DYNAMIC RELATIONS BETWEEN MACROECONOMIC VARIABLES AND INDIAN STOCK PRICE: AN APPLICATION OF ARDL BOUNDS TESTING APPROACH

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ABSTRACT

The purpose of the present study is to examine the dynamic long run and the short run relationship between stock price and a set of macroeconomic variables for Indian economy using monthly data from April 2004 to July 2014. The long run relationship is examined by implementing the ARDL bounds testing approach to co-integration. VECM method is used to test the short and long run causality and Variance Decomposition (VDC) is also used to explore how much the forecast error variance of a conditional stock market volatility is explained by the innovations to each explanatory conditional macroeconomic variables. The results confirm a long run co-integrating relationship among the variables. Evidence suggests that the Index of Industrial Production, inflation and exchange rate influence stock prices positively, whereas, gold price influences the stock price negatively. The VECM result indicates that only long run causality running from all the variables used in the study to stock prices in India. The result of the variance decomposition shows that stock market development in India is mostly explained by its own shocks.

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Keywords: BSE index, IIP, Gold price, REER, Inflation, ARDL, VECM.

JEL Classification: G10, N25, C58.

Contribution/ Originality

This study is the first of its kind to empirically examine the dynamic causal relationship between stock market price and some macroeconomic variables in India using modern econometric time series techniques. The contribution of the paper is to fill these research gaps in the literature.

1. INTRODUCTION

In the literature, it is well established that macroeconomic fundamentals play determining role in the performance of the stock market. Specifically, a number of studies offer the evidence that macroeconomic indicators affect stock prices to a large extent. After the findings of the Fama (1981) several studies have been conducted to investigate the interrelationship between macroeconomic indicators and stock prices (Fama, 1990; Chen, 1991; Poon and Taylor, 1992; Canova and De Nicolo, 1995; Dickinson, 2000; Nasseh and Strauss, 2000). But most of these studies are conducted on developed markets where all aspects are more efficient and well connected with the overall economy. There are very few studies analyzing the relationship in the developing and emerging markets. More recently, some amount of empirical studies has been focusing attention to relate the stock prices and macroeconomic factors for both developed and emerging economies (Mukherjee and Naka, 1995; Ratanapakorn and Sharma, 2007; Rahman *et al.*, 2009). These studies conclude that stock prices do respond to the changes in macroeconomic fundamentals, but the sign and causal relationship might not hold equal for all the studies. Further, these studies have been carried out either in a bivariate setting or have mostly used conventional econometric techniques.

The stock market avails long term capital to the listed firms by pooling funds from different investors and allow them to expand in business and also offers investors, the alternative investment avenues to put their surplus funds in. Hence, investors carefully watch the performance of the stock markets by observing the composite market index, before investing funds. The market index acts as the yardstick to compare the performance of individual portfolios and also provides investors for forecasting future trends in the market. Especially the stock markets of emerging economies are likely to be sensitive to fundamental changes in macroeconomic structure and policies play an important role in achieving financial stability.

India is one among the fastest growing economies, and the stock market in India plays a key role in the mobilization of capital leading to the economic growth of the country. Indian stock market has undergone tremendous changes since 1991, when the government has adopted liberalization and globalization policies. As a result, there is a growing importance of the stock market from the aggregate economic point of view. Nowadays, the stock market has become a key driver of the modern market based economy and is one of the major sources of raising resources for Indian corporate, thereby enabling financial development and economic growth. In fact, Indian stock market is one of the emerging markets in the world. The smoothing development process in Indian stock markets continues to be breathtaking. From 3,739.69 points on March 31st, 1999, within nine years; Bombay Stock Exchange (BSE) Sensitivity Index (SENSEX) had reached to 21,000 level points in January, 2008. But this impact doesn't last long as it was affected by the recent global financial crisis of 2007-08 and emerging euro-crisis. Now SENSEX is around 26,000 plus points (bseindia.com).

Hence, it is important to know how the current macroeconomic factors influence the behavior of the stock market. The results of this empirical research will help the analysts, policy makers and

investors to predict the movement of BSE index (Sensex), by tracking the changes in macroeconomic variables. Investors will find this study helpful for them to identify fundamental macroeconomic variables that they should focus on while investing in the stock market and will have an advantage of making their own strategic investment decisions.

Studies on Indian stock market behavior have also been conducted in recent years. Agrawalla and Tuteja (2008) stated that rising indices in the stock markets cannot be taken to be a leading indicator of the revival of the economy in India and vice-versa. However, Shah and Thomas (1997) supported the idea that stock prices are a minor which reflect the real economy. There are several other studies regarding the interaction of share market returns and the macroeconomic variables and all studies provide a different conclusion related to their test and methodology. Hence, this study helps in exploring whether the movement of stock market indices is the result of some related macroeconomic variables or it is one of the causes of variation in those macroeconomic variables of the Indian economy. However, unlike the conventional studies, in this paper, we employ the Auto Regressive Distributed Lag (ARDL) approach to co-integrate to examine the long-run stability between the macroeconomic variables and Indian stock prices. The study also uses VECM based granger causality to check the direction of causal relationships between variables. Variance Decomposition (VDC) is also used to explore how much the forecast error variance of a conditional stock market volatility is explained by the innovations to each explanatory conditional macroeconomic variables. For the purpose of analysis, the present study has taken monthly data starting from the April 2004 to July 2014.

The rest of the paper is organized as follows: Section 2 presents the review of empirical literature on the relationship between selected macroeconomic variables and stock market development. Section 3 outlines the data issues and econometric methodology used in the study; section 4 analyses the empirical results of the study, and section 5 presents the concluding remarks.

2. LITERATURE REVIEW

The relationship between macroeconomic variables and the stock market is an important area of research addressed by many researchers nationally and internationally. Geske and Roll (1983); Chen et al. (1986); Mukherjee and Naka (1995); Ibrahim and Aziz (2003); Nishat and Shaheen (2004); Erdogan and Ozlale (2005); Ratanapakorn and Sharma (2007); Sohail and Hussain (2009); Rahman et al. (2009) found a positive relationship between IIP and stock prices. Samadi et al. (2012) and Gupta and Reid (2013) found significant negative relation of gold price with stock prices.

Gjrde and Saetten (1999) examined the causal relation between stock returns and macroeconomic variables in Norway. Results showed that a positive link exists between oil price, real activity and stock returns. A study by Flannery and Protopapadakis (2002) concluded that two popular measures of aggregate economic activity (real gross national product and industrial production) were not related to stock returns. Coleman and Tettey (2008) studied the impact of macroeconomic indicators on the Ghana Stock Exchange (GSE) and concluded that lending rates

from deposit money banks and inflation have an adverse impact on stock market performance contradict to the findings of Adam Anokye and Tweneboah (2008). Mazuruse (2014) used canonical Correlation Analysis (CCA) found that maximization of stock returns at the ZSE is mostly influenced by the changes in CPI, money supply, exchange rate and treasury bills. Rafay *et al.* (2014) found a unidirectional relationship between exchange rate and KSE 100 index.

Studies on Indian stock market have also been conducted in recent years. Bhattacharya and Jaydeep (2002); Sharma and Mahendru (2010); Ray (2012); Yu and Michael Budden (2012); Hussin *et al.* (2012) and Bhargava (2014) by using different methodologies, studied the impact of macroeconomic variables like the Index of Industrial Production, Money Supply, national income, Gross Domestic Product, interest rate, inflation, FDI, FII, trade openness, exchange rate and Whole Sale Price Index on stock market and found a significant impact of selected macroeconomic variables on the stock market. Pal and Mittal (2011) by using ECM concluded that capital markets (BSE and S&P CNX Nifty) are dependent on macroeconomic variables. Hosseini *et al.* (2011) used Vector Error Correction Model technique, and indicated that there are both long and short run linkages between macroeconomic variable and stock market index in India and China. Pradhan *et al.* (2014) used panel VAR and found the presence of both unidirectional and bidirectional causality links between macroeconomic variables and stock market.

From the above studies we can conclude that the economic role of the stock markets in developing and relatively less developed countries is scant. It is also found that inconsistent results were obtained with regards to which variables significantly affects Indian stock market behavior. Further, the study finds that there has been no study conducted on the effects of macroeconomic variables on stock market index using the ARDL approach on the emerging economy like India. This study attempts to fill this gap by exploring the effects of these macroeconomic variables changes towards stock market index in India with the help of monthly time series data.

3. METHODOLOGY AND DATA DESCRIPTION

3.1. Model Specification and Data

The following general specification has been used in this study to empirically examine the effect of economic growth and other fundamental macroeconomic factors on the stock market.

$$LBSE = \alpha_0 + \alpha_1 LIIP + \alpha_2 LCPI + \alpha_3 LREER + \alpha_4 LCMR + \alpha_5 LGOR + \varepsilon_t \qquad \text{..... (1)}$$

Where LBSE= Sensitivity index of Bombay Stock Exchange (Sensex), LIIP= Index of Industrial Production, LCPI= Consumer Price Index, LREER= Real Effective Exchange Rate, LCMR= Call Money Rate, and LGOR = Gold Prices variable in the general model specification above. All the variables[1] are taken in their natural logarithm.

Stock market development is usually measured by stock market size, liquidity, volatility and prices. The stock market index is intended to represent an entire stock market and thus track the market changes over time. Therefore, in this study, we have taken the Sensitivity index of BSE

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[1] The study excludes the variable Money Supply (M3) because of the high correlation of M3 with inflation and exchange rate.

(Sensex) to track the changes in the market over time. The relationship between stock price and economic growth has been studied by Fama (1990); Levine (1991); Levine and Zervos (1996). The study expects a strong positive correlation between stock prices and real activity. The present study has taken Index of Industrial Production (LIIP) as the proxy for economic growth (Agrawalla and Tuteja, 2008). Fluctuations in exchange rates can sometimes have a significant effect on firm value, as they influence the terms of competition, the input and output prices, and the value of firm's assets and liabilities denominated in foreign currencies. According to Fama (1981) the exchange rate is a double edge weapon. A devaluation of domestic currency increase export, hence improve the cash flow and divide payoffs for firms that rely on exports. On the other hand, depreciation of home currency makes imports costlier and decreases the cash flow and hence affects the industries which depend on imports. The relationship between exchange rate and stock prices is positive (Gay-Jr, 2008) whereas others found it negative (Abugri, 2008). Hence the relationship between stock prices and exchange rate is an empirical one.

Inflation represents one of the major threats to stock investors. When the inflation rates start to rise, investors get very nervous anticipating the potentially negative consequences and therefore because of lack of confidence among investors, they resist to invest in the stock market which leads to a decline in stock prices. Therefore, researcher found a negative relationship between inflation and stock prices (Fama, 1981). On the other hand, Fisher (1911) hypothesized that shares, are hedged against inflation in the sense that an increase in expected inflation leads to a positive proportional change in nominal share returns.

Call money rate is considered as a proxy of interest rate (Mukherjee and Naka, 1995; Ray, 2012). The logic behind the negative relationship between interest rates and stock prices suggest that an upward trend in interest rate enhances the opportunity cost of holding money and thus substitution between stocks and interest bearing securities resulting declining stock prices. Gold is a substitute investment avenue for Indian investors. As the gold price rises, Indian investors tend to invest less in stocks, causing stock prices to fall. Therefore, a negative relationship is expected between gold price and stock price. (Ray, 2012; Gupta and Reid, 2013)

The Study empirically estimated the effect of fundamental macroeconomic variables on stock prices with the help of the below described methodology for India. The study uses monthly data covering the period from April 2004 to July 2014[2]. The selection of the monthly data set is used to capture the short run fluctuation in the variables. Most of the study in Indian context is carried on Annual data; hence this study will provide valuable information on the dynamic relationship of stock prices and macroeconomic variables. Based on the extensive literature review the above macroeconomic variables are selected for the study, which are expected to have some influence on stock market performance in the present context. The data has been taken and compiled from

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[2] The study limits to the starting period as April 2004 to July 2014 due to the non-availability of data with common base year on IIP and CPI prior to this period.

Handbook of Statistics on Indian economy, RBI; Economic Survey, Govt. of India; World Bank database; Official website of SEBI and RBI.

3.2. Co-Integration with ARDL

To empirically analyze the long run relationship and dynamic interaction of Stock Market Index with macroeconomic variables, the above model has been estimated by the Auto Regressive Distributed Lag (ARDL) co-integration procedure developed by Pesaran *et al.* (2001). The procedure is adopted for four reasons. Firstly, the bounds testing is simple as opposed to other multivariate co-integration technique such as Johansen and Juselius (1990) it allows co-integrating relationship to be estimated by OLS once the lag order is selected. Secondly, the bound test procedure does not require the pre testing of the variables included in the model for unit root. These approaches require that all the variables to be integrated of the same order (I(1)). Otherwise the predictive power will be lost (Perron, 1989; 1997). However ARDL technique is applicable irrespective of whether regressor in the model is I(0) or I(1). The procedure will, however crash in the presence of I (2) series. Thirdly, the test is relatively more efficient in small sample data sizes as is the case of this study. Fourth the error correction method integrates the short run dynamics with long run equilibrium without losing long run information. The unrestricted error correction model (UECM) of ARDL model is used to examine the long run and the short run relationship takes the following form.

$$\Delta LBSE = \delta_0 + \delta_1 T + \delta_2 LIIP_{t-1} + \delta_3 LCPI_{t-1} + \delta_4 LREER_{t-1} + \delta_5 LCMR_{t-1} + \delta_6 LGOR_{t-1} +$$
$$\sum_{i=1}^{q} \alpha_i \Delta LBSE_{t-i} + \sum_{i=1}^{q} \beta_i \Delta LIIP_{t-i} + \sum_{i=1}^{q} \mu_i \Delta LCPI_{t-i} + \sum_{i=1}^{q} \sigma_i \Delta LREER_{t-i} +$$
$$\sum_{i=1}^{q} \omega_i \Delta LCMR_{t-i} + \sum_{i=1}^{q} \partial i \, \Delta LGOR_{t-i} + \varepsilon_t \qquad \qquad \dots (2)$$

Where the series is as defined earlier and T is time trend and L implies that the variables have been transformed in natural logs. The first part of the equation (2) with $\delta_2, \delta_3, \delta_4, \delta_5$ and δ_6 refer to the long run coefficients and the second part with α, β, μ, σ, ω and ∂ refers to the short run coefficients. The null hypothesis of no co-integration $H_0: \delta_2 = \delta_3 = \delta_4 = \delta_5 = \delta_6 = 0$ and the alternative hypothesis $H_1: \delta_2 \neq \delta_3 \neq \delta_4 \neq \delta_5 \neq \delta_6 \neq 0$ implies co-integration among the series (equation 2).

3.3. ARDL Bounds Testing Approach

The first step in the ARDL test is to estimate the equation (2) by OLS in order to test for the existence of a long run relationship among variables by conducting an F-test for the joint significance of the coefficients of the lagged levels of variables i.e. H_0(Null hypothesis) as against H_1(Alternative hypothesis) as stated earlier.

In the second step, once the co-integration is established the conditional ARDL long run model [4] for $LBSE_t$ can be estimated as:

$$\Delta LBSE = \alpha_0 + \sum_{i=1}^{q} \delta_1 LBSE_{t-1} + \sum_{i=1}^{q} \delta_2 LIIP_{t-1} + \sum_{i=1}^{q} \delta_3 LCPI_{t-1} + \sum_{i=1}^{q} \delta_4 LREER_{t-1} +$$
$$\sum_{i=1}^{q} \delta_5 LCMR_{t-1} + \sum_{i=1}^{q} \delta_6 LGOR_{t-1} + \varepsilon_t \qquad \qquad \dots (3)$$

All the variables used are defined in section 3.1

The third and final step, we obtain the short run dynamic parameters by estimating an error correction model with the long run estimates. This is specified as below:

$$\Delta LBSE = \mu + \sum_{i=1}^{q} \alpha_i \Delta LBSE_{t-i} + \sum_{i=1}^{q_1} \beta_i \Delta LIIP_{t-i} + \sum_{i=1}^{q_2} \mu_i \Delta LCPI_{t-i} + \sum_{i=1}^{q_3} \sigma_i \Delta LREER_{t-i} +$$
$$\sum_{i=1}^{q_4} \omega_i \Delta LCMR_{t-i} + \sum_{i=1}^{q_5} \partial \Delta LGOR_{t-i} + \phi ECM_{t-1} + \varepsilon_t \qquad \text{... (4)}$$

Where $\alpha, \beta, \mu, \sigma, \omega$ and ∂ are short run dynamic coefficient to equilibrium and ϕ is the speed adjustment coefficient.

3.4. VECM based Granger Causality Test

The direction of causality between stock prices and macroeconomic indicators is investigated by applying Vector Error Correction Model (VECM) granger causality approach after confirming the presence of co-integrating relationship among the above mentioned variables. Granger (1969) argued that VECM is more appropriate to examine the causality between the series at I (1). VECM is restricted form of unrestricted VAR and restriction is levied on the presence of the long-run relationship between the series. The system of error correction model (ECM) uses all the series endogenously. This system allows the predicted values to explain itself both by its own lags and lags of forcing variables as well as the lags of the error correction term and by residual term. The VECM equation is modeled as follows:

$$\begin{pmatrix} \Delta LBSE_t \\ \Delta LIIP_t \\ \Delta LCPI_t \\ \Delta LREER_t \\ \Delta LCMR_t \\ \Delta LGOR_t \end{pmatrix} = \begin{pmatrix} C1 \\ C2 \\ C3 \\ C4 \\ C5 \\ C6 \end{pmatrix} + \sum_{i=1}^{p} \begin{bmatrix} \beta_{11i} & \beta_{12i} & \beta_{13i} & \beta_{14i} & \beta_{15i} & \beta_{16i} \\ \beta_{21i} & \beta_{22i} & \beta_{23i} & \beta_{24i} & \beta_{25i} & \beta_{26i} \\ \beta_{31i} & \beta_{32i} & \beta_{33i} & \beta_{34i} & \beta_{35i} & \beta_{36i} \\ \beta_{41i} & \beta_{42i} & \beta_{43i} & \beta_{44i} & \beta_{45i} & \beta_{46i} \\ \beta_{51i} & \beta_{52i} & \beta_{53i} & \beta_{54i} & \beta_{55i} & \beta_{56i} \\ \beta_{61i} & \beta_{62i} & \beta_{63i} & \beta_{64i} & \beta_{65i} & \beta_{66i} \end{bmatrix} \begin{pmatrix} \Delta LBDE_{t-i} \\ \Delta LIIP_{t-i} \\ \Delta LCPI_{t-i} \\ \Delta LREER_{t-i} \\ \Delta LCMR_{t-i} \\ \Delta LGOR_{t-i} \end{pmatrix} + \begin{pmatrix} \gamma_1 \\ \gamma_2 \\ \gamma_3 \\ \gamma_4 \\ \gamma_5 \\ \gamma_6 \end{pmatrix} ECM_{t-1} + \begin{pmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \\ \varepsilon_{5t} \\ \varepsilon_{6t} \end{pmatrix} \text{... (5)}$$

The C's, β's and γ's are the parameters to be estimated. ECM_{t-1} represents the one period lagged error-term derived from the co-integration vector and the ε's are serially independent with mean zero and finite covariance matrix. From the Equation (5) given the use of a VAR structure, all variables are treated as endogenous variables. The F test is applied here to examine the direction of any causal relationship between the variables. The coefficients on the ECM represent how fast deviations from the long-run equilibrium are eliminated. Another channel of causality can be studied by testing the significance of ECM's. This test is referred to as the long run causality test.

4. ESTIMATION RESULTS AND DISCUSSIONS
4.1. Stationarity Test and Lag Length Selection before Co-Integration

Before we conduct tests for co-integration, to test the integration properties of the series, we have used Ng-Perron unit root test. The results of the stationarity tests show that all the variables are non-stationary at levels. The next step is to difference the variables once in order to perform stationary tests on differenced variables. The results show that after differencing the variables once, all the other variables were confirmed to be stationary. It is, therefore, worth concluding that all the variables used in this study are integrated of order one i.e. difference stationary I(1). Therefore the study uses autoregressive distributed lag (ARDL) approach to co-integration. In addition, it is also important to ascertain that the optimal lag order of the model is chosen appropriately so that the

error terms of the equations are not serially correlated. Consequently, the lag order should be high enough so that the conditional ECM is not subject to over parameterization problems (Narayan and Narayan, 2006). The results of lag-length selection criteria suggest that the optimal lag length is based on LR (sequential modified LR test statistic) criteria and which comes out to be 4.

The next step for the empirical estimation is to employ an ARDL approach to co-integration in order to determine the long run relationship among the variables. By applying, the procedure in OLS regression for the first difference part of the equation (1) and then test for the joint significance of the parameters of the lagged level variables when added to the first regression.

The F-Statistics tests the joint Null hypothesis that the coefficients of lagged level variables in the equation (1) are zero. Table 1, reports the result of the calculated F-Statistics and diagnostic tests of the estimated model. The result shows the calculated F-statistics were 5.3790. Thus the calculated F-statistics turns out to be higher than the upper-bound critical value at the 5 percent level. This suggests that there is a co-integrating relationship among the variables included in the model, i.e. Sensex (LBSE), the Index of Industrial Production (LIIP), Inflation (LCPI), the Real Effective Exchange Rate (LREER), Call Money Rate (LCMR) and Gold Prices (LGOR)

Table-1. ARDL Bounds test
Panel I: Bound testing to co-integration
Estimated Equation   : *LBSE = F (LIIP LCPI LREER LCMR LGOR)*

Indicators	
Optimal lag	04
F – Statistics	5.379053

Panel II: Diagnostic Tests

Diagnostic Tests Indicators	
Normality J-B value	0.8901
Serial Correlation LM Test	1.5214
Heteroscedasticity Test (ARCH)	1.0145
Ramsey Reset Test	0.0724

The second step is to estimate the long- and short-run estimates of ARDL test. The long run results are illustrated in Table 2. The results show that the rise in IIP, Inflation and Exchange Rate has a positive effect on stock prices. The coefficient of Index of Industrial Production (LIIP), Inflation (LCPI) and Real Effective Exchange Rate (LREER) is statistically significant and positive at 5%, 1% and 10% respectively. It is evident from the table that 5% increase in IIP, a 1% increase in Inflation, and 10% increase in Exchange Rate leads to 1.200%, 1.922%, and 1.211%, respectively, increase in Stock Prices (Sensex). The findings are consistent with Chen *et al.* (1986); Rahman *et al.* (2009) and Ratanapakorn and Sharma (2007) for IIP, for Inflation and Mukherjee and Naka (1995) for Exchange Rate. Whereas the coefficient of Gold Price is negative and significant at the 1% level in explaining the variation in stock prices. Therefore, Gold Prices have a significant negative relationship adversely affecting stock prices and the findings are consistent with Ray (2012); Gupta and Reid (2013).

Table-2. Estimated Long Run Coefficients using ARDL Approach (Dependent variable: LBSE)

Regressors	ARDL(1,0,0,0)		
	Coefficient	**t- values**	**Prob. Values**
LIIP	1.2003**	2.260	[0.027]
LCPI	1.9215***	3.353	[0.001]
LREER	1.2119*	1.758	[0.083]
LCMR	-0.090	-0.756	[0.452]
LGOR	-0.866***	-2.953	[0.004]
CONS	-3.271	-1.237	[0.220]
Robustness Indicators			
R^2	0.946		
Adjusted R^2	0.938		
F Statistics	127.778[0.000]		
D.W. Stat	1.899		
Serial Correlation, F	9.632 [0.648]		
Heteroskedasticity, F	7.867 [0.005]		
Ramsey reset test, F	2.901 [0.089]		

Note: (1) The lag order of the model is based on Schwarz Bayesian Criterion (SBC). (2) *, ** and *** indicate significant at 10, 5 and 1 percent level of significance, respectively. Values in [#] are probability values.

The short-run relationship of the macroeconomic variables on stock market index is presented in Table 3. As can be seen from the table, IIP and Inflation has a significant and positive impact on stock market index in the short run also at 10% and 1% level, respectively. Similar to long-run, the gold price is significantly negative at 1% in the short-run also. The short run adjustment process is examined from the ECM coefficient. The coefficient lies between 0 and -1, the equilibrium is converging to the long run equilibrium path, is responsive to any external shocks. However, if the value is positive, the equilibrium will be divergent from the reported values of ECM test. The coefficient of the lagged error-correction term (-0.222) is significant at the 1% level of significance. The coefficient implies that a deviation from the equilibrium level of stock market index in the current period will be corrected by 22 percent in the next period to resort the equilibrium.

Table-3. Estimated Short Run Coefficients using ARDL Approach (Dependent variable: LBSE)

Regressors	ARDL(1,0,0,0)		
	Coefficient	**T – Ratio**	**Prob. Values**
ΔLIIP	0.267*	1.776	[0.080]
ΔLCPI	0.428***	2.724	[0.008]
ΔLREER	0.270	1.625	[0.108]
ΔLCMR	-0.019	-0.876	[0.383]
ΔLGOR	-0.546***	-3.494	[0.001]
ΔCONS	-0.729	-1.232	[0.222]
ECM $_{t-1}$	-0.222	-3.238	[0.002]
Robustness Indicators			
R^2	0.426		
Adjusted R2	0.348		
D.W. Stat	1.899		
SE Regression	0.053		
RSS	0.202		
F Statistics	6.033 [0.000]		

Note: (1) The lag order of the model is based on Schwarz Bayesian Criterion (SBC).
(2) *, ** and *** indicate significant at 10, 5 and 1 percent level of significance, respectively. Values in [#] are probability values.

The results of table 4 indicate that there is no short run causality running from any of the variable to LBSE in India. It is observed that error correction term is statistically significant for specification with LBSE as the dependent variable which indicate that there exist a long run causal relationship among the variable with LBSE as the dependent variable. This result is also confirmed by the ARDL test statistics.

Table-4. Results of Vector Error Correction Model

Dependent variable	Sources of Causation Short run independent variables						ECM$_{(t-1)}$
	LBSE	LIIP	LCPI	LREER	LCMR	LGOR	
LBSE	-	0.535	0.667	0.870	0.689	0.703	-2.794***
LIIP	5.490***	-	1.713	0.789	0.508	5.822***	-2.563***
LCPI	2.331*	3.224**	-	1.405	0.854	1.729	2.182
LREER	0.679	0.280	1.367	-	0.203	0.332	0.145
LCMR	1.543	4.677***	1.363	0.212	-	0.509	4.848
LGOR	1.136	0.702	1.241	1.026	0.311	-	0.785

*, ** and *** indicate significant at 10, 5 and 1 percent level of significance, respectively.

The robustness of the short run result is investigated with the help of diagnostic and stability tests. The ARDL-VECM model passes the diagnostic against serial correlation, functional misspecification and non-normal error. The cumulative sum (CUSUM) and the cumulative sum of square (CUSUMSQ) tests have been employed in the present study to investigate the stability of a long run and short run parameters. The cumulative sum (CUSUM) and the cumulative sum of square (CUSUMSQ) plots (Figure 1) are between critical boundaries at 5% level of significance. This confirms the stability property of the long run and short run parameters which have an impact on the market index in case of India. This confirms that models seem to be steady and specified appropriate.
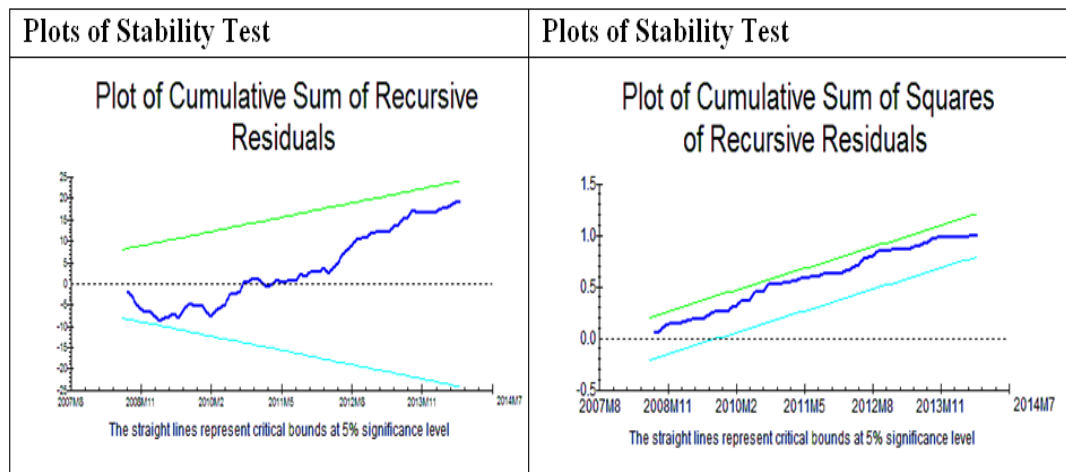

Fig-1. Plots of Stability Test

4.2. Variance Decomposition (VDC) Analysis

It is pointed out by Pesaran *et al.* (2001) that the variable decomposition method shows the contribution in one variable due to innovation shocks stemming in the forcing variables. The main advantage of this approach as it is insensitive to the ordering of the variables. The results of the VDC are presented in table 5. The empirical evidence indicates that 72.02% of stock price change is contributed by its own innovative shocks. Further shock in Gold price explains the stock price by 12.92%. IIP contributes to stock prices by 9.74% and inflation and exchange rate contributes 2.16% and 2.82% respectively. The share of other call money rate is very minimal.

Table-5. Variance Decomposition (VDC) Analysis

Period	S.E.	LBSE	LIIP	LCPI	LREER	LCMR	LGOR
1	0.059	100.00	0.000	0.000	0.000	0.000	0.000
2	0.100	97.545	1.917	0.295	0.068	0.020	0.151
3	0.125	95.908	2.976	0.506	0.279	0.196	0.131
4	0.146	94.879	3.246	0.555	0.714	0.305	0.298
5	0.170	94.009	3.639	0.706	0.920	0.346	0.376
6	0.191	92.822	4.951	0.823	0.727	0.373	0.301
7	0.207	91.810	6.032	0.741	0.701	0.408	0.306
8	0.220	91.021	6.730	0.659	0.830	0.426	0.331
9	0.232	89.664	7.622	0.615	1.147	0.416	0.533
10	0.243	87.496	8.429	0.679	1.668	0.384	1.341
11	0.253	85.134	9.061	0.883	2.104	0.355	2.460
12	0.262	82.626	9.562	1.209	2.439	0.337	3.825
13	0.272	79.997	9.826	1.563	2.689	0.335	5.586
14	0.280	77.609	9.988	1.841	2.830	0.342	7.388
15	0.288	75.629	10.041	2.051	2.900	0.350	9.026
16	0.296	74.114	9.973	2.177	2.912	0.357	10.464
17	0.302	73.068	9.895	2.211	2.889	0.354	11.581
18	0.309	72.374	9.823	2.199	2.860	0.344	12.397
19	0.315	72.020	9.737	2.164	2.821	0.332	12.923
20	0.320	71.929	9.676	2.109	2.774	0.320	13.190

5. CONCLUSIONS AND POLICY IMPLICATIONS

An effort has been made in this paper to investigate whether fundamental macroeconomic variables affect the stock price in India or not. Towards this effort, we use monthly data from April 2004 to July 2014 for the all the variables included in the estimation. The present paper used ARDL bounds testing approach to study the long-run co-integrating relationship among the variables. The bounds test confirms that there exist a long-run cointegrating relationship between different macroeconomic variables and stock prices in India. The long-run estimates of ARDL test showed that positive and significant relationship exists between economic growth (IIP) and stock prices, this could have been due to various reasons including pure coincidence, the working of the wealth effect, the stock market acting as a predictor of GDP or that the stock market does not move of its own accord but rather remains in line with physical production conditions. The stock prices and GDP are related because changes in information about the future course of GDP cause prices to

change in the stock market today Carlstrom *et al.* (2002). GDP is the most crucial economic indicator which tells us about the health of our economy. Higher economic activity implies higher expected profitability, which causes stock prices to rise. Thus, the finding implies that, in a country when the per capita real GDP will raise it will help stock prices to increase and boost up the investor's confidence, with the growing economy.

It also confirms a significant and positive influence of Exchange Rate and Inflation on stock price movements in India. Here, the positive influence of exchange rate on stock price movements is favorable for export based countries. The relationship between real exchange rates and stock prices may be useful because devaluation of domestic currency increase export, hence improve the cash flow and divide payoffs for firms that rely on exports in India.

The influence of inflation also comes out to be positive which proves Fisher (1911) hypothesis. The findings seem to suggest that investors in making better portfolio decisions should perhaps view, shares as long-term holdings against inflation's loss of purchasing power.

Further, the study confirms negative and significant relationship between gold prices and stock prices in India because gold is a substitute investment avenue for Indian investors. As the gold price rises, Indian investors tend to invest less in stocks, causing stock prices to fall. The finding also implies that, the increase in gold prices, gives an alternative and uncontroversial safe investment during the time of financial crisis as it allows its holder to resell it without loss at any time especially in the financial markets collapse.

Thus, it can be concluded from the study that IIP, Exchange rate, inflation and gold prices seem to be suitable targets for the government to focus on, in order to stabilize the stock market and encourage more capital flows into the capital market. Hence, Policy makers should be acquainted of these macroeconomic effects on stock market and help them to take efficient and effective policy decisions. The error correction model of ARDL approach reveals that the adjustment process from the short-run deviation is slow. More precisely, it is found that the ECM_{t-1} term is -0.222. This term is significant at 1%, again confirming the existence of co-integration that the derivation from the long run equilibrium path is corrected 22% per year.

To determine the direction of causality VECM is used in the study and the result found no short run causality running from any of the variables to BSE in India. Further, the result indicates the presence of long run causality for the equation with the stock price as the dependent variable. The CUSUM and CUSUMSQ test results suggest the policy changes considering the explanatory variables of the stock price equation will not cause major distortions in India. To predict the long-run and short-run shocks variance decomposition is used for the study, the results of VDC show that a major percentage of stock price change is its own innovative shocks.

The study limits to the starting period as April 2004 to July 2014 due to the non-availability of data with common base year on IIP and CPI prior to this period. Further, IIP has been taken as the proxy for GDP, which is a standard measure of economic growth because of unavailability of monthly data. The present study has further scope, as the research can be extended over a longer period and more domestic and international macroeconomic variables can be selected. Further,

research area can be extended by analyzing the fundamentals, the economy and stock markets of various developed and developing nations.

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