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THE CAUSAL RELATIONSHIP BETWEEN CAPITAL MARKET PERFORMANCE AND ECONOMIC GROWTH: A Vector Error Correction Model Estimation

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Abstract: This paper analyses the static and dynamic causal relationship between capital market performance and economic growth in India, along with other macroeconomic variables inflation rate and interest rate. The daily data on market capitalisation, Sensex, nifty50 and the value of shares traded are used as the measures of the stock market performance for a period of 17 years spanning from January 2000 to December 2016 consisting of 6210 observations. In the empirical analysis, the ADF, correlogram, cointegration and causality tests are performed. The VECM is employed to analyse the causality between the variables modelling each of the variables individually as a function of the lagged values of all the variables. The estimated VECM results show that the dynamic processes converge as the estimated value of the error correction termsarenegative, but statistically insignificant. The study indicates that there exists no strong long-run causal relationship between capital market performance and economic growth in India.

Keywords: Capital market performance, economic growth, dynamic causality, VAR estimation

INTRODUCTION

Economic growth is generally understood to indicate the level of development of a society. Among the various measures of economic growth, the performance of the capital market is the single most indicator of the health of an economy, especially the industrial and financial growth. The capital or stock market also plays a significant role in resource mobilisation and integration with the global economy. In fact, the development of the stock market of an economy and its performance is considered as the basis for industrialisation of an economy. The stock market acts not only as a

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measure of economic development but also contributes to the acceleration of economic growth. That is why governments of most nations tend to have a keen interest in the performance of stock markets. Adjasi and Yartey (2007) argue that the capital (stock) market accelerates economic growth by providing a boost to domestic savings and increasing the quantity and quality of investment. The development of the capital market transforms a country from a simple saver to an investor (Ewah *et al.* 2009).The capital market therefore positively influences economic growth through encouraging savings among individuals and providing avenues for firm financing.

The capital market, where buyers and sellers engage in trade of financial securities like bonds, stocks, etc., consists of primary markets which deal with the trade of new issues of stocks and other securities,and secondary markets wherethe exchange of existing or previously-issued securities are traded. The performance of the capital market in an economy can be understood by parameters like market size, market capitalisation - the market value of a company's outstanding shares, market liquidity - the ratio of the total value of shares traded to GDP, market turnover - the total value of shares traded in relation to the size of the market, market volatility - the rate and magnitude of changes in stock prices, and market efficiency. The stock market in India is under the strong regulatory mechanism and a more modernised market infrastructure and has a significant watch of the Reserve Bank of India. However, with the global financial crisis that originated from the US sub-prime mortgage market, the capital market of India delivered a sluggish performance. While the stock market suffered from volatility and weak form inefficiency, the market at the same time showed a strong potential for greater market size, more liquidity and reasonable market turnover ratio (Mishra *et al.* 2010).

This paper attempts to investigate the static and dynamic relationship between capital market and economic growth in India. The main objective of this paper is to examine the long and short-run causal relationship among the components of capital market performance and economic growth of India.This study considers real GDP as the measure of economic growthand market capitalisation, sensex, nifty50 and the value of shares traded as measures of capital market performance, along with other macroeconomic variables like rate of inflation (WPI) and interest rate (call money rate). The macro data are collected from the Reserve Bank of India (RBI), and the daily data on the stock market are collected from the Bombay Stock Exchange (BSE) and the National Stock Exchange (NSE) for seventeen years from January 2000 to December 2016 consisting of 6210 observations. In the empirical analysis, the unit root test addresses the stationarity of the time series data and the graphical representation of it is explained by the correlogram. The Vector Error Correction Model (VECM) is employed to analyse the long-run and short-run causal relationship between the capital market performance and economic growth in India during the study period.

REVIEW OF LITERATURE

Maysami *et al.* (2004) examine the relationship between macroeconomic variables and sector stock performancein Singapore. The macroeconomic variables include interest rate, inflation, exchange rate, industrial production and money supply.The stock market indices used are the SES All-S Equities Finance Index, SES All-S Equities Property Index and SES All-S Equities Hotel Index as well as the Singapore Composite Index.The vector error correction model results show that the Singapore stock market and the SES All-S Equities Property Index have a significant relationship with all macroeconomic variables identified, while the SES All-S Equities Finance Index and SES All-S Equities Hotel Index have a significant relationship with only a few variables.

Schneider *et al.* (2008) study the long-run relationship between macroeconomic variables in Germanyover the period 1991Q1–2005Q4. These long-run relations are based on production, arbitrage, solvency and portfolio balance conditions, together with stock-flow and accounting identities. The underlying economic theory provides five long-run relations or equilibrium conditions among the nine variables of the macro-model. The long-run relationships are embedded in an unrestricted VECM model with nine variables. The estimated VECM model, subject to the theoretical restrictions on the long-run coefficients, identifies five long-run relationships.

Ewah *et al.*(2009) investigate the impact of stock market performance on economic growth in Nigeria for the time series data from 1980-2002 using market capitalisation, value of shares traded, all share index, average prime lending rate, inflation rate, national savings and gross domestic product.The error correction mechanism (ECM) is employed to determine the short-run and long-run effects of stock market performance on economic growth. The OLS estimates show that the stock market has a positive and significant effect on economic growth in Nigeria. It also revealed that market capitalisation has a negative but significant relationship with gross domestic product.

Kehinde *et al.* (2013) examine the impact of capital market on economic growth in the log-run in Nigeria using annual data from 1981 to 2010 using an ordinary least square and vector autoregression methods. The Johansen cointegration technique identifies three co-integrating equation and the vector autoregression suggest the existence of a long-run relationship between the stock market and real GDP.

Ozurumba and Chigbu (2013) study the direction of causality between capital market performance and economic development and the transmission mechanism between capital market performance and economic development in Nigeria. The Johansen cointegration test shows that the variables are cointegrated implying that there is a long-run equilibrium relationship between capital market and economic development in Nigeria. The Granger causality test shows the direction of causalityis from the capital market to economic development. The regression results show a significant impact of the capital market on economic development in Nigeria.

Wild and Lebdaoui (2014) examine the relationship between stock market development and economic growth in Morocco for the period from 2000 to 2013 on a quarterly basis. The proxies for stock market development are Morocco All Shares Index (MASI), market liquidity, market capitalisation and a principal component analysis-based stock market development index.After testing for cointegration, the dynamic interactions between GDP growth and stock market development are investigated using both vector error correction model and Grangercausality techniques. The results show that there exists a long-run association between stock market development and economic growth and unidirectional Granger-causalities running from MASI, traded volume and stock market index to the real GDP, but no evidence for a Granger causality from market capitalisation to real GDP.

In the Indian context, Mishra *et al.* (2010) analyse the key market parameters such as market size, market liquidity, market turnover ratio, market volatility and market efficiency of the Indian capital market over a period from 2002 to 2009 in order to assess the performance of the two leading stock markets of India, theBombay Stock Exchange and NSE India. Application of time series econometrics shows evidence of greater volatility and weak form inefficiency of the Indian stock market. However, the market shows strong potential for greater market size, more liquidity and reasonable market turnover ratio.

Pal and Mittal (2011) investigate the long-run relationship between the Indian capital market and key macroeconomic variables employing a quarterly time series data spanning the period from January 1995 to December 2008. The capital market variables considered are stock market indices, value of shares traded and market capitalisation and the macro variables are money stock, interest rate and inflation rates. The Error

Correction Mechanism analysis shows no significant impact of gross domestic savings of India on the Indian capital market.

Makwana (2012) provides anoverview on various aspects of the Indian capital marketwhich includes concept, meaning, nature, and scope of the capital market and origin, history, development of the Indian capital market. The paper also shows the trends of the Indian stock market and capital market at the time of global crisis. Analysingmany factors that influence Indian capital market, such as macro-economic factors, global stock market performance, foreign investments, government and politic interferences, behavior of investors, etc., the paper concludes that the future of Indian stock exchange is undoubtedly very bright.

Mohanamani and Sivagnanasithi (2014) investigate the impact of macroeconomic variables on the behaviour of the Indian stock market using the monthly data for the period 2006 to 2013. The macro-economic variables considered are BSE sensex, call money rate, exchange rate between Indian rupees and US dollar, foreign institutional investment, industrial productivity, money supply and wholesale price index. The analysis reveals that the Indian stock market is positively related tothe wholesale price index, money supply and industrial productivity. The exchange rate and inflow of foreign institutional investment are insignificant to the Indian stock market. In the Granger causality sense, wholesale price index and industrial productivity influence the stock market to a great extent.

Muhammed Juman and Irshad (2015) also presents an overview of the Indian capital market, reviewing the process of growth of capital markets, their evolving structure and their functioning through stock exchanges in India. The paper also discusses the evolution of the regulatory mechanism for capital markets in India.The paper reveals that during the first and second five-year plans in India the publicsector undertakings were healthier than the private undertakings, but shares of these were not listed in the stock exchange and the capital markets were not well organized.With economic reforms of India, the capital markets in India are well developed, especially after the introduction of SEBI.

Jency (2017) looks into the trends in the capital market in India with reference to primary markets, mutual fund industry, FII, secondary markets and derivative markets between 2011 and 2016.The major observations of the study are that the market capitalisation of BSE has increased throughout 2011-15, but decreased by 7.11 percent in 2015-16, the total resources mobilised through the issuance of equity declines continuously for 3 years from 2011-12 to 2014-15 and the cumulative net assets under management by all mutual funds increased by 27 percent during 2015-16. The paper concludes that on almost all the operational and systematic risk management parameters, settlement system, disclosures, accounting standards, the Indian capital market is at par with the global standards.

DATA AND METHODOLOGY

The daily data on stock market performance used in this study is for seventeen years from January 1st 2000 to December 31st 2016 resulting in 6210 observations and the variables are market capitalisation, value of shares traded, sensex, nifty, real GDP, wholesale price index (WPI) and interest rates. The sources of the secondary data are the official websites of the Bombay Stock Exchange(BSE) and National Stock Exchange (NSE) and the Reserve Bank of India (RBI). The stock indices are collected from the historical indices column and the other variables are collected from the RBI Handbook of Statistics published by RBI.

The empirical analysis of the VECM proceeds with checking for changes over time by time plots and correlogram or autocorrelation function (ACF) plot, a summary of correlation at different periods of time. The stability or stationarity of the data series is tested by the Augmented Dicky-Fuller (ADF) unit root test.The testing equation is specified as:

$$\Delta Y_t = \alpha + \beta t + \gamma Y_{t-1} + \delta \Delta Y_{t-1} + \delta_{p-1} \Delta y_{t-p+1} + \varepsilon_t$$

where α is a constant, β is the coefficient on a time trend and p the lag order of the autoregressive process. The unit root test is then carried out under the null hypothesis $(H_0) : \gamma = 0$ and the alternative hypothesis (H_1): <0. If the test statistic is less than the critical value, then the null hypothesis of is rejected and no unit root is present.

To test the long-run equilibrium between non-stationary time series, the trace and maximum eigen value Johansen cointegration test is used. The trace test examines the number of linear combinations (i.e. K) to be equal to a given value (K_0), and the alternative hypothesis for K to be greater than C, $H_0 : K = K_0$ and $H_1 : K > K_0$. If the null hypothesis is rejected, then there is at least one cointegrating relationship. For the maximum eigen value test $H_0 : K = K_0$ and $H_1 : K = K_0 + 1$. Rejection of the null hypothesis implies that there is only one possible combination of the non-stationary variables to yield a stationary process. In the presence of cointegration, an error correction mechanism captures the long-run adjustment of cointegrating variables i.e. the derivation from long-run equilibrium is corrected gradually through a series of partial short-run adjustments (Engel and Granger, 1987). Causality exists in at least one direction of variables contain cointegrating vector and in this case, the direction of the causal relationship is detected through VECM.Apart from identifying the direction of causality, the incorporation of the error correction term in the VEC model helps to analyse the long-term relationship between the variables.The number of lags for cointegrating relations is identified by the lag length selection criteria.

The causal inferences in the multivariate framework are made by estimating the parameters of the VECM equations of different models. In this paper, the VECM approach has provided the following seven models:

Model 1:

$$\Delta LnRGDP_t = \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta LnRGDP_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I2}\, \Delta LnCAP_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta LnSENSEX_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta LnNIFTY_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta LnVST_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta LnINT_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta WPI_{t-j} + \alpha_I ECT_{t-1} + \varepsilon_t$$

Model 2:

$$\Delta LnCAP_t = \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta LnRGDP_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I2}\, \Delta LnCAP_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta LnSENSEX_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta LnNIFTY_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta LnVST_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta LnINT_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta LnWPI_{t-j} + \alpha_I ECT_{t-1} + \varepsilon_t$$

Model 3:

$$\Delta LnSENSEX_t = \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta LnRGDP_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I2}\, \Delta LnCAP_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta LnSENSEX_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta LnNIFTY_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta LnVST_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta LnINT_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta LnWPI_{t-j} + \alpha_I ECT_{t-1} + \varepsilon_t$$

Model 4:

$$\Delta LnNIFTY_t = \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta LnRGDP_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I2}\, \Delta LnCAP_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta LnSENSEX_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta LnNIFTY_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta LnVST_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta LnINT_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta LnWPI_{t-j} + \alpha_I ECT_{t-1} + \varepsilon_t$$

Model 5:

$$\Delta LnVST_t = \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta LnRGDP_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I2}\, \Delta LnCAP_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta LnSENSEX_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta LnNIFTY_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta LnVST_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta LnINT_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta LnWPI_{t-j} + \alpha_I ECT_{t-1} + \varepsilon_t$$

Model 6:

$$\Delta LnINT_t = \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta LnRGDP_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I2}\, \Delta LnCAP_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta LnSENSEX_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta LnNIFTY_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta LnVST_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta LnINT_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta LnWPI_{t-j} + \alpha_I ECT_{t-1} + \varepsilon_t$$

Model 7:

$$\Delta LnWPI_t = \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta LnRGDP_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I2}\, \Delta LnCAP_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta LnSENSEX_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta LnNIFTY_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta LnVST_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta LnINT_{t-j} + \sum_{j=1}^{\rho-1} \beta_{I1}\, \Delta LnWPI_{t-j} + \alpha_I ECT_{t-1} + \varepsilon_t$$

where Δ is the first difference operator and ε_t is a white noise error term, ECT is the error correction term, ρ is the order of VECM model which is translated to lag ρ-1 in the ECM and the pace of adjustment is represented by α_1 after the variables Ln(RGDP), Ln(CAP), Ln(SENSEX), Ln(NIFTY), Ln(VST), Ln(INT), Ln(WPI) deviate from the long-run equilibrium in period t-1.

Then, specify the coefficient diagnostics i.e. Granger causality using VEC Wald tests, residual diagnostics, i.e. serial correlation using VECLM Test, VEC residual normality test using Jarque Bera test, VEC residual heteroscedasticity test using ARCH test and then finally stability diagnostics using CUSUM test. The Wald chi-square test is a way to find out if explanatory variables in a model are significant. The VEC Breusch-Godfrey LM serial correlation testis a test for autocorrelation in the errors in a regression model. The VEC Jarque Beratest is a normality test to check the distribution of the model. The VECAutoregressive Conditional Heteroskedasticity (ARCH) test is a test of volatility clustering i.e. whether the variance of the current error term is related to the size of the previous periods' error terms. The CUSUM stability test is to ensure the reliability of the coefficients of the normalisedcointegration model for the long-run and vector error correction model for the short-run. The estimated model is stable if all roots have modulus less than one and lie inside the red line from the graph.

Empirical Analysis

The descriptive statistics of the variables used in the empirical analysis are presented in Table 1.There are 6210 observations in the daily data for the period January 1^{st} 2000 to December 31^{st} 2016 of this paper. The Jarque-Bera test measures the difference of skewness and kurtosis of a series with those from the normal distribution. The Jarque-Bera statistic rejects the null hypothesis of non-normal distribution for all the variables since their probability values are lesser than 0.05. Table 2 presents the results of the correlation matrix of the variables used in the study.

In the graphical analysis, the time series plots of all seven variables are presented in Figure 1.The plots show that the variables LGDP, LCAP, LSENSEX and LNIFTY are showing an upward trendand are constantly increasing over the period. The variables LWPI, LVST and LINT show seasonal elements implying that these variables are not stationary which are to be further checked for unit root before carrying the analysis.

Table 1: Descriptive Statistics of the Variables in the Stock Market Performance and Economic Growth Analysis

Variable	*Description*	*Mean*	*Median*	*Jarque-Bera*
Real GDP	Proxy for economic growth; quarterly data converted to daily data (Rs.)	1492005 (810542.8)	1128335	825.451
Market capitalisation	Market value of outstanding shares of a company; multiplying stock price by the total number of shares outstanding (Rs.)	5293647 (9932960.1)	4432596	1766285
Sensex	S&P BSE 30 index of Bombay Stock Exchange; market-weighted stock market index of 30 well-established and financially sound companies	13824.28 (8066.264)	14770.83	389.1699
Nifty50	Nifty50 of National Stock Exchange	4176.52 (2417.713)	4371.925	382.3110
VST	Total number of shares traded multiplied by their respective matching prices (Rs.)	1.29E+08 (7.4E+08)	1.23E+08	3496.774
Interest rate	Call money rate; interest rate on the short-term loan that banks give to brokers who in turn lend the money to investors to fund margin accounts	6.73 (2.41)	6.82	1532672.0
WPI	Inflation rate; Wholesale Price Index	108.28 (16.42)	109.42	72.14
No. of obs.			6210	

Note: Figures in parentheses are standard deviations.

Table 2: Pearson Correlation Matrix

Variable	*Ln(RGDP)*	*Ln(CAP)*	*Ln(SENSEX)*	*Ln(NIFTY)*	*Ln(VST)*	*Ln(INT)*	*Ln(WPI)*
Ln(RGDP)	1.00	-	-	-	-	-	-
Ln(CAP)	0.87	1.00	-	-	-	-	-
Ln(SENSEX)	0.87	0.97	1.00	-	-	-	-
Ln(NIFTY)	0.88	0.97	0.10	1.00	-	-	-
Ln(VST)	0.64	0.69	0.69	0.69	1.00	-	-
Ln(INT)	0.27	0.13	0.15	0.15	-0.09	1.00	-
Ln(WPI)	-0.06	-0.06	-0.04	-0.05	-0.28	0.005	1.00

The correlogram or the autocorrelation plots against lag k (24 lags) for all the seven variables are presented in Figure 2. The dotted lines in the plots of the ACF are the approximate two standard error bounds The ACF plots enable us to find quickly whether the plot follows stationarity or not. If the series contains a trend, the trend should be removed first and the first difference enables to check whether the non-stationarity is removed or not.All the variables are made stationary in its first difference, and hence all the variables are integrated of order 1 i.e. I(1). In the correlogram at

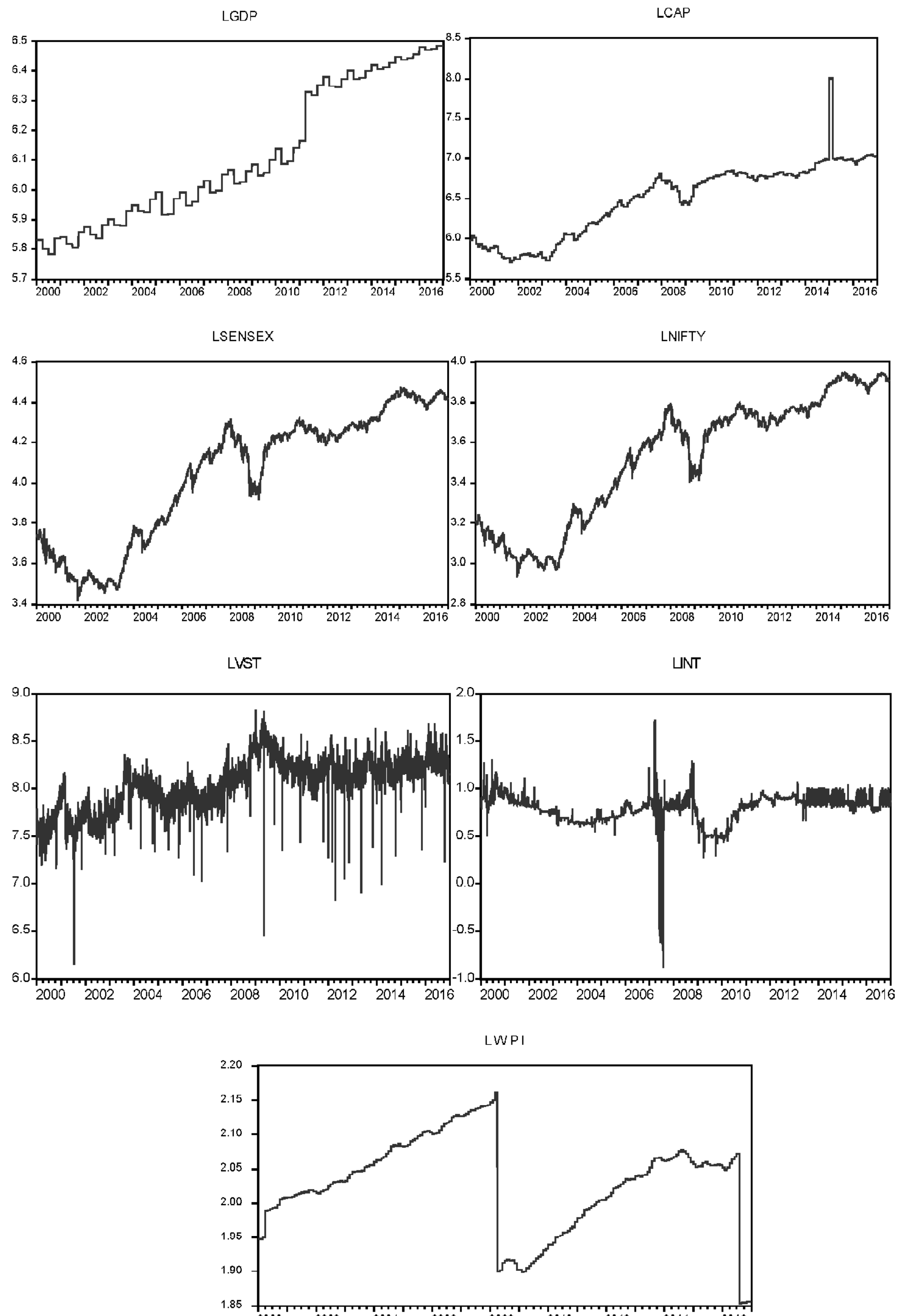

Figure 1: Time Series Plots of Variables

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	1.000	1.000	6207.2	0.000
		2	0.999	-0.00...	12410.	0.000
		3	0.999	-0.00...	18607.	0.000
		4	0.998	-0.00...	24800.	0.000
		5	0.998	-0.00...	30988.	0.000
		6	0.997	-0.00...	37171.	0.000
		7	0.997	-0.00...	43349.	0.000
		8	0.996	-0.00...	49523.	0.000
		9	0.996	-0.00...	55692.	0.000
		1...	0.995	-0.00...	61856.	0.000
		1...	0.995	-0.00...	68015.	0.000
		1...	0.994	-0.00...	74169.	0.000
		1...	0.994	-0.00...	80319.	0.000
		1...	0.993	-0.00...	86464.	0.000
		1...	0.993	-0.00...	92604.	0.000
		1...	0.993	-0.00...	98739.	0.000
		1...	0.992	-0.00...	10486...	0.000
		1...	0.992	-0.00...	11099...	0.000
		1...	0.991	-0.00...	11711...	0.000
		2...	0.991	-0.00...	12323...	0.000
		2...	0.990	-0.00...	12934...	0.000
		2...	0.990	-0.00...	13545...	0.000
		2...	0.989	-0.00...	14155...	0.000
		2...	0.989	-0.00...	14764...	0.000

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.00...	-0.00...	0.0041	0.949
		2	-0.00...	-0.00...	0.0082	0.996
		3	-0.00...	-0.00...	0.0123	1.000
		4	-0.00...	-0.00...	0.0164	1.000
		5	-0.00...	-0.00...	0.0205	1.000
		6	-0.00...	-0.00...	0.0246	1.000
		7	-0.00...	-0.00...	0.0287	1.000
		8	-0.00...	-0.00...	0.0328	1.000
		9	-0.00...	-0.00...	0.0369	1.000
		1...	-0.00...	-0.00...	0.0410	1.000
		1...	-0.00...	-0.00...	0.0451	1.000
		1...	-0.00...	-0.00...	0.0493	1.000
		1...	-0.00...	-0.00...	0.0534	1.000
		1...	-0.00...	-0.00...	0.0575	1.000
		1...	-0.00...	-0.00...	0.0616	1.000
		1...	-0.00...	-0.00...	0.0657	1.000
		1...	-0.00...	-0.00...	0.0699	1.000
		1...	-0.00...	-0.00...	0.0740	1.000
		1...	-0.00...	-0.00...	0.0781	1.000
		2...	-0.00...	-0.00...	0.0822	1.000
		2...	-0.00...	-0.00...	0.0864	1.000
		2...	-0.00...	-0.00...	0.0905	1.000
		2...	-0.00...	-0.00...	0.0947	1.000
		2...	-0.00...	-0.00...	0.0988	1.000

Figure 2a: ACF of LGDP at Level and First Difference

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.999	0.999	6199.1	0.000
		2	0.998	-0.00...	12385.	0.000
		3	0.997	-0.00...	18558.	0.000
		4	0.996	-0.00...	24719.	0.000
		5	0.994	-0.00...	30866.	0.000
		6	0.993	-0.00...	37000.	0.000
		7	0.992	-0.00...	43122.	0.000
		8	0.991	-0.00...	49231.	0.000
		9	0.990	-0.00...	55327.	0.000
		1...	0.989	-0.00...	61410.	0.000
		1...	0.988	-0.00...	67480.	0.000
		1...	0.987	-0.00...	73537.	0.000
		1...	0.985	-0.00...	79582.	0.000
		1...	0.984	-0.00...	85614.	0.000
		1...	0.983	-0.00...	91633.	0.000
		1...	0.982	-0.00...	97639.	0.000
		1...	0.981	-0.00...	10363...	0.000
		1...	0.980	-0.00...	10961...	0.000
		1...	0.979	-0.00...	11558...	0.000
		2...	0.978	-0.00...	12153...	0.000
		2...	0.976	-0.00...	12747...	0.000
		2...	0.975	-0.00...	13340...	0.000
		2...	0.974	-0.00...	13932...	0.000
		2...	0.973	-0.00...	14523...	0.000

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.00...	-0.00...	4.E-05	0.995
		2	-0.00...	-0.00...	7.E-05	1.000
		3	-0.00...	-0.00...	0.0001	1.000
		4	-0.00...	-0.00...	0.0001	1.000
		5	-0.00...	-0.00...	0.0002	1.000
		6	-0.00...	-0.00...	0.0002	1.000
		7	-0.00...	-0.00...	0.0002	1.000
		8	-0.00...	-0.00...	0.0003	1.000
		9	-0.00...	-0.00...	0.0003	1.000
		1...	-0.00...	-0.00...	0.0004	1.000
		1...	-0.00...	-0.00...	0.0004	1.000
		1...	-0.00...	-0.00...	0.0004	1.000
		1...	-0.00...	-0.00...	0.0005	1.000
		1...	-0.00...	-0.00...	0.0005	1.000
		1...	-0.00...	-0.00...	0.0005	1.000
		1...	-0.00...	-0.00...	0.0006	1.000
		1...	-0.00...	-0.00...	0.0006	1.000
		1...	-0.00...	-0.00...	0.0006	1.000
		1...	-0.00...	-0.00...	0.0007	1.000
		2...	-0.00...	-0.00...	0.0007	1.000
		2...	-0.00...	-0.00...	0.0008	1.000
		2...	-0.00...	-0.00...	0.0008	1.000
		2...	-0.00...	-0.00...	0.0008	1.000
		2...	-0.00...	-0.00...	0.0009	1.000

Figure 2b: ACF of LCAP at Level and First Difference

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	1.000	1.000	6207.3	0.000
		2	0.999	-0.00...	12410.	0.000
		3	0.999	0.013	18608.	0.000
		4	0.998	0.007	24802.	0.000
		5	0.998	0.014	30991.	0.000
		6	0.997	0.018	37176.	0.000
		7	0.997	0.015	43357.	0.000
		8	0.997	0.009	49535.	0.000
		9	0.996	0.006	55708.	0.000
		1...	0.996	0.046	61878.	0.000
		1...	0.996	0.030	68046.	0.000
		1...	0.995	0.044	74211.	0.000
		1...	0.995	0.041	80374.	0.000
		1...	0.995	0.004	86534.	0.000
		1...	0.994	-0.00...	92693.	0.000
		1...	0.994	0.002	98850.	0.000
		1...	0.994	-0.00...	10500...	0.000
		1...	0.994	-0.00...	11115...	0.000
		1...	0.993	-0.00...	11730...	0.000
		2...	0.993	0.000	12345...	0.000
		2...	0.993	-0.00...	12959...	0.000
		2...	0.993	-0.02...	13573...	0.000
		2...	0.992	0.009	14187...	0.000
		2...	0.992	-0.00...	14801...	0.000

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.015	0.015	1.3295	0.249
		2	-0.03...	-0.03...	7.8750	0.019
		3	-0.00...	-0.00...	8.2181	0.042
		4	-0.02...	-0.02...	12.164	0.016
		5	-0.02...	-0.02...	15.837	0.007
		6	-0.04...	-0.04...	27.276	0.000
		7	-0.00...	-0.00...	27.283	0.000
		8	-0.01...	-0.01...	28.286	0.000
		9	-0.08...	-0.08...	68.765	0.000
		1...	-0.05...	-0.05...	84.651	0.000
		1...	-0.06...	-0.07...	110.74	0.000
		1...	-0.06...	-0.07...	137.71	0.000
		1...	-0.00...	-0.01...	137.72	0.000
		1...	0.022	0.005	140.68	0.000
		1...	0.008	-0.01...	141.04	0.000
		1...	-0.00...	-0.01...	141.09	0.000
		1...	0.019	0.005	143.27	0.000
		1...	0.007	-0.00...	143.61	0.000
		1...	-0.00...	-0.01...	143.94	0.000
		2...	0.038	0.023	153.10	0.000
		2...	0.048	0.029	167.54	0.000
		2...	-0.01...	-0.02...	168.46	0.000
		2...	0.020	0.017	170.88	0.000
		2...	0.035	0.032	178.32	0.000

Figure 2c: ACF of LSENSEX at Level and First Difference

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	1.000	1.000	6207.2	0.000
		2	0.999	-0.00...	12410.	0.000
		3	0.999	0.013	18608.	0.000
		4	0.998	0.007	24801.	0.000
		5	0.998	0.016	30990.	0.000
		6	0.997	0.011	37175.	0.000
		7	0.997	0.016	43355.	0.000
		8	0.997	0.012	49532.	0.000
		9	0.996	0.009	55705.	0.000
		1...	0.996	0.027	61875.	0.000
		1...	0.995	0.033	68041.	0.000
		1...	0.995	0.039	74205.	0.000
		1...	0.995	0.026	80366.	0.000
		1...	0.995	0.009	86525.	0.000
		1...	0.994	0.004	92682.	0.000
		1...	0.994	-0.00...	98836.	0.000
		1...	0.994	-0.01...	10498...	0.000
		1...	0.993	-0.00...	11113...	0.000
		1...	0.993	-0.00...	11728...	0.000
		2...	0.993	-0.00...	12342...	0.000
		2...	0.993	-0.00...	12956...	0.000
		2...	0.992	-0.02...	13570...	0.000
		2...	0.992	-0.00...	14183...	0.000
		2...	0.991	-0.01...	14796...	0.000

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.014	0.014	1.1934	0.275
		2	-0.03...	-0.03...	10.038	0.007
		3	-0.00...	-0.00...	10.346	0.016
		4	-0.03...	-0.03...	16.557	0.002
		5	-0.01...	-0.01...	17.939	0.003
		6	-0.04...	-0.05...	32.235	0.000
		7	-0.00...	-0.00...	32.468	0.000
		8	-0.01...	-0.02...	34.388	0.000
		9	-0.05...	-0.05...	52.270	0.000
		1...	-0.05...	-0.06...	72.834	0.000
		1...	-0.06...	-0.07...	99.652	0.000
		1...	-0.03...	-0.04...	107.18	0.000
		1...	-0.01...	-0.02...	108.05	0.000
		1...	-0.00...	-0.01...	108.06	0.000
		1...	0.016	0.000	109.75	0.000
		1...	0.016	0.002	111.43	0.000
		1...	0.011	-0.00...	112.16	0.000
		1...	0.019	0.008	114.39	0.000
		1...	-0.00...	-0.02...	114.77	0.000
		2...	0.037	0.026	123.42	0.000
		2...	0.049	0.037	138.39	0.000
		2...	0.013	0.007	139.44	0.000
		2...	0.034	0.033	146.68	0.000
		2...	0.039	0.043	156.35	0.000

Figure 2d: ACF of LNIFTY at Level and First Difference

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.890	0.890	4916.9	0.000
		2	0.870	0.378	9622.3	0.000
		3	0.861	0.240	14226.	0.000
		4	0.859	0.203	18815.	0.000
		5	0.858	0.164	23393.	0.000
		6	0.849	0.083	27872.	0.000
		7	0.845	0.086	32315.	0.000
		8	0.840	0.059	36704.	0.000
		9	0.838	0.060	41069.	0.000
		1...	0.840	0.086	45459.	0.000
		1...	0.836	0.051	49810.	0.000
		1...	0.835	0.054	54149.	0.000
		1...	0.834	0.055	58480.	0.000
		1...	0.831	0.036	62783.	0.000
		1...	0.832	0.052	67099.	0.000
		1...	0.828	0.018	71365.	0.000
		1...	0.825	0.018	75604.	0.000
		1...	0.824	0.030	79839.	0.000
		1...	0.825	0.038	84080.	0.000
		2...	0.824	0.029	88311.	0.000
		2...	0.820	0.013	92505.	0.000
		2...	0.820	0.026	96697.	0.000
		2...	0.818	0.018	10087...	0.000
		2...	0.818	0.025	10505...	0.000

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.41...	-0.41...	1057.7	0.000
		2	-0.04...	-0.25...	1069.5	0.000
		3	-0.03...	-0.21...	1078.4	0.000
		4	-0.00...	-0.17...	1078.4	0.000
		5	0.037	-0.09...	1086.9	0.000
		6	-0.02...	-0.09...	1091.6	0.000
		7	0.008	-0.06...	1092.0	0.000
		8	-0.01...	-0.06...	1093.0	0.000
		9	-0.02...	-0.09...	1096.0	0.000
		1...	0.028	-0.05...	1100.9	0.000
		1...	-0.01...	-0.05...	1101.8	0.000
		1...	-0.00...	-0.05...	1101.8	0.000
		1...	0.009	-0.03...	1102.3	0.000
		1...	-0.01...	-0.05...	1104.3	0.000
		1...	0.027	-0.02...	1108.8	0.000
		1...	-0.01...	-0.02...	1109.4	0.000
		1...	-0.00...	-0.03...	1110.0	0.000
		1...	-0.00...	-0.04...	1110.1	0.000
		1...	0.006	-0.03...	1110.3	0.000
		2...	0.013	-0.01...	1111.4	0.000
		2...	-0.01...	-0.02...	1112.9	0.000
		2...	0.006	-0.02...	1113.0	0.000
		2...	-0.00...	-0.02...	1113.3	0.000
		2...	0.010	-0.01...	1113.9	0.000

Figure 2e: ACF of LVST at Level and First Difference

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.959	0.959	5715.6	0.000
		2	0.921	0.009	10983.	0.000
		3	0.887	0.043	15876.	0.000
		4	0.861	0.078	20487.	0.000
		5	0.834	-0.01...	24814.	0.000
		6	0.812	0.051	28910.	0.000
		7	0.789	0.002	32784.	0.000
		8	0.774	0.089	36514.	0.000
		9	0.764	0.061	40141.	0.000
		1...	0.755	0.035	43683.	0.000
		1...	0.743	-0.00...	47118.	0.000
		1...	0.738	0.096	50510.	0.000
		1...	0.738	0.077	53898.	0.000
		1...	0.735	-0.00...	57260.	0.000
		1...	0.712	-0.21...	60420.	0.000
		1...	0.690	-0.01...	63384.	0.000
		1...	0.674	0.066	66213.	0.000
		1...	0.667	0.086	68983.	0.000
		1...	0.663	0.072	71721.	0.000
		2...	0.656	-0.02...	74404.	0.000
		2...	0.647	-0.01...	77013.	0.000
		2...	0.639	-0.01...	79560.	0.000
		2...	0.630	-0.03...	82037.	0.000
		2...	0.626	0.074	84480.	0.000

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.02...	-0.02...	4.9306	0.026
		2	-0.06...	-0.06...	28.741	0.000
		3	-0.09...	-0.09...	79.040	0.000
		4	0.012	0.002	79.867	0.000
		5	-0.05...	-0.06...	97.731	0.000
		6	-0.00...	-0.01...	97.806	0.000
		7	-0.09...	-0.10...	150.74	0.000
		8	-0.04...	-0.07...	165.84	0.000
		9	-0.02...	-0.04...	169.00	0.000
		1...	0.032	-0.00...	175.28	0.000
		1...	-0.08...	-0.10...	218.09	0.000
		1...	-0.05...	-0.08...	236.61	0.000
		1...	0.033	0.002	243.26	0.000
		1...	0.237	0.202	592.06	0.000
		1...	0.002	0.002	592.09	0.000
		1...	-0.08...	-0.07...	633.42	0.000
		1...	-0.10...	-0.09...	703.29	0.000
		1...	-0.04...	-0.07...	714.33	0.000
		1...	0.037	0.016	722.95	0.000
		2...	0.028	0.003	727.81	0.000
		2...	-0.01...	0.008	729.27	0.000
		2...	0.012	0.026	730.22	0.000
		2...	-0.05...	-0.08...	749.26	0.000
		2...	-0.02...	-0.06...	752.45	0.000

Figure 2f: ACF of LINT at Level and First Difference

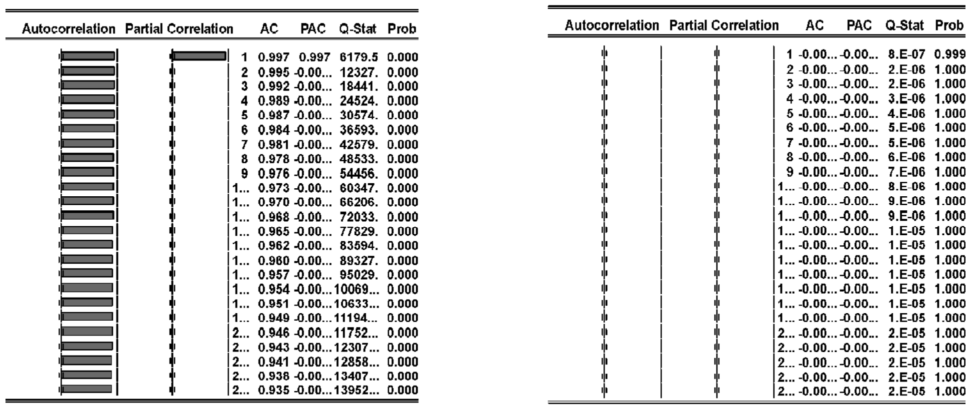

Figure 2g: ACF of LWPI at Level and First Difference

level, the autocorrelation coefficients of the variables show no trend. In the correlogram of the first difference, it is clear that the series hasbecome stationary. The autocorrelation coefficients of all the seven variables at levels are very high even up to 24 lags showing typical non-stationary time-series. The correlogram for the first difference of the variables showsthat the value of autocorrelation coefficients is 0.00 at all the lagged periods implying that the series has attained stationarity at first difference.

The results of the ADF test for the stationarity of the variables are presented in Table 3. The results show that all the variables are non-stationary in level form since their ADF values are less than the critical values except the variable LINT which is stationary at the level and is integrated of order I(0). However, the null hypothesis of no unit root was accepted for all other variables but was rejected in the first difference. Thus, all the variables are integrated of order onei.e. I(1).

Table 3: ADF Unit Root Test Results

Variable	*At level*	*Prob.*	*First difference*	*Prob.*
Ln(RGDP)	-0.1870	0.937	-78.843	0.0001
Ln(CAP)	-1.663	0.450	-78.78	0.0001
Ln(SENSEX)	-0.384	0.909	-30.475	0.00
Ln(NIFTY)	-0.39	0.908	-29.45	0.00
Ln(VST)	-3.555	0.007	-.32.253	0.00
Ln(INT)	-4.824	0.00	-19.841	0.00
Ln(WPI)	-2.041	0.270	-78.77	0.0001

Note: Critical values for significance at 1 percent level 3.43 and 5 percent level 2.86.

Since the variablesare integrated of the same order, their cointegrating relationship has to be examined using the Johansen co-integration procedure.Before Johansen test to be carried the lag length should be selected. The optimum lag length selection criteria used in the paper are the sequential modified Likelihood Ratio (LR) test, Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC) and Hannan Quin Information Criterion (HQ). The results are presented in Table 4.As various criteria show different results, the AIC lag selection criterion is used The AIC identifies the lag length of 5 and hence for the cointegration test the lag length of 4(5-1) is used in this paper.

Table 4: Lag Length Selection Results

Lag	*LnLR*	*LR*	*FPE*	*AIC*	*SC*	*HQ*
0	42020.97	NA	3.02e-15	-13.568	-13.561	-13.565
1	130906.2	177540.7	1.05e-27	-42.257	-42.196	-42.236
2	131261.7	709.3898	9.50e-28	-42.356	-42.242*	-42.317
3	131420.7	316.8470	9.16e-28	-42.391	-42.224	-42.334
4	131557.1	271.6003	8.91e-28	-42.420	-42.199	-42.343*
5	131645.3	175.3427	8.80e-28*	-42.433*	-42.159	-42.338
6	131678.5	65.94527	8.84e-28	-42.428	-42.106	-42.314
7	131714.5	71.29254	8.88e-28	-42.423	-42.043	-42.292
8	131764.6	99.38401*	8.88e-28	-42.424	-41.990	-42.273

Table 5 presents the results of the Johansen cointegration test. A necessary but not sufficient condition for the cointegrating test is that each of the variables is integrated of the same order. The Johansen cointegration test uses two statistics: the trace test and the likelihood eigenvalue test.

Table 5: Johansen Cointegration Test Results

Hypothesisedno. of CEs	*Eigen value*	*Trace statistic*	*0.05 critical value*	*Prob.*
None *	0.02891	514.9071	125.6154	0.0001
At most 1 *	0.026129	337.0015	95.75366	0.0000
At most 2 *	0.013511	172.8732	69.81889	0.0000
At most 3 *	0.012115	88.54613	47.85613	0.0000
At most 4	0.001232	12.98823	29.79707	0.8921
At most 5	0.000820	5.344109	15.49471	0.7712
At most 6	4.15E-05	0.257535	3.841466	0.6118
Hypothesisedno. of CEs	*Eigen value*	*Max-eigen statistic*	*0.05 critical value*	*Prob.*
None *	0.028291	177.9057	46.23142	0.0000
At most 1 *	0.026129	164.1282	40.07757	0.0001
At most 2 *	0.013511	84.32709	33.87687	0.0000
At most 3 *	0.012115	75.55790	27.58434	0.0000
At most 4	0.001232	7.644121	21.13162	0.9241
At most 5	0.000820	5.086574	14.26460	0.7308
At most 6	4.15E-05	0.257535	3.841466	0.6118

The trace and the eigen value tests in Table 5 suggest that there are three cointegrating equations at 5 per cent significance level among the gross domestic product, market capitalization, sensex, nifty50, value of shares traded, interest rate and wholesale price index.Therefore, the null hypothesis that there is no co-integration among the variables is rejected. Since the long-run cointegrating relationship is found among the variables, an estimation of cointegrating vectors is employed.Since all the variables are stationary with I(1) except LINT which is of order I (0), and there is evidence of cointegration, the Granger causality is performed in the VECM, which allows a distinction to be made between short-run and long-run causality.

The cointegrating equations include an error correction term (ECT) and the residual of cointegrating equations derived is called as a speed of adjustment towards long-run equilibrium. The error correction term must be significantly negative showing the long-run Granger causality; the insignificance of ECT implies that there is no long-run causality from the independent variable(s) to the dependent variable.The estimating VECM with their respective ECT are:

LGDP=f(LCAP, LGDP, LINT, LNIFTY, LSENSEX, LVST, LWPI)

LCAP = f(LCAP, LGDP, LINT, LNIFTY, LSENSEX, LVST, LWPI)

LSENSEX = f(LCAP, LGDP, LINT, LNIFTY, LSENSEX, LVST, LWPI)

LNIFTY = f(LCAP, LGDP, LINT, LNIFTY, LSENSEX, LVST, LWPI)

LNIFTY = f(LCAP, LGDP, LINT, LNIFTY, LSENSEX, LVST, LWPI)

LINT = f(LCAP, LGDP, LINT, LNIFTY, LSENSEX, LVST, LWPI)

LWPI = f(LCAP, LGDP, LINT, LNIFTY, LSENSEX, LVST, LWPI)

The estimated results of the VECM models are presented in Table 6 for the causal relationship between the variables, along with diagnostic checks of the model. The diagnostic tests are the Wald test for short-run causality, Breusch-Godfrey LM test for residual serial correlation, Jarque-Bera residual normality test and the ARCH residual heteroscedasticity test. For brevity, only the coefficient of lagged variables with their t-values and probability are indicated along with the coefficients. In Table 6, the estimated VECM results of LGDP shows that during the study period the process has converged in as the ECT is -6.52E-05 and the probability values are more than 0.05 showing that they are not significant. The Wald test does not indicate short-run causality from LGDP to the independent variables. The chi-square statistics accepts the null hypothesis that LGDP cannot affect other variables in the short-run because the corresponding p-value is not significant (0.9942). The LM test does not reject the null hypothesis that there is no serial correlation as the p-value is greater than 0.05 (0.6245). And there is no evidence of heteroscedasticity as the chi-square value is greater than 0.05 (0.9122). The model residual is normally distributed as the Jarque-Bera test value is greater than 0.05 and accepts the null hypothesis.

The estimated VECM results of LCAP show that during the study period the process has converged as the ECT is -0.00039 and the probability values are more than 0.05 showing that they are not significant. The Wald test does not indicate short-run causality from LCAP to the independent variables. The chi-square statistics accepts the null hypothesis that LCAP cannot affect other variables in the short-run because the corresponding p-value is not significant (1.0000). The LM test does not reject the null hypothesis that there is no serial correlation as the p-value is greater than 0.05 (0.6123). And there is no evidence of heteroscedasticity as the chi-square value is greater than 0.05 (0.9749). The model residual is normally distributed as the Jarque-Bera test value is greater than 0.05 and accepts the null hypothesis.

The estimated VECM results of LSENSEX show that during the study period the process has converged as the ECT is -0.00364 and the probability values are more than 0.05 showing that they are not significant. The Wald test does not indicate short-run causality from LSENSEX to the independent variables. The chi-square statistics accepts the null hypothesis that LSENSEX cannot affect other variables in the short-run because the corresponding p-value is not significant (0.2651). The LM test does not reject the null hypothesis that there is no serial correlation as the p-value is greater than 0.05 (0.5552). And there is no evidence of heteroscedasticity as the chi-square value is greater than 0.05 (0.0543). The model residual is normally distributed as the Jarque-Bera test value is greater than 0.05 and accepts the null hypothesis.

The estimated VECM results of LNIFTY show that during the study period the process has converged as the ECT is -0.000327 and the probability values are more than 0.05 showing that they are not significant. The Wald test does not indicate short-run causality from LSENSEX to the independent variables. The chi-square statistics accepts the null hypothesis that LSENSEX cannot affect other variables in the short-run because the corresponding p-value is not significant (0.1132). The LM test does not reject the null hypothesis that there is no serial correlation as the p-value is greater than 0.05 (0.6341). And there is evidence of heteroscedasticity as the chi-square value is almost zero (0.0000). The model residual is normally distributed as the Jarque-Bera test value is greater than 0.05 and accepts the null hypothesis.

The estimated VECM results of LVST show that during the study period the process has not converged as the ECT is a positive 0.05863 and the probability values are more than 0.05 showing that they are not significant. The lagged variables of LVST and LINT are significant as the probabilities are lesser than 0.05. The Wald test does not indicate short-run causality from LVST to the independent variables. The chi-square statistics accepts the null hypothesis that LVST affects other variables in the short-run because the corresponding p-value is significant (0.0000). The LM test rejects the null hypothesis that there is no serial correlation as the p-value is lesser than 0.05 (0.0000). And there is evidence of heteroscedasticity as the chi-square value is almost zero (0.0000). The model residual is normally distributed as the Jarque-Bera test value is greater than 0.05 and accepts the null hypothesis.

The estimated VECM results of LINT shows that during the study period the process has not converged as the ECT is a positive 0.01380 and the probability values are more than 0.05 showing that they are not significant. The lagged variables of LVST (-1) are significant as the probabilities are lesser than 0.05. The Wald test indicates short-run causality from LINT to the independent variables. The chi-square statistics accepts the null hypothesis that LINT affects other variables in the short-run because the corresponding p-value is significant (0.0000). The LM test rejects the null hypothesis that there is no serial correlation as the p-value is lesser than 0.05 (0.0000). And there is evidence of heteroscedasticity as the chi-square value is almost zero (0.0000). The model residual is normally distributed as the Jarque-Bera test value is greater than 0.05 and accepts the null hypothesis.

The estimated VECM results of LWPI shows that during the study period the process has not converged as the ECT is a positive 0.000155and the probability values are more than 0.05 showing that they are not significant. The lagged variables of LVST (-1) are significant as the probabilities are lesser than 0.05. The Wald test does not indicate short-run causality from LWPI to the independent variables. The chi-square statistics accepts the null hypothesis that LWPI does not affect other variables in the short-run because the corresponding p-value is not significant (0.9989). The LM test does not reject the null hypothesis that there is no serial correlation as the p-value is greater than 0.05 (0.1478). And there is no evidence of heteroscedasticity as the chi-square value is almost zero (0.9791). The model residual is normally distributed as the Jarque-Bera test value is greater than 0.05 and accepts the null hypothesis.

Table 6: Vector Error Correction Results

Variable	*LGDP*	*LCAP*	*LSENSEX*	*LNIFTY*	*LVST*	*LINT*	*LWPI*
ECT	-6.52E-05	-0.0004	-0.0003	-0.0003	0.059	0.014	0.0002
	(0.51)	(0.59)	(1.43)	(1.36)	(1.56)	(8.13)	(1.01)
D[LGDP(-1)]	-0.0002	-0.016	0.010	0.015	0.335	-0.039	0.0001
	(0.02)	(0.24)	(0.39)	(0.62)	(0.99)	(0.23)	(0.007)
D[LGDP(-2)]	-0.001	-0.0008	-0.012	-0.004	0.334	0.294	-0.0003
	(0.08)	(0.01)	(0.46)	(0.16)	(0.99)	(1.74)	(021)
D[LCAP(-1)]	-0.0001	0.0003	0.008	0.008	0.033	-0.002	-3.13E-05
	(0.04)	(0.02)	(1.56)	(1.69)	(0.46)	(0.07)	(0.01)
D[LCAP(-2)]	-4.89E-06	2.01E-05	0.004	0.005	-0.035	0.011	3.63E-05
	(0,002)	(0.002)	(0.89)	(0.98)	(0.50)	(0.35)	(0.01)
D[LSENSEX(-1)]	-0.0030	-0.0019	0.010	0.041	-0.072	-0.105	0.0004
	(0.18)	(0.02)	(0.28)	(1.28)	(0.14)	(0.47)	(0.02)
D[LSENSEX(-2)]	-0.002	-9.32E-06	-0.031	-0.031	-0.125	-0.135	0.0004
	(0.09)	(0.0001)	(0.92)	(0.98)	(0.25)	(0.60)	(0.02)
D[LNIFTY(-1)]	0.003	-0.0002	0.006	-0.026	0.420	0.030	-0.0004
	(0.17)	(0.002)	(0.17)	(0.76)	(0.79)	(0.12)	(0.02)
D[LNIFTY(-2)]	0.0012	9.19E-05	-0.002	-0.008	0.465	0.137	-0.0004
	(0.07)	(0.001)	(0.07)	(0.23)	(0.88)	(0.57)	(0.02)
D[LVST(-1)]	-9.33E-05	-0.0006	-0.0005	-0.0002	-0.434	0.022	0.0002
	(0.20)	(0.26)	(0.57)	(0.21)	(3.27)	(3.74)	(0.38)
D[LVST(-2)]	-5.30E-05	-0.0004	-0.001	-0.0009	-0.210	0.009	0.0001
	(0.12)	(0.16)	(0.55)	(1.10)	(1.69)	(1.74)	(0.21)
D[LINT(-1)]	-0.0015	0.0049	-0.002	-0.002	0.104	-0.020	0.001
	(0.61)	(0.97)	(0.99)	(1.04)	(3.72)	(1.54)	(1.26)
D[LINT(-2)]	0.0006	-0.0006	0.002	0.0005	0.061	-0.053	0.002
	(0.66)	(0.11)	(0.85)	(0.30)	(2.17)	(4.17)	(1.37)
D[LWPI(-1)]	-0.0002	0.0014	-0.013	-0.007	0.192	0.023	3.86E-05
	(0.02)	(0.02)	(0.60)	(0.37)	(0.61)	(0.16)	(0.003)
D[LWPI(-2)]	0.0001	-0.0004	0.006	0.004	0.034	-0.190	0.0004
	(0,01)	(0.006)	(0.26)	(0.21)	(0.11)	(1.34))	(0.03)
Constant	0.0001	0.0002	0.0001	0.0001	-5.29E-05	-4.20E-05	-1.47E-05
	(2.24)	(0.69)	(1.18)	(1.27)	(0.04)	(0.07)	(0.26)
Wald test	0.9942	1.0000	0.2651	0.1132	0.000	0.000	0.9989
Breusch-Godfrey LM test	0.6245	0.6123	0.5552	0.6341	0.000	0.000	0.1478
Jarque-Bera test	1310	1620	3307	44089.93	6739	6659	2320
ARCH test	0.9122	0.9749	0.0543	0.000	0.000	0.000	0.9791

Note: Absolute t-values in parentheses.

The stability test presented in Figure 3 shows that all the models are dynamically stable as the trend lines lie within the boundaries.

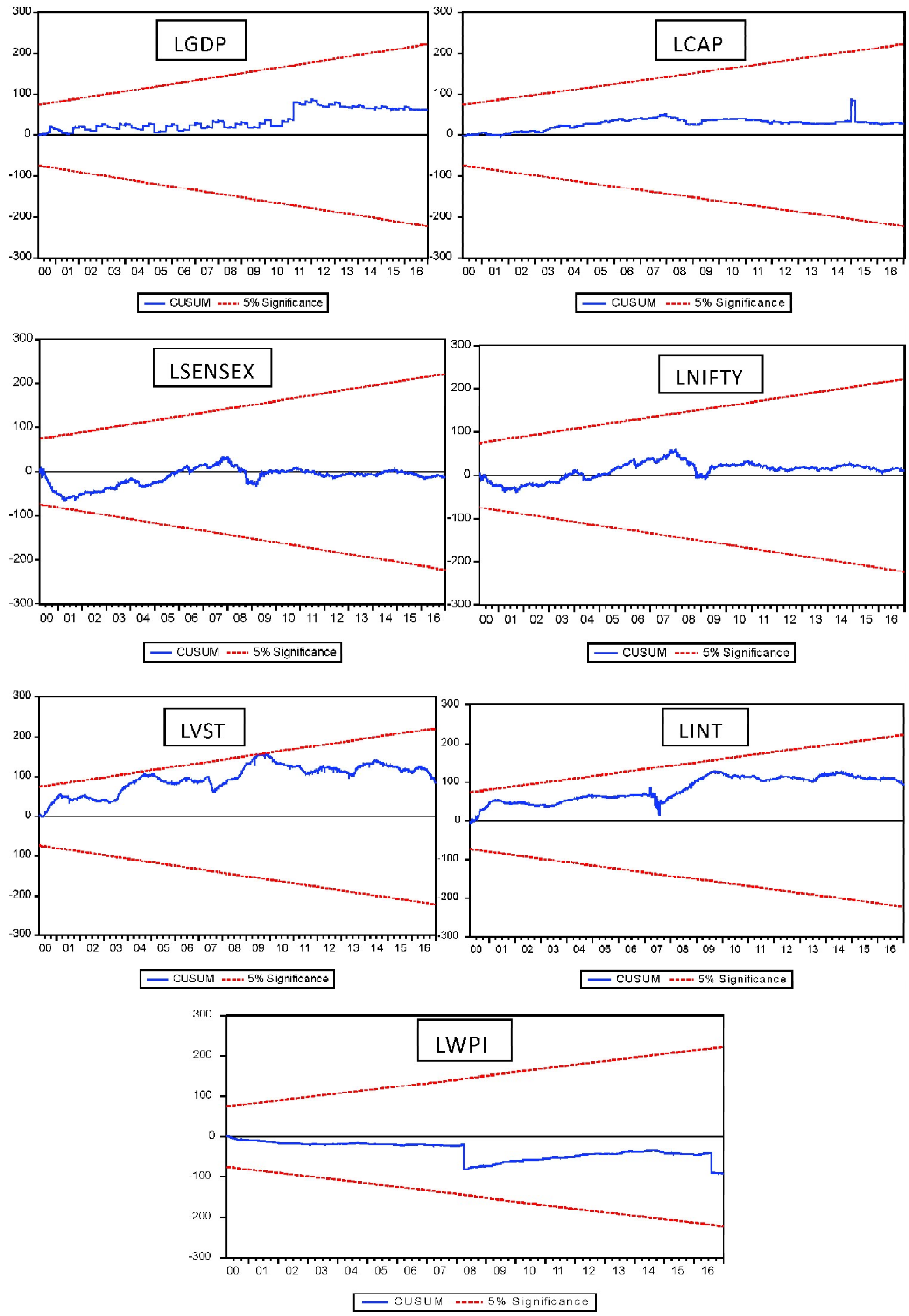

Figure 3: CUSUM Stability Test

CONCLUSION

This paper examines the relationship between capital market performance and economic growth in India along with other major macroeconomic variables for a period of seventeen years spanning from January 2000 to December 2016 with daily data consisting of 6210 observations and applying the vector error correction model (VECM). The variables considered are GDP, the measure of economic growth, and the measures of capital market performance are market capitalisation, sensex, nifty and value of shares traded. The macroeconomic variables are interest rates, measured by the call money rate, and inflation rate, measured by the wholesale price index. The ADF unit root test and the graphical representation of correlogram show that the variables LGDP, LCAP, LSENSEX, LNIFTY, and LWPI are stationary at the first difference, and LINT and LVST are stationary at levels. The Johansen cointegration test identifiesthree cointegrating equations in the long-run. Since all the variables show the existence of cointegration among them, theVEC models are used to analyse the long-run causalitybetween the seven variables. Each of these variablesis individually modeled as the dependent variable and their relations with the rest of the variables are estimated using the VECM approach. The stability tests exhibit that the modelsare dynamically stable in all cases. The estimated VECM results show that the dynamic processes converge as the estimated value of the error correction terms are negative, but statistically insignificant. In India, there is a weak long-run causal relationship between capital market performance and economic growth.

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