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Monetary Policy and Stock Price Dynamics in Nepal

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Abstract

Monetary authorities are attentive towards stock price movement because of its significance in financial stability. Though stock price is one of the major channels of monetary transmission, very little is known about it in Nepali context. This study analyzed monetary variables, stock prices, and monetary policy goals using time series data. Results from Koyck approach to distributed lags, vector autoregression and mediation analysis revealed mixed evidence of causality between monetary policy and stock prices. Though results were not consistent across different econometric analysis, inter-bank interest rate, narrow money supply, broad money supply, monetary policy announcement, and monetary policy stances were found to be significant in explaining stock prices. Furthermore, causality also existed from stock prices to monetary policy, suggesting that monetary authorities also consider development in stock prices while formulating monetary policies. However, stock prices had not been found to mediate the relationship between monetary policy variables and monetary policy goals, which questioned stock prices being a channel of monetary policy transmission in Nepal.

Keywords: Monetary policy, stock price, Koyck distributed lag, VAR, mediation

Introduction

The transmission mechanism of monetary policy, the channels through which monetary impulses are transmitted to the real sectors of an economy, occurs through monetary and credit aggregates, market interest rate structure, asset prices, and exchange rate (Loayza & Schmidt-Hebbel, 2002). Mishkin (2009) has identified three categories of asset prices besides those on debt instruments that are viewed as providing important channels through which monetary policy affects an economy viz., stock prices, real estate prices, and exchange rates. Transmission mechanisms of monetary policy involving the stock market are further classified into three types: stock market effects on investment, firm balance-sheet effects, and household liquidity effects. Stock market effects on investment works through Tobin's q theory that is, expansionary monetary policy raises stock prices, which raises Tobin-q (the market value of firms divided by the replacement cost of capital). This raises investment, thereby leading to an increase in aggregate demand and a rise in output. As regards the effect of monetary policy through firms' balance sheets and aggregate spending, the expansionary monetary policy causes a rise in stock prices, raises the net worth of firms, which reduces adverse selection, and moral hazard problems, and so leads to higher lending. Higher lending then leads to higher investment spending and aggregate spending. Finally, monetary policy transmission on stock prices also works through

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household liquidity effect. Expansionary monetary policy increases stock prices, which increases the value of financial assets, decreases the likelihood of financial distress, increases expenditure in consumer durables, increases spending in residential housing, and ultimately increases output (Mishkin, 2009).

One school of thought suggests that monetary policy should respond to asset prices only to the extent that asset prices impact on ultimate goals of monetary policy (Kohn, 2008). Yet others believe that asset price bubbles can have serious adverse macroeconomic consequences and hence, it is acceptable to have monetary policy affect the asset prices (Orphanides, 2010). Some researchers even view that central banks should not target and react to asset prices (Kohn, 2008). Ambiguity also lies in whether monetary policy could respond to asset prices directly or not.

Global financial crisis of 2007-08 offered lessons to central bankers that asset price reversals could have serious macroeconomic implications. History is full of examples in which large swings in stock, housing and exchange rate markets coincided with prolonged booms and busts (Cecchetti, Genberg, Lipsky, & Wadhwani, 2000). The 1920's boom and 1929 crash of stock market, and the 1980s Japanese asset bubble are two salient examples where asset price reversals were followed by protracted recessions and deflation (Bordo & Jeanne, 2002).

Asset price bubbles create distortions in investment and consumption activities, which then lead to extreme rise and then fall in both output and inflation, including instability in financial system (Cecchetti et al., 2000). Therefore, it is natural for central banks to view price stability and financial stability as highly complementary and mutually reinforcing objectives. In a world of efficient capital markets and without regulatory distortions, movements in asset prices simply reflect changes in underlying economic fundamentals (Bernanke & Gertler, 2000). Under these circumstances, central bankers would have no reason to concern themselves with asset price volatility per se. But non-fundamental factor like irrational behavior of investors also trigger asset market volatility. Though it is difficult to conclusively identify bubbles, episodes of irrational exuberance in asset markets are certainly a logical possibility. Moreover, boom-bust episodes seem to be more frequent in small countries than in large countries (Bordo & Jeanne, 2002).

Nepali economy is characterized as a small, partially open, and having a highly pronounced degree of openness and dependence towards India (Khatiwada, 1994). Furthermore, Nepali financial market comprises problems of inadequate legal frameworks, lower resources to regulator, lack of diversification in instruments, poor corporate governance practices, high transaction cost, and so forth (Adhikari, 2005). All these facts show that Nepali economy is undeveloped, constitutes frictions in credit market, and has imperfections or inefficiencies in capital markets. Hence, it provides some impetus for monetary authorities of Nepal to look at financial stability aspect of monetary policy and stock prices.

Even though disagreement might exist over what constitutes asset price bubbles and busts, episodes of irrational exuberance are clearly identifiable in Nepali context. Monetary policy announcements for fiscal year 2006/07 and 2015/16 were followed by growth in stock prices by 77 percent and 79 percent, respectively in 2006/07 and 2015/16, compared to the corresponding previous fiscal years. Stock prices also witnessed a decline of 36 percent in fiscal year 2009/10 vis-à-vis fiscal year 2008/09. Considering that stock prices as one of the channels of monetary policy transmission (Mishkin, 1995), its role in financial sector stability, and it manifesting bubbles and busts around the world including

Nepal, questions on the interrelationship between monetary policy and stock prices deserved to be empirically analyzed in the context of Nepal.

Empirical Literature

Rogalski and Vinso (1977) argued that the causality does not appear to go from money supply to stock prices, but rather such causality occurred from stock prices to money supply. Canto, Findlay and Reinganum (1983) concluded that the relationship between monetary policy variables and stock market is dependent on the existence of particular type of monetary system. A study of federal funds interest rate showed that interest rate on federal funds rate is extremely informative about future movements of real macroeconomic variables (Bernanke & Blinder, 1992). A study of reaction of monetary policy to the stock market by Rigobon and Sack (2003) found a significant monetary policy response to the stock market. Stock market movements were found to have a significant impact on short-term interest rates, driving them in the same direction as the change in stock prices. Ehrmann and Fratzscher (2004) presented evidence that individual stocks react in a highly heterogeneous fashion to U.S. monetary policy shocks. Bernanke and Kuttner (2005) analyzed the impact of changes in monetary policy on equity prices using federal funds futures data to gauge policy expectations. They found a relatively strong and consistent response of the stock market to unexpected monetary policy actions. Chen (2007) analyzing monetary policy and stock returns in VAR framework found a strong and negative effect of a contractionary monetary policy on stock returns. Results also indicated that effects of monetary policy were found to be much larger during bear market periods than during bull market periods. Gerlach (2010) argued that monetary policy has powerful effects on asset prices and also has important effects on real economic activity. The author suggested use of monetary policy tools only if banking and financial regulatory tools are ineffective. Budha (2015) found the existence of bank lending, interest rate, and asset price channels of monetary policy transmission in Nepal, though with some lags due to high information asymmetry, adjustment costs, and poor financial infrastructure.

Data and Methods

This study employed distributed lag and Vector Autoregressive (VAR) models to examine whether monetary policy variables affected stock prices or vice-versa, and mediation analysis to analyze the mediating role of stock prices between monetary policy variables and monetary policy goals.

Inter-bank interest rate, interest rate on T-bills, net domestic asset (domestic credit minus capital of banks and financial institutions), narrow money supply, broad money supply, and three dummy variables: monetary policy announcement, contractionary monetary policy, and expansionary monetary policy were considered as monetary policy variables.

Among the dummy variables, monetary policy announcement refers to the period when a new monetary policy is introduced/ published by Nepal Rastra Bank (the central bank of Nepal) or a mid-term review of the existing policy is done by Nepal Rastra Bank. For the 156 monthly observations covering 13 years, monetary policies have been introduced/ published in August for all fiscal years except for the fiscal year 2008/09, when it was done in October. And mid-term review of the preceding monetary policies was done in March for all fiscal years except for 2007/08, 2008/09 and 2009/10 when it was done in April of 2008, 2009, and 2010 respectively, and for fiscal 2011/12 it was done in February of 2012. Monetary policy for a fiscal year has been taken as expansionary, contractionary or stable based on mandatory cash reserve ratio, capital adequacy ratio, the stance of the monetary policy as specified in the policy document itself, and the bank rate or the interest rate charged by the central bank for lender of the last resort facility. An increase in cash reserve, capital adequacy ratio, and/or

bank rate vis-a-vis preceding monetary policy has been taken as contractionary monetary policy for the period, a decrease taken as expansionary monetary policy, and no changes considered as stable or balanced monetary policy. Fiscal years 2005/06, 2006/07, 2008/09, 2012/13, and 2014/15 were periods of contractionary monetary policies. Fiscal years 2003/04, 2004/05, 2011/12, 2013/14, and 2015/16 were periods of expansionary monetary policies, whereas fiscal year 2007/08 entailed period of balanced or stable monetary policy.

Stock price data was measured by index data. Since, the focus of the study was not in the performance of individual companies, index data has been taken instead of individual companies' prices, as in Bordo and Wheelock (2002). Moreover, Nepali stock market also constitutes nine sectoral indices viz. commercial banks, manufacturing and processing companies, hotels, hydropower companies, trading companies, insurance companies, finance companies, development banks, and other sector. Data on monthly and daily frequencies have also been analyzed for these sectoral indices. The study is based purely on published secondary data. Data sources include Ministry of Finance, Nepal Rastra Bank, and Nepal Stock Exchange Ltd's publications. To measure the variables in terms of growth, non-stationary variables at level form were changed to stationary with natural log transformation, taking first differences and multiplying by 100.

Among the eight monetary policy variables considered in the study, interest rate on treasury bills rate (91-days), inter-bank interest rate, and contractionary monetary policy variables were hypothesized to negatively affect stock prices. Net domestic asset, narrow money supply, broad money supply, and expansionary monetary policy variables were hypothesized to positively affect stock prices. No conclusive sign was hypothesized for monetary policy announcement, as its effect depended on information content.

Data were collected for three time frequencies: yearly, monthly, and daily. Yearly data covered the period from fiscal year 1994/95 to 2015/16, monthly data from August 2003 to July 2016, and daily data from 17 July 2007 to 14 July 2016, and were selected on basis of data availability.

Distributed lag model. Distributed lag models were estimated to analyze the causality from monetary policy variables to stock price variables. With lack of consensus on the relationship between monetary policy and asset prices, both on theoretical and empirical grounds, Koyck approach to distributed lag model was employed, which is devoid of any theoretical underpinning. The model was:

$$Y_t = c(1-\lambda) + B_1 TBR_t + B_2 IBR_t + B_3 GNDA_t + B_4 GNM_t + B_5 GBM_t + B_6 DUMA_t + B_7 DUMC_t + B_8 DUME_t + \lambda Y_{t-1} + V_t$$

Where,

Y = Stock price, measured by overall NEPSE index, and sectoral indices of NEPSE for monthly and daily data; TBR = Interest rate on Treasury bills (with maturity of 91 days) p.a.; IBR = Inter-bank interest rate p.a.;GNDA = Growth in net domestic asset; GNM = Growth in narrow money supply; GBM = Growth in broad money supply; DUMA = Dummy variable for monetary policy announcement, which takes "1" for the month corresponding to announcement of a new monetary policy for a fiscal year and mid-term review of the monetary policy for the fiscal year, and "0" else; DUMC = Dummy variable for contractionary/ tight monetary policy, which takes "1" for the month corresponding to prevalence of contractionary monetary policy, and "0" else. Contractionary monetary policy contracts the money supply and thus raises interest rates in an effort to restrain the economy (Case et al., 2012); DUME = Dummy variable for expansionary/liberal monetary policy, which takes

"1" for the month corresponding to prevalence of expansionary monetary policy, and "0" else. According to Case, Fair and Oster (2012), an expansionary monetary policy is the policy that expands money supply and thus lowers interest rates in an effort to stimulate the economy.

VAR analysis. VAR models are a kind of hybrid between univariate and structural time series models. Furthermore, as VARs are a-theoretical models, VAR system of equations has been employed without theoretical justification on the variables. Block Exogeneity Wald test was conducted to test Granger causality between monetary policy and stock price. Furthermore, to analyze the proportion of variation in regressand explained by regressors and to trace the effect of one time shock on endogenous variables, variance decomposition and impulse responses were computed following the Nepalese monetary policy framework in order of short-term interest rate (monetary policy instrument), net domestic asset (operating target), and money supply variables (intermediate target). Then, stock price followed money supply variables because asset price variables followed monetary policy variables in transmission mechanism of monetary policy. Lag length in VAR model was selected based on information criteria.

Mediation analysis. Mediation analysis was conducted following the methodology suggested by Rucker, Preacher, Tormala, and Petty (2011), and Aguinis, Edwards, and Bradley (2016). Mediation role of stock prices in monetary policy variables and monetary policy goals was analyzed with special focus on indirect effect rather than the step-wise fashion of Barron and Kenny (1986), and test statistic was compared with the confidence interval constructed by non-parametric statistic viz., 10,000 bootstrap samples.

Results

The results are first presented with annual frequency data, and are extended for monthly and daily data. Tables and figures are presented as annexure. Table I presents the sample size, minimum and maximum values, mean and standard deviations of the study variables with annual frequency data.

Results with Annual Data

The Pearson's correlation coefficients in Table II showed that interest rate variables had significant negative correlation with stock price, but positive with money supply.The time series plot of the variables in Figure 1 showed that interest rate on 91 days T-bills, inter-bank interest rate, overall NEPSE index, inflation rate, and GDP growth rate had cyclical trend. Net domestic asset, narrow money supply, and broad money supply had consistently risen over the period. All variables were tested for stationarity using KPSS and ADF tests. Interest rate on 91 days T-bills, inter-bank interest rate, inflation rate, and GDP growth rate variables were stationary at level. However, net domestic asset, narrow money supply, broad money supply, and overall NEPSE index were not stationary at level form. These variables were made stationary by taking first difference on their natural log transformation and multiplying by 100.

Distributed Lag Model

Results of distributed lag model, presented in Table III, showed that stock price was significantly affected by inter-bank interest rate. Other monetary policy variables were not found to significantly affect stock price. Moreover, inter-bank interest rate had only immediate impact. In short-run, 1 percent increase in inter-bank rate decreased growth in NEPSE index by 8.9 percent on average, ceteris paribus. Since, the coefficient of first lag of stock price (the dependent variable), the rate of decay, was

not statistically significant, nothing could be concluded on long-run causal effect of monetary policy on stock price.

VAR Analysis

The VAR output in Table IV showed that inter-bank interest rate, net domestic assets, and narrow money supply were significantly affected by stock prices. However, the result was inconsistent across different lags, in sign and significance. Stock price was also found to be significantly affected by inter-bank interest rate, net domestic assets, narrow money supply, broad money supply, and its own first lag. Among these variables, only broad money supply had consistently positive sign for both lags.

As reported in Table V, all monetary policy variables were found to Granger cause stock price, indicating unidirectional causality from monetary policy to stock price.

As presented in Table VI, over the 10 years' horizon, net domestic asset explained the largest variation in stock price (about 44 percent), followed by inter-bank interest rate (about 25 percent), narrow money supply (about 14 percent)and broad money supply (about 9 percent).

As presented in Figure 2, innovation in inter-bank interest rate, net domestic asset, narrow money supply, and broad money supply variables did not have impact on stock price variable. This impulse response result indicated that stock price was not responsive to monetary policy variables.

Mediation Analysis

Under mediation analysis, direct effect shows direct causal relationship of independent variable on dependent variable. Indirect effect shows causal relationship of independent variable on dependent variables through mediating variable. Total effect is the sum of direct and indirect effects. As presented in Table VII, none of the indirect effects was significant, which meant stock prices did not mediate monetary policy variables and monetary policy goals. This raised question on the presence of stock price channel of monetary policy transmission.

Results with Monthly Data

Similarly, models were estimated using monthly data. For analysis with distributed lag model, three dummy independent variables were added in monthly estimations; viz., dummy for monetary policy announcement (DUMA), dummy for contractionary monetary policy (DUMC), and dummy for expansionary monetary policy (DUME); and eight sectoral stock market indices viz., commercial banks, manufacturing and processing companies, hotels, other companies, trading companies, insurance companies, finance companies, and development banks were incorporated. Hydropower sector could not be incorporated in monthly analysis because of data unavailability for the estimation period.

Distributed lag model. As presented in Table VIII, overall NEPSE index was found to be significantly affected by inter-bank interest rate. Other monetary policy variables were found insignificant. Moreover, inter-bank interest rate had both short-run and long-run effects. Result indicated that 1 percent increase in inter-bank rate decreased growth in monthly NEPSE index by 0.44 percent. In the long-run, 1 percent increase in inter-bank interest rate would decrease growth of overall NEPSE index (measured monthly) by 0.54 percent. Similar effects were observed for insurance companies and development banks' indices as dependent variables, where both short and long-run coefficients of the independent variables were significant. Among the independent variables, inter-

bank interest rate had consistent significant negative effect on most stock price variables, in line with the hypothesized signs. All three dummy variables had negative impact on stock price.

VAR analysis. The VAR output in Table IX showed evidence on bi-directional causality; bidirectional effect between monetary policy variables and stock prices were observed. Furthermore, signs of inter-bank interest rate and narrow money supply were in line with the hypothesized signs.

As reported in Table X, both monetary policy variables viz., inter-bank interest rates and narrow money supply, and stock price were found to Granger cause each other, indicating bi-directional causality.

Mediation analysis. Similar to annual frequency data, result in Table XI showed that none of the indirect effects was significant. This meant asset price variables did not perform mediation role between monetary policy variables and monetary policy goals.

Results with Daily Data

Robustness of the results above were examined using daily data. However, unlike yearly and monthly frequencies, data on daily frequencies were only available for inter-bank interest rate and stock price variables. Distributed lag model with daily frequency data had also incorporated nine sectoral stock price indices viz., commercial banks, manufacturing and processing companies, hotels, other companies, hydropower companies, trading companies, insurance companies, finance companies, and development banks, along with overall stock price index.

Distributed lag model. Table XII showed that overall NEPSE index was significantly affected by inter-bank interest rate. Moreover, inter-bank interest rate had both short-run and long-run effect on overall NEPSE index. A 1 percent increase in inter-bank rate decreased growth in daily NEPSE index by 0.02 percent. In the long-run, 1 percent increase in inter-bank rate decreased growth of overall NEPSE index (measured at daily interval) by 0.03 percent. Inter-bank interest rate had consistent significant negative impact on several measures of stock price indices.

VAR analysis. As presented in VAR output of Table XIII, inter-bank interest rate was significantly affected by itself (both first and second lags) and by first lag of overall stock price index. The sign of stock price variable was negative, whereas of lags of inter-bank interest rate were positive. Though overall model was significant, the signs on lagged NEPSE variables were not consistent.

As presented in Table XIV, the stock price index had been found to Granger cause inter-bank interest rate. However, monetary policy variable had not Granger caused stock price, indicating unidirectional causality from stock price to monetary policy variable.

Discussion

The study presented a mixed evidence of causal relationship between monetary policy and stock prices in Nepali context. Although no consistency was observed in significance of coefficients of monetary policy variables across different models and different data frequency (yearly, monthly, and daily); but it was found that inter-bank rate and stock prices moved in opposite direction. Interest rate was found to affect stock price negatively. This finding is similar to the findings of previous studies viz., Jensen and Johnson (1993), and Rigobon and Sack (2002). This finding revealed significance of short-term interest rate in explaining stock price movements. Probably considering such importance of short-term interest rate, specifically the inter-bank interest rate, Nepal Rastra Bank implemented interest rate

corridor from fiscal year 2016/17, where inter-bank interest rate was a major determinant in setting the lower and upper bounds of the interest rate corridor.

Money supply variables, both narrow and broad, indicated significant positive effects on stock price. This finding was observed in previous studies, viz., Darrat (1987). Such significance of money supply variable in explaining asset price variables is to be noted in light of monetary policy framework of Nepal, where money supply variable (specifically, broad money supply) is considered as an intermediate target of monetary policy. Each monetary policy in Nepal has been setting some specific targets for broad money supply. For instance, monetary policy for fiscal year 2016/17 had set broad money supply growth of 17 percent.

Dummy variables for monetary policy have been found to exert negative effect on stock price indices of "others" sector, finance companies, and development banks. This result is in line with the findings of Ehrmann and Fratzcher (2004), where a strong industry-specific effect of monetary policy and Chen (2007), where a strong and negative effect of contractionary monetary policy on stock returns were reported. The sign of contractionary monetary policy was in line with the negative hypothesized sign. Monetary policy announcements connoted negative information about stock prices. Such significant asymmetrical effects of monetary policy announcement and contractionary monetary policy on certain sectors of stock market made sense considering the fact that there had been cases of below satisfactory corporate governance practices in development banks and finance companies viz., Nepal Development Bank Ltd., United Development Bank Ltd., Gurkha Development Bank Ltd., Corporate Development Bank Ltd., Samjhana Finance Company Ltd., Nepal Share Market and Finance Ltd., and so forth. Since it was quite natural that bad news travelled fast, monetary policy announcement (with negative information content) and contractionary monetary policy had negatively affected stock prices of development banks and finance companies, and so had stock price of "others" sectors because it was a highly concentrated sector with only one company, Nepal Doorsanchar Company (Nepal Telecom), and was also hugely capitalized.

Overall, the study reported bi-directional causality between monetary policy and stock price. This finding was similar to the findings of Rogalski and Vinso (1977), and Rigobon and Sack (2003). This showed that monetary policy authorities in Nepal took into account the development in stock market while devising monetary policy, which was also in accordance with their mandate to maintain financial stability - stipulated as an objective in Nepal Rastra Bank Act, 2002.

Findings also suggested that asset prices did not mediate the relationship between monetary policy variables and monetary policy goals. This showed that monetary policy transmission through asset prices was weak or non-existent in the context of Nepal, unlike in Mishkin (2001), and Singh and Pattanaik (2012). The reason for such insignificant mediating role of asset prices might be due to typical features of Nepali economy viz., small, underdeveloped, frictions in credit market, very few financial instruments, domination of banks in financial system, profound dependency on a single country, fixed exchange rate regime, and so forth. Moreover, studies by Canto et al. (1983) and Kaul (1990) have also presented evidence that the relationship between monetary policy, asset prices, and policy goal depended on monetary policy regime and system.

Implications and Future Research Directions

This study was expected to improve understanding of relation between stock price and monetary policy. It found evidence of causal relationship from monetary policy to asset prices which implied that policy makers needed to consider monetary policy variables in order to maintain financial sector

stability. A positive relationship of narrow money supply and broad money supply with stock prices indicated the need for policy makers to be careful in influencing money supply in order to contain stock prices.

Assets prices, specifically stock prices, didn't mediate relationship between monetary policy variables and monetary policy goals. This indicates the need for policy makers to focus on other channels of monetary policy transmission mechanism in order to achieve the goals of monetary policies.

This study did not find evidence for mediating role of stock prices or the transmission mechanism of monetary policy involving asset prices, unlike studies of Mishkin (2001), and Singh and Pattanaik (2012). Since monetary policy can also be transmitted through other channels, except those involving asset prices, future studies can be directed towards testing for existence of credit and interest channels of monetary transmission, in Nepali context.

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ANNEXURES

Table 1

Descriptive Statistics

	N Statistic	Minimum Statistic	Maximum Statistic	Mean Statistic	S.D. Statistic
TBR	22	0.1	10.9	4.1	2.9
IBR	22	0.2	9.3	4.1	2.6
NDA	22	43,899.20	1,288,556.50	384,611.00	378,922.40
NM	22	32,985.40	503,287.10	162,533.70	134,318.40
BM	22	80,984.70	2,244,578.60	614,308.60	625,051.60
NEPSE	22	163.4	1,718.20	492.5	387.6
INF	22	2.5	12.6	7.4	2.8
GDPG	22	-	6.1	3.9	1.6

Note. S.D. = standard deviation; S.E. = standard error; INF = inflation measured by growth in consumer price index in percentages; GDPG = growth in real gross domestic product at basic price in percentages. Data source for TBR, IBR, NDA, NM, BM, and INF is Nepal Rastra Bank (the central bank of Nepal), and for NEPSE is Nepal Stock Exchange Ltd.

Table 2

Correlation Matrix

	TBR	IBR	NDA	NM	BM	NEPSE	INF	GDPG
TBR								
IBR	.97**							
NDA	-.57**	-.47*						
NM	-.56**	-.47*	.99**					
BM	-.58**	-.50*	.99**	.99**				
NEPSE	-.49*	-.46*	.81**	.84**	.83**			
INF	0.02	0.05	0.40	0.40	0.38	0.31		
GDPG	0.26	0.22	-0.26	-0.30	-0.29	-0.28	0.02	

Note: ** p <. 01, * p < .05

Table 3

Estimates of Relations between Monetary Policy and Stock Price: Distributed Lag Model

	GNEPSE
Constant	50.19
	(2.08)*
IBR_t	-8.90
	(-4.90)***
$GNDA_t$	0.55
	(0.80)
GNM_t	-1.74
	(-0.75)
GBM_t	0.33
	(0.22)
$GNEPSE_{t-1}$	0.29
	(0.84)
Adjusted R^2	0.24
F- statistic	7.87***

Notes: GNEPSE = growth of NEPSE index in percentages. TBR variable has been dropped in order to address multicollinearity with IBR.

$$\boldsymbol{GNEPSE_t = C(1-\lambda) + \beta_1 IBR_t + \beta_2 GNDA_t + \beta_3 GNM_t + \beta_4 GBM_t + \lambda GNEPSE_{t-1} + V_t}$$

*, **, and *** indicates significance at the 10, 5, and 1 percent level respectively.t-statistics are in ( ).

Table 4

Estimates of Relations between Monetary Policy and Stock Price: VAR Model

	IBR	GNDA	GNM	GBM	GNEPSE
Constant	-3.34	7.42	12.21	14.70	155.25
	(-2.14)*	(1.22)	(3.05)**	(2.01)*	(8.66)***
IBR(-1)	0.42	1.69	-1.15	0.75	6.24
	(1.30)	(1.44)	(-1.55)	(0.49)	(2.05)*
IBR(-2)	-0.05	-0.21	0.14	-0.09	-10.28
	(-0.33)	(-0.31)	(0.27)	(-0.10)	(-3.99)***
GNDA(-1)	0.16	-0.17	0.62	0.36	-3.32
	(1.47)	(-0.52)	(2.38)**	(0.63)	(-3.03)**
GNDA(-2)	-0.01	-0.10	0.56	0.22	-5.22
	(-0.05)	(-0.39)	(2.22)*	(0.62)	(0.01)***
GNM(-1)	0.30	0.90	-0.13	-0.21	-6.22
	(3.32)**	(2.68)**	(-0.54)	(-0.43)	(0.01)***
GNM(-2)	0.23	-0.35	-0.43	-0.67	-5.79
	(1.95)*	(-0.96)	(-1.72)	(-1.28)	(0.01)***
GBM(-1)	-0.09	-0.01	-0.37	-0.08	5.40
	(-0.72)	(-0.01)	(-1.25)	(-0.12)	(0.01)***
GBM(-2)	-0.15	0.01	-0.12	0.11	5.28
	(-3.79)***	(0.03)	(-1.03)	(0.59)	(0.01)***
GNEPSE(-1)	0.01	0.06	0.05	0.05	-0.35
	(0.45)	(2.73)**	(2.07)*	(1.12)	(-2.68)**
GNEPSE(-2)	-0.02	-0.04	0.04	0.01	0.26
	(-2.15)*	(-0.88)	(1.10)	(0.03)	(1.54)
Adjusted R^2	0.51	-0.54	0.10	-0.64	0.68
F-statistic	67.75***	5.20***	33.95***	2.82*	115.54***

Note. The VAR equation is:

$$IBR_t = C + \beta_1 IBR_{t-1} + \beta_2 IBR_{t-2} + \beta_3 GNDA_{t-1} + \beta_4 GNDA_{t-2} + \beta_5 GNM_{t-1} + \beta_6 GNM_{t-2} + \beta_7 GBM_{t-1} + \beta_8 GBM_{t-2} + \beta_9 GNEPSE_{t-1} + \beta_{10} GNEPSE_{t-2} + U_t$$

$$GNDA_t = C + \beta_1 IBR_{t-1} + \beta_2 IBR_{t-2} + \beta_3 GNDA_{t-1} + \beta_4 GNDA_{t-2} + \beta_5 GNM_{t-1} + \beta_6 GNM_{t-2} + \beta_7 GBM_{t-1} + \beta_8 GBM_{t-2} + \beta_9 GNEPSE_{t-1} + \beta_{10} GNEPSE_{t-2} + U_t$$

$$GNM_t = C + \beta_1 IBR_{t-1} + \beta_2 IBR_{t-2} + \beta_3 GNDA_{t-1} + \beta_4 GNDA_{t-2} + \beta_5 GNM_{t-1} + \beta_6 GNM_{t-2} + \beta_7 GBM_{t-1} + \beta_8 GBM_{t-2} + \beta_9 GNEPSE_{t-1} + \beta_{10} GNEPSE_{t-2} + U_t$$

$$GBM_t = C + \beta_1 IBR_{t-1} + \beta_2 IBR_{t-2} + \beta_3 GNDA_{t-1} + \beta_4 GNDA_{t-2} + \beta_5 GNM_{t-1} + \beta_6 GNM_{t-2} + \beta_7 GBM_{t-1} + \beta_8 GBM_{t-2} + \beta_9 GNEPSE_{t-1} + \beta_{10} GNEPSE_{t-2} + U_t$$

$$GNEPSE_t = C + \beta_1 IBR_{t-1} + \beta_2 IBR_{t-2} + \beta_3 GNDA_{t-1} + \beta_4 GNDA_{t-2} + \beta_5 GNM_{t-1} + \beta_6 GNM_{t-2} + \beta_7 GBM_{t-1} + \beta_8 GBM_{t-2} + \beta_9 GNEPSE_{t-1} + \beta_{10} GNEPSE_{t-2} + U_t$$

*, **, and *** indicates significance at the 10, 5, and 1 percent level respectively. t-statistics in ( ).

Table 5

Granger Causality Test of Monetary Policy and Stock Price: VAR Model

Dependent Variable: IBR					
Excluded	GNDA	GNM	GBM	GNEPSE	All
Chi-sq	1.74	6.35	1.69	1.46	21.07
Df	2	2	2	2	8
Prob.	0.42	0.04	0.43	0.48	0.01
Dependent Variable: GNDA					
Excluded	IBR	GNM	GBM	GNEPSE	All
Chi-sq	0.47	0.98	0.01	0.57	3.22
Df	2	2	2	2	8
Prob.	0.79	0.61	1.00	0.75	0.92
Dependent Variable: GNM					
Excluded	IBR	GNDA	GBM	GNEPSE	All
Chi-sq	0.57	1.67	0.42	1.81	9.80
Df	2	2	2	2	8
Prob.	0.75	0.43	0.81	0.41	0.28
Dependent Variable: GBM					
Excluded	IBR	GNDA	GNM	GNEPSE	All
Chi-sq	0.06	0.13	0.54	0.24	2.91
Df	2	2	2	2	8
Prob.	0.97	0.94	0.76	0.89	0.94
Dependent Variable: GNEPSE					
Excluded	IBR	GNDA	GNM	GBM	All
Chi-sq	6.94	5.25	19.05	14.64	39.14
Df	2	2	2	2	8
Prob.	0.03	0.07	0.01	0.01	0.01

Note. Chi-sq = chi-square; df = degrees of freedom; Prob. = probability.

Table 6

Variance Decomposition of Stock Price

Period	S.E.	IBR	GNDA	GNM	GBM	GNEPSE
1	1.48	0.01	50.36	16.84	0.08	32.72
2	2.11	1.61	39.75	21.10	17.10	20.43
3	2.37	25.51	33.77	12.22	17.01	11.49
4	2.66	18.25	46.80	14.10	10.76	10.09
5	2.67	20.54	43.93	15.76	10.11	9.66
6	2.75	25.45	40.04	14.30	10.99	9.22
7	2.89	21.93	45.36	14.55	9.37	8.79
8	2.94	23.93	43.97	14.40	9.11	8.60
9	2.95	25.80	42.56	13.84	9.18	8.63
10	3.01	24.64	44.13	14.13	8.61	8.48

Table 7

Summary of Mediation Analysis

Models	Independent Variable	Mediation Variables	Dependent Variable	Direct Effect	Indirect Effect	Total Effect
1	IBR	GNEPSE	INF	Insignificant	Insignificant	Insignificant
2	GNDA	GNEPSE	INF	Insignificant	Insignificant	Insignificant
3	GNM	GNEPSE	INF	Insignificant	Insignificant	Insignificant
4	GBM	GNEPSE	INF	Significant*	Insignificant	Significant*
5	IBR	GNEPSE	GDPG	Significant**	Insignificant	Insignificant
6	GNDA	GNEPSE	GDPG	Significant*	Insignificant	Significant*
7	GNM	GNEPSE	GDPG	Insignificant	Insignificant	Insignificant
8	GBM	GNEPSE	GDPG	Significant*	Insignificant	Significant*

*Note.**, and ** indicates significance at the 10, and 5 percent level respectively.

Table 8

Estimates of Relations between Monetary Policy and Stock Price: Distributed Lag Model (Monthly)

	Regressands								
	GNEPSE	GCB	GMP	GH	GO	GT	GI	GFC	GDB
Constant	3.73	3.60	2.13	4.24	3.25	1.61	3.49	8.71	7.12
	(1.45)	(1.19)	(1.08)	(1.57)	(1.65)	(0.81)	(1.75)*	(3.69)***	(1.61)
IBR_t	-0.44	-0.52	-0.10	-0.28	-0.34	0.17	-0.50	-0.58	-0.60
	(-2.78)***	(-2.50)**	(-0.80)	(-2.31)**	(-1.55)	(0.99)	(-2.73)***	(-3.93)***	(-3.38)***
$GNDA_t$	0.34	0.34	-0.34	0.12	0.45	-0.25	-0.04	0.65	-0.01
	(1.31)	(0.94)	(-1.22)	(0.50)	(1.71)*	(-0.63)	(-0.13)	(1.56)	(-0.03)
GNM_t	0.07	-0.02	-0.28	0.01	0.30	0.12	-0.24	0.11	-0.01
	(0.41)	(-0.10)	(-2.82)***	(0.04)	(1.49)	(0.98)	(-1.36)	(0.95)	(-0.05)
GBM_t	-0.39	-0.28	0.62	-0.59	-0.79	0.16	0.33	-0.82	0.17
	(-0.82)	(-0.46)	(1.47)	(-1.56)	(-1.51)	(0.37)	(0.60)	(-1.75)*	(0.32)
$DUMA_t$	-0.56	0.07	0.02	0.19	-2.86	-0.64	0.10	0.02	-2.86
	(-0.42)	(0.01)	(0.02)	(0.19)	(-2.27)**	(-0.53)	(0.08)	(0.02)	(-1.89)*
$DUMC_t$	-1.82	-1.58	-0.13	-1.75	-0.98	-1.77	-1.06	-7.18	-4.89
	(-0.81)	(-0.57)	(-0.07)	(-0.72)	(-0.57)	(-0.83)	(-0.59)	(-3.03)***	(-1.14)
$DUME_t$	-0.50	0.08	-0.32	-1.18	0.20	-1.63	1.31	-5.66	-4.13
	(-0.21)	(0.03)	(-0.16)	(-0.48)	(0.09)	(-0.74)	(0.63)	(-2.57)**	(-0.96)
1st lag of	0.18	0.06	-0.14	0.14	0.03	-0.04	0.13	0.11	0.34
regressands	(1.78)*	(0.57)	(-1.16)	(1.13)	(0.48)	(-0.31)	(1.67)*	(0.72)	(4.76)***
Adjusted R^2	0.07	0.01	0.01	0.03	0.01	-0.02	0.09	0.21	0.18
F- statistic	4.86***	2.62**	1.34	3.05***	3.12***	0.34	3.37***	7.44***	6.14***

Note. The table reports distributed lag OLS regression of growth of asset price variables: GNEPSE, growth of commercial bank's index in percentages (GCB), growth of manufacturing companies' index in percentages (GMP), growth of hotel sector's index in percentages (GH), growth of other sector's index in percentages (GO), growth of trading companies' index in percentages (GT), growth of insurance companies' index in percentages (GI), growth of finance companies' index in percentages (GFC), and growth of development bank's index in percentages (GDB) on monetary policy variables: IBR, GNDA, GNM, GBM, DUMA, DUMC, and DUME.

$$GNEPSE_t = C(1-\lambda) + \beta_1 IBR_t + \beta_2 GNDA_t + \beta_3 GNM_t + \beta_4 GBM_t + \beta_5 DUMA_t + \beta_6 DUMC_t + \beta_7 DUMC_t + \lambda GNEPSE_{t-1} + V_t$$
$$GCB_t = C(1-\lambda) + \beta_1 IBR_t + \beta_2 GNDA_t + \beta_3 GNM_t + \beta_4 GBM_t + \beta_5 DUMA_t + \beta_6 DUMC_t + \beta_7 DUMC_t + \lambda GCB_{t-1} + V_t$$
$$GMP_t = C(1-\lambda) + \beta_1 IBR_t + \beta_2 GNDA_t + \beta_3 GNM_t + \beta_4 GBM_t + \beta_5 DUMA_t + \beta_6 DUMC_t + \beta_7 DUMC_t + \lambda GMP_{t-1} + V_t$$
$$GH_t = C(1-\lambda) + \beta_1 IBR_t + \beta_2 GNDA_t + \beta_3 GNM_t + \beta_4 GBM_t + \beta_5 DUMA_t + \beta_6 DUMC_t + \beta_7 DUMC_t + \lambda GH_{t-1} + V_t$$
$$GO_t = C(1-\lambda) + \beta_1 IBR_t + \beta_2 GNDA_t + \beta_3 GNM_t + \beta_4 GBM_t + \beta_5 DUMA_t + \beta_6 DUMC_t + \beta_7 DUMC_t + \lambda GO_{t-1} + V_t$$
$$GT_t = C(1-\lambda) + \beta_1 IBR_t + \beta_2 GNDA_t + \beta_3 GNM_t + \beta_4 GBM_t + \beta_5 DUMA_t + \beta_6 DUMC_t + \beta_7 DUMC_t + \lambda GT_{t-1} + V_t$$
$$GI_t = C(1-\lambda) + \beta_1 IBR_t + \beta_2 GNDA_t + \beta_3 GNM_t + \beta_4 GBM_t + \beta_5 DUMA_t + \beta_6 DUMC_t + \beta_7 DUMC_t + \lambda GI_{t-1} + V_t$$
$$GFC_t = C(1-\lambda) + \beta_1 IBR_t + \beta_2 GNDA_t + \beta_3 GNM_t + \beta_4 GBM_t + \beta_5 DUMA_t + \beta_6 DUMC_t + \beta_7 DUMC_t + \lambda GFC_{t-1} + V_t$$
$$GDB_t = C(1-\lambda) + \beta_1 IBR_t + \beta_2 GNDA_t + \beta_3 GNM_t + \beta_4 GBM_t + \beta_5 DUMA_t + \beta_6 DUMC_t + \beta_7 DUMC_t + \lambda GDB_{t-1} + V_t$$

*, **, and *** indicates significance at the 10, 5, and 1 percent level respectively. t-statistics are in ( ).

Table 9

Estimates of Relations between Monetary Policy and Stock Price: VAR Model (Monthly)

	IBR	GNDA	GNM	GBM	GNEPSE
Constant	0.81	1.20	2.50	1.13	3.24
	(4.50)***	(2.40)**	(7.53)***	(3.34)***	(4.18)***
IBR(-1)	0.82	0.08	-0.16	0.05	-0.56
	(19.26)***	(0.65)	(-2.42)**	(0.57)	(-4.32)***
GNDA(-1)	0.15	-0.06	-0.19	-0.12	0.02
	(1.70)*	(-0.66)	(-1.31)	(-1.73)*	(0.05)
GNM(-1)	0.05	-0.01	-0.13	-0.02	0.33
	(1.57)	(-0.26)	(-1.72)*	(-0.87)	(2.33)**
GBM(-1)	-0.33	-0.02	-0.17	0.20	-0.57
	(-2.81)***	(-0.12)	(-0.79)	(1.79)*	(-1.16)
GNEPSE(-1)	-0.04	0.04	-0.12	0.03	0.20
	(-2.07)**	(0.83)	(-3.30)***	(0.78)	(2.08)**
Adjusted R^2	0.76	-0.01	0.12	-0.01	0.11
F-statistic	93.11***	1.18	12.67***	0.92	9.62***

Note. The VAR equation is:

$$IBR_t = C + \beta_1 IBR_{t-1} + \beta_2 GNDA_{t-1} + \beta_3 GNM_{t-1} + \beta_4 GBM_{t-1} + \beta_5 GNEPSE_{t-1} + U_t$$
$$GNDA_t = C + \beta_1 IBR_{t-1} + \beta_2 GNDA_{t-1} + \beta_3 GNM_{t-1} + \beta_4 GBM_{t-1} + \beta_5 GNEPSE_{t-1} + U_t$$
$$GBM_t = C + \beta_1 IBR_{t-1} + \beta_2 GNDA_{t-1} + \beta_3 GNM_{t-1} + \beta_4 GBM_{t-1} + \beta_5 GNEPSE_{t-1} + U_t$$
$$GNM_t = C + \beta_1 IBR_{t-1} + \beta_2 GNDA_{t-1} + \beta_3 GNM_{t-1} + \beta_4 GBM_{t-1} + \beta_5 GNEPSE_{t-1} + U_t$$
$$GNEPSE_t = C + \beta_1 IBR_{t-1} + \beta_2 GNDA_{t-1} + \beta_3 GNM_{t-1} + \beta_4 GBM_{t-1} + \beta_5 GNEPSE_{t-1} + U_t$$

*, **, and *** indicates significance at the 10, 5, and 1 percent level respectively. t-statistics in ( ).

Table 10

Granger Causality Test of Monetary Policy and Stock Price: VAR Model (Monthly)

Dependent Variable: IBR					
Excluded	GNDA	GNM	GBM	GNEPSE	All
Chi-sq	4.33	1.48	8.31	6.23	14.42
Df	1	1	1	1	4
Prob.	0.04	0.22	0.01	0.01	0.01
Dependent Variable: GNDA					
Excluded	IBR	GNM	GBM	GNEPSE	All
Chi-sq	0.99	0.03	0.01	1.74	2.32
df	1	1	1	1	4
Prob.	0.32	0.87	0.92	0.19	0.68
Dependent Variable: GNM					
Excluded	IBR	GNDA	GBM	GNEPSE	All
Chi-sq	3.05	1.35	0.43	9.63	18.57
df	1	1	1	1	4
Prob.	0.08	0.25	0.51	0.01	0.01
Dependent Variable: GBM					
Excluded	IBR	GNDA	GNM	GNEPSE	All
Chi-sq	1.14	1.69	0.18	1.96	3.98
df	1	1	1	1	4
Prob.	0.29	0.19	0.67	0.16	0.41
Dependent Variable: GNEPSE					
Excluded	IBR	GNDA	GNM	GBM	All
Chi-sq	8.70	0.01	3.57	1.21	12.61
df	1	1	1	1	4
Prob.	0.01	0.96	0.06	0.27	0.01

Table 11

Summary of Mediation Analysis (Monthly)

Models	Independent Variable	Mediation Variables	Dependent Variable	Direct Effect	Indirect Effect	Total Effect
1	IBR	GNEPSE	INF	Insignificant	Insignificant	Insignificant
2	GNDA	GNEPSE	INF	Insignificant	Insignificant	Insignificant
3	GNM	GNEPSE	INF	Insignificant	Insignificant	Insignificant
4	GBM	GNEPSE	INF	Insignificant	Insignificant	Insignificant
5	DUMA	GNEPSE	INF	Significant***	Insignificant	Significant***
6	DUMC	GNEPSE	INF	Insignificant	Insignificant	Insignificant
7	DUME	GNEPSE	INF	Insignificant	Insignificant	Insignificant

Note. * and *** indicates significance at the 10 and 1 percent level respectively.

Table 12

Estimates of Relations between Monetary Policy and Stock Price: Distributed Lag Model (Daily)

	Regressands									
	GNEPSE	GCB	GMP	GH	GO	GHY	GT	GI	GFC	GDB
Constant	0.10	0.10	0.12	0.15	0.08	0.10	-0.02	0.21	0.12	0.16
	(2.70)***	(1.85)*	(4.14)***	(3.05)***	(1.07)	(1.87)*	(-0.80)	(4.41)***	(3.77)***	(3.60)***
IBR_t	-0.02	-0.02	-0.01	-0.01	-0.02	-0.02	0.01	-0.03	-0.03	-0.03
	(-2.64)***	(-1.88)*	(-1.33)	(-1.94)*	(-1.89)*	(-1.52)	(1.23)	(-4.29)***	(-4.02)***	(-3.28)***
First lag of	0.25	0.25	0.11	0.07	-0.24	0.23	0.07	0.26	0.10	0.24
Regressands	(8.22)***	(7.54)***	(3.16)***	(2.36)**	(-1.46)	(6.18)***	(2.60)***	(7.72)***	(1.34)	(4.02)***
Adjusted R^2	0.07	0.06	0.01	0.01	0.05	0.06	0.01	0.08	0.02	0.07
F- statistic	39.24***	30.77***	5.95***	3.98**	2.41*	19.81***	4.70***	39.50***	17.56***	31.90***

Note. GHY = Growth of hydropower companies' index in percentages (GHY).

$$GNEPSE_t = C(1-\lambda) + \beta_1 GIBR_t + \lambda GNEPSE_{t-1} + V_t$$
$$GCB_t = C(1-\lambda) + \beta_1 GIBR_t + \lambda GCB_{t-1} + V_t$$
$$GMP_t = C(1-\lambda) + \beta_1 GIBR_t + \lambda GMP_{t-1} + V_t$$
$$GH_t = C(1-\lambda) + \beta_1 GIBR_t + \lambda GH_{t-1} + V_t$$
$$GO_t = C(1-\lambda) + \beta_1 GIBR_t + \lambda GO_{t-1} + V_t$$
$$GHY_t = C(1-\lambda) + \beta_1 GIBR_t + \lambda GHY_{t-1} + V_t$$
$$GT_t = C(1-\lambda) + \beta_1 GIBR_t + \lambda GT_{t-1} + V_t$$
$$GI_t = C(1-\lambda) + \beta_1 GIBR_t + \lambda GI_{t-1} + V_t$$
$$GFC_t = C(1-\lambda) + \beta_1 GIBR_t + \lambda GFC_{t-1} + V_t$$
$$GDB_t = C(1-\lambda) + \beta_1 GIBR_t + \lambda GDB_{t-1} + V_t$$

*, **, and *** indicates significance at the 10, 5, and 1 percent level respectively. t-statistics are in ( ).

Table 13

Estimates of Relations between Monetary Policy and Stock Price: VAR Model (Daily)

	IBR	GNEPSE
Constant	0.06	0.11
	(3.54)***	(2.60)***
IBR(-1)	0.85	-0.03
	(12.86)***	(-0.73)
IBR(-2)	0.14	0.08
	(2.11)**	(0.19)
GNEPSE(-1)	-0.03	0.28
	(-2.61***	(7.79)***
GNEPSE(-2)	0.01	-0.12
	(0.24)	(-3.33)***
Adjusted R^2	0.96	0.08
F-statistic	9439.74***	18.93***

Note. The VAR equation is:

$$IBR_t = C + \beta_1 IBR_{t-1} + \beta_2 IBR_{t-2} + \beta_3 GNEPSE_{t-1} + \beta_4 GNEPSE_{t-2} + U_t$$
$$GNEPSE_t = C + \beta_1 IBR_{t-1} + \beta_2 IBR_{t-2} + \beta_3 GNEPSE_{t-1} + \beta_4 GNEPSE_{t-2} + U_t$$

*, **, and *** indicates significance at the 10, 5, and 1 percent level respectively. t-ratios are in ( ).

Table 14

Granger Causality Test of Monetary Policy and Stock Price: VAR Model (Daily)

Dependent Variable: IBR	
Excluded	GNEPSE
Chi-sq	5.306554
df	2
Prob.	0.0704
Dependent Variable: GNEPSE	
Excluded	IBR
Chi-sq	0.285357
Df	2
Prob.	0.8670

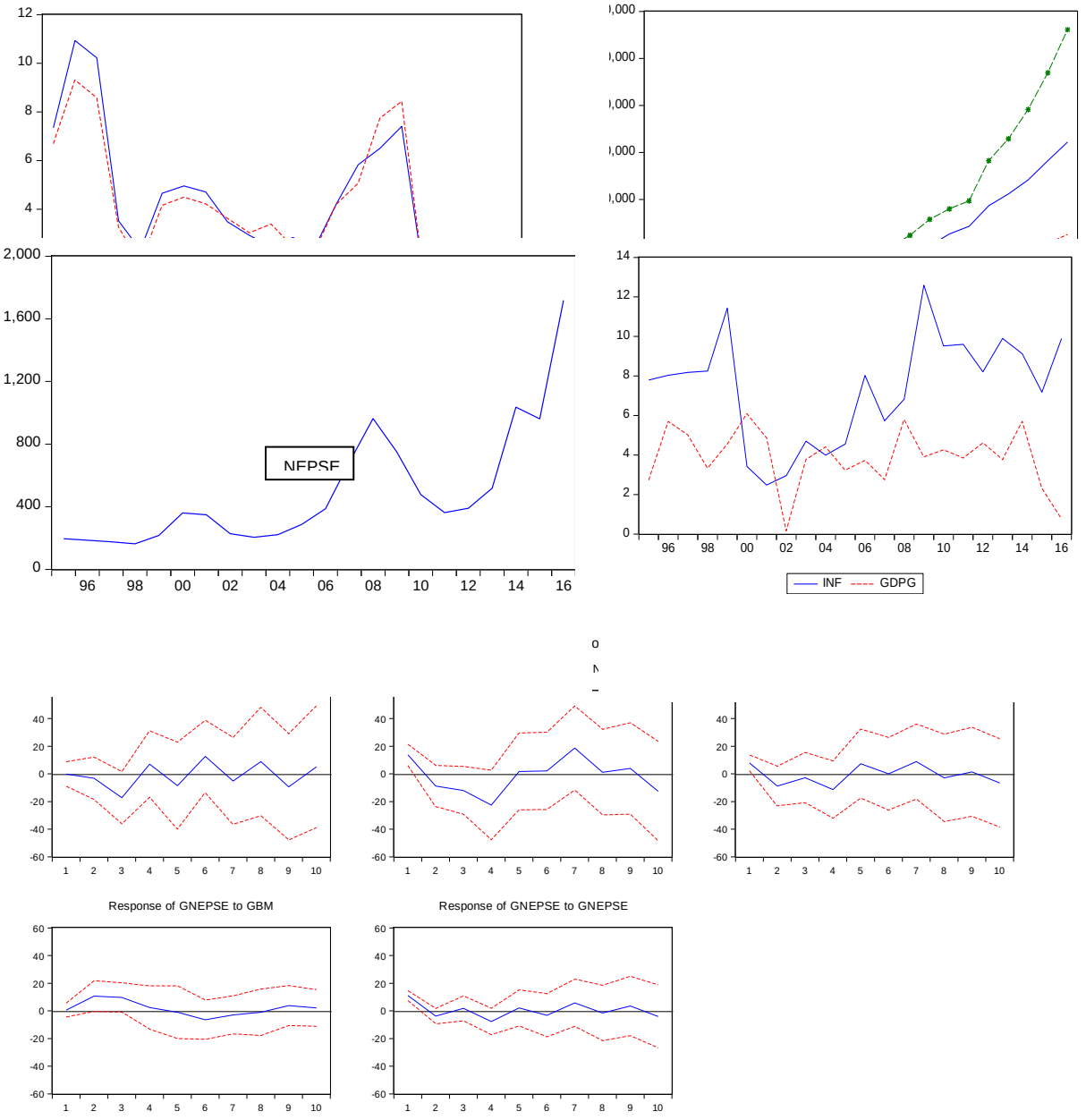

Figure 2. Impulse response of stock price.