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Revisiting the Dynamic Relationship between Macroeconomic Fundamentals and Stock Prices: An Evidence from Indian Stock Market

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Abstract

The relationship between stock prices and macroeconomic variables varies across countries, time periods, datasets used, and the frequency of data used. Thus, an in-depth study to reinvestigate the relationship between selected macroeconomic variables i.e. inflation rate, exchange rate, index of industrial production, gold price, money supply and yields on treasury bills, and Indian stock market for the period of April 2005 to March 2014 has been carried out. In this study Johansen's cointegration test, vector error correction model (VECM), impulse response functions (IRFs), and variance decomposition (VDCs) test have been applied. The results of Johansen cointegration test indicates a significant negative relationship between exchange rate, inflation rate, and index of industrial production with stock prices whereas there exists a significantly positive relationship of money supply and yield on treasury bills with stock prices. Vector error correction model helps to determine both short and long run causal relationship between macroeconomic variables and stock price. The results found short run causality runs from exchange rate to Nifty, Nifty to money supply, and inflation rate whereas long run causality found from Nifty to short term interest rate and money supply.

Keywords: Macro-Economic Variables, Indian Stock Market, Johansen Cointegration Test, Vector Error Correction Model

1. Introduction

Stock markets play a noteworthy role in mobilisation and allocation of funds among competing uses. Stock market may serve as leading indicator to the development and growth of an economy. Various techniques have been used by investors to analyse the securities; most extensively fundamental and technical techniques have been favoured. Core of each technique is different. Technical analysis is concerned with analysing securities on the basis of past trends in stock prices and volumes whereas fundamental analysts try to find out the intrinsic worth of a financial asset which largely depends on future trend in key fundamental macroeconomic factors. With the increase in globalisation, now a country not only gets affected by changes in its own economy but also gets influenced by the change in international market. There are ample evidences in finance literature on linkages between stock prices and a wide range of fundamental macroeconomic variables like gross domestic product (GDP), inflation, interest rate, index of industrial production, exchange rate, balance of trade, money supply, oil prices, gold prices, savings etc. However, the results vary across countries, time periods, datasets used, and the frequency of data used. Thus, an in-depth study on the sensitivity of the stock prices to change in key macroeconomic variables is important for policymakers, investment experts, and the regulators. The present study is an endeavour to diagnose whether the stock market leads the macroeconomic variables or it follows them.

The remainder of the paper is organised as follows. The second section is devoted to literature review; research methodology is presented in the third section; results and discussions are presented in fourth section; and finally concluding remarks are presented in the fifth section.

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2. Review of Literature

This section gives review of selected number of papers that endeavour to establish the relationship between macro-economic variables and stock market indices or stock price in developed and developing countries.

Chen, Roll & Ross (1986) conducted a study in US market to analyse the influence of macroeconomic variables on stock market returns. They found that variables such as industrial production, inflation, yield spread between the long and short term government bonds are significant in explaining stock market returns. In the same direction, Mookherjee & Yu (1997) explored the relationship between macroeconomic variables such as narrow money supply, broad money supply, exchange rate and foreign exchange reserves and Singapore stock market. The results found that except exchange rate all explains stock prices. Maghayereh (2003) found significant relationship between macroeconomic variables i.e. exports, foreign reserves, money supply (m1), interest rates, inflation (CPI) and industrial production, and Amman Stock Price Index. Pilinkus & Boguslauskas (2009), Rad (2011), Vejzagic & Zarafat (2013) discovered that stock price is positively related with money supply and negatively with exchange rate. Rahman & Uddin (2009) explored the relationship between stock prices and exchange rate in south Asian countries i.e. Bangladesh, India and Pakistan. The results found no cointegration and causal relationship between the variables in all the three nations. Similar study done by Asaolu & Ogunmuyiwa (2010) confirmed unidirectional causality from exchange rate to stock price in Nigeria. Zubair (2013) found no significant long run relationship between exchange rate, money

Table 1: Empirical Work Supporting Selection of Variables

Variables	*Author(s) in support of significant negative relationship*	*Author(s) in support of significant positive relationship*
Money supply	Raju & Khanapuri (2009, India), Hosseini *et al*. (2011, China), Osamwonyi & Evbayiro-Osagie (2012, Nigeria), Momani & Alsharari (2012, Jordan)	Pilinkus & Boguslauskas (2009, Lithuania), Sohail & Hussain (2009, Pakistan), Abbas Alavi Rad (2011, Iran), Sarbapriya Ray (2012), Naik & Padhi (2012), Pramod Kumar Naik (2013), Vejzagic & Zarafat (2013)
Exchange rate	Pilinkus & Boguslauskas (2009, Lithuania), , Abbas Alavi Rad (2011, Iran), Pal &Mittal, (2011, India), Saeed & Akhtar (2012, Pakistan), Vejzagic & Zarafat (2013, Malaysia)	Sohail & Hussain (2009, Pakistan), Raju & Khanapuri (2009, India), Osamwonyi & Evbayiro-Osagie (2012, Nigeria), Gulati &Kakhani (2012, India)
IIP (Index of industrial production)	Momani & Alsharari (2012, Jordan)	Sohail & Hussain (2009, Pakistan), Hussainey & Ngoc (2009), Aman Srivastava (2010, India), Hosseini *et al*. (2011, China), Raju & Khanapuri (2009), Sarbapriya Ray (2012, India), Naik & Padhi (2012, India), Pramod Kumar Naik (2013, India).
Gold Price	Yahyazadehfar & Babaie (2012, Iran) & Sarbapriya Ray (2012, India)	
Inflation rate	Coleman & Tettey (2008, Pakistan), Raju and Khanapuri (2009), Sohail & Hussain (2009, Pakistan), Aman Srivastava (2010), Hosseini *et al*. (2011) in Chinese Stock market, Pal & Mittal, (2011, India), Naik & Padhi (2012), Pramod Kumar Naik (2013, India)	Hosseini *et al*. (2011 in Indian stock market), Abbas Alavi Rad (2011, Iran) Osamwonyi & Evbayiro-Osagie (2012, Nigeria),
Interest rate	Pilinkus & Boguslauskas (2009, Lithuania), Aman Srivastava (2010, India), Yahyazadehfar & Babaie (2012), Momani & Alsharari (2012, Jordan), Saeed & Akhtar (2012, Pakistan), Vejzagic & Zarafat (2013, Malaysia	Coleman & Tettey (2008, Pakistan), Pal & Mittal, (2011, India), Sarbapriya Ray (2012, India)

Source: Review of literature

Table 2: Description of Variables

Acronym	*Construction of Variables*	*Data Source*
LNIFTY	Natural logarithm of the closing price of the last day of the month of S & P CNX Nifty of National stock exchange	NSE website
LEXR	Natural logarithm of the month-end exchange rate of the Indian rupee vs US dollar	RBI website
LIIP	Natural logarithm of the month-end Index of Industrial Production	CSO and RBI websites
LGOLD	Natural logarithm of the monthly average of gold price in domestic market	RBI website
LWPI	Natural logarithm of the monthly average wholesale price index	RBI website
LM2	Natural logarithm of month-end money supply (M2)	Economic Outlook of CMIE database and RBI website
LYIELD	Natural logarithm of Monthly average of yields 91days Government of India treasury bills	RBI website

supply (M2) and stock market index in pre global crisis period and during crisis in Nigeria. Sohail & Hussain (2009), Srivastava (2010), Naik & Padhi (2012) and Naik (2013) discovered that stock prices are negatively related to exchange rate and positively with index of industrial production. Ray (2012) and Yahyazadehfar & Babaie (2012) examined the relationship between gold price and stock price. Both the studies found negative relationship between them. Relationship between foreign investments and stock market investigated by Kumar (2011) found no relationship between FDI and stock price whereas Siddiqui & Azad (2012)found positive relationship of FII with stock return of BSE Sensex, BSE- 500, BSE-100 and the sectoral indices of BSE. Dhiman & Sharma (2013) explored the impact of FDI on BSE Sensex and NSE Nifty by applying correlation and regression technique. The results found that flow of FDI determines both the stock index. Mireku *et al*. (2013) in Ghana and Al-Majali & Al-Assaf (2014) in Jordon examined the relationship between macroeconomic variables and stock market index using vector error correction model and found both long run and short-run relationship between macroeconomic variables and stock market index. The sign of error correction coefficient indicates that stock price do counter significantly to re-establish the equilibrium relationship once deviation occurs. There are studies also which describes no relationship between macroeconomic variables and stock market. Some of them are Pethe & Karnik (2000), Gay (2008) and Rahman & Uddin (2009).

Amongst many macroeconomic variables, six variables on the basis of their theoretical relevance and support available from the literature have been chosen. Table 1presents the brief delineation of the empirical researches supporting the significance of selected variables.

3. Research Methodology

Data of selected economic variables were accumulated from Reserve Bank of India (RBI) website, Central Statistical Organization (CSO) website i.e. www.cso.gov.in and Economic outlook database of CMIE. NSE Nifty has been taken as proxy of stock price, which has been sourced from official website of National Stock Exchange i.e. www.nseindia.com. The data set covers nine year period from 2005:4 to 2014:3 on monthly basis. The economic variables are selected on the basis of the support available from the empirical literature. The analysis was done through Eviews 6. Table 2presents a brief description of the variables and their source.

As a first step, descriptive analysis is performed to describe the basic features of the data in the study. They provide simple summaries about the sample and the measures. Mean, maximum value, minimum value, standard deviation, skewness, kurtosis, JarqueBera statistics were calculated and the results of same are presented in Table 3.

The present study employs the times series analysis to examine the relationship between stock market index and the selected macroeconomic variables. Many studies

have shown that most of the macroeconomic time series are non-stationary in nature. Thus, applying ordinary least square regression on such series might provide spurious results. Thus, data series must obey the time series properties i.e. the series should be stationary which means that mean, variance should be constant and the covariance between the two time periods depends only on the distance between the two periods and not the actual time at which it is computed. Augmented Dickey Fuller (ADF) test and Philip Perron (PP) unit root test have been used to check the stationarity of the selected variables.

Augmented Dickey Fuller (ADF) test

ADF test is an extended version of Dicky Fuller test, which makes a parametric correction in the original DF test for higher-order correlation by assuming that the series follows an AR (p) process. The ADF test specification used here is as follows:

$$\Delta yt = \alpha_0 + \beta y_{t-1} + \sum_{t=1}^{p} \gamma_i y_{t-1} + u_t \quad (1)$$

The null hypothesis of ADF test is that series has unit root.

3.1. Phillips-Perron (PP) Test

For adjusting with higher- order serial correlation in a given time series Phillips &Perron (1988) adopted a nonparametric method. The test regression for the PP test is the AR (1) process.

3.2. Johansen cointegration test

Johansen cointegration test has been performed to examine whether there is long run relationship between selected macroeconomic variables and stock price. The Johansen's multivariate cointegration test is based on the following vector auto-regression (VAR) equation:

$$y_t = A_1 y_{t-1} + \ldots\ldots\ldots A_p y_{t-p} + Bx_t + u_t \quad (2)$$

whereyt and xt are, respectively, a k-vector of non-stationary I (1) variables and a vector of deterministic variables and u_t is a vector of innovations. Equation 2 may be rewritten as a VAR as follows:

$$\Delta yt = \prod y_{t-1} + \sum_{i=1}^{p} \Gamma_i \Delta y_{t-i} + \beta x_t + u_t \quad (3)$$

$$\text{Where } \prod = \sum_{i=1}^{p} A_i - I \text{ and}$$

$$\Gamma_i = \sum_{j=i+1}^{p} A_j$$

According to Engle and Granger (1987), if the coefficient matrix $\prod$ has reduced rank r<k, there are k*r matrices of α and β each with rank r such that $\prod = \alpha\beta'$ and $\beta' y_t$ is I (0). r represents number of cointegrating relationships and each column of β is the cointegrating vector. In the Johansen method, we estimate the $\prod$ matrix from an unrestricted VAR and test whether we can reject the restrictions implied by the reduced rank of $\prod$ using either the trace statistic or the maximal eigenvalue statistic. The trace statistic is determined using the following formula:

$$\lambda_{trace} = - T \sum_{i=r+1}^{n} \log (1-\lambda_i) \qquad r=0,1,2,\ldots\ldots n-1$$

where T is the number of observations and is the λ_i is the ith eigenvalue. The maximum eigenvalue statistic is determined using the following formula

$$\lambda_{max} = - T \log (1-\lambda_{r+1}) \qquad r=0,1,2,\ldots\ldots n-2, n-1$$

3.3. Error-correction model

According to Engle & Granger (1987), if two variables are cointegrated, there exists an error-correction model of the following form described in equations 4 and 5.

$$\Delta xt = \alpha_1 + b_1 ect_{t-1} + \sum_{i=1}^{m} c_1 \Delta x_{t-1} + \sum_{i=1}^{n} d_1 \Delta y_{t-i} + e_{1t} \quad (4)$$

$$\Delta yt = \alpha_2 + b_2 ect_{t-1} + \sum_{i=1}^{m} c_2 \Delta y_{t-1} + \sum_{i=1}^{n} d_2 \Delta x_{t-i} + e_{2t} \quad (5)$$

wherext and yt are the variables which are cointegrated, Δ is the difference operator, m and n are the lag lengths of the variables, ect_t denotes the residuals from the cointegrating equation and e_{1t} and e_{2t} are the white-noise residuals. We

Table 3: Descriptive Statistics

	LNIFTY	*LEXR*	*LIIP*	*LGOLD*	*LWPI*	*LM2*	*LYIELD*
Mean	8.408	3.864	4.998	9.654	4.904	9.449	1.864
Std. Dev.	0.294	0.122	0.165	0.514	0.176	0.336	0.308
Maximum	8.810	4.198	5.268	10.363	5.201	9.950	2.424
Minimum	7.551	3.671	4.595	8.704	4.629	8.816	1.136
Skewness	-1.007	0.737	-0.744	-0.140	0.129	-0.295	-0.914
Kurtosis	3.063	2.949	2.716	1.729	1.705	1.843	3.015
Jarque-Bera	18.265	9.804	10.348	7.623	7.840	7.519	15.052
Probability	0.000	0.007	0.005	0.022	0.019	0.023	0.000
Observations	108	108	108	108	108	108	108

Note: *, **and *** indicates significance at: 10, 5 and 1 percent levels respectively.

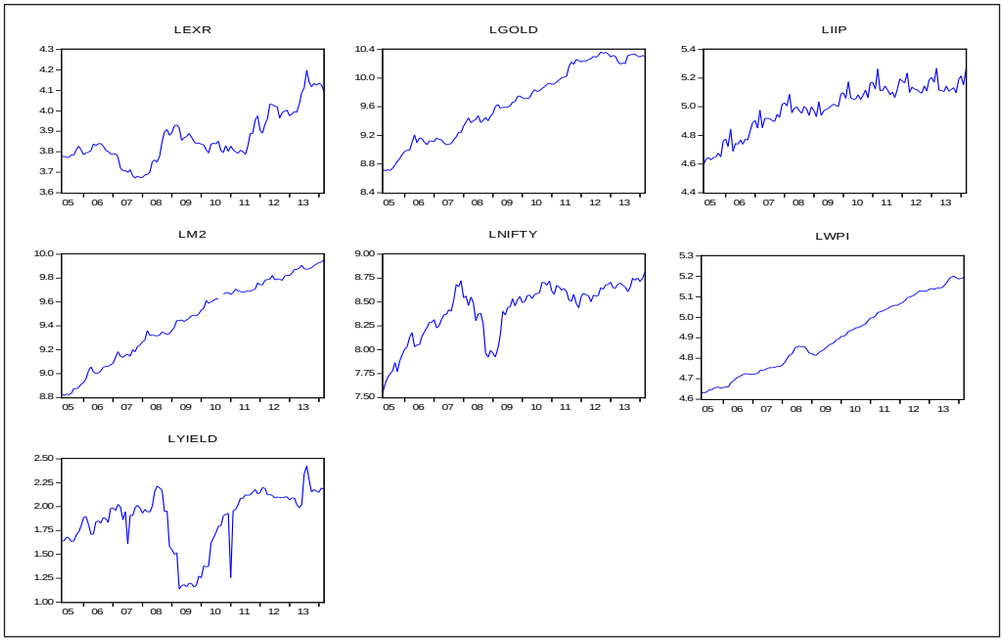
Source: Result output of Eviews 6.

can extend the above model to the multivariate case in which we have equations equal to the number of variables of interest and error-correction terms equal to the number of cointegrating relationships.

4. Results and Discussion

The descriptive statistics for all the six variables under study, namely, log of NSE S&P CNX Nifty, log of industrial production index (IIP), log of wholesale price index (WPI), log of broad money supply (M2), log of exchange rate (EXR), log of gold price and log of treasury bills rate (TBR) are presented in Table 3. The value of standard deviation indicates that gold price is more volatile followed by money supply and yield on treasury bills. Exchange rate exhibits minimum variations about its mean. The values of skewness and kurtosis show that the observed distributions are not normal because if the value of skewness is 0 and of kurtosis is 3 then, the observed distribution is supposed to be normal. The distribution of all the variables is negatively skewed implying a left skewed distribution except exchange rate and inflation

Figure 1: Dataset Graph



Source: Result output of Eviews 6.

rate. The results of Jarque-Bera statistics show that all the variable are not normally distributed at 5% level of significance.

The first and simplest method for determining whether the time series is stationary is to actually plot the time series and may look for possibility of trend in mean and variance, which is shown in Fig.1. The time series of exchange rate, gold price, money supply, index of industrial production, and inflation rate clearly exhibit the trend in mean and variance which is a sign of non- stationarity.

Apart from visual inspection, formal test of stationarity i.e. Augmented Dickey Fuller (ADF) test and Philip Perron (PP) unit root tests have also been applied. The results of ADF and PP statisiticsare presented in Tables4 and 5respectively. The results of ADF test show that all the variables are found to be non-stationary at level except LNifty and LIIP which is found to be stationary at 10% at level without trend. After first differencing all variables have become stationary with and without trend.

The results of PP test depict that at level, LNifty is found stationary at 10% in both cases with or without trend. LIIP is found stationary at level with intercept and trend at 1%, whereas rest of the variable becomes stationary after first differencing. The results of both the unit root tests confirm each other and reinforce that most of the observed variables are I (1).

After determining the order of integration, we proceed to test the long run relationship between stock price and the selected macroeconomic variables.

It is important before applying cointegration test to determine the optimum number of lags. For this AIC (Akaike selection information criterion), SIC (Schwarz information criterion), and HQC (Hannan-Quinn information criterion)have been used. Table 6depicts the lag order selection criteria. AIC recommends the lag order

Table 4: Augmented Dickey –Fuller Unit root test

Variables	*At Level*		*At First difference*	
	Intercept no trend	*Intercept with trend*	*Intercept no trend*	*Intercept with trend*
LNIFTY	-2.669077 (0.0828)*	-3.020465 (0.1316)	-9.737078 (0.0000)***	-9.747526 (0.0000)***
LEXR	-0.509207 (0.8841)	-1.846634 (0.6750)	-8.870917 (0.0000)***	-8.877549 (0.000)***
LIIP	-2.745134 (0.0703)*	-1.913778 (0.6396)	-1.855344 (0.0000)***	-3.311581 (0.0706)*
LGOLD	-1.444921 (0.5576)	-1.813673 (0.6914)	-10.25085 (0.0000)***	-10.36503 (0.0000)***
LWPI	-0.198218 (0.9342)	-2.814400 (0.1955)	-7.116626 (0.0000)***	-7.080236 (0.0000)***
LM2	-2.463699 (0.1281)	0.889000 (0.9998)	-11.25183 (0.0000)***	-4.604692 (0.0020)***
LYIELD	-1.667551 (0.4447)	-1.864261 (0.6659)	-13.50665 (0.0000)***	-13.44388 (0.0000)***

Note: *, **and *** indicates significance at: 10, 5 and 1 percent levels respectively.

Source: Result output of Eviews 6.

Table 5: Philip-Perron Unit root test

Variables	*At Level*		*At First difference*	
	Intercept no trend	*Intercept with trend*	*Intercept no trend*	*Intercept with trend*
LNIFTY	-2.672105 (0.0823)*	-3.187311 (0.0925)*	-9.765104(0.0000)***	-9.77093(0.0000)***
LEXR	-0.61738 (0.8612)	-1.972862 (0.6091)	-8.829307 (0.0000)***	-8.788047(0.0000)***
LIIP	-2.035157 (0.2716)	-5.017964 (0.0004)***	-24.97130 (0.0000)***	-30.09995(0.0001)***
LGOLD	-1.444921 (0.5576)	-1.955384 (0.6184)	-10.25086 (0.0000)***	-10.36503(0.0000)***
LWPI	0.006748 (0.9565)	-2.757680 (0.2163)	-7.092968(0.0000)***	-7056496(0.0000)***
LM2	-2.282684 (0.1795)	-2.330198 (0.4139)	12.89596 (0.0000)***	-15.20528(0.0000)***
LYIELD	-2.041810 (0.2688)	-2.298932 (0.4306)	-13.50435(0.0000)***	-13.44181(0.0000)***

Note: *, **and *** indicates significance at: 10, 5 and 1 percent levels respectively.

Source: Result output of Eviews 6.

Table 6: VAR Lag Order Selection Criteria

Endogenous variables: LNIFTY LEXR LGOLD LIIP LWPI LM2 LYIELD

Lag	*Log L*	*LR*	*FPE*	*AIC*	*SC*	*HQ*
0	622.896	NA	3.12e-15	-13.536	-13.343	-13.458
1	1330.705	1291.167	1.61e-21*	-28.015	-26.470*	-27.392*
2	1378.757	80.262	1.67e-21	-27.994	-25.097	-26.825
3	1416.461	57.178	2.25e-21	-27.746	-23.497	-26.032
4	1461.827	61.817	2.67e-21	-27.666	-22.065	-25.406
5	1506.552	54.063	3.44e-21	-27.572	-20.619	-24.767
6	1581.338	79.895	2.51e-21	-28.139	-19.834	-24.788
7	1653.680	65.186	2.21e-21	-28.652	-18.995	-24.756
8	1710.245	42.268	3.31e-21	-28.818*	-17.809	-24.377

Notes: * indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Source: Result output of Eviews 6.

Table 7: Multivariate (Johansen) Cointegration Test results

H0 (No. of CE(s))	*Trace Test*	*5% Critical Value*	*Probability*	*Maximum Eigen Values Test*	*5% Critical Value*	*Probability*
None	159.259	125.615	0.000*	65.268	46.231	0.000*
Atmost 1	93.986	95.753	0.065	42.280	40.077	0.027*
Atmost 2	51.705	69.818	0.562	19.617	33.876	0.782
Atmost 3	32.088	47.856	0.607	16.409	27.584	0.630
Atmost 4	15.679	29.797	0.734	7.714	21.131	0.920
Atmost 5	7.969	15.494	0.469	4.737	14.264	0.774
Atmost 6	3.227	3.841	0.072	3.227	3.841	0.072

Notes: * denotes rejection of the hypothesis at the 0.05 level, **MacKinnon-Haug-Michelis (1999) p-values variable

Source: Result output of Eviews 6.

of 8, whereas Final prediction error, Schwarz information criterion, and Hannan-Quinn information criterion suggest lag order of 1 is enough for the analysis. Hence, lag order of 1 is selected for the analysis.

Results of Johansen cointegration test are shown in Table7. Results of Trace test indicate one cointegration equation whereas maximum eigen value test depicts that there are two cointegrating equations. Thus, there exists cointegration relationship among variables.

The estimated co-integrating coefficients for S&P CNX Nifty based on the first normalized eigenvector are as follows.

Thus, the co-integration relationship can be re-expressed as equation 6:

LNIFTY	*LEXR*	*LGOLD*	*LIIP*	*LM2*	*LWPI*	*LYIELD*
1.000000	3.522783	0.766982	12.37467	-13.73409	10.61513	-1.203733
	(0.82959)	(0.52755)	(1.54142)	(1.61566)	(2.29578)	(0.22081)

The t-statistics are given in [ ]. The coefficient of exchange rate is significant and negative which means the relationship between exchange rate and stock price is negative. The results are in consistence with the results of Pilinkus & Boguslauskas (2009), Abbas Alavi Rad (2011), Vejzagic & Zarafat (2013), Pal &Mittal, (2011), and Saeed & Akhtar (2012).The relationship between index of industrial production and stock price is negative and statistically significant which confirms the findings by Momani & Alsharari (2012). However, the findings were at variance with the findings of Sohail & Hussain (2009), Hussainey & Ngoc (2009), Aman Srivastava (2010), Hosseini *et al*. (2011). Stock prices are also significantly influenced by inflation rate negatively. Coleman & Tettey (2008, Pakistan), Raju & Khanapuri (2009), Sohail & Hussain (2009, Pakistan), and Aman Srivastava (2010) also repoted the same results. Coefficient of gold price is also negative but statistically insignificant. The coefficients of money supply and treasury bills yield are positive and statistically significant. The results are consistent with those of Sarbapriya Ray (2012).

As the results found cointegration between the variables, VECM is determined. The VECM can confine both short and long run equilibrium relations between the variables and therefore can differentiate between short run and long run Granger causality. The significant coefficient for lagged error correction term (i.e. by testing H0: $\gamma 1 = 0$) presents the long run causality which can be examined through the t-statistics,whereas, the short run causal relationship can be tested by the joint significance of the coefficients of the differenced explanatory variables by using the F-statistics or χ^2 test statistics.

The results of Table 8 show short run causality runs from exchange rate to Nifty, Nifty to money supply and inflation. Long run causality is found from Nifty to money supply and short run interest rate. However, no causality is found between Nifty & gold price and Nifty & index of industrial production.

4.1. Variance Decomposition Analysis

In the variance decomposition analysis, variance of the anticipated error of a variable is separated into fraction attributable to innovations (or shocks) in each variable in the system, including its own. Table 9 presents the results of variance decomposition. Results show how much of forecast error variance of LNifty is explained by movements in its own shock and the selected macroeconomic variables.The results show that mostly all variance in LNifty is explained by itself which isfollowed

Table 8: Causality Test Result Based on the Vector Error-Correction Model

Causality from	*Causality to*	*χ2 test statistic*	*ECT (t-statistic)*	*Nature of causality*
LEXR	LNIFTY	2.786611*	-1.190726	Short-run
LNIFTY	LEXR	0.125160	-0.529800	No causality
LGOLD	LNIFTY	0.009854	-1.190726	No causality
LNIFTY	LGOLD	0.655840	0.134656	No causality
LIIP	LNIFTY	0.032992	-1.190726	No causality
LNIFTY	LIIP	0.174551	-1.236482	No causality
LM2	LNIFTY	0.834518	-1.190726	No causality
LNIFTY	LM2	5.098403**	5.020240***	Short & Long-run
LWPI	LNIFTY	0.414602	-1.190726	No causality
LNIFTY	LWPI	3.000149*	-1.165040	Short-run
LYIELD	LNIFTY	0.266221	-1.190726	No causality
LNIFTY	LYIELD	0.017127	1.844270*	Long-run

Note: *, **and *** indicates significance at: 10, 5 and 1 percent levels respectively.

Source: Result output of Eviews 6.

$$\begin{matrix} \text{LNIFTY} = -3.522783\ \text{LEXR} - 0.766982\ \text{LGOLD} - 12.37467\ \text{LIIP} + 13.73409\ \text{LM2} - 10.61513\ \text{LWPI} + 1.203733\ \text{LYIELD} - 11.32419 \\ [4.24640] \qquad [1.45385] \qquad [8.02814] \qquad [-8.50059] \qquad [4.62376] \qquad [-5.45149] \end{matrix} \quad (6)$$

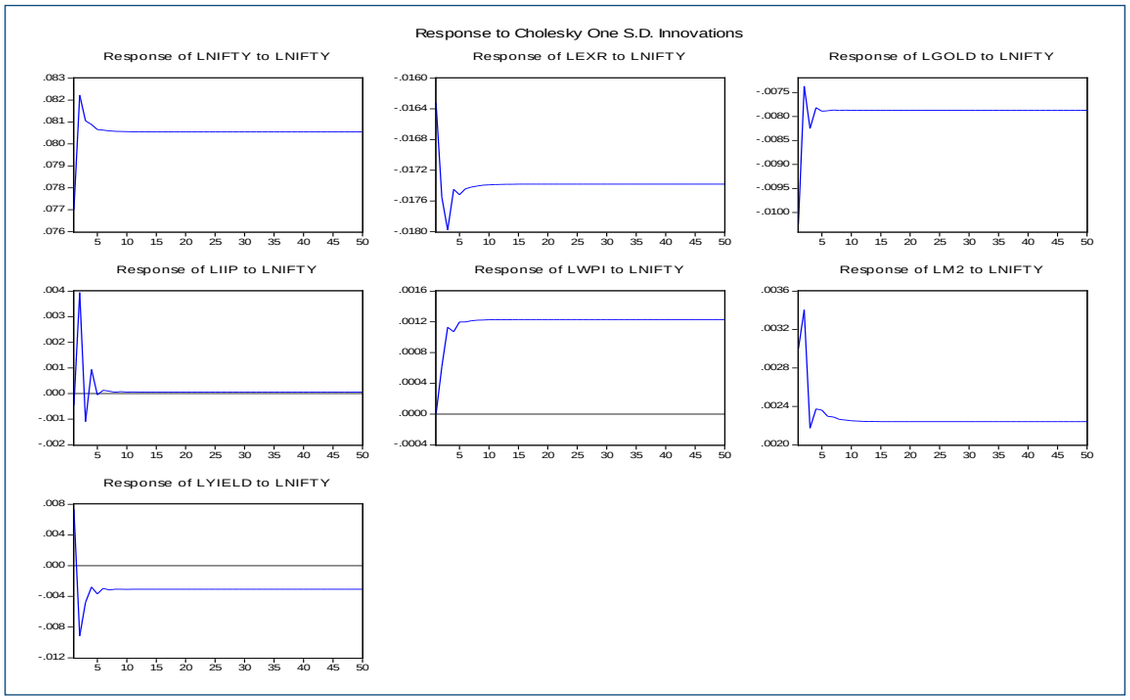
Table 9: Variance decomposition of LNifty

Period	*S.E.*	*LNifty*	*LEXR*	*LGold*	*LIIP*	*LWPI*	*LM2*	*LYield*
1	0.076	100.000	0.000	0.000	0.000	0.000	0.000	0.000
2	0.113	98.142	0.674	0.022	0.069	0.098	0.613	0.378
3	0.140	98.013	0.627	0.015	0.067	0.322	0.665	0.287
4	0.162	97.827	0.696	0.013	0.054	0.521	0.645	0.241
5	0.181	97.665	0.770	0.012	0.045	0.686	0.615	0.203
6	0.199	97.524	0.840	0.013	0.037	0.818	0.589	0.176
7	0.215	97.408	0.898	0.013	0.032	0.924	0.566	0.156
8	0.230	97.312	0.947	0.014	0.028	1.010	0.547	0.140
9	0.244	97.233	0.988	0.014	0.025	1.079	0.531	0.127
10	0.258	97.167	1.218	0.001	0.022	1.137	0.518	0.117
11	0.271	97.112	1.050	0.015	0.020	1.185	0.507	0.109
12	0.283	97.065	1.074	0.015	0.018	1.225	0.497	0.102
24	0.400	96.803	1.209	0.017	0.009	1.450	0.445	0.064
36	0.491	96.715	1.254	0.018	0.006	1.525	0.427	0.051
48	0.567	96.672	1.277	0.018	0.004	1.562	0.419	0.045

Source: Result output of Eviews 6.

Impulse response analysis

Figure 2: Impulse Response Function



Source: Result output of Eviews 6.

by inflation rate and exchange rate. The explanation of forecast error of LNifty by index of industrial production, money supply, and treasury bills yield is showing a downward trend.

Impulse response analysis is used to examine how the shocks given to the residuals (innovations) of equations within the system of every equations (one equation for each variable) impact on the variables involved at different time horizons.

The response of macroeconomic variables to one standard deviation shock to the equation for the stock market index has been examined. The results are shown in Figure- II.

The results of impulse response function shows that response of Lnifty to Lnifty is positive and increasing up to 5 month after that it is constant. Response of exchange rate is negative and after horizon 10 it is constant. Response of gold price and yield is also negative on Nifty whereas the response of rest of the variables is positive.

5. Conclusion

The main objective of this paper is to examine the relationship between a range of macroeconomic variables i.e. inflation rate, exchange rate, index of industrial production, gold price, money supply and yields on treasury bills, and Indian stock market represented by NSE S&P CNX Nifty for the period of April 2005 to March 2014. To conclude the results disclosed that on the basis of ADF and PP unit root test almost all the variables are integrated of order 1. The results of Johansen cointegration test indicates a significant negative relationship between exchange rate, inflation rate, and index of industrial production with stock prices whereas there exists a significantly positive relationship of money supply and yield on treasury bills with stock prices. The findings of vector error correction model found that short run causality runs from exchange rate to Nifty, Nifty to money supply and inflation rate whereas long run causality is found from Nifty to short term interest rates and money supply. The results of variance decomposition test depict that most of the variance in Nifty is explained by Nifty itself which is followed by exchange rate and inflation rate. The results of the study are expected to provide a deeper insight to policymakers and financial regulators who are interested in knowing the factors that influence stock markets and in formulating appropriate economic policies. The study would also be useful to professional and institutional investors who rely on fundamental analysis for their portfolio selection and revision.The present study is restricted to only six macroeconomic variables. Thus, further studies may include more fundamental factors spanning over a longer time period.

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