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DO MACROECONOMIC VARIABLES IMPACT THE INDIAN STOCK MARKET?

Khalid Ul Islam*, Mohsina Habib**

Abstract *This paper is intended to study the impact of various macroeconomic variables on Indian stock market. Based on the Arbitrage Pricing Theory (APT) propounded by Ross in 1976 and various other studies, a number of macroeconomic variables including, inflation, industrial production, exchange rate, money supply, interest rate, and oil price have been identified to have a significant impact on the stock market. We have applied the multivariate extension of the classical linear regression model computed on Ordinary Least Squares method and Granger Causality test to re-establish the relationship between macroeconomic variables and stock returns over a period of 10 years from 2005 to 2015 using monthly observations. The results of this study show that only exchange rate has a significant negative impact on stock returns. The other macroeconomic variables are not significantly affecting stock returns; however, their impact is in accordance with the economic theory. The Granger Causality test reveals absence of any causal relationship between stock returns and macroeconomic variables, except in case of oil prices, where we find a unidirectional causal relationship running from stock returns to oil prices. However, the Granger Causality results should not be taken in the conventional meaning of causality, but results merely identifying precedence.*

Keyword: *Stock Returns, Macroeconomic Variables, OLS, Granger Causality*

JEL Classification: G12, G14

INTRODUCTION

Stock market is considered as the barometer of growth of any economy. It plays a pivotal role in allocation of scarce resources to their most productive uses. Thus, it acts as a medium through which flow of funds takes place, from funds surplus sectors to funds deficient sectors. Besides this, a stock market plays a very important role in imparting liquidity to the financial system, as it provides a market for trading of securities. Thus, stock market is considered to be a vital part of the financial system. A number of idiosyncratic and systemic factors have been identified to have an impact on the functioning of the stock market. As per the Arbitrage Pricing Theory (APT), an extension of the Capital Asset Pricing Model developed by Ross in 1976, a number of macroeconomic factors including, unanticipated risk premium shifts, changes in expected level of industrial production, unexpected inflation, and unanticipated changes in the term structure of interest rates primarily influence the stock market. Over the years, some of the macroeconomic variables have been identified which affect the stock markets including, inflation, industrial production, exchange rate, domestic money supply, interest rates, and international oil prices.

Though, a large number of studies have been done on the relationship between stock returns and macroeconomic variables for developed countries, very less evidence is available for the developing countries particularly in the Indian context. The available literature in the Indian context establishes the impact of macroeconomic variables using pre liberalisation data. However, post liberalisation, the Indian economy has witnessed radical changes including inflation targeting and depreciation of the home currency. Apart from this, India has emerged as the leading developing country in terms of GDP growth rate. Thus, the economic scenario of India has changed calling for revisiting the relationship between macroeconomic variables and stock returns. The present study aims at identifying the macroeconomic variables that have a significant impact on the Indian stock market. The paper is intended to provide useful insights to policy makers, regulators, academicians and the investment community. The rest of this paper is organised as follows: second section reviews the relevant literature on the relationship between stock returns and macroeconomic variables. The variable description, time period, and the relevant methodology are presented in third section. In the fourth section the results of the study are presented along with their economic significance. Finally, fifth section discusses the conclusions and implications of the present study.

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REVIEW OF LITERATURE

One of the earliest attempts towards analysing the impact of macroeconomic variables on stock market returns has been the Arbitrage Pricing Theory (APT) developed by Ross in 1976. The APT is an extension of Capital Asset Pricing Model (CAPM), however, it proposes that stock returns are preliminarily influenced by some macroeconomic forces including, industrial production, inflation, and term structure of interest rates. A large number of studies including Fama (1981), Chen, Roll, and Ross (1986), Flannery and Protopapadakis (2002), and Ratanapakorn and Sharma (2007) established the relationship between macroeconomic variables and stock returns for the developed countries. Fama (1981) studied the relationship between stock returns and macroeconomic variables including real activity and inflation. The study established a negative relationship between inflation and stock returns. Other studies include Lintner (1973), Jaffe and Mandelker (1977), and Fama and Schwert (1977) examining the relationship between inflation and stock prices. While testing the Fisher hypothesis which predicts a positive relationship between expected nominal returns and expected inflation confirm results inconsistent with the Fisher hypothesis. All these studies reported a negative linkage between stock returns and inflation. Chen, Roll and Ross (1986) while studying NYSE stocks revealed presence of strong positive correlation between industrial production, interest rates and stock returns. In another study, Mukherjee and Naka (1995) examined the long-run relationship between six macroeconomic indicators and Japanese stock returns for the period 1971-1990. They found a positive long-run relationship between short-term interest rate, money supply and stock prices. Their evidence also shows a negative relationship between inflation, long-term interest rate and stock prices. Gjerde and Saettem (1999) have probed the relation between stock returns and macroeconomic variables in Norway. Their findings have revealed a positive relationship between oil price and stock returns as well as real economic activity and stock returns. However, their results failed to show a significant relation between stock returns and inflation. Boyd, Levine, and Smith (2000) made a comprehensive study regarding the effect of inflation on the financial sector performance at various thresholds. They studied the relationship between inflation and financial sector performance for a period from 1960 to 1955 for mainly 65 countries. The study revealed that predictable, high rates of inflation hamper the financial sector to allocate resources effectively. As per the study, when inflation passes these thresholds, we will observe a corresponding collapse in financial system performance with adverse effects on resource allocation and economic activity. Flannery and Protopapadakis (2002) studied the returns of NYSE-AMEX-NASDAQ stock returns and various macroeconomic variables. The study revealed presence of a significant relationship between inflation, money supply and stock returns. Ratanapakorn and Sharma (2007) studied the US market to establish the relationship between various macroeconomic variables and stock returns. They revealed that stock returns were positively related with inflation, industrial production, money supply and short term interest rates. They also showed that stock returns were negatively related with long term interest rates. Mahedi (2012) examined the dynamics among macroeconomic variables and the stock returns for Germany and United Kingdom. The study used Johansen Co-integration test to find the presence of long run equilibrium relationship between the stock prices and macroeconomic variables. Further, the study uses error-correction model to investigate the short run casual relationships. For Germany, the results reveal that unidirectional causality runs from stock returns to inflation, from money supply to stock returns and from industrial production to stock returns in the short run. The long-run causality runs from inflation to stock returns and from exchange rate to stock returns. For the United Kingdom, the study confirms that unidirectional causality runs from stock returns to T-bill, from stock returns to money supply, and stock returns to industrial production. Also the results show presence of bi-directional causality between stock returns and exchange rate. The long run causality runs from inflation to stock returns. These results indicate the existence of short-run as well as long term causal relationship between stock returns and macroeconomic variables for both Germany and United Kingdom.

Owing to the growth and development in case of developing markets, the more recent studies have focused on studying the relationship between stock returns and macroeconomic variables in case of developing markets. Some of the important studies include Chatrath, Ramchander, and Song (1996) studying the relationship between stock returns and macroeconomic variables in the Indian context for a period from April 1984 to December 1992. They have used the ARMA model, while the variables of the study taken were stock prices, industrial production and consumer price levels. They revealed a negative relationship between inflation and real activity, consistent with the proxy hypothesis. However the study does not support the final stage of the proxy hypothesis. Basher and Sadorsky's (2006) exploration of the impact of oil price changes on the stock market returns of 21 emerging economies, who found strong evidence of the effect of oil prices being positive and statistically significant at the 10% level to stock market returns for most of the countries studied. Gay (2008) investigated the relationship between stock prices and macroeconomic variables including exchange rate and oil price for BRIC countries using Box-Jenkins model. The study reveals absence of any significant relationship between exchange rate and oil price and the stock prices in any of the emerging countries.

Other studies including that by Mohammad (2011) tested the impact of changes in selected microeconomic and macroeconomic variables on stock returns in Bangladesh. The study found a negative relationship between stock returns and inflation.

Geetha, Rosle, Chandran, and Chong (2011) analysed the effect of macroeconomic variables on stock market returns for Malaysia, U.S. & China for the period between 2000 & 2009 using secondary data on monthly basis. They have used co-integration test to determine the long run relationship and vector error correction modeling to determine the short run relationship. They revealed that, in the long run, expected inflation, exchange rate and interest rate have a negative impact on stock market, while as GDP has a positive impact on stock market. However Sarbapriya (2012) found contrasting results, indicating the presence of unidirectional casuality running from foreign exchange to stock market. In another study, Naik and Padhi (2012) examined the relationship between the Indian stock market and macroeconomic variables. Their results confirmed presence of co-integration between the stock market, exchange rates, treasury bill rates, money supply, wholesale price index, and industrial production index. Further evidence reveals that, money supply and index of industrial production were positively related to stock prices while inflation negatively affects asset prices. Tripathi and Kumar (2015a & b) studied the relationship between inflation and stock returns using granger causality and panel co-integration on BRICS market. The results show that inflation rate is significantly related to stock returns in the short run, but in the long run they do not seem to move together. In another study, Tripathi and Kumar (2015c), while using ALDL bounds testing approach, further examined the BRICS countries for establishing the impact of macroeconomic variables on stock returns. The study revealed a negative impact of exchange rates, interest rates and oil prices on the stock market. Further, they revealed a positive relationship between money supply and stock returns.

RESEARCH METHODOLOGY

Data Description

This study aims at establishing the impact of various macroeconomic variables on the Indian stock market. The stock returns have been taken as the variable representing the Indian stock market activity. The data on stock returns has been arrived at by taking logarithmic differences of monthly closing prices of BSE SENSEX taken from Yahoo Finance. The various macroeconomic variables taken to study their relationship with stock market returns include inflation, industrial production, exchange rate, interest rate, money supply, and oil prices. The description of the variables of the study along with their operational definitions and source is summarised in Table 1. We have taken the period of this study from April 2005 to October 2015 including 127 monthly time series observations due to the absence of data on industrial production before and after the sample period.

Table 1: Variable Description

S.no.	Macroeconomic Variables	Operational Definition	Source	Symbol
1.	Inflation	Consumer Price Index, Base 2010	OECD	CPI
2.	Industrial Production	General Index of Industrial Production	RBI	IIP
3.	Interest Rate	Weighted Average Call Money Rates	RBI	IR
4.	Exchange Rate	One US Dollar in Indian Rupees	Quandl	EX
5.	Money Supply	Broad Money M3	OECD	MS
6.	Oil Prices	International	Index Mundi	OIL

Unit Root Test

The most important issue to be dealt with while modeling time series data is to test the data for stationarity or unit root properties. A series is said to be stationary if it has constant mean, variance and auto-covariances for each lag. However, if the series is not stationary, it is said to have unit root properties. This implies that, mean, variance and auto-covariances of the data series is not constant. If such a series is used for estimating any regression model, it would give biased estimators. As such, the results obtained will be unreliable and inaccurate. Even though, the results would seem to be excellent and impressive, the results of the regression would be spurious or nonsense. In order to check stationarity properties of time series, we have used Augumented Dickey Fuller (ADF) test and Phillips-Perron (PP) test. Stationarity of data is a prerequisite for conduction of regression analysis. These tests of unit root have the null hypothesis of presence of unit root in data, meaning the data is non-stationary. The stationarity of the data in both the tests have been checked at both log levels as well as at their 1st differences.

Multivariate Linear Regression Model

To establish the impact of various macroeconomic variables on the stock returns, we have used ordinary least squared (OLS) model as the main regression model. The stock

returns have been taken as the dependent variable and the various macroeconomic variables have been taken as the independent variables. Thus, we have attempted to identify the macroeconomic variables which have a significant impact on the stock returns.

The multivariate model used in this study is as follows:

$$\begin{aligned} Dlog(BSESENSEX)_t &= \alpha + \beta_1 Dlog(CPI)_t \\ &+ \beta_2 Dlog(IIP)_t + \beta_3 log(MS)_t \\ &+ \beta_4 Dlog(EX)_t + \beta_5 log(IR)_t \\ &+ \beta_6 Dlog(OIL)_t + \varepsilon_t \end{aligned} \quad (1)$$

To check whether the regression residuals (ε_t) is a pure white noise, we further perform the residual diagnostics. For any process to be pure white noise, it should not possess autocorrelation and heteroscedasticity, and should be normally distributed. We have used the Breusch-Godfray Serial Correlation Lagrange Multiplier Test to check the presence of autocorrelation in the regression residuals. The null hypothesis for this test is that there is no autocorrelation. To check the presence of heteroscedsticity in the regression residuals, we have employed the Breush-Pagan-Godfray test having the null hypothesis of no heteroscedasticity. Finally, the histogram of residuals and the Jarque-Bera test have been conducted to check whether the regression residuals are normally distributed. The null hypothesis of the Jarque-Bera test is that the residuals are normally distributed.

Granger Causality Test

In order to check whether the macroeconomic variables individually impact the stock returns, we have used Granger Causality Test, which is a Vector Auto-regression (VAR) model. . To describe the Granger causality, *X* Granger causes *Y* when past values of *X* are able to give explanation of *Y*. This causality is only associated with time series variables. Thus Granger Causality should not be taken in the exact sense of causality as it is more of a test of precedence i.e., chronological ordering of movements in the series (Brooks 2008), and thus Granger Causality.

The basic p-lag vector autoregressive (VAR(p)) model has form of:

$$\begin{aligned} Y_t &= \alpha_1 + \delta_{1t} + \Pi_{11} Y_{t-1} + \ldots + \Pi_{1p} Y_{t-p} \\ &+ \beta_{11} X_{t-1} + \ldots + \beta_{1q} X_{t-q} + \varepsilon_{1t} \end{aligned} \quad (2)$$

$$\begin{aligned} X_t &= \alpha_2 + \delta_{2t} + \Pi_{21} Y_{t-1} + \ldots + \Pi_{2p} Y_{t-p} \\ &+ \beta_{21} X_{t-1} + \ldots + \beta_{2q} X_{t-q} + \varepsilon_{2t} \end{aligned} \quad (3)$$

RESULTS AND DISCUSSIONS

Before running any linear regression model, we need to check whether the variables in the regression model are stationary or not. If the variables are non stationary, the regression results will be spurious or non sense even though the explanatory power or R-squared of the model will be very high. Firstly, we will convert the variables in their logarithmic form. Then, we need to check whether our variables are stationary or not. If the variables are found to be non-stationary at level, then, we transform them into their 1st differences. Then again we check for the presence of unit root properties in the differenced series. Once the variables has time invariant mean, variance and auto-covariance it is said to be stationary and can be used for running a linear regression model. We have used the Augmented Dickey Fuller (ADF) Test as well as the Phillips-Perron (PP) Test to check for stationary of variables.

The null and alternate hypothesis for both these tests are:

Ho: $\rho = 1$ Unit Root [Variable is non-stationary]

H1: $\rho < 1$ No Unit Root [Variable is stationary]

From the results of both the unit root tests as presented in Table 2, it is found that in all the variables except interest rate and money supply, p-values are greater than the critical value (5%). Thus, we cannot reject the null hypothesis and conclude that all the variables of the present study are non stationary at level except interest rate and money supply which are found to be stationary at level. Thus we need to convert the non stationary variables into their first differences before running the regression model.

Table 2: ADF and PP Test Results at Level

Null Hypothesis	ADF Test p-value	P-P Test p-value	Null Hypothesis	Result
LBSE-SENSEX is non- stationary	0.111	0.116	Do not reject	LBSE-SENSEX is non-stationary
LCPI is non-stationary	0.957	0.952	Do not reject	LCPI is non-stationary
LIIP is non-stationary	0.059	0.113	Do not reject	LIIP is non-stationary
LEX is non-stationary	0.891	0.885	Do not reject	LEX is non-stationary
LIR is non-stationary	0.001*	0.001*	Reject	LIR is stationary
LMS is non-stationary	0.026*	0.000*	Reject	LMS is stationary
LOIL is non-stationary	0.051	0.181	Do not reject	LOIL is non-stationary

Source: All the above measures have been calculated using the monthly time series data obtained from their respective sources as mentioned in Table 1: Variable Description.

Notes: 1.Where 'LBSESENSEX' Stands for Logged BSE SENSEX closing prices, 'LCPI' for logged consumer prices', LIIP' for logged Industrial Production, 'LEX' for logged USD/INR exchange rate, 'LIR' for logged interest rate, 'LMS' for logged money supply and 'LOIL' for logged international oil prices.

2. * denotes significance at 5% level.

The above results of Unit Root Tests conclude that all the variables except interest rate and money supply are non-stationary. Thus we need to convert the non-stationary variables including CPI, IIP, EX and OIL into their respective first differences and check whether these variables are stationary or not at first differences. Table 3 presents the Unit Root Test results for the above mentioned variables.

Table 3: ADF and PP Test Results at 1st Difference

Null Hypothesis	ADF Test p-value	P-P Test p-value	Null Hypothesis	Result
DLBSE-SENSEX is non- stationary	0.033*	0.066	Reject	DLBSE-SENSEX is station-ary
DLCPI is non-station-ary	0.000*	0.000*	Reject	DLCPI is stationary
DLIIP is non-stationary	0.214	0.000*	Reject	DLIIP is stationary
DLEX is non-stationary	0.000*	0.000*	Reject	DLEX is stationary
DLOIL is non-station-ary	0.001*	0.000*	Reject	DLOIL is stationary

Source: All the above measures have been calculated using the monthly time series data obtained from their respective sources as mentioned in Table 1: Variable Description.

Notes: 1.Where 'DLBSESENSEX' Stands for 1st difference of BSE SENSEX closing prices, 'DLCPI' for 1st difference of consumer prices', DLIIP' for 1st difference of Industrial Production, 'DLEX' for 1st difference of USD/INR exchange rate, and 'DLOIL' for 1st difference of international oil prices.

2. * denotes significance at 5% level.

We conclude that all the variables to be taken for running the multivariate extension of the classical linear regression model are stationary.

The OLS model of our study is:

$$\begin{aligned} Dlog(BSESENSEX)_t = \alpha + \beta_1 Dlog(CPI)_t + \beta_2 Dlog(IIP)_t \\ + \beta_3 log(MS)_t + \beta_4 Dlog(EX)_t \\ + \beta_5 log(IR)_t + \beta_6 Dlog(OIL)_t \\ + \varepsilon_t \qquad (4) \end{aligned}$$

Here D represents the first difference. The OLS regression results are summarised in Table 4.

Table 4: The Impact of Macroeconomic Variables on Stock Returns

Variable	Coefficient	t-statistics	Probability
C	0.068	1.298	0.197
DLCPI	-0.022	-0.032	0.974
DLIIP	0.054	0.615	0.539
DLEX	-1.289	-6.744*	0.000
LMS	-0.002	-0.191	0.849
LIR	-0.022	-1.481	0.141
DLOIL	0.067	1.079	0.283
R-Squared	0.347		
Adj R-Squared	0.314		
F-Statistics	10.541		0.000
N	126		

Source: All the above measures have been calculated using the monthly time series data obtained from their respective sources as mentioned in Table 1: Variable Description.

Note: 1. DLBSESENSEX, DLCPI, DLIIP, DLEX and DOIL represent the first difference of the log values of BSESENSEX, CPI, IIP, EX and OIL respectively, and LMS and LIR represent the logarithmic transformation of LM and IR respectively.

2.* denotes significance at 5% level.

Table 4 presents the results of OLS regression showing the impact of macroeconomic variables on stock prices. The log transformation of variables influences the interpretation of results. The results denote price elasticity, meaning that percentage change in the predicted variables is caused by one percent change in the predictor variable. The beta values in this regression model are partial regression coefficients. From the above results it is clear that only exchange rate has a significant impact on the Indian stock market. This means that by 1% change in exchange rate there is a corresponding decrease in the stock prices by 128.9%. The negative sign of the coefficient imply that an increase in exchange rate will lead to a decrease in stock prices. The results are in line with the economic theory, according to which an increase in the exchange rate will lead to the depreciation of the home currency which will eventually cause a fall in the stock prices. Although, the other macroeconomic variables are not significant in explaining the changes in stock prices, the sign of their respective betas are again confirming the economic theory. For instance, the negative coefficient of CPI confirms a negative relationship between inflation and stock returns. The negative inflation-stock return relationship supports the proxy hypothesis put forth by Fama in 1981. Again, the coefficient of IIP, which has been taken as a proxy for real activity, confirms the proxy hypothesis. As per Fama, there is an indirect relationship between stock returns and inflation. As inflation increases, it affects the real activity in an opposite direction. The positive association between real activity and real returns thus leads to a fall in the stock prices.

From the regression results, it is also clear that money supply and interest rates have a negative impact on stock prices. Increase in money supply may lead to inflationary pressures and can thus negatively impact the stock prices. On the other hand, any increase in interest rates results in the availability of funds at a higher cost, leading to a reduction in future cash flows. This will in turn lower the prices of stocks. Regarding the impact of international oil prices on stock prices, there is a difference of opinion in the academic world. On the one hand, oil prices are regarded as least correlated with stock prices as there are a lots of factor prices including wages, interest rates, technology, etc. which offset any changes in energy costs. On the other hand, an increase in oil prices lead to an increase in input costs for most industries which further result in a reduction in corporate earnings and thus share prices.

The F-statistics of the OLS regression result is very important in terms of model specification when a multivariate extension of the classical linear regression model is estimated. From the above table, the F-statistic comes to be 10.541 which is statistically significant. The R-squared of the regression model (34.7%), the explanatory power, is also moderate. However, to meet the assumptions of the classical linear regression model, and confirm the t-statistics, we need to make sure that the OLS residuals are pure white noise, i.e., the residuals are free from autocorrelation at all lags, their variance are not time bound, and are normally distributed. For this purpose, we have diagnosed the regression residuals for problems of autocorrelation, heteroscedasticity and normality.

We have employed the Breusch-Godfray Serial Correlation Lagrange Multiplier Test to check the presence of autocorrelation in the regression residuals. The null and the alternate hypotheses of this test are:

Ho: No autocorrelation

H1: Autocorrelation

The results of Breusch-Godfray Serial Correlation LM Test at lag 2 are summarised in Table 5.

Table 5: Breusch-Godfray Serial Correlation Lagrange Multiplier Test

	Coefficient	Probability
F-statistic	0.024	0.976
Obs R-Squared	0.051	0.975

Source: All the above measures have been calculated using the monthly time series data obtained from their respective sources as mentioned in Table 1: Variable Description.

It is clear from Table 5 that the p-value of the test statistic is 97.6%, which is greater than the critical level of 5%. Hence, we cannot reject the null hypothesis of no autocorrelation. Thus, the above results confirm absence of autocorrelation in the OLS regression residuals.

Further, we test for the presence of heteroscedasticity in the regression residuals by using Breusch-Pagan-Godfray Test. The null and alternative hypotheses of this test are:

Ho: No Heteroscedasticity

H1: Heteroscedasticity

The results of Breusch-Pagan-Godfray Test are summarised in Table 6.

Table 6: Breusch-Pagan-Godfray Test

	Coefficient	Probability
F-statistic	1.249	0.286
Obs R-Squared	7.466	0.280
Scaled explained SS	11.774	0.067

Source: All the above measures have been calculated using the monthly time series data obtained from their respective sources as mentioned in Table 1: Variable Description.

Table 6 presents the results for testing the presence of heteroscedasticity. The p-value of the test statistic is 28.6%, which is greater than the critical level of 5%. Thus, we cannot reject the null hypothesis of no heteroscedasticity, and as such the OLS residuals are free from hetroscedasticity error.

Finally, we test the normality assumption by looking at the histogram and Jarque-Bera test statistics. The null and the alternative hypotheses of this test are:

Ho: Residuals are normally distributed

H1: Residuals are not normally distributed

The results of the Jarque-Bera test statistic are given in Fig. 1.

From the results of Fig. 1, it can be concluded that the regression residuals are not normally distributed, since the p-value of the Jarque-Bera test statistic is less than the critical value of 5%. However, we can rely on the t-statistics since our sample period is fairly large enough. Thus it can be concluded that, the regression results are pure white noise process, and as such do not contain any systematic information.

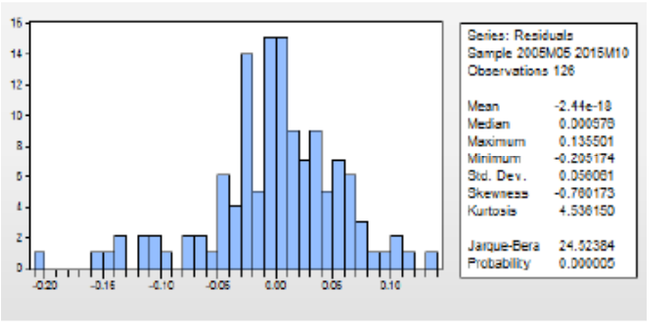

Fig. 1: Histogram and Jarque-Bera Test

Source: All the above measures have been calculated using the monthly time series data obtained from their respective sources as mentioned in Table 1: Variable Description.

In order to analyse the impact of various macroeconomic variables on the Indian stock market individually, we use Granger Causality test. The Granger Causality test is basically a test of precedence of the VAR form, in which lagged values of the independent as well as the dependent variable are regressed against the contemporaneous values of the dependent variable. The null and the alternate hypotheses of this test are:

Ho: X does not Granger cause Y

H1: Y does not Granger cause X

We have conducted the Granger Causality test between stock prices and all the other macroeconomic variables. The results of the Granger Causality test at lag 2 are summarised in Table 7.

Table 7: Granger Causality Test Results

Null hypothesis	p-value	Result	Relationship
DLCPI does not Granger cause DLBSESENSEX	0.325	Do not Reject	No relationship
DLBSESENSEX does not Granger cause DL-CPI	0.586	Do not Reject	
DLIIP does not Granger cause DLBSESENSEX	0.883	Do not Reject	No relationship
DLBSESENSEX does not Granger cause DLIIP	0.690	Do not Reject	
DLEX does not Granger cause DLBSESENSEX	0.468	Do not Reject	No relationship
DLBSESENSEX does not Granger cause DLEX	0.715	Do not Reject	
LMS does not Granger cause DLBSESENSEX	0.704	Do not Reject	No relationship
DLBSESENSEX does not Granger cause LMS	0.788	Do not Reject	
LIR does not Granger cause DLBSESENSEX	0.056	Do not Reject	No relationship
DLBSESENSEX does not Granger cause LIR	0.784	Do not Reject	
DLOIL does not Granger cause DLBSESENSEX	0.275	Do not Reject	Unidirectional relationship
DLBSESENSEX does not Granger cause DLOIL	0.002*	Reject	

Source: All the above measures have been calculated using the monthly time series data obtained from their respective sources as mentioned in Table 1: Variable Description.

Note: 1. DLBSESENSEX, DLCPI, DLIIP, DLEX and DOIL represent the first difference of the log values of BSESENSEX, CPI, IIP, EX and OIL respectively, and LMS and LIR represent the logarithmic transformation of LM and IR respectively.

2.* denotes significance at 5% level.

Table 7 presents the Granger Causality results between the stock returns and macroeconomic variables. From the table it is evident that, there is a unidirectional relationship running from stock returns to international oil prices, since the p-value is less than the 5% critical value. Thus the Granger Causality results reveal that, only stock returns Granger cause oil prices in short run, while as, there is absence of any causal relationship between stock returns and other macroeconomic variables.

CONCLUSION AND IMPLICATIONS

Stock market plays a significant role in mobilising funds from surplus to deficient sectors of the economy. Besides this, it enables pooling of funds from small investors to be utilised by productive sectors of the economy, which would not be otherwise possible and would remain idle. It also imparts liquidity to the financial system. However, on the basis of the vast literature review, we have identified six macroeconomic variables having an impact on the stock market. The present study aims at re-establishing the relationship between stock returns and macroeconomic variables in the changing Indian economic scenario. The data for the study have been taken for a period of 10 latest years, which is a fair representative sample of the changing economic environment for India. This study uses the multivariate extension of the classical linear regression model, as well as, the Granger Causality Test to identify the impact of individual macroeconomic variables on the Indian stock market. Further, residual diagnostics has been carried out to check whether any systematic information is present in the OLS residuals. The results of this study conclude that, exchange rate, i.e., one US dollar in terms of INR, has a negative and statistically significant impact on stock returns. The other macroeconomic variables have been found to be affecting stock returns as per the economic theory.

However, their impact has been found to be insignificant. The Granger Causality Test has revealed absence of any causal relationship between macroeconomic variables and stock returns, except for oil prices, where a unidirectional causality has been established, running from stock returns to oil prices. The results of Granger Causality are to be taken as a case of precedence and not actual causality. There is scope for further research on the area by implementing advanced econometric and time series modeling techniques which can provide better and more plausible results.

The present study has important implications for policy makers, regulators, academicians, and investment community at large. Even though, the regression coefficients for most of the macroeconomic variables have come insignificant while studying their impact on the performance of Indian stock market, the direction of their impact is in accordance with the economic theory. Thus, this study provides useful insights for economic reformers, including policy makers and regulators, to identify the various macroeconomic factors to be targeted which impact the Indian stock market. For the academic world, this study fills in the research gap of lack of research on the issue and provides way for re-assessing the studied relationship by using more advanced research tools and techniques. Regarding the investment community, this study provides presence of arbitrage opportunity for earning above normal returns on the basis of exchange rate variable.

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