Macroeconomic Determinants of Stock Index: A Study of NEPSE

Prakash Pandey¹

Abstract

This research, conducted to examine the macroeconomic determinants of the stock index of Nepal, has applied the Engle-Granger cointegration to test the long-run relationship with two controlled variables political stability index and capital mobilization through the primary market-the error correction model to determine the short-run relationship, and the Granger-causality test with lag 2 to check the causality of the variables. The data were collected from the secondary source from the years 1998 to 2020 with a sample size of n = 22 years. In the long run, broad money supply, interest rate, exchange rate, gross national income, political stability index, and capital mobilization through the primary market had statistically significant relationships with the NEPSE index; however, the relationship became positive only with the broad money supply, political stability index, and capital mobilization through primary market. Although the relationship became negative with the inflation rate, it was insignificant in the long run. In the short run, all the variables became statistically significant except for the exchange rate. The coefficient of error correction term (-1.0396) indicates that the deviation converges at the rate of 103.96% every year. The Granger-causality test showed no much stronger relationship among the variables: a unidirectional causality from broad money supply to the NEPSE index, a bidirectional causality in the case of capital mobilization through the primary market and NEPSE index, a bidirectional causality from GNI to NEPSE index, and NEPSE index not granger causing GNI.

Keywords: NEPSE, capital mobilization through primary market, granger causality

Introduction

With the development of a free market economy, the stock market has been developed world widely that fostering the mobilization of capital from the surplus to deficit sectors directly. The direct transfer of funds indicates that the investors of the stock market have a direct claim on the income and assets of the company (Saunders & Cornett, 2012). Stock market development and economic growth are related directly since they fulfill the financial requirements for the corporations and the government as well. Moreover, the economic growth also affects the development of the stock market.

The stock market is one of the components of the capital market, which provides the portion of ownership of issuing companies. Based on the creation and trading of securities, the stock market can be categorized as a primary and secondary market. The primary market ensures the mobilization of capital from surplus to deficit sectors whereas the secondary market provides a liquidity facility to the investors where the securities issued in the primary market as traded among the investors (Saunders & Cornett, 2012).

¹ Pandey is M.A. scholar of Economics at Ratna Rajyalaxmi Campus Email: pandeyprakash1010@gmail.com

A stock market index is calculated by dividing the market capitalization of the current period by the base period and then multiplying by the base year index. Market capitalization is calculated using the market price of the securities listed in the stock market and the number of securities issued in the stock market. Thus, the stock index is based on the stock price movement and number of the securities however, several factors affect the stock prices of the securities (Bodie, Kane, & Marcus, 2014).

A stock market index is a leading indicator of an economy which is mainly determined by the macroeconomic and company-specific determinants. The macroeconomic determinants mainly focus on money supply, interest rate, gross domestic product, inflation, etc. whereas the company-specific determinants include earning, dividend capacity, etc. In addition to this political stability, rule of law, government effectiveness, etc. also play an important role in determining the stock market index (Metadeen, 2019).

The full-fledged stock market in Nepal started only on January 13, 1994. The liberalization policy adopted in the 1990s boosted the capital market development as well. The capital market is in an emerging phase; thus, the number of capital market investors has been growing rapidly. The digitalization and use of new technology such as mero share, Trade Management System, online settlement, and clearing procedures have created easiness as well as motivation for investors to invest in the capital market (Adhikari, 2013).

The study of the relationship between macroeconomic variables and stock market performance has been a debatable and burning issue in today's free market economy. In Nepal, it seems to fluctuate with the monetary policy transmission mechanism however, because of the absence of real sector companies in the stock exchange, it couldn't capture the real picture of the economy (Panta, 2020). Moreover, capital market development is very influential for the economic growth in Nepal (Pokharel, 2020). The investment decisions of investors in the capital market are dependent on macroeconomic determinants such as money supply, interest rate, inflation rate, etc. Shrestha and Subedi (2014) examine that the the higher inflation the stock market performance is better since to hedge against the inflation, the investors have to invest thereby pushing up the stock prices. Thus, this paper also tries to study the various macroeconomic determinants of the stock index of Nepal with some controlled variables as well.

Literature Review

Shrestha and Lamichhane (2020) examined the relationship between the macroeconomic and stock market performance in Nepal for 32 years from the period of fiscal year 1987/88 to 2019/20 using ARDL bound test approach. Interest rate, gross domestic product, and broad money supply as considered as the explanatory variables whereas market capitalization is taken as the proxy of stock market performance. The study found that in the long run, broad money supply and interest have a negative significant relationship with the stock market performance however economic growth has a significant positive relationship in the long run. (Shrestha & Lamichhane, 2020).

The research was conducted on the topic *Macroeconomic Determinants of Stock Market Performance in Nigeria* from the period of 1985 to 2018 with the ARDL cointegration approach of co-integration. The findings of the research showed that the inflation rate, interest rate real effective exchange rate, and world oil price were major determinants of the Nigerian stock market (Ogunsakin & Awe, 2020).

Panta (2020) examined the macroeconomic determinants of stock market prices in Nepal from 1994 to 2019 using the ARDL bound test with the Error Correction Model (ECM). He found that in the long run, the NEPSE index is strongly associated with broad money supply, interest rate, inflation exchange rate, and real gross domestic product however, the relationship is positive only with the broad money supply.

Islam et al. (2017) examined the macroeconomic and institutional determinants of capital market performance of the Dhaka Stock Exchange for 20 years period from 1995 to 2015 both descriptive and inferential statistics. Gross Domestic Product (GDP), CPI, inflation rate, and Foreign Direct Investment (FDI) inflows are taken as the macroeconomic determinants whereas market capitalization, total capital issued, and turnover are taken as the institutional variables. The multiple regression model showed that CPI, GDP, and market capitalization have a significant relationship with the stock index.

Shrestha and Subedi (2014) empirically examined the stock market determinants of Nepal where the impact of major political changes and Nepal Rastra Bank's policy on lending against share collateral has been used as the dummy variable. The result found that inflation and broad money growth have a significant relationship with the stock market performance whereas the interest rate has a negative relationship to stock market performance.

Methodology and Data

This research has applied the inferential research design with described econometric tools to explain the cause of independent variables on the dependent variable. To explain the cause-and-effect relationship between the variables the correlational research design has been used.

The Augmented Dicky Fuller (ADF) test as well as the Phillips Perron (PP) test has been used to check the stationarity of the variables. To check whether the long-run co-integration exists among the variables, the Engle-Granger co-integration test has been used. The Error Correction Model (ECM) has been applied to explain the short-run coefficient as well as to determine the time required to converge the short-run deviation into the long run.

This study used broad money supply, interest rate, inflation rate, exchange rate, Gross National Income (GNI), and the independent variables and the NEPSE index as the independent variable. Since the stock market index is very sensitive to changes in political and policy changes, the political stability index has also been used as the controlled variable to see the effect on the stock market index. Similarly, capital mobilization through primary market (CMP) has also been used as another controlled variable is also defined as the institutional determinant of capital market performance (Islam et al., 2017).

Shrestha and Subedi (2014) used the interest rate, CPI, and broad money supply as explanatory variables whereas the monthly index of NEPSE has been used as the dependent variables. Similarly, Panta (2020) used inflation, exchange rate, and real GDP as the macroeconomic determinants. Instead of using the real GDP the GNI has been taken as the proxy of the country's income since the data of real GDP for the study period is not stationarity at the first difference. The two more variables i.e political stability index and capital mobilization through the primary market also been used in this paper as the controlled variables.

This study has used the yearly data for the period of 22 years from the fiscal year 1998 to 2020. Although the formal stock exchange was started in Nepal in 1994, the data on the political stability index has been available only from 1998. The data on broad money supply, interest rate, exchange rate, GNP, and CMP have been collected from the website of Nepal Rastra Bank. The data of the NEPSE index has been collected from the website of the Nepal Stock Exchange. The researcher has used the Simple Moving Average (SMA) technique to calculate the yearly NEPSE index data. Similarly, the data on political stability has been extracted from the website of the World Bank. The 91-day t-bill rate has been used as a proxy of for the interest rate.

From the above-mentioned variables that have been used in the study, the specification of the model is presented as follows:

 $NEPSE_t = f(M2, IR, EXR, GNP, CMP, POL) \dots (1)$

Where

NEPSE = Average NEPSE index

M_2	= Broad Money Supply
IR	= Interest rate
EXR	= Exchange Rate
GNP	= Gross National Product
CMP	= Capital Mobilization through Primary Market
POL	= Political Stability Index
t	= Period

The log-linear transformation of the variables is presented as follows:

 $LogNEPSE_{t} = \alpha_{0} + \theta_{1}LogM2_{t} + \theta_{2} LogINT_{t} + \theta_{3} INF_{t} + \theta_{4} EXR_{t} + \theta_{5}LogGNI_{t} + \theta_{6} LogPOL_{t} + \theta_{7} LogCMP_{t} + \epsilon_{t}...$ (2)

Where	
α_0	= Constant term
θ_i	= Coefficient of explanatory variables
ε _t	= Error term

After explaining the long-run coefficient, the following error correction model has been performed to explain the long-run coefficient:

$$\begin{split} \delta LogNEPSE_t &= \alpha + \ \rho_1 ECT_{t-1} + \ \theta_1 \delta LogM2_t + \ \theta_2 \delta LogINT_t + \ \theta_3 \delta INF_t + \ \theta_4 \delta EXR_t + \ \theta_5 \delta LogGNI_t + \\ \theta_6 \delta LogPOL_t + \ \theta_7 \delta LogCMP_t + \ \mu_{1t}.....(8) \end{split}$$

Granger Causality Test

To examine the significant causality relationship of broad money supply, interest rate, inflation, exchange rate, gross national income, political stability index, and capital mobilization through the primary market on the NEPSE index, the Granger causality test has been performed. The independent variable is the granger cause variable of Y, if Y_t is conditional on the past variable of X (i.e., X_{t-1} , X_{t-2} X₀). The hypothesis for the bidirectional causal relationship between the variables X and Y is considered as follows:

- i) X does not Granger cause Y
- ii) Y does not Grange cause X.

Empirical Results

Stationarity Test

This research paper has used the time series data for the period of 23 years from fiscal year1996/97 to 2019/20. The nature of time series data is generally trended upward with time which generally gives the spurious result during the analysis. Thus, the stationarity test has been carried out using the following two formal unit root test procedures:

- a) Augmented Dicky Fuller Test
- b) Phillips Perron Test

Table 1

Variables	Order of Integration	p-value*	Order of Integration	p-value*
log NEPSE	I (0)	0.9881	I (1)	0.0010
log M2	I (0)	0.9913	I (1)	0.0053
log INT	I (0)	0.3955	I (1)	0.0062
INF	I (0)	0.0889	I (1)	0.0001
EXR	I (0)	0.9534	I (1)	0.0017
log GNI	I (0)	0.8755	I (1)	0.0479
log POL	I (0)	0.7496	I (1)	0.0325
log CMP	I (0)	0.6961	I (1)	0.0001

Stationarity Test of Variables Using Augmented Dicky Fuller Test

Note. Author's Calculation

The hypothesis for the ADF test is: that the variables have unit roots. Table 1 shows that variables are not stationary at level i.e. I (0) since their associated p-value is greater than 0.05. The associated p-value of all the variables is less than 0.05 at first difference i.e. I (1) indicating the rejection of the null hypothesis. It means all the variables are stationarity at first difference.

Explanation of Long-run Coefficient

The long-run coefficient has been explained using the ordinary least square model. The null hypothesis for the study of the significance of the long-run effect is: that there is no significant relationship between the variables.

Table 2

Variable	Coefficient	Std. Error	t-Statistic	Prob.	
LOGM2	3.973678	1.169204	3.398617	0.0040	
LOGINT	-0.292525	0.083193	-3.516221	0.0031	
INF	-0.034825	0.022894	-1.521146	0.1490	
EXR	-0.031836	0.013465	-2.364350	0.0320	
LOGGNI	-4.548425	1.309835	-3.472518	0.0034	
LOGNPOL	0.264310	0.111011	2.380931	0.0310	
LOGCMP	0.302242	0.107963	2.799479	0.0135	
С	15.95999	4.049172	3.941544	0.0013	
R-squared	R-squared 0.921292		Durbin-Watson stat		
F-statistic	25.08247	Prob(F	-statistic)	0.00000	
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OLS Run on LogNEPSE to LogM2, LogINT, INF, EXR, LogGNI, LogPOL, and LogCMP

Note. Author's calculation.

Table 2 shows that all the variables except inflation have a significant relationship with the NEPSE index since their associated p-value is less than 0.05. The coefficient of broad money supply (M2) is 3.97 which indicates that a 1 percent increase in money supply leads to a 3.97 percent increase in the NEPSE index. Similarly, the coefficient of interest is negative indicating the negative association between the interest rate and NEPSE index. A 1 percent rise in interest rate decreases the NEPSE index by 0.2925 percent. The exchange rate and Gross National Income also have a negative association with the NEPSE index. 1 percentage point increase in the exchange rate decreases the NEPSE index by 3.18 percent. Similarly, the 1 percent increase in GNI decreases the NEPSE index by 4.54 percent. Among the chosen macroeconomic indicators only the inflation rate doesn't show a significant association with the NEPSE index. Both the controlled variables have a positive and significant relationship with the NEPSE index. The 1 percent rise in the political stability index and capital mobilization through the primary market increases the NEPSE index by 0.2643 and 0.3022 percent respectively.

The R^2 value is 0.9213 indicates that 92.13 percent of the NEPSE index is explained by the variables mentioned in the study and the rest is due to other factors. The R^2 value is greater than the D-W value indicating the non-spuriousness of the model. The probability value of F-statistics is 0.0000 indicating the significance of the overall model.

Engle-Granger Test of Co-integration

The Engle-Granger co-integration test follows the two-step procedure. First, the ordinary least square method is applied and then the stationarity test of the Error Correction Term (ECT), also called residual is done to check the long-run co-integration. If the error correction term is stationarity at level, then there exists the long-run co-integration among the variables.

Table 3

Type of test	Variable	t-statistics	prob*
		I (0)	I (0)
Augmented Dicky Fuller	ECT	-4.6254	0.0021
Test critical value	5%	-3.0403	

Unit Root Test of Residual Using Augmented Dicky Fuller

Note. Author's Calculation

Table 3 shows that the associated p-value is 0.0021 which is less than 0.05 indicating the significance at a 5 percent level of significance. The significance of the ECT indicates the long-run association among the variables.

Explanation of Short-run Coefficient and Error Correction Term

After explaining the long-run coefficient, the short-run coefficient as well as the error correction term have been explained using the following model:

Table 4

OLS Run on $\Delta LogNEPSE$ to $\Delta LogM2$, $\Delta LogINT$, ΔINF , ΔEXR , $\Delta LogGNI$, $\Delta LogPOL$, and $\Delta LogCMP$

Variable	Coefficient	Std. Error	t-Statistic	Prob.
δLOGM2	3.4918	1.2097	2.8864	0.0127
ΔlogINT	-0.1929	0.0771	-2.5026	0.0265
ΔINF	-0.0456	0.0182	-2.5089	0.0261
ΔEXR	-0.0185	0.0122	-1.5158	0.1535
δLOGGING	-3.1311	0.9988	-3.1348	0.0079
δLOGNPOL	0.1943	0.1792	1.0844	0.2979
δLOGCMP	0.2697	0.1002	2.6906	0.0185
ECT (-1)	-1.0396	0.2896	-3.5904	0.0033
С	-0.0986	0.1824	-0.5407	0.5978
R-squared	0.6827	Durbin	Durbin-Watson stat	
F-statistic	3.4955	Prob(F-statistic)		0.0223

Note. Author's calculation.

Table 4 presents that the error correction term has a negative value with significance at a 1 percent level of significance. The value of ECT is -1.0396 which signifies that the short-term deviation in equilibrium fully converges towards equilibrium within 11.54 months (\approx 12). The convergence rate of short-term deviation into the long-run equilibrium is 103.96 percent.

The value of R^2 for the short-run model is 0.6827 indicates that 68.27 percent of the NEPSE index is defined by the variables mentioned in the model and the rest is due to the other factors. The D-W value of the model is 1.7521 which is greater than the R^2 indicating the non-spuriousness of the model. The p-value for F-statistics is also significant at a 5 percent level of significance. The significance of F-statistics is an indicator of the fitness of the overall model.

The model further signifies that in the short run M2, GNI, and CMP are significant at a 1 percent level of significance however the relationship is positive only with the M2 and CMP. The 1 percent increase in M2 and CMP increases the NEPSE index by 3.49 percent and 0.27 percent respectively. It further shows that in the short run, the NEPSE index has a negative relationship with GNI which is also the indicator of national income. In the short run, the 1 percent increase in GNI decreases the NEPSE index by 3.13 percent. The other macroeconomic determinants: INT and INF both have a negative significant relationship with the NEPSE index. Both determinants are significant at a 5 percent level of significance. The 1 percent increase in interest decreases the NEPSE index by 0.19 percent and 1 percentage point increase in inflation rate decreases the NEPSE index by 4.56 percent.

Granger Causality Test

The Granger causality test is carried out whether the past values of the variables explain other variables that have been used in the test. There can be unidirectional and bidirectional relationships between the variables. This paper has used the lag length of 2 indicating whether the variable with two lag periods causes another variable or not. The result of the Granger causality test has been presented in the table given below:

Table 5

Obs	F-Statistic	Prob.
21	8.19440	0.0035
	0.37634	0.6923
21	1.29290	0.3017
	0.21618	0.8079
21	4.70329	0.0247
	11.5082	0.0008
21	8.66375	0.0028
	0.52987	0.5987
21	0.91670	0.4198
	0.42581	0.6604
21	2.99743	0.0784
	0.32815	0.7250
21	0.29445	0.7489
	2.70035	0.0976
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Granger Causality Test

Note. Author's Calculation.

Table 5 shows the Granger causality test of all variables with each other. The null hypothesis for the test is: that there is no Granger causality, for each of the variables that have been used. It shows that there exists a unidirectional causal relationship between M2 and GNI to NEPSE index with a 5 percent level of significance however the is a bidirectional relationship between CMP and NEPSE index. In the case of other variables, the null hypothesis of no Granger causality has been accepted.

Residual and Stability Diagnostic

The residual test has been performed to ensure the validity of the model that had been developed. The following test has been performed to check the residual and stability of the model:

Breusch-Godfrey (BG) Serial Correlation Lagrange Multiplier (LM) Test

Table 6

BG serial correlation LM test

Test	Test statistics		prob.*	
	F -statistics	Obs*R-squared	F-stat	Chi-Square
BG serial correlation	0.0260	0.0918	0.9743	0.9551
	0.0200	0.0710	012712	0.700

Note. Author's Calculation.

The null hypothesis for the BG serial correlation LM test is: that there is no serial autocorrelation. Table 6 shows that the null hypothesis of no serial autocorrelation has been accepted since its associated probability value is 0.9551 which is greater than 0.05 and indicates significance at a 5 percent level of significance.

Breusch- Pagan-Godfrey (BPG) Heteroskedasticity Test

Table 7

Breusch-Pagan-Godfrey Test

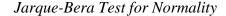
test st	atistics		prob.*		
		Scaled			
F-	Obs*R-	explained		Chi-	Chi-
statistics	squared	SS	F-stat	Square	Square
0.2766	2.6300	1.6996	0.9536	0.9170	0.9746
	F- statistics	statistics squared	Scaled F- Obs*R- explained statistics squared SS	Scaled F- Obs*R- explained statistics squared SS F-stat	Scaled F- Obs*R- explained Chi- statistics squared SS F-stat Square

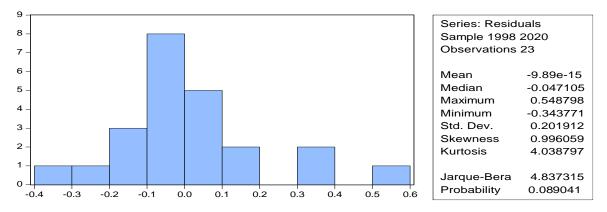
Note. Author's Calculation

The null for the BPG test is: that there is no heteroskedasticity. Table 4.7 shows that the null hypothesis of no heteroskedasticity has been accepted since its associated probability value is 0.9170 which is greater than 0.05 and indicates significance at a 5 percent level of significance.

Jarque-Bera Test for Normality

Figure 5





Note. Author's Calculation

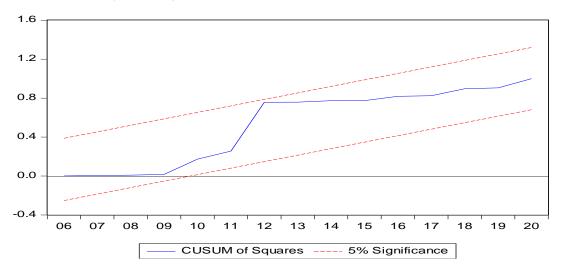
Jarqure-Bera test has been applied to check the normality of the data. The decision-making consideration is based on the probability value of the Jarque-Bera test. The null hypothesis for the test is: the data are normal distribution has been accepted since its associated probability value is 0.089041 which is greater than 0.05, indicating significance at a 5 percent level of significance.

Cumulative Sum of Square Test for Stability

The cumulative Sum of the Square Test has been done to check the stability of the model.

Figure 6

Cumulative Sum (CUSUM) Test



Note. Author's Calculation.

The null hypothesis for the CUSUM of Square test is: that there is no stability of the model. Figure 6 shows that the cumulative sum of residuals lies within the 5 percent level of significance indicating that the long run model is stable. Hence, the null hypothesis for the test is rejected at a 5 percent level of significance.

Conclusions and Policy Recommendations

This research examines the determinants of stock market performance in Nepal. This research has used the yearly data for 22 years from of 1998 to 2022. Since the stock market data are highly volatile, instead of using the year-end index, the moving average of the index has been used. The result found in the analysis has been similar to the other empirical evidence except the GNI. Most of the empirical analysis shows that the stock market growth has a positive trend with the country's income including Islam et al., (2017) however the relationship with the stock market performance, measured through the NEPSE index, in Nepal has a negative significant relationship with the income which is measured by GNI. Most of the time, when the rate of economic growth declines, there

seems to the bullish sentiment in the stock market. The last two higher highs in the NEPSE index took place during the period when the economy was suffering from the severe situation of earthquake, economic embargo, and COVID-19 pandemic respectively. The economic growth during the fiscal year 2015 was only 0.40 percent which was the period when Nepal suffered from the earthquake and economic embargo. Similarly, the economic growth during the COVID-19 pandemic was negative 2.4 percent. When the real sectors of the economy get distributed the demand for the loan in that sector is also low leading towards an increase in money supply and declines in the interest rates. Bank and financial institutions with, high liquidity, want to invest their funds with the hope of earning a return whereas the borrowers are encouraged to borrow more with a low-interest rate in the economy. Thus, the NEPSE index has a positive significant relationship with the broad money supply and a negative significance with the interest rate both in the short-run as well as in the long-run. The result is similar to the findings of Shrestha and Subedi (2014). Since, there is no positive connotation with the country's income and stock index in Nepal, the NEPSE index can't be fully considered as the leading indicator of the real sector of the economy. There seems abnormal growth in the stock market only when the interest rate is very low indicating the stock market performance is highly based on the loan issued by banks and financial institutions rather than its real growth.

Further, the relationship with inflation is insignificant in the long run however there is a significant negative relationship in the short run. The result is consistent with (Fama, 1981). The exchange rate has a negative significance only in the only in long-run. The exchange rate in the economy increases with the demand for consumption and investment demand in the economy. Higher consumption and investment demand will lead to higher imports however the Nepal Rastra Bank has a mandate to stabilize the exchange rate due to which Nepal Rastra Bank has to contract the money supply. The decrease in money supply will lead towards in rise in interest rates and a decrease in the NEPSE index as explained previously.

Political stability also seems to be positively significant in the long-run development of the stock market however in the short-run there is no association between the political stability index and the NEPSE index. The study conducted by Metadeen

(2019) also depicts a similar result. Political stability leads towards policy stability which creates confidence among the investors of the stock market for the long-run investment however political stability doesn't have any significant impact in the short-run. The NEPSE index is also positively influenced by the CMP in the short run as well as in the long run, which is considered the institutional development indicator. Capital mobilization through primary market influences positively on the market capitalization which ultimately increases the stock market index.

The NEPSE index is quite responsive to macroeconomic indicators including the political stability index and capital mobilization. Since it is a monetary market and quite influenced by the monetary policy mechanism, however, the NEPSE index couldn't capture the real economic growth of the country since it has a negative connotation with the country's income measured by GNI. Thus, the policy should be made in such a way that the more real sector companies should be encouraged to be listed on the capital market. Since the stock market seems wide fluctuate with the minimum change in money supply and interest rate in the economy. Sentiments of short-term return are highly dominant in the market. NEPSE index increases only with the loose monetary policy. Thus, the policy should be made in such a way that the long-term investors get encouraged in the market, and stock price fluctuation could be based on real performance by the companies more than the loose monetary policy.

The NEPSE index has a positive connotation with the exchange rate. Since Nepal's exchange rate depends upon the Indian exchange rate due to the pegged exchange rate system, no effective policy could be implemented by the concerned authorities to maintain the exchange rate. Similarly, the investors of the stock market also rely on the stability of the government to make their investment decisions. Since stock market development could play a vital role in the mobilization of savings into investment in the economy, a stable political condition with stable policy should be maintained for effective capital market development. Capital mobilization also has a significant impact on the NEPSE index. Thus, for more capital mobilization, more companies should be listed on the stock exchange. However, the list of real sector companies is necessary to reflect the NEPSE index as the real indicator of the economy.

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