a shock in the base rate for the period of 1980-2017, generated from FAVAR model ( $Y$  = base rate, Seven Factors).**



Note: The dotted lines represent a 95% confidence band around the impulse response functions.

Source: Authors' calculations

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## Appendix

The appendix shows the list of the variables used in the study. It also shows whether the variable is assumed to be slow (S) or fast (F) moving. As described in the paper, each variable underwent unit roots tests and, if necessary, transformations are taken to attain stationarity. The transformation codes are: 1 – no transformation (i.e., the variable is stationary at level), 2 – first difference of logarithms (or percentage change).

	S KOREA 1980 - 2017	Unit	Transf	S or F
1	KO INDUSTRIAL PRODUCTION VOLA	KW	2	S
2	KO MANUFACTURING PRODUCTION INDEX VOLA	KW	2	S
3	KO PRODUCERS INVENTORY - MANUFACTURING VOLA	KW	2	S
4	KO PRODUCERS SHIPMENTS - MANUFACTURING VOLA	KW	2	S
5	KO BOP: INCOME - COMPENSATION OF EMPLOYEES CURA	US	2	S
6	KO CONSTRUCTION ORDERS - DWELLINGS CURN	KW	2	S
7	KO MACHINERY ORDERS RECEIVED CURN	KW	2	S
8	KO CONSTRUCTION ORDERS CURN	KW	2	S
9	KO CONSTRUCTION ORDERS - BUILDING CURN	KW	2	S
10	KO CONSTRUCTION ORDERS-GENERATION & TRANSMISSION OF ELCTRICITY	KW	2	S
11	KO CONSTRUCTION ORDERS FROM PRIVATE SECTOR CURN	KW	2	S
12	KO CONSTRUCTION ORDERS FROM PUBLIC SECTOR CURN	KW	2	S
13	KO NEW ORDERS - CONSTRUCTION, NON-MANUFACTURING OTHERS CURN	KW	1	S
14	KO NEW ORDERS - CENTRAL GOVERNMENT CURN	KW	2	S
15	KO NEW ORDERS - FINANCE & INSURANCE CURN	KW	2	S
16	KO NEW ORDERS - LOCAL GOVERNMENT CURN	KW	2	S
17	KO NEW ORDERS - PRIVATE DEMAND CURN	KW	2	S
18	KO NEW ORDERS - PUBLIC CORPORATION CURN	KW	1	S
19	KO NEW ORDERS - PUBLIC OTHERS CURN	KW	2	S
20	KO NEW ORDERS - REAL ESTATE CURN	KW	2	S
21	KO NEW ORDERS - TRANSPORT & STORAGE CURN	KW	1	S
22	KO MONEY SUPPLY - M1 (EP) CURA	KW	2	F
23	KO MONEY SUPPLY - M2 (EP) CURA* (Policy Instrument)	KW	2	F
24	KO BROAD MONEY (M3) SADJ	KW	2	F
25	KO MONETARY AGGREGATES: RATIO OF MONETARY BASE TO BROAD MONEY		2	F
26	KO BILL DEFAULT: AMOUNT - NATIONWIDE CURN	KW	1	F
27	KO DEPOSITS AT COMBS & SBS - SAVINGS CURN	KW	2	F
28	KO GOVERNMENT FUND OPERATION LOANS CURN	KW	2	F

29	KO GOVERNMENT FUND EQUIPMENT LOANS CURN	KW	2	F
30	KO STOCK PRICE INDEX (EP) NADJ	KW	2	F
31	KO INTEREST RATES: GOVERNMENT SECURITIES, GOVERNMENT BONDS NADJ		2	F
32	KO INTEREST RATES: DEPOSIT RATE NADJ		2	F
33	KO INTEREST RATES: LENDING RATE NADJ		2	F
34	KO INTEREST RATES: BASE RATE* (Policy Instrument)		2	F
35	KO DISCOUNT RATE (END OF PERIOD) NADJ		2	F
36	KO KOREA CORPORATE BOND YIELD - 3 YEAR NADJ		2	F
37	KO KOREAN WON TO 1 US \$ (EP) CURN	KW	2	F
38	KO REAL EFFECTIVE EXCHANGE RATES - CPI BASED NADJ	KW	2	F
39	KO EXCHANGE RATE MONTHLY AVERAGE NADJ	KW	2	F
40	KO EXCHANGE RATE: NATIONAL CURRENCY PER SDR NADJ	KW	2	F
41	KO KOREAN WON TO 100 JAPANESE YEN (ARBITRATED) NADJ	KW	2	F
42	KO KOREAN WON TO US \$ (ARBITRATED) CURN	KW	2	F
43	KO KOREAN WON TO CANADIAN DOLLAR (ARBITRATED) CURN	KW	2	F
44	KO KOREAN WON TO SAUDI RIYAL (ARBITRATED) CURN	KW	2	F
45	KO KOREAN WON TO SWISS FRANC (ARBITRATED) CURN	KW	2	F
46	KO KOREAN WON TO UK £ (ARBITRATED) CURN	KW	2	F
47	KO KOREAN WON TO HONG KONG DOLLAR (ARBITRATED) CURN	KW	2	F
48	KO PPI NADJ	KW	2	S
49	KO PPI EXCLUDING FOODS NADJ	KW	2	S
50	KO PPI EXCLUDING ENERGY NADJ	KW	2	S
51	KO PPI - BEVERAGES NADJ	KW	2	S
52	KO PPI - CIGARETTE NADJ	KW	2	S
53	KO PPI - ENERGY NADJ	KW	2	S
54	KO PPI - FOODS NADJ	KW	2	S
55	KO PPI - GOODS NADJ	KW	2	S
56	KO PPI - PHARMACEUTICALS NADJ	KW	2	S
57	KO PPI - AGRICULTURAL, FOREST & MARINE PRODUCTS NADJ	KW	2	S
58	KO PPI - COMMUNICATIONS, IMAGING & SOUND EQUIPMENT NADJ	KW	2	S
59	KO PPI - ELECTRICAL & ELECTRONIC EQUIPMENT NADJ	KW	2	S
60	KO CPI NADJ	KW	2	S
61	KO CPI - EXCLUDING AGRICULTURAL PRODUCT & OIL NADJ	KW	2	S
62	KO CPI ALL ITEMS NON-FOOD NON-ENERGY NADJ	KW	2	S
63	KO CORE CPI (STANDARDIZED) NADJ	KW	2	S
64	KO BUS.EXP.: COMPOSITE BUS.CONDITIONS (METHO BREAK AUG '08) NADJ		1	F
65	KO BUSINESS EXPECTATIONS: DOM. DEMAND (METHO BREAK AUG '08) NADJ		1	F

66	KO BUSINESS EXPECTATIONS: EMPLOYMENT (METHO BREAK AUG '08) NADJ	1	F
67	KO BUSINESS EXPECTATIONS: EXPORTS (METHO BREAK AUG '08) NADJ	1	F
68	KO BUSINESS SURVEYS: BUSINESS CONDITIONS, FORECAST SADJ	1	F
69	KO BUSINESS SURVEYS: BUSINESS CONDITIONS, ACTUAL SADJ	1	F
70	KO BUSINESS SURVEYS: EMPLOYMENT CONDITIONS, ACTUAL NADJ	1	F