AN EMPIRICAL STUDY ON STOCK MARKET INDEX (BSE) AND MACRO ECONOMIC VARIABLES

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ABSTRACT:

The movement of stock indices is highly sensitive to the changes in fundamentals of the economy and to the changes in expectations about future prospects. In the decade of 1990s in India, a large number of measures have been taken for economic liberalization. At the same time, vast number of steps has been taken to strengthen the stock market such as opening of the stock markets to international investors, regulatory power of SEBI, trading in derivatives, etc. These measures have resulted in significant improvements in the size and depth of stock markets in India and they are beginning to play their due role. Presently, the movement in stock market in India is viewed and analyzed carefully by large number of global players. Understanding macro dynamics of Indian stock market may be useful for policy makers, traders and investors. In this paper, an attempt has been made to explore the influential relationship between BSE Sensex and selected macro-economic variables of India by using Regression Analysis Technique. The period of study is April 2003 to March 2013. The results show that changes in Wholesale Price Index (aproxy for Inflation) and Index of Industrial Production has a strong influence on the BSE Index.

Keywords:*BSE Index, Wholesale Price Index, Industrial Production Index, Foreign Institutional Inflow, Call Money Rate.*

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INTRODUCTION:

A Stock Exchange forms a vital part of any nation. In many ways it is the indicator through which the economy of a country is professed by many people even though there are other economic tools to judge the actual health of the economy. Stock exchanges are places through which the public at large take part as investors. In India, the BSE has been attracting thousands of investors each year. Worldwide, there are millions of transactions that take place every day. Stock market is one of the major economic reflectors.

The movement of stock indices is highly sensitive to the changes in fundamentals of the economy and to the changes in expectations about future prospects. Expectations are influenced by the micro and macro fundamentals which may be formed either rationally or adaptively on economic fundamentals, as well as by many subjective factors which are unpredictable and also non-quantifiable[1]. It is assumed that domestic economic fundamentals play determining role in the performance of stock market. However, in the globally integrated economy, domestic economic variables are also subject to change due to the policies adopted and expected to be adopted by other countries or some global events. The common external factors influencing the stock return would be stock prices in global economy, the interest rate and the exchange rate. For instance, capital inflows and outflows are not determined by domestic interest rate only but also by changes in the interest rate by major economies in the world. From the beginning of the 1990s in India, a number of measures have been taken for economic liberalization. At the same time, large number of steps has been taken to strengthen the stock market such as opening of the stock markets to international investors, regulatory power of SEBI, trading in derivatives, etc. These measures have resulted in significant improvements in the size and depth of stock markets in India and they are beginning to play their due role. In contemporary phase, the movement in stock market in India is viewed and analyzed carefully by large number of global players. Understanding macro dynamics of Indian stock market may be useful for policy makers, traders and investors.

[1] *Due to low labor cost and skillful manpower sectors like textile, garments, manufacturing, banking and insurance has made a significant contribution to foster the growth potentials of the economy but there are several factors which directly or indirectly affect the performance of BSE Sensex such as inflation, foreign exchange reserves, exchange rate, Industrial Production, crude oil, interest rate structure, gold price, etc.*

Therefore, it is of our interest in this study, to examine and review the nature of the relationship between BSE Sensex and Macro Economic variables using RBI data sets for post economic reform period. The data used in this present study is for one decade- April 2003 to March 2013[2]

Before we proceed with the empirical verification of these relationships, a brief description of the rough theoretical framework is presented and the nature of hypothesis being tested is discussed in next section.

SECTION II

In the economic literature, there are several studies to witness the relationship of stock exchange index and macro-economic variables. In some cases the studies have even provided different results. The observations varied according to the macroeconomic factors used. Here we present in a nutshell some of the reviews done to understand the causal relationship.

A study by **Naka et. al. (1998)**, examined the relationships among macroeconomic variables and Indian stock market. To examine the relationship among the variables, the related data were analyzed with the help of Vector Error Correction Model. On the basis of the results of this study researchers suggested that domestic inflation was the most deterrent to Indian stock market performance and domestic output was its predominant driving force, is also an important pointer to the indices.

Bhattacharya (2001) by applying the techniques of unit–root tests, cointegration and the long–run Granger non–causality test tests the causal relationships between the BSE Sensitive Index and the five macroeconomic variables, viz., money supply, index of industrial production, national income, interest rate and rate of inflation using monthly data for the period 1992-93 to 2000-01. They found that (i) there is no causal linkage between stock prices and money supply, stock prices and national income and stock prices and interest rate, (ii) index of industrial production leads the stock price, and (iii) there exists a two – way causation between stock price and rate of inflation.

[2] *The period which witnessed different business cycles.*

Mishra (2004) by using monthly data for the period 1992 to 2002, examined the relationship between stock market and foreign exchange markets using Granger causality test and Vector Auto Regression technique study suggested that there is no Granger causality between the exchange rate return and stock return.

Ahmed (2008), tried to explore the nature of causal relationships between stock prices and the economic variables. In this study, researchers' collected quarterly data of index of industrial production, exports, foreign direct investment, money supply, exchange rates, interest rate, NSE-Nifty and BSE-Sensex in India. Granger causality test were applied to explore the long-run relationships while BAVR modeling for variance decomposition and impulse response functions were applied to examine the short-run relationships. The study revealed that the movement of stock prices was not only the behavior of the key macroeconomic variables but it was also one of the causes of movement in macro dimension in the economy.

Tripathi et al (2012), say that significant levels affecting the stock market are few more macroeconomic variables and these are dollar price, money exchange, rate inflation, exchange rate, IIP, crude oil, interest rate and gold price also.

Another such exhaustive study has also see the relationship with more precision of impacts both ways by **Dasgupta (2012),** make a study to examine the long-run and short-run relationships between BSE-Sensex and macroeconomic variables like Wholesale Price Index (WPI), Index of Industrial Production (IIP), Exchange Rate and Call Money Rate. In this study, to examine the relationships between variables monthly data from April, 2007 to March, 2012, short span though, were analyzed with the help of various analytical tools like descriptive statistics, ADF Test, Granger Causality Test and Johansen &Juselius Cointegration Test.

Another such study has be taken by **Vashishtha & Singh (2013)** studied the impact of economic growth rates on capital market movements, using descriptive statistics using Coefficient of Correlation for growth rates (IIP and WPI) and S&P BSE SENSEX. Their study shows that inverse relationship between the correlation of S&P BSE SENSEX with IIP and BSE SENSEX with WPI. Here only relevance of WPI and IIP is shown in this study for major movement in stock market Index

Leading economic indicators have long been a tool of economists, particularly those working in the business sector, for expecting turning points in the business phase. Prepared with knowledge of likely peaks and troughs in the pace of aggregate economic activity, business economists can warn corporate leaders as to the probable path of the macroeconomic, thereby influencing if not improving the quality of strategic decision making within organizations.

While **Sharma & Chaitanya (2013)** explore the influential relationship between SENSEX and select Indian macro-economic variables by using Regression model and their findings reveal influential relationship on SENSEX by Industrial Production and Foreign Exchange Rate, These two factors taken together are accounted for almost 85 percent of the SENSEX movements during the considered time period.

Other studies say that the significance of FII for affecting the markets are by **Reddy & Saleem (2013)** study shows that the Foreign Institutional Investors (FIIs) have emerged as important players in the Indian equity market in the recent past so factors influencing FIIs and returns in the Indian equity market, so the study concludes that FIIs inflows in India are determined by stock market characteristics, macroeconomic factors and international factors.

The study by **Chen, Pian et al, (2013)**, use nonparametric dimension-reduction methods to extract from a set of 15 macroeconomic variables the risk factors that are priced in the stock market. This study is more exhaustive in turn, shows, dominant factor moves with the business cycle but, because it is a nonlinear function of observed macroeconomic variables, it captures a rich set of interactions. Low-credit risk and low-inflationary expectations have a greater positive effect on stock returns when leading macroeconomic indicators are high relative to current economic activity, i.e. early in the business cycle as the economy emerges from recession. High-stock returns also arise in periods when the economy is booming relative to its leading indicators, but such periods tend to portend crashes.

Based on the literature evidences, it can be observed that there is strong influence of BSE Sensex and Macro Economic Variables. Therefore to examine the status of such in post liberalization phase, we too have formulated similar objective and hypothesis.

Objective:

- To study the relationship between Whole Sale Price Index, Industrial Production Index, Foreign Institutional Inflow and Call Money Rate on BSE Sensex in Post-economic liberalization phase.

Hypothesis:

- There is significant relationship of Stock Price Index and Macro Economic Variables.

Methodology:

The analysis is focused on four macro-economic variables that are Whole Sale Price Index, Industrial Production Index, Foreign Institutional Inflow and Call Money Rate. We study the impact of these variables on the BSE Index. BSE Index levels are taken as the dependent variables. The Macro-economic variables are taken as the independent variables. The data collected is from the period April 2003 to March 2013. The source of the data has been from RBI website. With the help of Karl Pearson Correlations and regression analysis we try to interpret the observation taking BSE Sensex as dependent variable and macro-economic variables as independent.

The functional forms used in the linear analysis are with totally 6 equations in the estimations are[3]:

1. $Y = \alpha + \beta_1 WPI$
2. $Y = \alpha + \beta_1 IIP$
3. $Y = \alpha + \beta_1 FII$
4. $Y = \alpha + \beta_1 CMR$
5. $Y = \alpha + \beta_1 WPI + \beta_2 FII + \beta_3 CMR$
6. $Y = \alpha + \beta_1 IIP + \beta_2 FII + \beta_3 CMR$

SECTION III

[3] Due to Multi-collinearity problem Whole Sale Price Index & Industrial Index of Production are not together estimated in the model.

A brief description of Dependent Variables and Independent Variables being studied are discussed in this section.

Bombay Stock Exchange Sensex (BSE-Sensex)

Bombay stock exchange or BSE is the largest stock exchange in India in terms of number of listed companies in the exchange and the market capitalization of the listed companies. The prime index of the Bombay Stock Exchange is the BSE 30 that is popularly known as the Sensex. First compiled in 1986, Bombay Stock Exchange Sensitive (SENSEX) is a basket of 30 constituent stocks representing a sample of large, liquid and representative companies. By including the prestigious companies and due to be wide acceptance amongst the Indian investors; SENSEX is regarded to be the pulse of the Indian stock market. As the oldest index in the country, it provides the time series data over a fairly long period of time (From 1979 onwards). Also it is a value weighted stock average, using the free float market capitalization methodology, of 30 largest and most actively traded stocks of Indian stock markets from varied sectors being the most quoted Index.

Whole sale Price Index (WPI)

The Wholesale Price Index (WPI) is used extensively as a measure of inflation and important monetary and fiscal policy changes are often linked to it. The WPI indices are also used for the purpose of escalation clauses in the supply of raw materials, machinery and construction work. The weekly index numbers of wholesale prices have acquired considerable significance over time, since this is the only index which gives an idea of the week-to-week fluctuations in the prices of all the traded commodities. WPI in India is used extensively for short term policy intervention because it is the only index that is available on a weekly basis with a two weeks' lag. [4]

[4] *The Wholesale Price Index or WPI is "the price of a representative basket of wholesale goods". Some countries use the changes in this index to measure inflation in their economies, In India – The Wholesale Price Index focuses on the price of goods traded between corporations, rather than goods bought by consumers, which is measured by the CPI. The purpose of the WPI is to monitor price movements that reflect supply and demand in industry, manufacturing and construction. This helps in analyzing both macroeconomic and microeconomic conditions. Inflation is based on Wholesale Price Index.*

Index of Industrial Production (IIP)

Industrial Production Index is used as proxy to measure the growth rate in real sector. Industrial production presents a measure of overall economic activity in the economy and affects stock prices through its influence on expected future cash flows. Thus, it is expected that an increase in industrial production index is positively related to stock price. The IIP and Sensex are positively related because increase in IIP results in increase in production of industrial sector thatleads to increase in the profit of industries and corporations. As dividend increases, it results in increase of share prices, therefore, it is expected to have positive relationship between IIP and share price according to economic theory.

Foreign Institutional Investment (FII)

FII includes an investor or investment fund that is from or registered in a country outside of the one in which it is currently investing. Institutional investors consist of hedge funds, insurance companies, pension funds and mutual funds. The term is used most commonly in India to refer to outside companies investing in the financial markets of India. International institutional investors must register with the Securities and Exchange Board of India to participate in the market. FII is allowed to enter into our country only through stock exchanges either in the form of equity or debt. Thus it makes an impact on the rise or fall of SENSEX, since FII is allowed to be purchased or sold daily. The daily transaction of FII is the reason behind the volatility in the stock markets movement to a greater extent. It has been observed that Sensex increases when there are positive inflows of FIIs and decreases when there are negative FII inflows.

Call Money Rate (CMR)

The observations in regard to the relationship between interest rates and stock prices generally suggests that an increase in interest rates increases the opportunity cost of holding money and thereby causing substitution of stocks with interest bearing securities, and hence would result in falling Sensex. It is mention worthy here that the expected exchange rate (Rs. /US$) and inflation rate do play roles in the determination of the domestic interest rates along with the

domestic money supply. The CMR has been selected in this study as a proxy to interest rate. It is selected because the Reserve Bank of India has no control on it unlike the Repo Rate, Cash Reserve Ratio, Prime Lending Rate, etc. This rate is fully market-driven and dependent on the demand-supply equilibrium relationships. Changes in the Call Money Rate affect the Indian stock markets by affecting the corporate profits, general demand for goods and services in the economy, relative attractiveness of competing financial assets like shares, bonds, and other fixed interest investments, the way companies finance their operations and cost of borrowing money for the purchase of shares.

SECTION IV

ANALYSIS AND FINDINGS:

The relationship between these selected variables – Whole Sale Price Index, Index of Industrial Production, Foreign Institutional Investment, Call Money Rate and BSE SENSEX obtained in terms of Coefficient Correlation is reported in Table 1 as correlation matrix.

We observe a significant moderately high positive correlation of Index of Industrial Production (0.793) and Whole Sale Price Index (0.788) with BSE Sensex. Whereas, the other two variables- Foreign Institutional Investment (0.286) and Call Money Rate (0.315) though show positive correlation, but it is weaker and is not statistically significant to reveal a kind of relationship. In order to further investigate the significance of relationship thus obtained the data inputs are further analyzed with linear regressions.

Here we present the findings of linear regression Model, which is found to be a satisfactory fit in explaining the causal relationship.

The R^{-2} (R bar square) values vary from 0.618 to 0.626 (equation 3 and 4 are an exception) and F-Statistics for overall regression is statistically significant in all the estimations.

As per the findings (Table 2) the coefficients of the variable **Whole sale Price Index (WPI)** are positive and statistically significant. The positive impact of WPI on BSE Sensex survives irrespective of BSE Sensex is regressed against FII and CMR in the estimation (equation 5).

When the same dependent variable BSE Sensex is regressed against WPI, FII and CMR, we observe a positive effects of on all variables taken up for observation. The coefficients of WPI are 47.1 whereas the FII is 1.49 and CMR is 6.89. **It reveals that with every unit of WPI increase there will be 47.1 units of increase in BSE Sensex, holding all other variables constant;** whereas the same Sensex increases by 14.9 percent and 68.9 percent with every increase in FII and CMR respectively (it is observed the coefficients of FII and CMR are not statistically significant to confirm the relationship. This observation confirms our finding in Correlation analysis also. Only WPI coefficient shows a robust linear relationship. This observation coincides with the studies of **Vashishtha, Singhet.al, (2013)**.[5]

The coefficients of the variable IIP are also positive and statistically significant. The positive impact of **Industrial Production Index (IIP)** on BSE Sensex survives irrespective of BSE Sensex is regressed against FII and CMR in the estimation (equation 6).

When the same dependent variable BSE Sensex is regressed against IIP, FII and CMR, we do not observe a positive effect of CMR on Stock Prices. The coefficients of IIP are 16.1 whereas the FII is 1.16 and CMR is -1.8. **It reveals that with every unit of IIP increase there will be 16.1 units of increase in BSE Sensex, holding all other variables constant;** whereas the same Sensex increases by 1.16 percent for FII and decrease by -1.8 percent with CMR (it is observed the coefficients of FII and CMR are not statistically significant to confirm the relationship. This observation confirms our finding in Correlation analysis also. Only IIP coefficient shows a robust linear relationship. This observation coincides with the studies of **Subrahamanya and Chaitanya(2013)**. As per the study goes on they observed a significant influential relationship

[5] *Vashishtha,Singhet al(2013) have studied for 3 different years WPI were highly correlated (0.86) in the year 2009-10, little correlated (0.22) in the year 2008-09, this being year of financial crisis and well correlated in the rest of the years.(the values of Karl Person's Coefficient of Correlation).*

between SENSEX, and Industrial Production & Foreign Exchange Rate and that these two factors taken together are accounted for almost 85 percent of the SENSEX movements[6].

Foreign Institutional Investment (FII)and Call Money Rate (CMR)are one among the key factors in influencing BSE Sensex. From the analysis it is observed that the equations when done as a single variable with BSE Sensex, the coefficients do show a statistically significant positive relationship. A **unit change in FII brings in 4.6 units increase in BSE Sensex (equation 3) and similar observation when tried for CMR brings in 220.3 units increase in BSE Sensex (equation 4).** When the same variables are tried in multi regression estimation, the evidence does not suffice the relationship (equation 5 and 6).

In our analysis, because of multi-co linearity problems, the independent variables WPI and IIP together are not included in the regression model. From the findings, there is an interesting observation, CMR do not show any strong evidence of explaining the variation in determining the BSE Sensex. Therefore, it is necessary to do further research on this aspect.

Taken as a whole, our analysis corroborates with the literature evidences in explaining the significant relationship of BSE Sensex and Macro-economic Variables.

Observations in a nutshell: Among all the four macro-economic variables taken for analysis, we observed a stronger influential relationship of BSE Sensex only with Wholesale Price Index and Index of Industrial Production. Whereas, Foreign Institutional investment and Call Money Rate does not show any satisfactory explanation for influencing the stock prices movement.

However, our study has few limitations. The maximum macro-economic variables are not estimated and moreover the factors affecting BSE Sensex is likely to be confounded also with other factors which are not considered in our scope of study. Such issues are not taken care of.

[6] *Ideally in any economy, exchange rate i.e. the supply anddemand position of the currency is primarily dependent onbalance between exports and imports between the two countries. Further in a globalized environment, 'currency flows'through FIIs and FDIs tend to affect the exchange rate. AgainExchange rate is dependent on various other factors, including but not limited to, Interest Rates, Government BudgetDeficits or Surpluses, and Business and Political Environment.*

To conclude, these are some of the interesting aspects which remain to be examined and a thorough understanding of the factors involved in BSE is necessary before making any recommendations for investors.

TABLE 1

CORRELATIONAL ANALYSIS

BSE SENSEX AND MACRO ECONOMIC VARIABLES

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Pearson Correlation	BSE Index	WPI	IIP	FII	CMR
BSE Index	1	0.78*	0.79*	0.29*	0.31*
WPI	0.78*	1	0.95*	0.25*	0.41*
IIP	0.79*	0.95*	1	0.27*	0.42*
FII	0.28*	0.25*	0.27*	1	-0.12
CMR	0.31*	0.41*	0.42*	-0.12	1
N	111	111	111	111	111

Note: **(*) -** Statistically significant

Abbreviations:

WPI – Wholesale Price Index

IIP – Index of Industrial Production

FII – Foreign Institutional Investment

CMR – Call Money Rate

N – Total Observations in the analysis

TABLE 2

REGRESSION ANALYSIS

CAUSAL RELATIONSHIP OF BSE SENSEX AND MACRO ECONOMIC VARIABLES

Equation No.→	1	2	3	4	5	6
Independent Variables↓	BSE INDEX	BSE INDEX	BSE INDEX	BSE INDEX	BSE INDEX	BSE INDEX
Constant	-2050.1 (-4.2)	-737 (-1.9)	4029 -26.6	2895.8 -6.9	-1947.3 (-3.9)	-667.2 (-1.7)
Wholesale Price Index (WPI)	48.7* (-13.3)	-	-	-	47.0* (-11)	-
Industrial Production Index (IIP)	-	16.5* (-13.6)	-	-	-	16.1* (-11.1)
Foreign Institutional Investment (FII)	-	-	4.6* (-3.1)	-	1.5 -1.4	1.16 (-1.13)
Call Money Rate (CMR)	-	-	-	220.3* (-3.4)	6.9 (-0.14)	-1.8 (-0.03)
F-statistics	178.9*	184.9*	9.74*	12.0*	60.4*	61.7*
R^2	0.62	0.62	0.82	0.99	0.62	0.63
R^{-2}	0.61	0.62	0.74	0.91	0.61	0.62

Note: a) Figures in parentheses are t-values &**(*) -** Statistically significant.

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