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Impact of Macroeconomic Variables on Indian Stock Markets

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Abstract – The present study investigates the relationship between the various macroeconomic variables with the Indian stock market. The macroeconomic variables included in the study are interest rate, inflation rate, money supply and exchange rate and BSE Sensex has been taken as the benchmark for the Indian stock market. Monthly data for the period from to has been taken as sample for the study. The study finds that the long term relationship exist between the macroeconomic variables and stock market except the money supply. The short run causality also exist in between the macroeconomic variables and stock market. The bidirectional causality is found in between the interest rate and BSE Sensex.

Keywords: Stationarity, Co-Integration, Vector Error Correction Model

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INTRODUCTION

Indian economy has changed after the post liberalization in terms of micro and macro indicators. The changing patterns of macroeconomic indicators are influencing the overall stock market as well as the individual stock. It's very difficult to predict the exact degree of change in the stock market but it is possible to investigate the extent to which various factors affect the stock markets. The participant interested in the stock market keeps watch on the various indicators/events which have impact on the stock market returns. Therefore various models have developed to explain the stock market returns. The first model Capital Asses Pricing Model was developed by Sharpe in 1964. But the model has considered only one variable to explain the variation in the dependent variable. After that arbitrage pricing theory (APT) has developed that considers the multiple variables for determining the stock returns. The expected stock return is a linear combination of responsiveness to each variable's beta. The present study investigates the long run and short term relationship between the macroeconomic variables and the BSE Sensex.

REVIEW OF LITERATURE

Ray Prantik and Vani Vina (2002) evaluated the relationship between the real economic variables and the movement of the stock market. The researcher used the macroeconomic variable namely Index of Industrial Production, Whole Sale Price Index, SBI prime lending rate, FII in capital market, Fiscal Deficit and money stock. Data for the period of 1994 to 2003 examined with the Artificial Neural Network and Vector Auto Regressive Model. The Study indicated that real economic variables affect the stock market in the post economic reform era in India and also explain that some macroeconomic variable doesn't affect the stock market.

Robert D. Gay, Jr. (2008) explicated the relationship between stock market index and the macroeconomic variables of oil price and exchange rate for Brazil, India, China and Russia. To analyze the data monthly average of respected stock market indices, oil prices and exchange for a period of 1999 to 2006 is examined. The Box Jenkins Autoregressive Integrated moving average (ARIMA) time series process was used to examine the relationship between the dependent variable (Stock Market Index) to the independent variables (Exchange rate and oil price). It was found that the effect of international macroeconomic factors of exchange rate and oil price on the stock market exchange index of Brazil, Russia, China and India did not reveal a significant relationship.

D.V.Lokeswar Reddy (2011) analyzed the relationship between Inflation Rate, GDP and Interest Rates with respect to stock market returns. The researcher analyzed the data of 20 yrs from 1990-91 to 2009-10. He has used correlation, Regression, Standard Deviation techniques of statistics for analyzing the data. The finding of the researcher indicates that the increased RDGP has a positive relation and a reduction in inflation and interest rate indicate the increase in stock returns.

M.S.Ramaratnam, R.jayaraman and V. Krishnamoorthy(2012) investigated the correlation between Net FII (Foreign Institutional Investment) Flows and the SENSEX (Bombay stock market index). The Researcher has taken the data for three years i.e.2010-2012 for the inflow of FII's investment and movement in the Bombay stock exchange index (Sensex). To analyzed the data researcher used Correlation, Linear Regression Model and also test the significant difference between FII and SENSEX through application of T test. The researchers found that there is momentous impact of FII on the BSE SENSEX and there is significant relationship between the variables of FII investment made by FII indicatively differs in terms of equity and debt segment.

Syed Tabassum Sultana and S. Paradhasaradhi (2012) examined the patterns and trends of foreign capital inflow and outflow in India in the form of FDI and FII. The researcher further investigated the impact of FDI and FII on Indian stock Market (Nifty and Sensex). The Researcher analyzed the data of 11years starting from 2001 to 2011 in order to analyze the data Multi Regression OLS model and correlation statistical techniques were used. The Study finds that there is a high degree of positive correlation between FDI and Nifty. Also finds that there is moderate positive correlation between FII and SENSEX.

Pramod Kumar Naik and Puja Padhi (2012) analyzed the relationship between BSE Sensex and various macroeconomic variables. The researchers used Time series analysis, Johansen's co-integration model and vector correction model to explore the long run and short run equilibrium relationship between the stock market index and macroeconomic variables. The study reveals that stock market index, money supply and industrial index of production (IIP) are positively related or exchange rate and short term interest rate are insignificant in determining stock price. Inflation rate is negatively correlated with the stock market index (BSE SENSEX).

Vanita Tripathi and Ritika Seth(2014) explained the short and long run causal relation between stock market performance and six macroeconomic variable using monthly data by applying a variety of statistical economic techniques (these are correlation, factor analysis regression, ARCH Test, Garanger Casuality test, Bi-variate test, Multivariate Johansen Co-integration test, VAR and impulse response analysis). The researcher has analyzed the monthly data from july1997 to June 2011. The study finds that there is significant correlation among stock market and macroeconomic factors except the exchange rate, the granger causality results shows that the few variables are causing the changes in each other out of which exchange rate is the only variable that is granger causing BSE Sensex.

Abdullah, Saiti & Masih (2014) examined the relationship between the Kuala Lumpur stock exchange and macroeconomic variables i.e. exchange rate, interest rate, export, inflation using the sample from January 1996 to September 2013. The sample has analyzed using the cointegration, VECM technique. The finding of the study suggested that there is no long run relationship between the macroeconomic variable and Kuala Lumpur stock exchange while the interest rate has influenced on the performance of stock market.

Hsing, Y.(2014) examined the relationship between Romania stock exchange and the macroeconomic variables i.e. GDP, M2, real interest rate, nominal effective exchange rate, inflation rate, stock market index of US using the quarterly data from 2001 to 2010. The GARCH model was used to analyze the sample data. The findings of the study suggested that the Romania stock market has significant influenced by industrial production. The US stock market is negatively influenced by the interest rate, inflation rate, bond yield and government borrowing to GDP.

EMPIRICAL PROCEDURES

Variables: The present study identified the macroeconomic indicators by review of literature and through the economic theory. The macroeconomic indicators included in the study are consumer price index, exchange rate, foreign exchange reserve, interest rate(repo rate) and money supply (M2).

Inflation Rate (LCPI): The inflation rate affects the savings and interest rate that will lead to change in the stock prices. More saving attracts the more investment that increases the stock price. Similarly to control over the inflation rate regularity authorities increase the interest rate that will lead to reduction in the stock prices.

Exchange Rate (LER): The exchange rate affects the stock prices because deprecation in the currency leads to higher cost of import of raw material, technology, machinery and equipment. The higher cost has adverse affect on the firm's profitability and stock prices.

Interest Rate (LIR): The interest rate has negative impact on the stock market because in case of higher interest rate people would prefer to invest in banks instead of stock market. Less investment in stock market leads to decrease in the stock prices or less interest rate attracts more investment in the stock market.

Foreign Exchange Reserves (LFER): A country which has high amount of foreign exchange reserves has more financial stability and also the value of the national currency would be high in the international market. The financial stability attracts

the foreign investment in the capital markets that will leads to high in the stock prices.

Money Supply (LMS): Increase in money supply lead to enhancement of business turnover so as to increase the profitability of the business concern. But increase money supply also impact the inflation rate thus money supply has multiple impact on the stock market.

BSE Sensex (LBSE): BSE sensex is an index comprising of 30 stock of large companies calculating using the free float market capitalisation. BSE Sensex includes the shares of various sectors therefore it reflect the overall market.

Data: the sample data from has been retrieved from the various sources like CEIC database, investing.com, yahoo finance, rbi website etc.

ANALYTICAL TOOLS

For the purpose of studying Cointegration, a stepwise procedure needs to be followed. The following analytical tools have been used for the purpose:

1. Unit Root Tests (ADF)
2. Johansen's cointegration testing
3. Trace test
4. Max Eigenvalue test
6. Unrestricted VAR
7. VAR Granger Causality Test

The Johansen Cointegration process is a maximum likelihood method that determines the number of cointegrating vectors in a non-stationary time series Vector Autoregression (VAR) with restrictions imposed, known as a vector error correction model (VECM). Johansen's estimation model is as follows:

$$\Delta X_t = \mu + \sum_{i=1}^{p} \Gamma_i \Delta X_{t-i} + \alpha\beta' X_{t-i} + \varepsilon_t$$

Where :

X_t = (nx1) vector of all the non-stationary indices in the study

r_i = (nxn) matrix of coefficients

α= (nxr) matrix of error correction coeffecients where r is the number of cointegrating relationshios in the variables so that 0<r<n. it measures the speed at which the variables adjust to their equilibrium.

β= (nxr) matrix of r cointegrating vectors, so that 0<r<n. this is what represents the long-run cointegrating relationship between variables.

RESULTS AND DISCUSSION

Table 1: Descriptive Statistics

	LBSE	LCPI	LER	LFER	LIR	LMS
Mean	9.936495	1.971143	4.019807	12.57407	1.913946	12.75156
Median	9.897201	2.138501	4.024323	12.52706	1.909543	12.77037
Maximum	10.4628	2.786012	4.223024	12.89782	2.197225	13.15912
Minimum	9.104474	0.378721	3.754262	12.38303	1.558145	12.35968
Std. Dev.	0.309099	0.462291	0.150687	0.138928	0.177312	0.161219
Skewness	-0.55926	-0.77113	-0.22069	0.657711	-0.57998	-0.29014
Kurtosis	3.160879	3.229872	1.482701	2.20651	2.393796	3.231778
Jarque-Bera	6.225178	11.8531	12.17293	11.5048	8.350714	1.903458
Probability	0.044486	0.002668	0.002273	0.003175	0.01537	0.386073

Table 1 represents the descriptive statistics of the log transformed sample data. The Jarque Bera test results shows that the none of the variables following the normal distribution.

Table 2: Result of unit root test

Variables At Level	ADF Test			Philips Perron Test		
	Intercept	Intercept and Trend	No Intercept and No Trend	Intercept	Intercept and Trend	No Intercept and No Trend
LBSE	0.8337	0.4204	0.9704	0.7509	0.1391	0.9443
LCPI	0.5560	0.0163	0.3463	0.6172	0.0672	0.3792
LER	0.5324	0.4138	0.9546	0.5541	0.6295	0.9762
LFER	0.9954	0.1646	0.9551	0.9758	0.1216	0.9171
LIR	0.0946	0.1759	0.6431	0.2012	0.4226	0.3722
LMS	0.6129	0.0887	0.9326	0.8986	0.5012	0.9874
First Difference						
LBSE	.0000	.0000	.0000	.0000	.0000	.0000
LCPI	.0000	.0000	.0000	.0000	.0000	.0000
LER	.0000	.0000	.0000	.0000	.0000	.0000
LFER	.0000	.0000	.0000	.0000	.0000	.0000
LIR	.0101	.0167	.0005	.0000	.0000	.0000
LMS	.0000	.0000	.0000	.0000	.0000	.0000

The table 2 represents that none of the variable is stationary at level and all of them are stationary at first difference so all the research has carry out on the first difference

Table 3: Result of laglength Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	459.6138031	NA	9.78E-12	-8.323189	-8.175041	-8.26311
1	1383.009261	1728.19	8.31e-19*	-24.60567*	-23.56864*	-24.18512*
2	1417.111645	60.07026*	8.65E-19	-24.57086	-22.64494	-23.78983
3	1445.638947	47.10931	1.01E-18	-24.43374	-21.61894	-23.29224
4	1464.88784	29.66802	1.41E-18	-24.12638	-20.42269	-22.6244
5	1494.361705	42.18278	1.66E-18	-24.00664	-19.41406	-22.14418
6	1528.712176	45.38044	1.84E-18	-23.97637	-18.49491	-21.75344
7	1556.321275	33.43487	2.38E-18	-23.82241	-17.45206	-21.239
8	1587.263155	34.06446	3.02E-18	-23.7296	-16.47037	-20.78572

*Indicates lag order selected by the criterion

Table 3 results find that the optimal lag is 1 which is suggested by AIC, SC, HQ and FPE lag length criterion.

Table 4: Result of co-integration test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	'p' Value
Unrestricted Cointegration Rank Test (Trace)				
None *	0.389652	143.3482	95.75366	0.0000
At most 1	0.333937	86.56965	69.81889	0.0013
At most 2	0.147347	39.83706	47.85613	0.2284
At most 3	0.117297	21.50576	29.79707	0.3268
At most 4	0.059111	7.157655	15.49471	0.5594
At most 5	0.00131	0.150691	3.841466	0.6979
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
None *	0.389652	56.77858	40.07757	0.0003
At most 1	0.333937	46.73259	33.87687	0.0009
At most 2	0.147347	18.3313	27.58434	0.4678
At most 3	0.117297	14.34811	21.13162	0.3371
At most 4	0.059111	7.006963	14.2646	0.4883
At most 5	0.00131	0.150691	3.841466	0.6979

Table 5: Normalised co-integrating coefficients

Variable	L BSE	L CPI	L ER	L FER	L IR	L MS
Coefficient	1	0.445192	-1.38221	1.096867	0.33747	-0.40159
Std. Error		-0.09505	-0.21387	-0.40259	-0.13139	-0.24413
't' statistics		4.68393	-6.46283	2.72449	2.56838	-1.64497

LBSE = 1.38LER-1.097LFER+0.40LMS-0.44LCPI-0.338LIR

The result of the Johansen Cointegration test exhibits that the long term relationship exist between the bse sensex and macroeconomic variables. The coefficient of the various variable indicated their elasticity on the bse sensex. The table 5 exhibits that all the coefficient are statistically signigicant except the money supply. In case of CPI 1% change in the CPI reduce the stock price by 0.44%. The 1% change in the exchange rate postiviely influence the stock price by 1.38% further 1% change in the stock market brings negative 1.09% and 0.33% change in the foreign exchange reserve and interest rate resptively.

Table 6: Result of vector error correction model

Error Correction:	D(BSE)	D(CPI)	D(ER)	D(FER)	D(IR)	D(MS)
Coefficient	-0.11804	-0.156172	0.033298	-0.037868	0.061508	-0.0398
Std. Error	-0.02656	-0.08017	-0.0106	-0.01126	-0.01757	-0.02331
't' statistics	-4.44359	-1.94792	3.14193	-3.36443	3.50049	-1.70777

Table 6 exhibits that the speed of adjustment towards the equilibrium is found negative and significant in case of BSE and foreign exchange reserves. The vector adjustment factor for other variables found to be positive and insignicant.

Table 7: Result of Granger Causality Test

Null Hypothesis:	Obs	F-Statistic	Prob.
CPI does not Granger Cause BSE	116	1.34211	0.2491
BSE does not Granger Cause CPI		3.98525	0.0483
ER does not Granger Cause BSE	116	5.84293	0.0172
BSE does not Granger Cause ER		0.36118	0.5491
FER does not Granger Cause BSE	116	0.27172	0.6032
BSE does not Granger Cause FER		9.79893	0.0022
IR does not Granger Cause BSE	116	8.46974	0.0044
BSE does not Granger Cause IR		8.75837	0.0038
MS does not Granger Cause BSE	116	0.04735	0.8281
BSE does not Granger Cause MS		4.04388	0.0467

The result of granger causality test which is mentioned in the table 8 explains the short run causality running from macroeconomic variable to the stock market. The interest rate has bidirectional causality running from each other. In case of inflation rate (CPI) unidirectional causality is found which is from BSE to the CPI. The exchange rate has impact on the BSE Sensex. The foreign exchange reserves are impacted by the change in the BSE Sensex. In Case of money supply the change in the money supply has influenced over the BSE.

CONCLUSION

The present study investigated the long term and short run relationship between the stock market and various macroeconomic variables. The BSE Sensex has been taken as benchmark for the stock market and repo rate for the interest rate. The macroeconomic variables included in the study are money supply, interest rate, inflation rate, exchange rate and foreign exchange reserves. The study finds that the long term relationship exist between the macroeconomic variables and stock market except the money supply. The short run causality also exist in between the macroeconomic variables and stock market. The bidirectional causality is found in between the interest rate and BSE Sensex.

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