Macro Economy and Stock Market Performance in India: An Econometric Analysis

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Abstract
This paper, based on 164 monthly observations, investigates the dynamic relationship between macroeconomic variables and Indian stock market by employing Johnson's cointegration test and vector error correction model. Eleven macro-economic variables branded as macroeconomic forces and nifty stock index displayed cointegration of first order. This has been proved that in the long-run Indian stock market is positively related to the performance of real economic variables. Variables of international nature such as crude oil, exchange rate, FIIs have negative relationship with stock market in long-run. As expected, money supply and interest rates expounded negative relationship with stock market. Consumer price index may be stock depressing variable in the short period; however, it may trigger the real activities in the economy and reflected positively in the stock market in the long-period. FDI and gold prices have not been recognized by the Indian stock market in long-run. Vector Error Correction model highlights that disequilibrium in the long-run relationship is corrected promptly towards equilibrium values of stock market. The impulses generated in the international financial and commodity markets are reflected in the Indian stock prices. Indian stock market expounds stable relationship with, exchange rate, crude oil, money supply, consumer price index and its. However, such relationship is unstable with index of FII's, FDI, and interest rates.

Keywords
Cointegration, Vector Error Correction, Stock Market, Economic Forces, Impulses Response Function

I. Introduction
This has been recognized in economic literature that stock markets play a sizeable role in the development of an economy [34] and form an integral part of the financial markets. For, stock markets provide access to cheaper capital to business houses and investors get chance to lucratively invest their savings. Since stock prices are subject to fluctuations; therefore, it is essential to determine the forces that influence them for better understanding of the functioning of the stock market in particular and the economy in general. So, it may evince interest among investors, as they are better enabled to forecast stock prices accurately to make apt decisions regarding their portfolio for maximum gain. The changes in real economic activities, in multi-period economic set up, affect the consumption and investment divide [15-16]. Such changes in consumption and investment opportunities along with innovations in economic state of variables are priced in stock markets [7]. Besides, Stock prices are sign of firms' financial health that may help them to mobilize additional resources from the market at higher premium. As, performance of these economic forces is reflected in cash flows and may impact the risk adjusted discount rate [18, 33, 45]Prices of stocks influence economic activities in the long run; therefore, may interest the policy makers and economists [10]

Many economists believe that stock market performance is highly influenced by macroeconomic fundamentals. The relationship of stock market performance and macroeconomic variables such as interest rates, exchange rates, GDP and the money supply has been investigated by many researchers [20, 26, 41-42]. Most of these studies are based on well-established stock markets such as the US, UK and Japan [8, 38, 41] and some are related to emerging stock markets [2, 4, 22].

Since such relationships are successfully captured in developed economies; however, such studies are not much prevalent in country like India. This study endeavors to fill such research gap and attempts to examine the dynamic relationship between economic forces and stock prices in an emerging economy like India. For, the behaviour of stock prices in less developed economies is not tied to economic fundamentals [22] and, therefore, makes it difficult to predict the forces affecting the stock prices. Also, research on such markets has revealed that returns and risks in these markets are higher relative to those in developed countries [24]. Hence, it is interesting to determine factors that cause these risks and returns and study the relationship between macroeconomic forces and stock prices in emerging stock markets.

II. Hypotheses Formulation: Coined from Theory and Empirical Evidences
This has been widely established in literature that several macroeconomic variables may affect the performance of stock market [9] and Indian experience might not be exceptional. Taking cue from previous studies, three set of variables namely-financial, foreign and real sector are identified to establish such relationship in Indian economy.The relationship between the stock market performance and the interest rate is traced back to Friedman's money demand function [39]. Friedman (1956) [19] theoretically illustrated that an agent's decision of portfolio allocation such as equity investments has an impact on savings-consumption decision and it is determined by the interest rates changes. Interest rates are expected to bear negative relationship with the stock market performance [3]; for, interest rates represent the opportunity cost of investors in the equity markets. An increase in the interest rates results in high opportunity cost of holding cash and leads investors to substitute it with stocks and other interest bearing securities. Moreover, the interest rates, through their effect on the risk-free rate, will cause an increase in the discount rate [23, 37]. Thus, stock prices are expected to fall and vice versa.

A positive as well as negative relation is hypothesized between foreign exchange rate (against the US dollar) and stock prices [13, 35, 47]. For, appreciation in rupee may reduce competitiveness in the international market, consequently international demand for Indian products. Therefore, economic activity in the economy may slow down and it may affect negatively the stock prices. However, appreciation in exchange rate may indicate the strength and potential of the economy, hence, may positively reflect in stock prices [13]. On the other hand, depreciation in Indian rupee may leverage the firms depending on foreign demand whereas inelastic imports increase the financial burden on the economy and negatively reflected in stock prices.

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A fall in consumer price index lowers the nominal risk free rate and decreases the discount rate in stock valuation model, leading to higher stock prices. Many previous studies like Fama and Schwert (1977) [17], Geske and Roll (1980) [21], Chen, Roll and Ross (1986) [6], Chen (199l) [7], and DeFina (1991) [12], Omotor (2010) [38], have documented negative relationship between stock price and inflation. So the relation between consumer price index and stock returns has been theorized to be negative. However, Mukherjee and Naka (1995) [37] suggested that the effect of lower discount rate would be neutralized if cash flows decrease with the CPI. It must be noted that prices, in general, may be subject to greater fluctuations in the developing countries, which may render the relationship insignificant. Thus, a negative or insignificant relationship is expected between CPI and stock prices.

Since India is a net crude oil importer and performance of the economy is dependent on oil prices, we hypothesize a negative relationship between oil prices and Indian stock market. Jones and Kaul (1996) [31] investigated the effect of oil prices on stock markets and concluded that in oil importing economies like UK and Japan, changes in oil prices appear to cause larger change in stock prices. High oil prices will result in reduced economic activities, as it serves as an input for production in the real sector, and lower expected cash flows and stock prices[25] [1]So, a negative relationship is hypothesized between oil prices and stock prices.

The relationship between money supply and stock prices is not definite [11] because changes in money supply have important direct effects on stock prices via portfolio changes, and indirect effects via its effects on real activity variables [36]. As money growth rate is likely to be positively related to inflation, it will increase the discount rate and, hence, lower stock prices. The increase in money supply may also lead to a boost in companies' cash flows resulting from the increased money supply [6, 37] known as corporate earnings effect, which is likely to increase stock prices. For this study, a negative relationship is expected between money supply and stock prices since prices and interest rates are subject to greater fluctuations in developing countries.

Real economic activity in the economy is measured by the industrial production. Enhanced real economic activities are expected to be positively reflected in stock prices [28].The industrial performance provides more confidence in the economy; hence, more faith in the stock market. Surplus balance of trade strengthen the economy in the international arena and help to generate surplus funds to import important needs of the economy, therefore, confidence in the economy improves and ultimately reflected in the stock market [5].Thus, BOT has been included as a variable in the analysis and may positively affect the stock prices.

People are very much fond of gold in Indian set up and consider it as a secure investment. Since, gold has an asset value; it works as an important saving material. Hence, any expectation for better returns in gold may depress the stock prices as the savings diverted into yellow metal [4]. Therefore, it is hypothesized that stock prices bears negative relation gold prices.

It has been proved in the literature that Indian stock market is highly FII driven. Inflow of FIIs, not only bring the cash to the stock market but also a sign of better performance of the economy. Therefore, quantum of inflow is expected to be positively associated stock market returns [27].The technology transfer in terms of innovations and invention to developing country like India in terms of FDI is expected to have positive impact on the stock market. The studies have predicted complementarities between stock market and the FDIs [32][48].

III. Methodology, Data Source and Description:

A. The Model

This paper investigates the dynamic relations between macroeconomic variables and Indian stock market. To this purpose cointegration tests and vector error correction technique have been used. To examine the cointegration relationship between the stock market performance and economic forces, Johansen Cointegration test has been employed which is widely used in such contexts in recent times. Until now, the most widely used framework in this regard was the Arbitrage Pricing Theory (APT) model developed by Ross (1976) [44].Though, Engle and Granger's (1987) [14] two step error correction model may be used in multivariate context, Johansen's vector error-correction model (VECM)yields more efficient estimates of cointegrating vectors. This is because the VECM is a full information maximum likelihood estimation model which allows testing for cointegration in a whole system of equations in one step and without requiring a specific variable to be normalized. If cointegration between Indian stock market performance and the economic forces is observed, it implies that stock market performance bears long run relationship with the economic forces prevailing in the economy. Johansen cointegration testing method is based on a following model (Johansen, 1988, 1991) [29-30].

$$\Delta Yt = \sum_{j=1}^{k-1} \Gamma j \Delta Yt - j + \Pi \Delta Yt - k + \mu + \varepsilon t \qquad (1)$$

Here Δ is a notation for first differences and Yt is a p×1 vector of variables. μ is a p×1 vector of constants and k is a lag structure while ε_t is a p×1 vector of white noise error terms. Γ_j is a p×p matrix that represents short-term adjustments among variables across p equations at the j^{th} lag. The coefficient matrix contains information about long-run relationship between the variables in the data vector. If the matrix has full rank, it implies that the vector process Y is stationary and VAR model without differencing the data set can be used. If the rank of matrix is zero i.e. a null matrix, implies that there is no long-term relationship between level variables and a first difference VAR model is appropriate. If the rank of matrix isr< p, it implies that there exist (p x r) matrices of α and β such that = αβ′ where α denotes the adjustment coefficient and β denotes the cointegrating vector. In this case the vector $\beta' Y_t$ is stationary, even though Y_t is non-stationary. It should be noted that;

$$\sum_{j=1}^{k} \Gamma j \Delta Y_{t-j} \quad \text{and } \Pi Y_{t-k} \qquad (2)$$

are the Vector Autoregressive (VAR) component in first differences and error-correction component in levels of equation (1) respectively.

B. Estimation

VECM is estimated by the following procedure:

Before employing the VECM, time series of variables in the system are tested for the stationarity. The tests for stationarity or unit roots here employ the augmented Dickey-Fuller (ADF) and Phillips-Peron (PP) tests performed on the variables in levels and first differences. Only variables integrated of the same order can be cointegrated and the unit roots tests will help us determine which variables are integrated of order one or I(1). For example, the ADF tests the null hypothesis;

H_0: φ = 0

$$\Delta Y_t = \varphi Y_{t-1} + \sum_{i=1}^{k} \alpha_i \Delta Y_{t-i} + \mu_t \quad (3)$$

If the turned out to be insignificant then the unit root exists in the series hence, the series is termed as non-stationarity. The lagged values of Y_t are added on the right hand side of the model to make the residual values purely white noise. The ADF test, however, assumes the asymptotic normality of the idiosyncratic error term in Equation (3).The Phillips-Peron test, while similar, allows for weaker statistical assumptions regarding μ_t. PP unit root test does not require that the μ_t's are conditionally homoscedastic and normality of the error term. The number of lagged values to be added in the model is determined by information criteria provided by Akaike Information Criterion (AIC) and Schwarz Information Criterion (SIC).

After determining the stationarity of the variables and order of integration cointegration relationship can be established by estimating the equation-1and determine the rank of αβ′. The eigenvectors in β′ are estimated from the canonical correlation of the set of residuals from the regression equations. The test of cointegration between the Ys is calculated by looking at the rank of the Π matrix through its Eigen values. The number of Eigen values that are different from zero determines the rank of a matrix. There are two test statistics for cointegration under Johansen methodology: Trace (λ_{trace}) Statistic and Max-Eigen value Statistic (λ_{max}). The test statistics are formulated in the following way:

$$\lambda_{trace}(r) = -T\Sigma_{r+1}^{k} \ln (1 - \hat{\lambda}_i) \quad (4)$$

$$\lambda_{max}(r, r+1) = -T \ln (1 - \hat{\lambda}_{r+1}) \quad (5)$$

Where r is the number of cointegrating vectors under the null hypothesis (r=0, 1, k-1), k represents number of variables in the system, T is number of observations and λ_i^ is the estimated value for i^{th} ordered Eigen value obtained from the estimated Π matrix λ trace is a joint test where the null hypothesis is that the number of cointegrating vectors is less than or equal to r against the alternative hypothesis that there are more than r.λ_{max} conducts separate tests on every Eigen value and the null hypothesis that number of cointegrating vectors is r against the alternative hypothesis r +1.

After ascertaining the order of cointegration, relevant cointegrating vector are selected and analyzed for speed of adjustment of variables. Tests on the parameters of the cointegrating vector can be performed using the likelihood ratio test;

$$LR = T\sum \ln [(1- \hat{\lambda}_{i}^{H_i}) / (1- \hat{\lambda}_i)] \quad (6)$$

and follows a chi-squared (χ2) distribution with r,(p+1-s) (with restrictions) degrees of freedom. The $\hat{\lambda}_i$ Hi are Eigen values based on restricted eigenvectors; the are those based on unrestricted eigenvectors.

C. Impulse Response Function

An impulse response function traces the effect of a one standard deviation shock to one of the innovations on current and future values of the endogenous variables. A shock to the ith variable directly affects the ith variable, and is also transmitted to all of the endogenous variables through the dynamic structure of the VAR. The impulse response functions can be used to produce the time path of the dependent variables in the VAR, to shocks from all the explanatory variables. If the system of equations is stable any shock should decline to zero, an unstable system would produce an explosive time path.

Table 1: Macroeconomic Variables Used in the Analysis

Variable	Symbol	Data Source	Unit of Measurement
Index of Industrial Production	IIP	www.mospi.nic.in	Index (2004-5=100)
Balance of Trade	BOT	www.tradingeconomics.com	INR Billion
Exchange Rate	ER	www.X-rates.com	Rupee vs. US Dollar
Crude Oil Price	COP	www.indexmundi.com	US $ / Barrel
Gold Prices	GP	www.indexmundi.com	Per Troy Ounce
Foreign Exchange Reserves	FER	www.tradingeconomics.com	INR Billion
Foreign Institutional Investment	FII	www.moneycontrol.com	INR Crore
Foreign Direct Investment	FDI	www.tradingeconomics.com	US $ Million
Money Supply	M3	www.tradingeconomics.com	INR Billion
Consumer Price Index	CPI	Consumer Price Index	Index (2001-2=100)
Interest Rate	IR	www.allbankingsolutions.com	Percentages

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Table 2: Descriptive Statistics (January, 2000 to August, 2013)

Variable	Mean	Median	Minimum	Maximum
CNX Nifty	3322.43	6138.60	913.85	1816.01
IIP	125.033	194.200	75.600	35.003
BOT	-303.548	11.060	-1111.46	293.666
ER	46.704	62.695	39.387	3.964
Crude Oil Price	62.089	132.55	18.520	31.334
Gold Price	37309.8	95194.24	12100.23	25665.25
FER	7938.44	15012.00	1391.340	4531.530
FII	3689.40	29195.80	-17326.30	7605.081
FDI	1175.91	5670.00	58.00	1204.366
M3	37219.1	87567.88	10911.30	22767.60
CPI	139.923	237.00	92.870	40.624
IR	11.437	14.00	8.00	1.161

P.C Version of E-Views Econometric Package has been employed to analyze the data.

Data Description and Sample Period:

The study covers the period from January 2000 to August 2013. This period observed the phases of boom as well as recession; hence, may better mirror the dynamic relationships between economic forces and Indian stock market performance. CNX nifty has been selected as the stock market index

In order to perform a cointegration test and vector error correction model, the non-stationarity of the data series has to be established. Here, each variable included inthe study is tested for unit roots using the Augmented Dickey-Fuller Test (ADF). Assuming the series have non-zero mean, a constant is included in the regression. Table 3 summarize the results of the ADF test. The critical values of the tests MacKinnon (1991) are used. Lag lengths are chosen according to Akaike Information Criterion (AIC) and Schwarz Information Criterion (SIC).Table 3 reveals that all unit root tests for the variables under the study have shown that test statistics are insignificant at levels and hence all the variables at levels are non-stationary. However, for the first difference series, the null hypothesis of a unit root is rejected for all the variables. Therefore, the data series are stationary in the first difference and all variables are individually integrated of order one I (1), a necessary pre-condition for Cointegration analysis. To vindicate the results obtained in Table 3 regarding stationarity, Phillips-Perron's unit root test has been employed and the results are presented in Table 4. The results of ADF are corroborated by the Phillips-Perron test.

Table 3: Unit Root Test (ADF) for Level and First Difference Data

Variable	Level Data		First Difference Data	
	Without Drift	With Drift	Without Drift	With Drift
CNX Nifty	0.3692	-1.0737	-4.8174*	-4.9268*
IIP	1.3231	-0.9171	-7.1094*	-7.5708*
BOT	-0.0234	-1.0064	-8.0585*	-8.1524*
ER	1.2623	0.3802	-3.8105*	-3.9519*
Crude Oil Price	0.1324	-1.3803	-5.8215*	-5.8836*
Gold Price	2.3135	0.6549	-4.7883*	-5.5000*
FER	2.6319	-0.2504	-4.7886*	-6.0264*
FII	-1.9669	-2.1075	7.1934*	-7.1681*
FDI	-1.2410	-1.9507	-7.2416*	-7.2276*
M3	7.4833	5.9446	-1.7795**	-3.9389*
CPI	5.4318	4.8950	-2.7584*	-4.8680*
IR	-0.4888	-2.1080	-6.1528*	-6.1429*

*Stands for significant values

D. Johansen Cointegration

Since, the unit root tests have determined the data series to be cointegrated of the same order I (1), therefore, Johansen's cointegration test can be employed. The determination of cointegration r is concluded by using two statistics, the Trace Statistic (λ_{trace}) and Max-Eigen Value Statistic (λ_{max}). A Vector Error Correction (VEC) model is a restricted VAR that has cointegration restrictions. The VEC specification restricts the long run behaviour of the endogenous variables to converge to their cointegrating relationships while allowing a wide range of short term dynamics. The cointegration term is, thus, known as the error correction term.

The empirical results of the cointegration rank test derived from Johansen multivariate VECM involving the twelve variables chosen in the study are summarized in Table 5 & 6.

Table 4: Unit Root Test (Phillips-Perron) for Level and First Difference Data

Variable	Level Data		First Difference Data	
	Without Drift	With Drift	Without Drift	With Drift
CNX Nifty	0.5808	-1.0737	-4.8274*	-4.9268*
IIP	1.1518	-1.0112	-23.8319*	-24.5350*
BOT	-0.6062	-1.006	-8.1234*	-8.1524*
ER	1.3849	0.5377	-8.7432*	-8.8313
Crude Oil Price	0.1519	-1.3803	-8.0044*	-8.0233*
Gold Price	2.3135	0.7618	-11.3737*	-11.8157*
FER	2.6319	-0.2504	-9.2257*	-9.9313*
FII	-2.017	-1.9575	-22.3416*	-22.2614*
FDI	-2.510	-2.1551	-27.0689*	-26.9985*
M3	14.7973	6.9681	-12.7005*	-16.4453*
CPI	9.6267	5.8867	-7.0239*	-9.4628*
IR	-0.6522	-2.3242	-11.7295*	-11.7065*

Table 5: Johansen Cointegration Test (Trace Test)
(January, 2000 to August, 2013, Monthly Data)

Eigen Value	Likelihood Ratio	5% Critical Value	1% Critical Value	Hypothesized No. of CE(s)
0.5120	592.2406	233.13	247.18	None**
0.4816	478.1536	233.13	247.18	At most 1**
0.3980	373.6637	233.13	247.18	At most 2**
0.3559	292.9644	192.89	204.95	At most 3**
0.3231	223.0092	156.00	168.36	At most 4**
0.2728	160.9521	124.24	133.57	At most 5**
0.2358	110.2886	94.15	103.18	At most 6**
0.1602	68.1975	68.52	76.07	At most 7
0.1008	40.4206	47.21	54.46	At most 8
0.0872	23.5183	29.68	35.65	At most 9
0.0541	8.9948	15.41	20.04	At most 10
0.0008	0.1385	3.76	6.65	At most 11

** denotes rejection of the null hypothesis at 1% significance level, LR test indicates 7 cointegrating equations

Table 6: Johansen Cointegration Test (Maximum Eigen Value Statistic)
(January, 2000 to August, 2013, Monthly Data)

Eigen Value	Likelihood Ratio	5% Critical Value	1% Critical Value	Null	Alternative
0.5120	114.087*	46.77	48.48	r = 0	r = 1
0.4816	104.489*	52.24	55.38	r = 1	r = 2
0.3980	80.699*	50.84	54.07	r = 2	r = 3
0.3559	69.955*	46.86	49.66	r = 3	r = 4
0.3231	62.057*	44.06	47.78	r = 4	r = 5
0.2728	50.663*	39.51	42.05	r = 5	r = 6
0.2358	42.091*	36.62	39.98	r = 6	r = 7
0.1602	27.776	29.16	31.11	r = 7	r = 8
0.1008	16.902	19.94	22.98	r = 8	r = 9
0.0872	14.523	18.44	22.14	r = 9	r = 10
0.0541	8.856	15.32	19.70	r = 10	r = 11

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Trace statistic reveals that likelihood ratio statistic 592.2406 for no cointegrating vector is larger than the critical values (both at 1% and 5%) leading to conclude that null hypothesis of no cointegrating vector is rejected. Testing the hypothesis of at most one cointegrating vectors is also rejected; and hypotheses are rejected up to six cointegrating vectors. The null hypothesis of at most seven cointegrating equations has been accepted, hence it can be concluded that system has seven cointegrating relations (Table 5). Likelihood ratio tests statistics based on Max-Eigen value statistic further substantiate the earlier result of seven cointegrating vector (Table 6).

E. Long Run-Cointegrating Model

Long-run cointegrating relations generated by Johnson's cointegrating model are presented in Table 7. Since better industrial performance generally bears positive relation with stock prices. The result in this context is on expected lines as the IIP variables turned out to be positively significant in influencing the stock market in Indian economy. It has been hypothesized that exchange rate bears negative relationship with the stock market performance. Since the movement of exchange rate affect the real market activities hence, the performance of the stock market. The Table 7 shows that this variable is negatively significant in explaining the movement of the stock market overtime. Indian economy is highly dependent on the import of crude and any upward movement of crude oil in the international market is negatively reflected in the stock market. This hypothesis has been accepted by the data (albeit at low level of significance).

The general notion that gold prices significantly affect the stock prices is not supported by the data in the Indian set up. We may conclude here that purchase of gold is more of emotional than the rational decision. Contrary to the general feature that inflation (measured by CPI) may depress the stock market performance, long period relationship does not support such relationships. For, other variables adjust accordingly in the long run. Therefore, the coefficient of CPI variable turned out to be positively significant.

Table 7: Normalized Cointegration Relations of Variables (Dependent Variable: CNX Nifty)

Variable	Cointegration Coefficient	T-Statistic
IIP	124.61	3.50*
BOT	-18.06	2.9*
ER	-290.71	3.19*
Crude Oil Price	-44.42	1.87***
Gold Price	-0.05	1.25
FER	-0.45	3.00*
FII	-0.18	2.33*
FDI	-0.25	1.18
M3	-0.72	3.22*
CPI	327.21	3.40*
IR	-229.76	2.20*
Constant	-1695.23	

Money supply may affect the performance of the economy positively as well as negatively. But the long period relations shown in the Table 7 depicts that money supply establishes negative relationship with the stock market performance. Since, it is considered that Indian stock market is FII driven, as this is hot money and withdraw from the market as they feel discomfort here. Hence, long period relation is negative, contrary to expectations. We may say here that FII drives the market more towards volatility instead of real growth. However, the role of FDI in stock market performance long period is not supported by the data and its coefficient has turned out to be insignificant. Hence it can be concluded here that Industrial production bear long period positive relationship with the stock market prices. However, crude oil, exchange rate, foreign institutional investments, money supply and interest rates bear negative relationship with stock prices. Consumer price index may be stock price depressing variable in the short period, however it may trigger the real activities in the economy and positively reflected in the stock market in long period. FDI and gold prices are not recognized by the stock market in long period.

F. Vector Error Correction

The foregoing discussion has established that cointegrating relationship exists among the selected variables. The inclusion of such error correction terms exclusively in the VAR system, the estimated equation for CNX Nifty in VAR along with cointegration components is presented in the box (Table 8).

The Table 8 reports the results of the Vector Error Correction Model regarding the short run dynamics of CNX nifty. The model explains about 40 percent variation in the CNX nifty by the error correction and the lagged values of the first differences of the variables included in the model. Besides, significant value of F-Statistics justifies the model. The sign and magnitude of the error correction coefficients (adjustment Coefficients) indicate the direction and speed of adjustment towards the long-run equilibrium path. A negative error correction coefficient implies that in the event of a positive deviation of the model from the long-run equilibrium, is corrected by changes in the dependent variable. This confirms the existence of a long–run relationship. The error correction terms except 4th are insignificant in relation to first difference of CNX Nifty. Therefore, it may, obviously, be interpreted as the disequilibrium in the long run relationship is corrected promptly towards the equilibrium value of CNX nifty. However, Z4 bears a positive and significant coefficient, hence exchange rate does not provide and correcting mechanism rather it is explosive overtime.

The short run results indicate that CNX nifty is negatively affected by its previous values. As the positive performance of the stock market in the past lures the investors to book the profit, hence the previous performance negatively affects the current value. However, such values are also insignificant. The industrial performance is promptly reflected in the stock prices, however such contribution fades gradually. The error correction model reports that stock market does not recognize the balance of trade immediately, however it is reflected in the stock market after some time when the effect of such BOT variable start appearing in the performance of the economy. In the short period, exchange rate depreciation is negatively affected in the stock prices, however, when the firms benefiting from such depreciation this reflection changes into positive. Crude oil price play a significant role in the Indian economy, and any change in this variable in the short period is immediately reflected negatively in the stock prices. Though, gradually its impact gets slower. Though, FIIs do not have long period sustaining affect but they have significant positive effects on the performance of stock market. In addition, in the short period, FDI do have positive effects. Hence, it can be concluded here that impulses generated in the international financial and commodity market are reflected in the prices of Indian stock market. As an obvious consequence, inflation does affect the stock market negatively and facilitated by the money supply in the same manner.

Table 7: The ECM Equation of CNX Nifty

$$\Delta \text{CNX NIFTY} = 45.40 + 0.03Z_1 + 7.71\,Z_2 + 0.15\,Z_3 + 25.43^{*}\,Z_4 - 0.15Z_5 - 0.01Z_6 - 0.03Z_7 - 0.14\Delta \text{CNX NIFTY}_{-1}$$

(0.85) (0.48) (1.14) (0.15) (3.48) (0.05) (1.79) (0.83) (1.08)

$$- 0.22\,\Delta \text{CNX NIFTY}_{-2} + 6.71^{*}\Delta IIP_{-1} - 0.48\Delta IIP_{-2} - 0.22\Delta BOT_{-1} - 0.59^{*}\Delta BOT_{-2} - 47.32\Delta ER_{-1} + 34.41\Delta ER_{-2} - 0.73^{*}\Delta COP_{-1}$$

(1.75) (2.18) (1.11) (0.53) (2.06) (1.38) (0.97) (2.20)

$$- 3.71\Delta COP_{-2} + 0.01\,\Delta GP_{-1} + 0.04^{*}\,\Delta GP_{-2} - 0.04\Delta FER_{-1} + 0.10\Delta FER_{-2} + 0.01^{*}\Delta FII_{-1} + 0.06^{*}\Delta FII_{-2} + 0.06^{*}\Delta FDI_{-1}$$

(0.63) (0.61) (2.99) (0.41) (0.97) (2.66) (1.97) (2.08)

$$+ 0.05\Delta FDI_{-2} - 0.03\,\Delta M3_{-1} - 0.06\Delta M3_{-2} - 36.73^{*}\,\Delta CPI_{-1} + 40.34\,\Delta CPI_{-2} - 31.81\Delta IR_{-1} - 71.51\,\Delta IR_{-2}$$

(1.73) (0.73) (1.84) (2.13) (1.75) (0.54) (1.20)

$R^2 = 0.3949$ N=163 F=2.74 (Significant) $Z_1, Z_2, Z_3, Z_4, Z_5, Z_6, Z_7$, are co-integrated factors

Figures in parentheses are T values * indicates significant values

Following co-integrated equations have been generated by E-Views econometric software

$$Z_1 = \text{CNX Nifty}_{-1} - 0.23FII_{-1} - 2.82\,FDI_{-1} - 0.24M3_{-1} + 110.48CPI_{-1} + 542.89IR_{-1} - 11523.14$$

$$Z_2 = IIP_{-1} - 0.003FII_{-1} - 0.02FDI_{-1} - 0.004M3_{-1} + 2.20CPI_{-1} + 6.74\,IR_{-1} - 316.48$$

$$Z_3 = BOT_{-1} + 0.002FII_{-1} + 0.07FDI_{-1} + 0.04M3_{-1} + 13.26CPI_{-1} - 2.53IR_{-1} + 508.57$$

$$Z_4 = ER_{-1} + 0.02FII_{-1} + 0.005FDI_{-1} - 0.001M3_{-1} - 0.102\,CPI_{-1} - 1.08IR_{-1} - 12.32$$

$$Z_5 = COP_{-1} - 0.003FII_{-1} - 0.05FDI_{-1} - 0.01M3_{-1} + 4.55CPI_{-1} + 15.41IR_{-1} - 456.20$$

$$Z_6 = GP_{-1} + 1.93FII_{-1} + 0.25FDI_{-1} - 6.94\,M3_{-1} + 237.88CPI_{-1} + 126.12IR_{-1} - 1326.45$$

$$Z_7 = FER_{-1} - 0.39FII_{-1} - 0.21FDI_{-1} - 6.94\,M3_{-1} + 23.88CPI_{-1} + 126.12IR_{-1} - 132.45$$

G. Impulse Response Function (IRF)

Apart from the long and short term dynamics, VEC model of selected variables is useful for identifying the relative importance of each variable to others, based on the dynamic interaction among them through impulse response functions (IRF).This is useful for estimating the importance of innovations in one variable to other variables and the nature of transmission across variables. IRF traces the impact of one standard deviation change in exogenous variable on the endogenous variable. The impulse response functions can be used to produce the time path of the dependent variables in the VAR, to shocks from all the explanatory variables. If the system of equations is stable any shock should decline to zero, an unstable system would produce an explosive time path. The results of Impulse Response Functions are reported in figure-1. In this research paper primary concern is about the behaviour of the short-run dynamics of the model in the presence of any external shock emanating from any of the variables particularly on CNX Nifty.

This Impulse response has been tracked to 10 months. The figure-1 shows that the nifty shock may initially depress the variable, however gradually it stabilizes at its long-period level. Since stock markets generally lists the business firms and any shock to the variable of industrial production continuously positively reflected in stock market with much less fluctuations. However, the impact emanating from the balance of trade variable could not be recognized by the stock market. Oil prices shock lead to a large increase in the Nifty initially and the effect increases with time before again settling at a permanent level. Similarly, money supply shock leads to slight fall in up to a few initial months, which supports the cash flow effect of money supply, and ultimately settled down to the constant level. The exchange rate shock does provide the fluctuating set up to the stock market in India. As expected any shock to FII is reflected in stock market fluctuating but positive. The figure-1 depicts that Indian CNX Nifty index bears stable relationship with itself, exchange rate, crude oil, gold prices, money supply and consumer price index. However, such relationship is unstable with IIP, FII, FDI and interest rates.

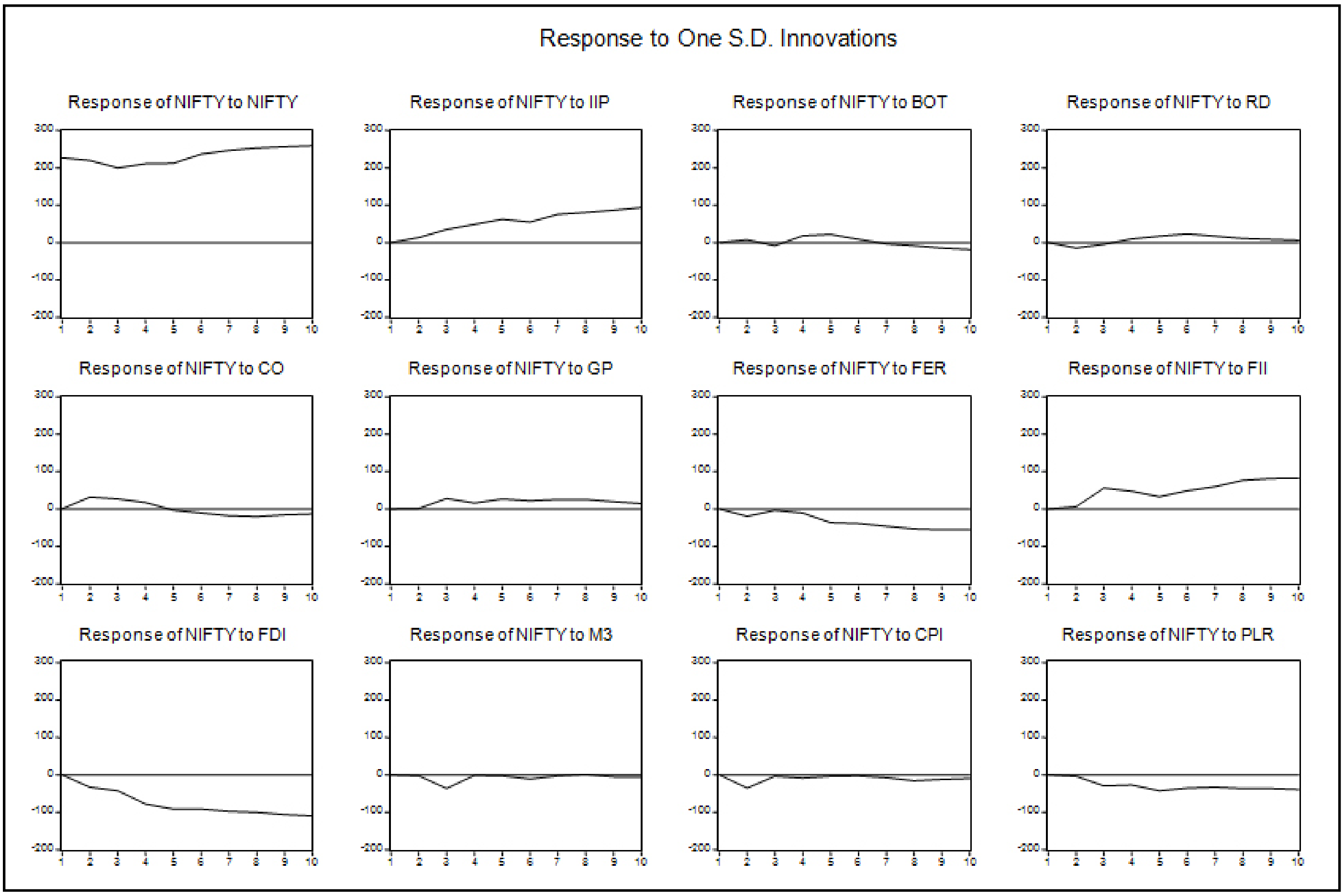

Fig. 1: Impulse Response Function

IV. Concluding Remarks

This study investigates the dynamic relationship between the economic forces and Indian stock market by employing Johnson's cointegration test and Vector Error Correction Model. Based on 164 monthly observations (from January, 2000 to August, 2013) of eleven macroeconomic variables labeled as economic forces and Nifty stock index, it has been discovered that variables have cointegration of order one. This has been proved that in the long-run Indian stock market is positively related to the performance of real variables. Variables of international nature such as crude oil, exchange rate, FIIs have negative relationship with stock market in long-run. As expected, money supply and interest rates bears negative relationship with stock market. Consumer price index may be stock depressing variable in the short period; however, it may trigger the real activities in the economy and positively reflected in the stock market in the long-period. FDI and gold prices are not recognized by the Indian stock market in long-run. Vector Error Correction model highlights that disequilibrium in the long-run relationship is corrected promptly towards equilibrium values of stock market. The impulses generated in the international financial and commodity market are reflected in the Indian stock prices. Indian stock market bears stable relationship with itself, exchange rate, crude oil, money supply and consumer price index. However, such relationship is unstable with index of FII's, FDI, and interest rates.

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