2. Macroeconomic Structural Changes in a Leading Emerging Market: The Effects of the Asian Financial Crisis

Dohyun CHUN[1]
Hoon CHO[2]
Doojin RYU[3]

Abstract

This study investigates stock market behavior in response to money supply, financial, aggregate spending, and aggregate supply shocks within a structural vector autoregression framework. Analyzing financial and macroeconomic data from the Korean market, a globally leading emerging market, we find that each type of macroeconomic shock has a significant effect on the price level and that real stock returns react positively (negatively) to aggregate supply (spending) shocks. Cumulative impulse response analyses suggest that the Korean economy's structure changed significantly following the Asian financial crisis. The results by industry sector indicate that, although the manufacturing and financial sectors share similar impulse response structures, the financial crisis' effects on the two sectors differ significantly.

Keywords: Asian financial crisis; Emerging market; Financial Economics; Macroeconomic shock; Structural VAR

JEL Classification: E44; E49; E52; G15; G19

1. Introduction

Stock price changes mainly comprise general economic and idiosyncratic fluctuations. Macroeconomic shocks, such as shocks to the money supply, aggregate spending, and aggregate supply, can account for financial market movements, particularly in developed and emerging market countries whose financial markets have a significant influence and role in their economic structure. Fama (1981) suggests a negative correlation between inflation and stock returns, and Geske and Roll (1983) argue that unexpected negative stock returns could precede an increase in expected inflation. Ram and Spencer (1983) find an indirect

[1] *College of Business, Korea Advanced Institute of Science and Technology, Seoul, Korea.*
[2] *College of Business, Korea Advanced Institute of Science and Technology, Seoul, Korea.*
[3]*Corresponding author. College of Economics, Sungkyunkwan University, Jongno-gu, Seoul 03063, Republic of Korea. Email:sharpjin@skku.edu.*

causality from inflation to stock returns and support Fama's (1981) argument. Song (2017) claims that the aggressiveness monetary policy and macroeconomic shocks significantly affect the dynamics and structures of equity and bond markets. Blanchard and Quah (1988) impose structural restrictions to examine the dynamic responses of output and unemployment to demand and supply shocks, in line with Evans (1989) and Campbell and Mankiw (1990). Following Blanchard and Quah (1988) and Clarida and Gali (1994), numerous studies analyze the dynamic responses of financial markets to unexpected macroeconomic shocks using the structural vector autoregression (SVAR) model (Kronen and Belke, 2017; Kontonikas and Zekaite, 2018), the main purpose of which is to identify key macroeconomic shocks by imposing long-run restrictions. The model enables simultaneous analyses of how multiple variables affect the dependent variable while allowing for structural restrictions. Zero or non-zero long-run restrictions can be imposed on the model, and setting intuitive restrictions allows for the accurate identification of structural shocks. The correlations among the variables can be measured using this extension of vector autoregression (VAR), and the variables' impulse responses to unanticipated shocks can be examined. Furthermore, forecast error variance decomposition enables an understanding of each variable's contribution to the shocks. Accordingly, despite its limitations (Keating, 1992; Kilian, 2011), the SVAR model remains one of the most powerful macroeconomic tools available (Lee and Ryu, 2013; Bouri, Gupta, Hosseini, and Lau, 2018). Rapach (2001) utilizes the SVAR model to verify the significant impacts of the money supply, portfolio, aggregate spending, and aggregate supply shocks on the real stock price. Later studies build on Rapach (2001) by analyzing the impacts of various macroeconomic shocks on international stock prices. For instance, Berg (2012) considers technology shocks to examine European stock price movements. Fry, Hocking, and Martin (2008), Huang and Guo (2008), Araújo (2009), and Jiranyakul (2011) investigate the stock markets in Australia, Japan, Latin America, and Thailand, respectively. Gupta and Inglesi-Lotz (2012) extend the sample period to focus on the effect of the global financial crisis.

This study pursues this line of analysis using financial and macroeconomic data from Korea, which is a leading emerging market and economy (Ryu, Ryu, and Hwang, 2016, 2017; Yang, Ryu, and Ryu, 2017; Chung, Kang, and Ryu, 2018). The 1997 Asian financial crisis nearly drove Korea into bankruptcy (Seo, Kim, and Ryu, forthcoming). On December 3, 1997, the International Monetary Fund (IMF) approved a US $21 billion bailouts of the Korean government. The fundamentals and traits of the Korean economy have been changing dramatically since the IMF bailout and resultant market reform. Foreign investment increased due to deregulation. Because of the foreign investors' characteristics[4], the domestic stock price became more sensitive to overall economic performance[5]. Thus, in the open-economy setting after the Asian financial crisis, we expect to observe a clearer and stronger relationship between stock prices and macroeconomic shocks (Kim, Ryu, and Seo, 2015; Song, Ryu, and Webb, 2016; Park, Ryu, and Song, 2017; Song, Park, and Ryu, 2018).

We examine the effect of macroeconomic shocks on the level of the Korea Composite Stock Price Index (KOSPI) using the SVAR model. The objective of this study is to assess and

[4] *Most foreign investors are considered as professional and informed institutional investors in the Korean financial market. They are generally more informed and better performed than their domestic counterparts (Ahn, Kang, and Ryu, 2008; Webb, Ryu, Ryu, and Han, 2016; Yang, Choi, and Ryu, 2017).*

[5] *Foreign investors tend to include more multinational stocks and assets in their portfolios (Chung, Kim, and Ryu, 2017).*

examine the relative importance of macroeconomic shocks in explaining real stock price variations. Employing the theoretically and empirically validated methodology, our empirical results on the structural dynamics suggest that each type of macroeconomic shock has an important effect on real stock prices. In line with prior results (Fama, 1981; Geske and Roll, 1983; Ram and Spencer, 1983; Blanchard and Quah, 1988; Rapach, 2001), we find that aggregate spending shocks have a negative long-run correlation with stock returns, and that stock returns have negative (positive) short-term responses to money supply (aggregate supply) shocks. Moreover, the price level is found to respond positively to aggregate spending shocks, but inflation emerges in response to aggregate supply shocks. This reaction likely reflects inflation of export, given that Korea is a small open economy (Shim, Kim, Kim, and Ryu, 2015; Song, Ryu, and Webb, forthcoming). The variance decomposition results suggest that financial shocks explain most of the variance in stock returns and that aggregate supply shocks play a greater role than aggregate spending shocks do in explaining stock return volatility. Furthermore, the Korean economy exhibits significant structural changes following the Asian financial crisis. As the Korean financial market matures, the connections among the financial, money, and goods markets are becoming clearer and more significant. Additionally, the manufacturing and financial sectors have similar cumulative impulse response structures; however, shocks to financial stocks do not affect the price level, whereas shocks to manufacturing stocks lower it. Finally, the structural effect of the Asian financial crisis differs across industry sectors.

The rest of this paper is organized as follows. Section 2 reviews related studies in the field of economics and finance. Section 3 outlines the SVAR model. Section 4 reports the sample data. Section 5 presents the estimation results, including the accumulate impulse responses to structural shocks and their correlations. Finally, Section 6 concludes the paper.

2. Literature Review

The financial market and macroeconomic structures are strongly and significantly related and affect each other. Recent empirical studies investigate their associations and various relations (Gilchrist, Schoenle, Sim and Zakrajšek, 2017; Jawadi and McGough, 2018; Martinez and Tsomocos, 2018; Yao and Sun, forthcoming). The VAR model is widely utilized in the fields of finance and economics to demonstrate dynamics among variables because it has clear and useful advantages as mentioned above. For instance, Sadorsky (1999) uses the VAR model to examine the relationship among the S&P500 stock and oil prices, industrial production, and three-month treasury bill rates. Park and Ratti (2008) build on existing research by including the consumer price as an endogenous variable. They employ a four-variable VAR to analyze 13 European stock markets and the US market. Yang (2017) investigates the impulse responses and dynamic relationships among macroeconomic variables. His study finds that the unemployment (federal funds) rate is negatively (positively) related to inflation and supports the monetary neutrality.

Rapach (2001) finds significant short- and long-run relationships between real stock prices and portfolio shocks and a negative correlation between inflation and real stock returns. The study of Rapach (2001) reveals that aggregate supply shocks increase stock price levels and can account for more than half of long-run stock price volatility, indicating that the long-run supply has a significant impact on long-run stock price movements. Additionally, money supply shocks are found to explain more than 30% of short-run stock price volatility. In line with Rapach (2001), Lastrapes (1998) finds that money supply shocks decrease real interest rates and increase stock price levels. Hess and Lee (1999) determine the effect of macroeconomic shocks on stock returns by imposing long-run restrictions. Rubio-Ramirez, Waggoner, and Zha (2010) analyze the theoretical properties of the SVAR model. They suggest general rank conditions and it can be implemented widely for identifying restrictions. Primiceri (2005) uses the SVAR model to demonstrate that systemic and non-systemic monetary policy have both changed over the last 40 years. Benati and Surico (2009) investigate structural changes in the systematic component of monetary policy after the Great Moderation and analyze the impulse responses of the nominal interest rate, inflation, and output. Bjørnland and Leitemo (2009) discover a simultaneous interdependence between stock prices and monetary policy in the US economy—finding specifically that interest rates increase by about four basis points after a 1% increase in stock prices but that the real stock price drops 7% to 9% immediately after a 100-basis-point increase in the federal funds rate. Christiano, Ilut, Motto, and Rostagno (2010) supplement the evidence of a negative relationship between equity returns and prices and propose low inflation during a bull market through a dynamic stochastic general equilibrium model. Using the Korean market dataset, Lee (2008) and Hong, Khil, and Lee (2013) also provide supporting evidence of a negative relationship between equity returns and prices. Christiano, Eichenbaum, and Evans (1996) argue that monetary policy shocks slowly reduce the GDP deflator and commodity prices, while Bernanke and Gertler (2001) find that unexpected monetary policy shocks significantly affect stock returns and claim that an inflation-targeting central bank should not react to equity market shocks.

That said, several studies offer different interpretations of the correlations among these variables. Modigliani and Cohn (1979) suggest that inflation and stock returns have no negative correlation, and Campbell and Vuolteenaho (2004) estimate a VAR model indicating that the resulting inflation is highly correlated with stock market mispricing (i.e., the inflation illusion). Hess and Lee (1999) show that the relationship between stock returns and inflation can be either positive or negative depending on the type of inflation shock; using long-run restrictions, they show that real output shocks cause a negative relationship between stock returns and inflation, whereas demand shocks create a positive relationship. The related studies of Lee (1992, 2010) support Hess and Lee’s (1999) result. The empirical studies of Smets and Wouters (2003, 2007) and Kim (2014) examine the effects of monetary policy and macroeconomic shocks, showing that monetary policy and demand shocks are both important for explaining the business cycle. Uhlig (2005) argues for the neutrality of monetary policy, however, showing that contractionary monetary policy shocks do not significantly affect real GDP. Furthermore, Bein and Mehmet (2016) demonstrate that correlation structures between stock and oil prices differ between oil-importing and exporting countries, while Han and Zhou (2017), for BRICS countries, find that exchange rates and stock prices are negatively correlated using a mixed c-vine copula model.

A number of studies review and analyze the macroeconomic structures of Korea. Lee, Ryu, and Kutan (2016) examine the relationship between monetary policy and stock market liquidity. Shim, Kim, Kim, and Ryu (2016) reveal a relationship between foreign exchange rates and inflation rates, thus validating the relative purchasing power parity hypothesis. Ryu and Shim (2017) use an asymmetric BEKK-GARCH model to analyze the intraday dynamic relationship among volatilities, trading volumes, and asset returns. Shim, Chung, and Ryu (2018) study the long-term income distribution between labor and capital, while Song and Ryu (2016) find that adjustments to banking sector balance sheets result from credit cycles.

3. Methodology

This study examines the macroeconomic dynamics based on the SVAR method (Rapach, 2001). Eq. (1) illustrates the general covariance-stationary VAR process, which is a simplified dynamic economic system: ,

$$A(L)\Delta v_t = e_t, \qquad (1)$$

where v_t denotes an endogenous variable vector (n-by-1) that follows a unit root process. Shocks can affect the endogenous variables permanently, assuming a unit root process of v_t. L is a lag operator, and $A(L)=A_0 - A_1L - A_2L^2 - \ldots - A_pL^p$, given $A_0=I_n$, where I_n denotes the n-by-n identity matrix. e_t is a VAR innovation vector with a zero mean, no autocorrelation, and a given covariance matrix Σ_e. The VAR process can be transformed into a moving-average representation of Δx_t in terms of e_t by inverting Eq. (1):

$$\Delta v_t=B(L)e_t=\sum_{i=0}^{\infty} B_i L^i e_t, \qquad (2)$$

where $B(L)=A(L)^{-1}$ and $B_0=I_n$. We express the structural shock vector as ϵ_t, and we thus obtain $e_t=C\epsilon_t$. It is reasonable to assume that each structural shock is independent, which means that the structural shock vector has a diagonal covariance matrix, $E(\epsilon_t\epsilon_t^{'})=\Sigma_\epsilon$. Without loss of generality, the diagonal covariance matrix Σ_ϵ can be normalized as I_n.

In this analysis, we impose long-run restrictions to estimate the VAR model, following Blanchard and Quah (1988). Our endogenous variables are the first differences of the price level p_t, the real stock price s_t, the nominal interest rate i_t, and the real output y_t; thus, $v_t=(\Delta p_t, \Delta s_t, \Delta i_t, \Delta y_t)^T$. Equation (3) displays six long-run restrictions, expressed in terms of the long-run multiplier matrix R:

$$\lim_{s\to\infty}\begin{pmatrix}\Delta p_{t+s}\\ \Delta s_{t+s}\\ \Delta i_{t+s}\\ \Delta y_{t+s}\end{pmatrix}=\begin{pmatrix}r_{11} & r_{12} & r_{13} & r_{14}\\ 0 & r_{22} & r_{23} & r_{24}\\ 0 & k\cdot r_{22} & r_{33} & r_{34}\\ 0 & 0 & 0 & r_{44}\end{pmatrix}\begin{pmatrix}\epsilon_{MS,t}\\ \epsilon_{FN,t}\\ \epsilon_{IS,t}\\ \epsilon_{AS,t}\end{pmatrix}=R\epsilon_t, \qquad (3)$$

where ϵ_{MS}, ϵ_{FN},ϵ_{IS}, and ϵ_{AS} represent money supply (MS), financial (FN), aggregate spending (IS), and aggregate supply (AS) shocks, respectively. The aggregate spending shocks incorporate autonomous consumption and fiscal policy shocks. The financial shock denotes an exogenous shock to stock equity demands, which is related to exogenous market innovation (i.e., a transaction cost change or an equity-premium shock). Each restriction incorporates the idea of monetary neutrality and the natural-rate hypothesis (Kurozumi and Zandweghe, 2016; Carlsson, 2017; Sahin and Dogan, 2017; Kontonikas and Zekaite, 2018; Serletis and Koustas, forthcoming). First, we incorporate long-run monetary neutrality by imposing the long-run restrictions $r_{21}=r_{31}=r_{41}=0$; money supply shocks do not have long-run effects on stock market returns, interest rate changes, or output growth, whereas positive money supply shocks increase inflation in the long run. The other restrictions, $r_{41}=r_{42}=r_{43}=0$, are related to the natural-rate hypothesis. Only aggregate supply shocks (e.g., technology shocks) can have long-run effects on output growth, and the other shocks (i.e., money supply, financial, and aggregate spending shocks) do not affect output growth. Aggregate-demand-aggregate-supply models suggest that an aggregate spending shock increases the interest rate in the long run but has no permanent effect on output growth ($r_{43}=0$). The restriction $r_{42}=0$ signifies that output growth is not influenced by a purely financial shock (Tobin, 1969). In the asset market equilibrium, a positive financial shock increases the demand for stocks and raises the interest rate. Scale parameter k implies that an exogenous financial shock that increases stock returns by 10% should shift the interest rate by 10·k percentage points to maintain market equilibrium.

4.Sample Data

This study uses quarterly data spanning the first quarter of 1988 to the third quarter of 2017, comprising 119 observations. Stock price data are taken from the DataGuide 5.0, which provides financial data in the Korean market. Macroeconomic data are taken from the Economic Statistics System (ECOS) maintained by Bank of Korea. The price level (p_t) in this analysis is a seasonally adjusted GDP deflator, and the stock price (s_t) is divided by that deflator. The nominal interest rate (i_t) is the call rate that is used as a proxy for the risk-free rate. Real output (y_t) is defined as seasonally adjusted GDP. All variables are log transformed, except for the interest rate. We confirm, based on the test suggested by Kwiatkowski, Phillips, Schmidt, and Shin (1992), that the set of time-series variables, p_t, s_t, i_t, and y_t, are not stationary. In addition, Johansen's (1988) cointegration test indicates that no cointegration relationship exists among the variables, as shown in Table 1.

Table 1

Johansen Cointegration Test

Hypothesized CE(s)	Max Eigen Statistic	0.05 Critical Value	P-Values
None	22.509	28.588	0.245
At most 1	15.552	22.299	0.331
At most 2	11.543	15.892	0.214
At most 3	5.902	9.164	0.198

We use the first differences of the endogenous variables. We confirm that the empirical results are not sensitive to changes in z. We therefore follow Rapach's (2001) suggestion (i.e., z = 0.025). Panels A and B of Table 2 provide descriptive statistics for the original data and the first difference data.

Table 2

Descriptive Statistics

Panel A: Original Data

	Price Level	Stock Price	Interest Rate	Real GDP
Mean	4.359	2.591	0.069	12.271
Median	4.427	2.663	0.045	12.362
Max	4.723	3.172	0.230	12.880
Min	3.667	1.347	0.011	11.368
Standard Deviation	0.281	0.390	0.052	0.436
Skewness	-0.882	-0.910	0.917	-0.452
Kurtosis	-0.155	0.442	-0.060	-0.963
Jarque-Bera	14.702	15.826	15.700	8.729
	(0.001)	(0.000)	(0.000)	(0.013)
Correlation	1.0000	0.1226	-0.7825	0.9844
		1.0000	-0.3127	0.2521
			1.0000	-0.8355
				1.0000

Panel B: Differenced Data

	Inflation	Stock Return	Interest Rate Difference	Output Growth
Mean	0.009	0.002	-0.001	0.013
Median	0.008	0.002	0.000	0.013
Max	0.038	0.606	0.096	0.044
Min	-0.025	-0.580	-0.075	-0.073
Standard Deviation	0.011	0.151	0.016	0.014
Skewness	0.121	0.011	0.299	-2.083
Kurtosis	0.504	3.516	16.913	12.345
Jarque-Bera	0.949	49.871	1212.927	722.025
	(0.622)	(0.000)	(0.000)	(0.000)
Correlation	1.0000	-0.1739	0.3543	-0.0072
		1.0000	-0.1306	0.1427
			1.0000	-0.0371
				1.0000

5. Empirical Findings

5.1. Cumulative Impulse Response Analysis

In all cumulative impulse response figures of this section, we illustrate the cumulative impulse responses of each component in the vector v_t to the structural shocks of one standard deviation with a two-standard-error band. Figure 1 shows the effects of money supply, financial, aggregate spending, and aggregate supply shocks on macroeconomic variables in columns 1, 2, 3, and 4, respectively. The results in the first column show that the price increases directly following a money supply shock and that this positive association is permanent. However, the stock return, interest rate, and real output respond only in the short term, a result consistent with the monetary neutrality. The interest rate reacts positively in the short term (two quarters) given the expected increase in inflation. The cumulative impulse responses to a financial shock are shown in the second column. The price decreases as a consequence of a financial shock, and this response is maintained over the long term, as the literature shows (Fama, 1981; Geske and Roll, 1983; Ram and Spencer, 1983; Christiano, Eichenbaum, and Evans, 1996; Huang and Guo, 2008; Lee, 2008; Bjørnland and Leitemo, 2009; Hong, Khil, and Lee, 2013). The interest rate exhibits a short-term positive response that is maintained in the long term since a positive financial shock lowers the bond price and boosts the interest rate. The third column of Figure 1 illustrates the cumulative impulse responses to an aggregate spending shock. It causes permanent increases in prices and interest rates and a short-term increase in real output. This result is in line with standard macroeconomic theory and Rapach's (2001) results, and the cumulative impulse response of the real stock price conforms to the present value-equity valuation model. In response to an expansionary aggregate supply shock, the impulse response of real output increases positively in the long term, as illustrated in column 4. Inflation of export may explain this result in the Korean market. In a small open economy such as the Korean economy, a positive aggregate supply shock (e.g., technological progress) lowers the cost of production and the price of tradable (mostly manufacturing) goods. Moreover, a low export price leads to a trade surplus and increases aggregate income, both of which generate an overall domestic price increase. In addition, the stock return (interest rate) exhibits a strongly negative (positive) response for four quarters. Because of Korea's high nominal interest rate before the Asian crisis, stock returns were correlated more closely with interest rates than with output growth. Consequentially, a lower interest rate raises stock returns, following the present value-equity valuation model, but a permanent increase in real output does not influence the real stock return. In conclusion, the estimated cumulative impulse responses indicate that real stock returns react positively to aggregate supply shocks and negatively to aggregate spending and money supply shocks. The signs of the unconditional correlations of stock returns with the output growth (0.1427), the interest rate difference (-0.1306), and the inflation (-0.1739) support this result.

Figure 1

Cumulative Impulse Response Analysis for Full Sample

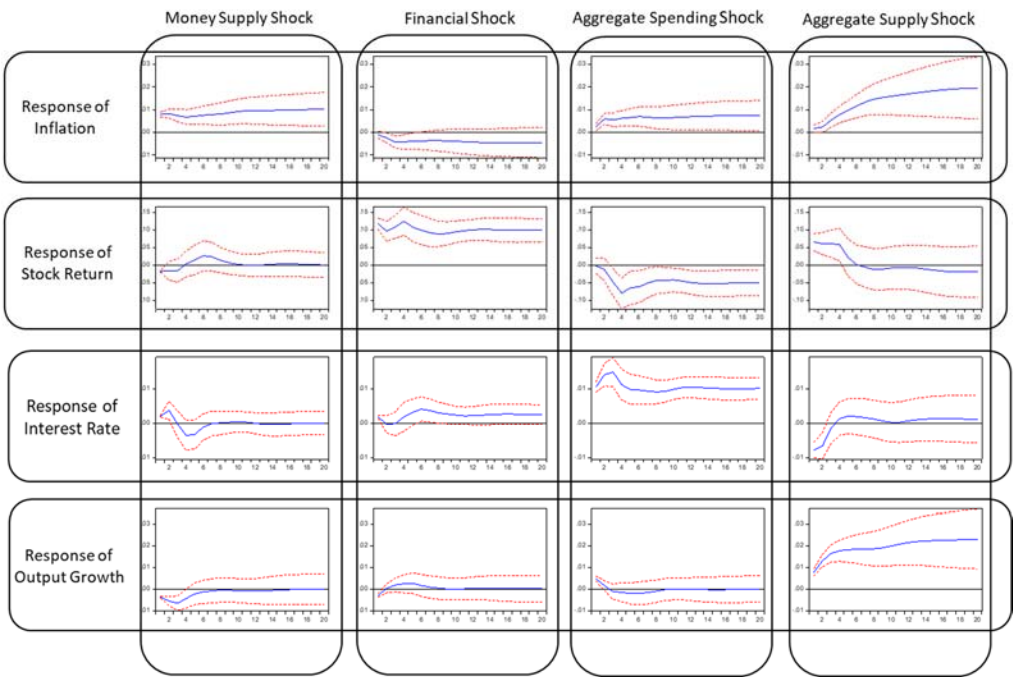
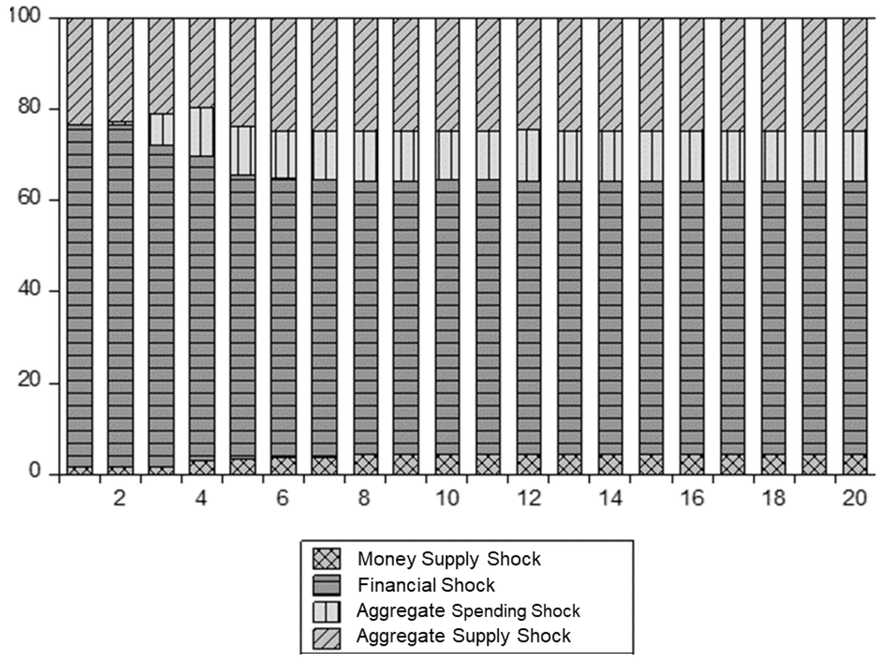


Figure 2 shows the results of the KOSPI stock return error variance decomposition. The results suggest that financial shocks explain most of the variance in stock returns and that aggregate supply shocks play a larger role than aggregate spending shocks do in explaining stock return volatility. Specifically, financial shocks account for about 70% of KOSPI returns, and aggregate supply shocks account for about 20%. Money supply and aggregate spending shocks have low absolute proportions of explanatory power, but their explanatory power is greater after longer lags.

Figure 2
Forecast Error Variance Decomposition of KOSPI Stock Returns



5.2 The Asian Financial Crisis

Figure 3 displays the historical time-series and trends of the macroeconomic variables during the sample period. During the Asian financial crisis, the GDP deflator, KOSPI index, and real GDP decrease, although the GDP deflator and real GDP rebound and subsequently follow a steady upward trend, and the KOSPI index fluctuates after the crisis. On the other hand, the interest rate falls dramatically due to the financial crisis, which implies significant structural changes. Table 3 presents the results of the Chow test for calculating exact breakpoints, indicating a statistically significant structural break after the Asian financial crisis. Therefore, the full sample is divided into two subsamples from 1988:Q1 to 1999:Q2 and from 1999:Q3 to 2017:Q3.

Figure 3

Trends in Macroeconomic Variables over the Sample Period

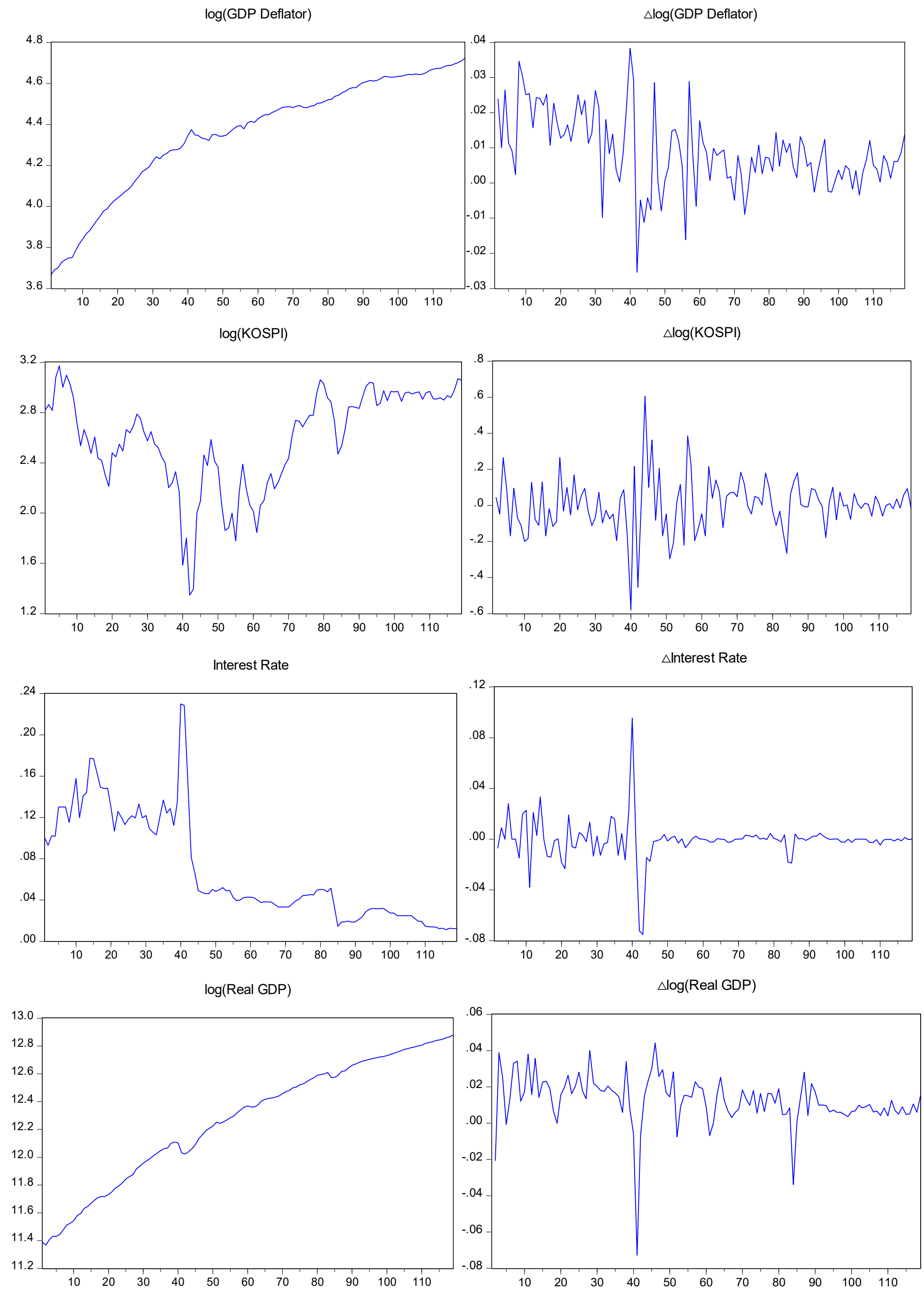


Table 3

Chow Breakpoint Test

	Price Level	Stock Market	Interest Rate	Real GDP
F-statistic	241.7283	4.857365	442.1857	359.3849
P-value	0	0.0295	0	0

Table 4 shows the correlation structure between variables for the full sample, the before-crisis sample, and the after-crisis sample. Correlation structures often differ before and after a crisis, so the impulse response structure can be expected to vary.

Table 4

Correlation Coefficients Before and After the Crisis

		Full Sample	Before Crisis	After Crisis
Stock Price	Price Level	-0.1739	-0.2044	-0.1021
	Interest Rate	-0.1306	-0.1864	0.1101
	Real GDP	0.1427	0.1086	0.2655
Price Level	Interest Rate	0.3543	0.5119	-0.1272
	Real GDP	-0.0072	-0.1512	-0.0233
Interest Rate	Real GDP	-0.0371	-0.0929	0.4751

Figures 4 and 5 show the cumulative impulse responses before and after the financial crisis, respectively. These figures indicate a statistically significant structural change following the financial crisis. Before the crisis, the connection between the money supply and price level was vague, implying an ineffective monetary policy. For instance, inflation does not clearly react to money supply shocks before the crisis, whereas money supply shocks create a significant price level increase after it. Furthermore, the money market and stock market have a limited relationship before the crisis, but there is a clearly positive response following a positive financial shock after the crisis. These phenomena can be explained as the effects of the maturation of the Korean market and economy via the intensive restructuring and fundamental enhancements required to overcome the financial crisis.

Figure 4

Cumulative Impulse Response Analysis before the Crisis

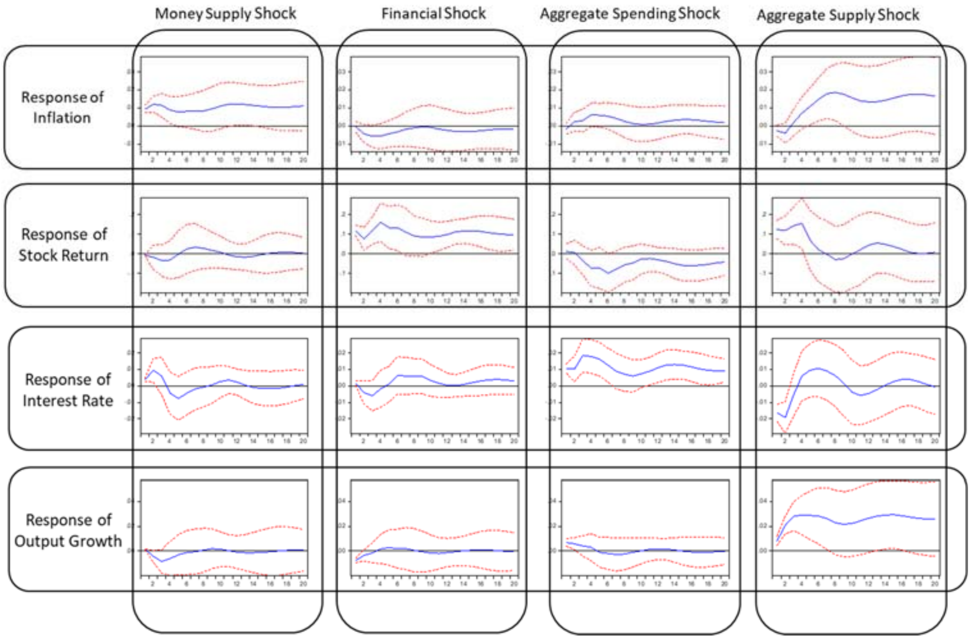
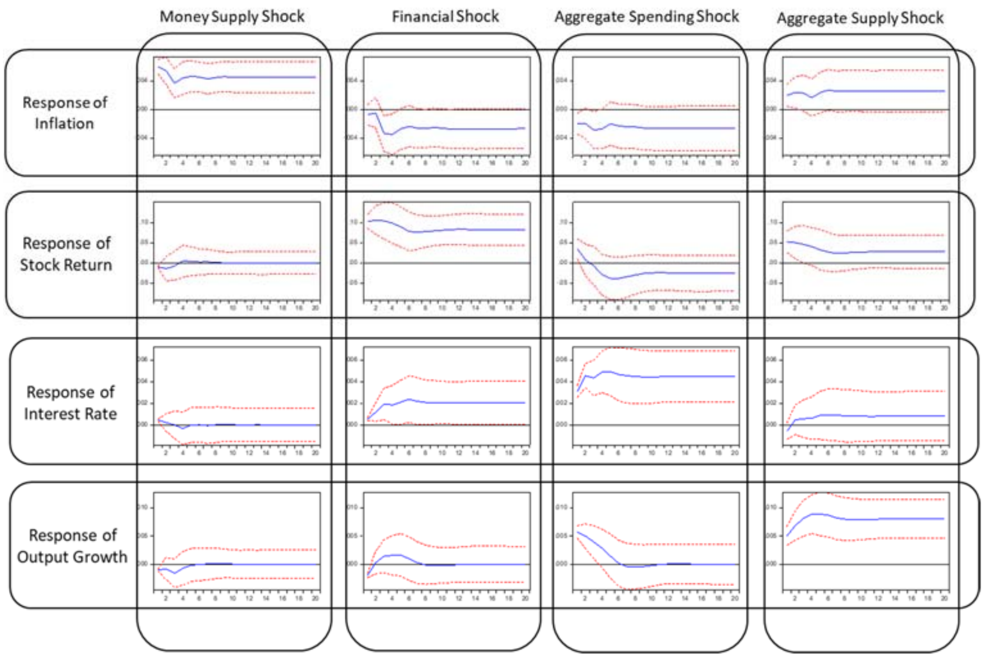


Figure 5

Cumulative Impulse Response Analysis after the Crisis



5.3. Industry Sector Analyses

This subsection explores the differences in impulse responses across industry sectors. The manufacturing and financial industries play important roles in Korea’s economy. These sectors have different fundamentals and are expected to react differently to the Asian financial crisis. This study divides the data into sectoral subsamples and examines how the impulse responses vary between them. We analyze the cumulative impulse response functions of the manufacturing and financial sectors using the KOSPI manufacturing index and the KOSPI financial index provided by DataGuide instead of the KOSPI index. Panels A and B of Table 5 show the correlation coefficients of KOSPI manufacturing stock prices and KOSPI financial stock prices, respectively, with other macroeconomic variables.

Table 5

Correlation Coefficients before and after the Crisis by Sector

Panel A: Manufacturing Sector

	Full sample	Before Crisis	After Crisis
Price Level	-0.1334	-0.1855	-0.0057
Interest Rate	-0.1270	-0.1891	0.1013
Real GDP	0.0893	0.0346	0.2482

Panel B: Financial Sector

	Full sample	Before Crisis	After Crisis
Price Level	-0.1594	-0.1215	-0.1736
Interest Rate	-0.0263	-0.0518	0.1040
Real GDP	0.2232	0.2577	0.2343

Figures 6 and 7 show the cumulative impulse response functions for the manufacturing and financial sectors, respectively, for the full sample. The cumulative impulse responses of the entire market (see Figure 1) and of the manufacturing sector are statistically identical. The cumulative impulse response of the financial sector is similar to that of the manufacturing sector but only shocks to manufacturing stocks significantly lower prices. Furthermore, some of the structural changes due to the Asian financial crisis are statistically significantly different across the two sectors. Figures 8, 9, 10, and 11 show the cumulative impulse responses of the manufacturing sector and financial sector before and after the crisis, respectively. Before the crisis, stock returns do not respond to aggregate spending shocks. After the crisis, however, manufacturing stock returns react positively to aggregate spending shocks in the short term. In addition, real output has no significant correlation with shocks to financial stocks after the crisis but interacts negatively with shocks to KOSPI and manufacturing stocks. Finally, the interest rate does not respond to manufacturing stock shocks before the crisis but shows a statistically significant long-run correlation after the crisis.

Figure 6

Cumulative Impulse Response Analysis: Manufacturing Sector

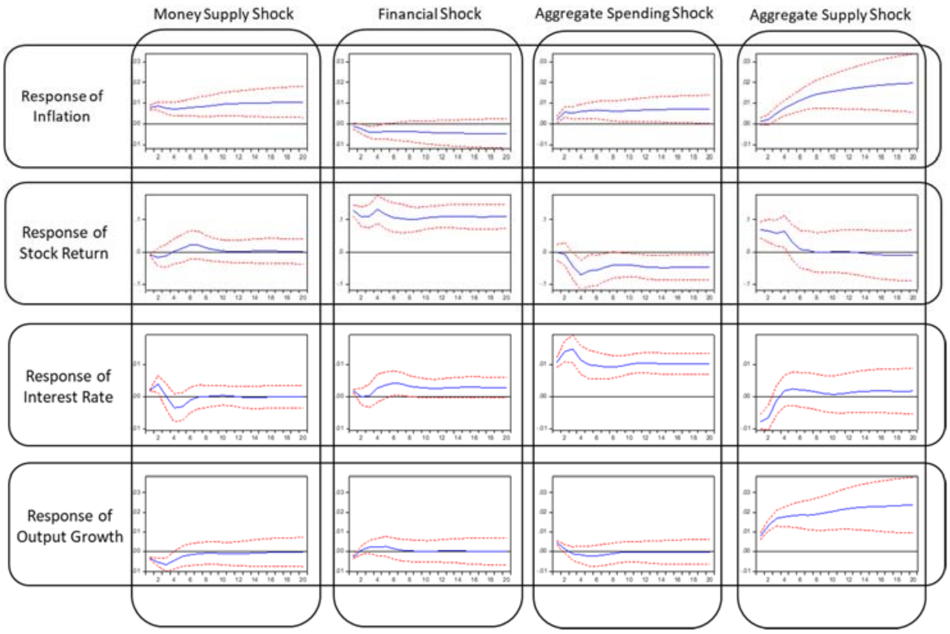


Figure 7

Cumulative Impulse Response Analysis: Financial Sector

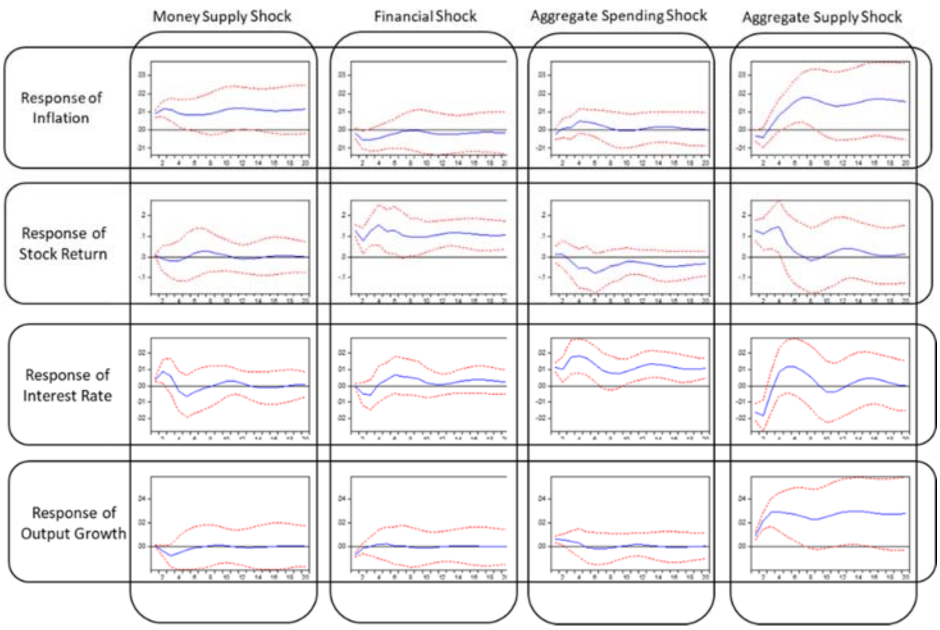


Figure 8

Cumulative Impulse Response Analysis before the Crisis: Manufacturing Sector

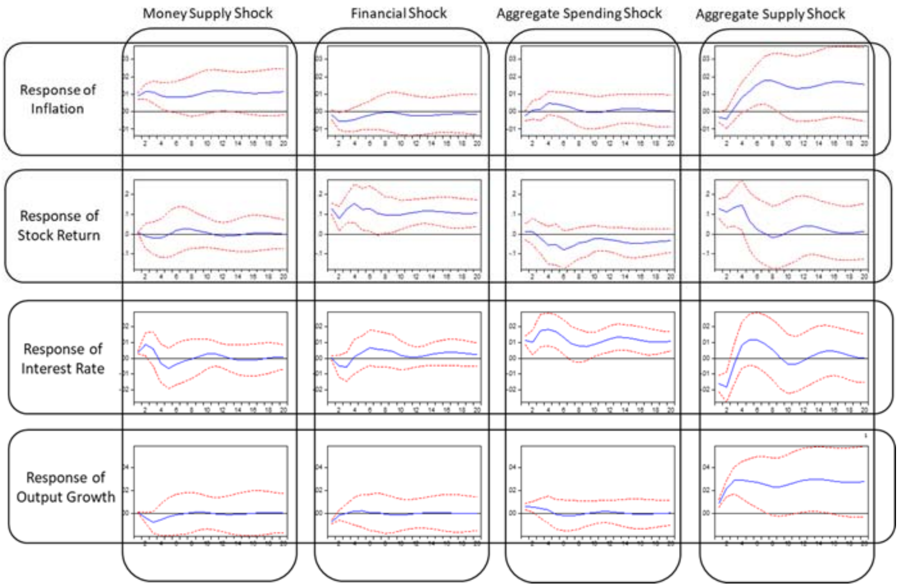


Figure 9

Cumulative Impulse Response Analysis after the Crisis: Manufacturing Sector

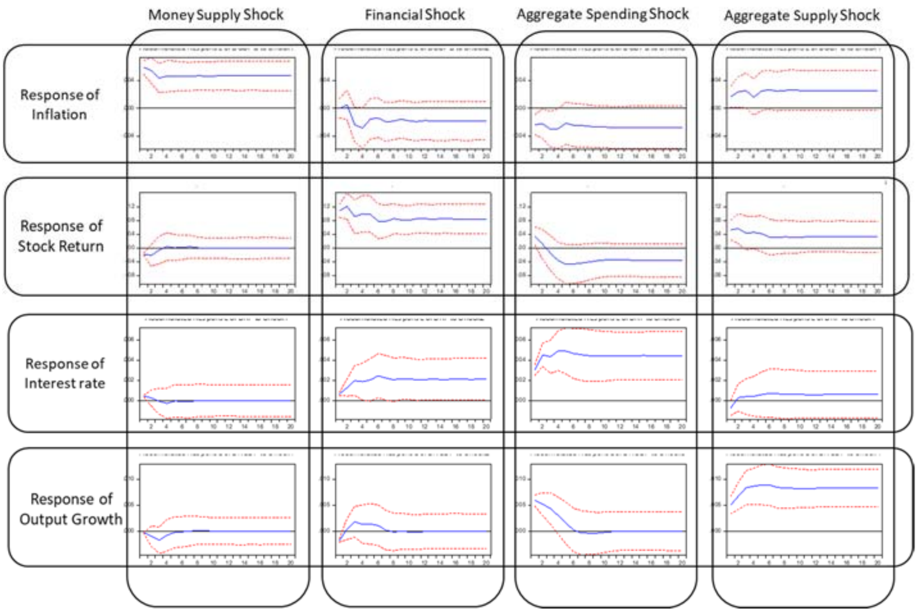


Figure 10

Cumulative Impulse Response Analysis before the Crisis: Financial Sector

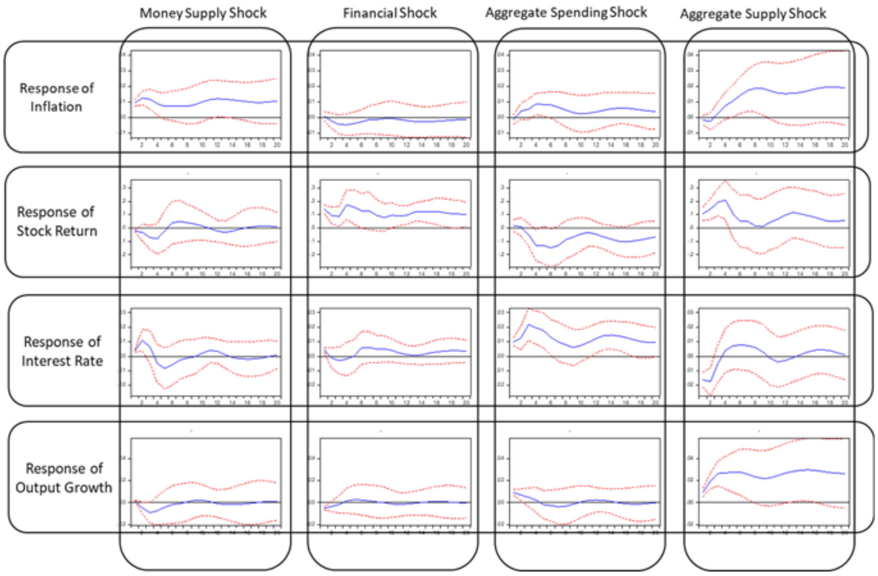
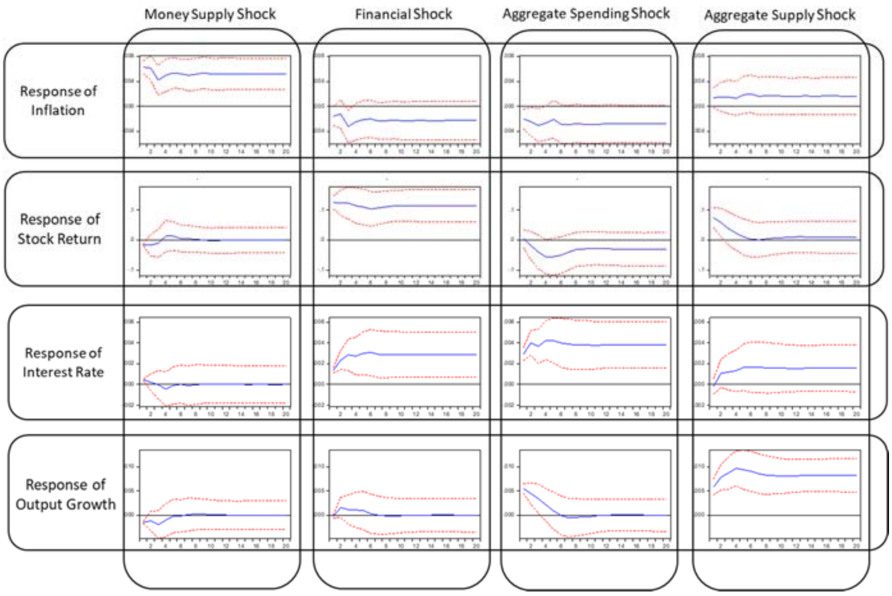


Figure 11

Cumulative Impulse Response Analysis after the Crisis: Financial Sector



6.Conclusions

This study has applied the SVAR model with long-run restrictions to examine correlations and associations among macroeconomic shocks (money supply, financial, aggregate spending, and aggregate supply shocks) and macroeconomic variables (inflation, real stock returns, interest rate, and real output). Our model is estimated using quarterly data from the Korean market covering the first quarter of 1988 to the third quarter of 2017. Our results suggest that macroeconomic shocks are significant factors in changes of real Korean stock prices. The empirical results are almost in line with standard macroeconomic theory and the results of past studies, but we do find a permanent increase in prices following an aggregate supply shock, likely due to inflation of export (i.e., inflation based on a trade surplus for the exporting country). Notably, real stock returns respond positively to an aggregate supply shock and negatively to money supply and aggregate spending shocks, in line with extant research. Our variance decomposition results suggest that financial shocks explain most of the variance in stock returns and that aggregate supply shocks play a greater role in explaining stock return volatility than aggregate spending shocks do. Furthermore, we divide the sample into two subsamples—from the first quarter of 1988 to the second quarter of 1999 and from the third quarter of 1999 to the third quarter of 2017—to examine changes in the economic structure before and after the Asian financial crisis. We find that, after the crisis, the connections among the financial, money, and goods markets become robust, reflecting the maturation of the Korean market and economy. We also extend the analysis to different industry sectors. The manufacturing and financial sectors are found to have similar cumulative impulse response patterns, but only manufacturing stock shocks affect price levels. Finally, we find that the effects of the financial crisis differ across sectors.

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