Impact of Key Macroeconomic Variables on Movement of the Indian Stock Market with Reference to BSE Sensex

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Abstract

The stock market is the barometer of the Indian economy. It is the vital system of the financial system of any economy. It helps in mobilizing the savings from different sectors. Many researchers have conducted studies to find out the relationship between the Indian stock market and key macro economic variables such as IIP, FDI, exchange rate, FII, gold price, oil prices, and so forth. In this research paper, an attempt was made to explore the relationship between the Indian stock market represented by BSE Sensex (SnX) and key macroeconomic variables : index of industrial production (IIP), foreign direct investment (FDI), and wholesale price index (WPI) of the Indian economy using the regression model. Quarterly data was collected from 2002-2003 to 2012-2013 for all variables like BSE Sensex, IIP, FDI, and WPI using secondary sources. The research is both descriptive and empirical in nature. The findings showed that IIP is a significant predictor of BSE Sensex ; whereas, FDI and WPI were not found to be a significant predictor of the BSE Sensex.

Key words: IIP (index of industrial production), FDI (foreign direct investment), WPI (wholesale price index), SnX (sensex)

JEL Classification : E00, E3, G1

Paper Submission Date: February 5, 2016 ; Paper sent back for Revision : March 5, 2016 ; Paper Acceptance Date : May 5, 2016

Numerous factors, both domestic and international, affect directly or indirectly the performance of the stock market. Many researchers have conducted a study on the relationship between the macroeconomic indicators and the Indian stock market. The present study extends the literature with few indicators. The study takes into consideration three macroeconomic indicators namely- index of industrial production (IIP), foreign direct investment (FDI), wholesale price index (WPI), and one widely used index of the stock market namely- BSE Sensex.

Index of industrial production reflects the growth of the industries in the economy. More and more production reflects the growth in industries. Hence, it is expected that there is a positive relationship between the IIP and the Indian stock market. The wholesale price index reflects the changes in prices of the commodities in an economy, and thus, it is a representative of the inflation rate. Increase in prices increases the cost of production. Hence, the study of relationship between the WPI and Sensex is needed. FDI is the foreign capital flow in an economy during a year. It is the global factor affecting the economy. Increase in FDI increases the capital in a market. Hence, the

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impact of FDI on the Sensex is important to study. The aim of this paper is to investigate the impact of macroeconomic indicators on the performance of the Indian stock market.

Foreign Direct Investment (FDI) - A Concept

According to IMF and OECD, FDI is defined as :

> Direct investment enterprises are corporations, which may either be subsidiaries, in which over 50% of the voting power is held, or associates, in which between 10% and 50% of the voting power is held, or they may be quasi-corporations such as branches which are effectively 100% owned by their respective parents. (OECD, 2008, p. 17)

It refers to the direct investment in another country with the aim of obtaining a "lasting interest" in investment enterprise. The investment enterprise here signifies the long term relationship between a direct investor and investment enterprise. According to OECD, a "foreign direct investor is an individual, an incorporated and unincorporated enterprise, a government or group of related individuals, or a group of related incorporated and/or unincorporated enterprises which has a direct investment enterprise" (OECD, n.d, para 1). FDI is simply bringing new technologies, capital into another economy so as to run businesses and earn profits.

FDI can be categorized as (Chapter 3, Literature Review, n.d.) :

(i) Market Seeking : The objective is to access the market of the host country.

(ii) Resource Seeking : Investment is made in the country for the more dependable sources of raw-material.

(iii) Platform Seeking : The objective is to provide a platform for sales and production activities.

FDI in India : It is the intent and objective of the Government of India to attract the capital, technology, and skills for accelerated economic growth. The New Industrial Policy, 1991 with the objective of LPG (liberalization, privatization, and globalization) gave momentum to FDI in India. The current FDI policy framework is as follows:

(i) FDI in 35 priority sectors are given automatic approval.

Table 1. Sector Wise FDI Inflows (In ₹ Millions)

Sectors	Amount
Automobile Industry	90,265.80
Chemical(Other than Fertilizers)	47,380.30
Computer software and Hardware	68,964.40
Construction	29,299.80
Construction Development: Township, housing	75,083.60
Drugs & Pharmaceuticals	71,907.60
Hotel & Tourism	29,487.30
Metallurgical Industry	34,355.40
Petroleum & Natural gas	6,783.90
Power	65,185.00
Service sector	132,942.2

Source: Centre Monitoring Indian Economy Pvt Ltd. (

(ii) All other proposals are considered through FIPB.

(iii) Since September 23, 1992, the government has constituted an empowered committee to deal with FDI. During 2013-14, the total FDI inflows were ₹ 1,475,177.5 million. The service industry grabbed the maximum FDI of ₹ 1,32, 944 million, and the construction sector (infrastructure) grabbed the least ₹ 29,299. The Table 1 shows the FDI inflows in different sectors of the Indian economy.

The Figure 1 shows the country wise FDI in the year 2013-2014. The country wise FDI shows that the maximum FDI was brought by Singapore, which was ₹ 3,56,246 followed Mauritius, which was ₹ 2,93,603 in the year 2013-14. The Figure 2 depicts the country wise FDI inflows. The total FDI in the year 2013-14 was ₹ 1,116, 406 million. Mauritius contributed the highest FDI (36%) followed by Singapore (12%), and the UK (9%). The least contribution was made by Switzerland (1%).

Upto 100% FDI is allowed on the automatic route in most sectors/activities. FDI is restricted in the lottery business including government/private lottery, online lotteries, etc.; gambling and betting including casinos ; chit funds; Nidhi company; trading in transferable development rights (TDRs); real estate business or construction of farm houses ; manufacturing of cigars, cheroots, cigarillos, and cigarettes of tobacco or of tobacco substitutes; activities/sectors not open to private sector investment, for example, atomic energy and railway transport (other than mass rapid transport systems). FDI plays an important role in attaining financial stability and growth with the help of investments in various sectors (Agarwal, Singla, & Aggarwal, 2012). The Figure 1 shows the annual
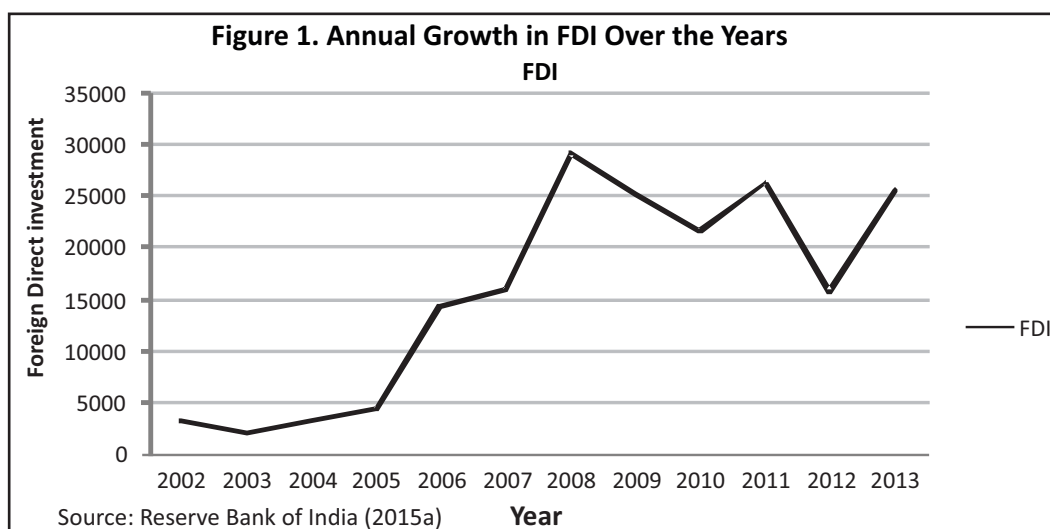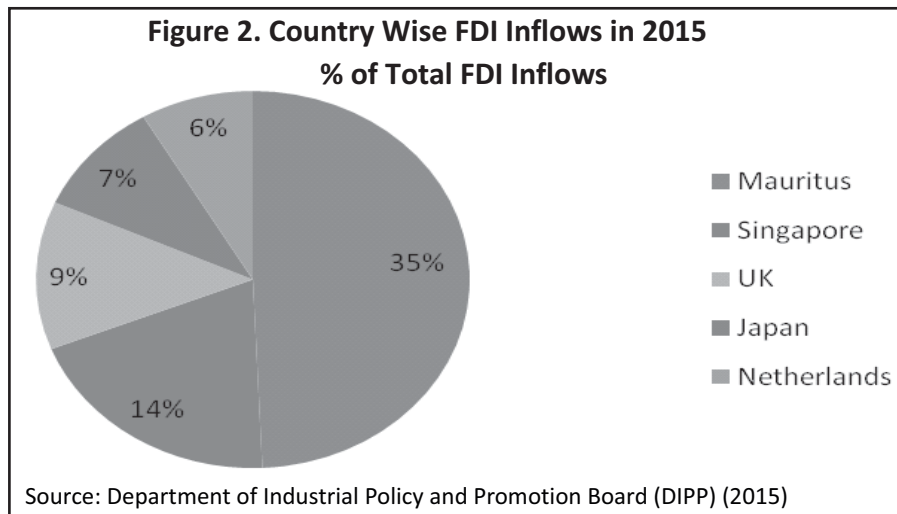

Figure 1. Annual Growth in FDI Over the Years

Source: Reserve Bank of India (2015a)

Table 2. FDI Limit in Various Sectors (In %)

SECTORS	FDI LIMIT
Defence Sector	26%
Insurance Sector	49%
Advertising	100%
Agriculture	100%
Air Transport Services(Domestic Airlines)	100%
Broadcasting	74%
Coal & Lignite	74%

Source: Department of Industrial Policy and Promotion Board (2015)

Figure 2. Country Wise FDI Inflows in 2015
% of Total FDI Inflows

Source: Department of Industrial Policy and Promotion Board (DIPP) (2015)

growth in FDI over the years and it shows that there was a sharp increase in FDI from 2002 to 2013. The Table 2 shows the FDI limit in various sectors and the Table 3 shows the country wise foreign direct investments.

Index of Industrial Production (IIP)

The industrial sector is a key sector in the Indian economy. It plays a vital role and contribution to the GDP. The IIP is the indicator or index which measures the performance of the industrial sector. The IIP measures the changes in the production and gives the measurement of the price changes. In other words, IIP measures the status of production in any economy in a given period of time. It is the single figure which depicts the general level of the industrial activity. The scope of IIP is to include mining, manufacturing, construction, electricity, and gas sector as recommended by United Nations Statistical office (UNSD). The Figure 3 shows the growth in IIP over the years. However, overtime, UNSD also included mining & quarrying, manufacturing and electricity, gas stream and air-conditioning supply, as well as water supply, sewage, waste management, and remediation activities. The IIP is generally computed as the weighted average of production relatives of all industrial activities. The Laspeyre's formula is used for computing the index of industrial production (IIP). Mathematically, IIP can be calculated as:

$$L_t = \frac{\Sigma R_i W_{i0}}{\Sigma W_{i0}} \times 100$$

where,
W_{i0} = weight of the ith item in the base year,
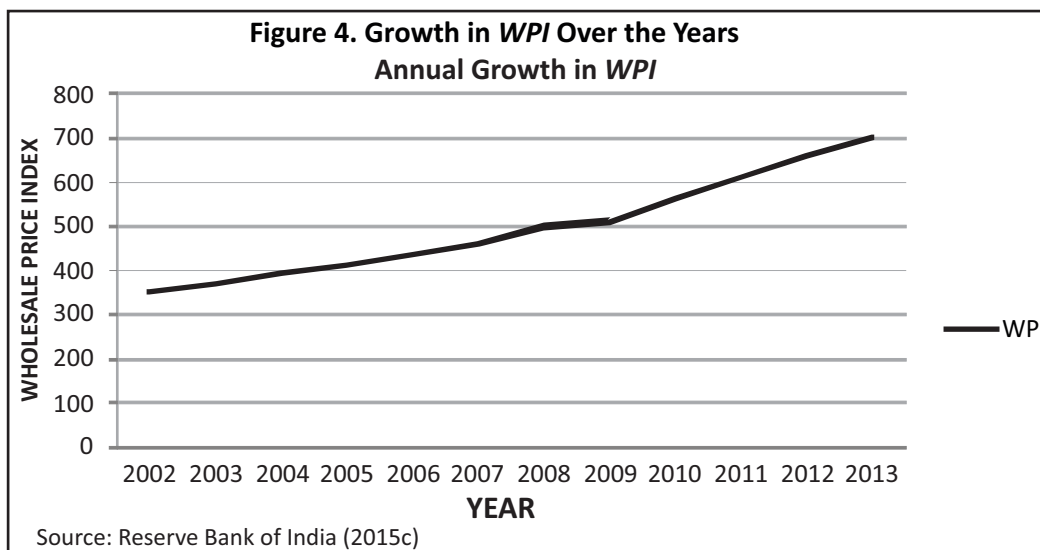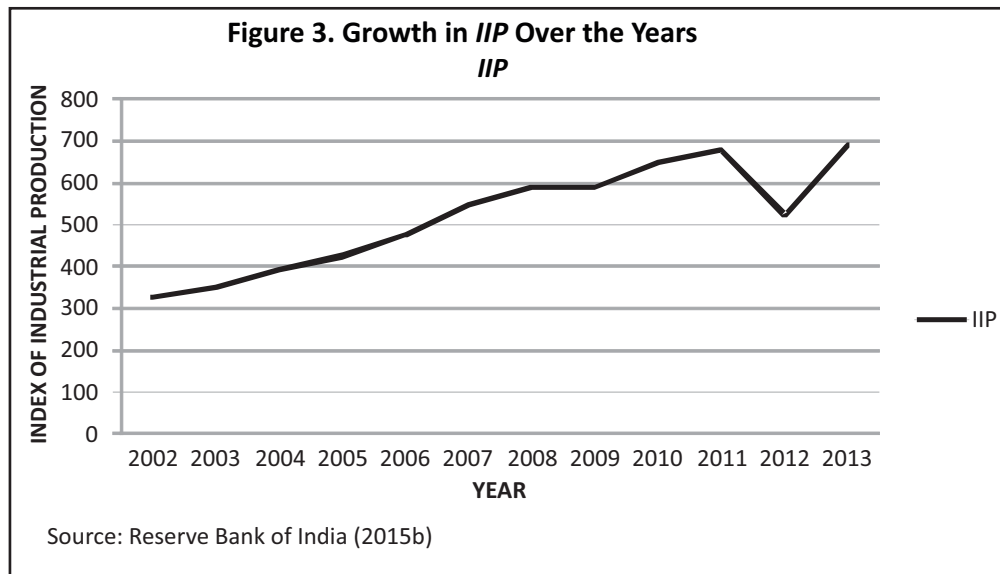R_i = production relative of the ith item,
Pit = Production of the ith item in the period t,
$Pi0$ = Production of the ith item in the base period,
and $Ri = Pit$ = Production of the ith item in the period $t/Pi0$ = Production of the ith item in the base period.

Wholesale Price Index (WPI)

In this dynamic world, prices do not remain constant. The prices of the products and services keep on changing with the passage of time. WPI is an important measure which monitors the movement of the price level. This

Figure 3. Growth in *IIP* Over the Years

IIP

Source: Reserve Bank of India (2015b)

Figure 4. Growth in *WPI* Over the Years

Annual Growth in *WPI*

Source: Reserve Bank of India (2015c)

measure is widely used by the government, banks, financial institutions, industry, and so forth. The office of the Economic Adviser in the Department of Industry Policy and Promotion, Ministry of Commerce & Industry is responsible for publishing the WPI figures. The WPI figures are released on a weekly basis. Through the WPI figures, one can ascertain the rate of inflation prevailing in the economy. The Figure 4 shows the growth in WPI over the years and increase from 2002 to 2013.

Review of Literature

Dadhich, Chotia, and Chaudhary (2015) studied the impact of foreign institutional investment on stock market volatility in India. The study was conducted for the period from 2004-2014 and used the ARCH-GARCH model. The results revealed that FIIs' investment significantly contributed to the volatility of the Indian stock market. A similar study was conducted where the impact of foreign portfolio investment was examined on stock market volatility and found that no significant causal relationship existed between the two variables (De & Chakarborty,

2015). Another study examined the impact of the Union Budget on the Indian stock market (Pandya, 2014).

Patel (2012) selected eight variables as macro-economic variables such as interest rate, inflation, exchange rate, index of industrial production, oil prices, gold prices, and silver prices. Two stock market indices were selected as dependent variable, that is, BSE Sensex and S&P CNX Nifty. The analysis was done by using various prominent tools, which included Augmented Duckey Fuller unit root test, co-integration test, Granger causality test, and vector error correction model. Important information found in this study is that the exchange rate provides important information to guide a stock exchange ; hence, it should have a healthy regulation by RBI.

IIP is a vital significant factor. Money supply and inflation are one of the crucial factors affecting the performance of the stock market. Commodity prices such as gold, silver, and oil are the significant predictors of the stock market performance. Seeresha (2013) considered GDP, IIP, money supply, gold prices, and silver prices as an independent variable ; whereas, S&P CNX Nifty acted as the dependent variable. The trend pattern of nominal and real returns at various levels of inflation, GDP, IIP, and money supply were analyzed. The study concluded that GDP was positively related to the stock returns ; whereas, it was inversely related to silver and gold.

Singh, Tripathi, and Parashar (2013) considered dependent variable as NSE Nifty ; whereas, independent variables considered were money exchange rate, IIP, and WPI. The research conclusively proved the relationship between NSE Nifty and various macro economic variables such as exchange rate, IIP, and WPI. The study revealed that exchange rate, IIP, and WPI significantly affected the stock market performance with reference to Nifty. The research was conducted by using the regression analysis technique. In Parmar's (2013) study, the macro economic variables selected were CRR, repo rate, reverse repo rate, SLR, inflation, CPI, index of industrial production, gold price, oil price, and exchange rate. The impact of these variables was studied on the Sensex. The analysis was done through tools such as correlation, regression, and ANOVA. Finally, the study revealed that in the long run, the stock market was more driven by the domestic factors rather than the global factors.

Jain, Meena, and Mathur (2012) selected the variables FII to see its impact on Sensex, which reflects the movement of the stock market. The study was conducted for the period from 2001 to 2010 and tried to ascertain the fluctuations caused due to FIIs. The relationship is defined with the help Karl-Pearson Coefficient of correlation. The study concluded that FIIs influenced the Sensex to a large extent. Naik (2013) considered five macro-economic variables, including index of industrial production, money supply, short term interest rate, inflation, and exchange rate. The impact of these variables was seen on the BSE Sensex. The study carried out the research by analyzing the data through tools such co-integration test and Granger's causality test. The study revealed that three out of five macro-economic variables had a significant long run relationship with the Sensex. In the long run, the IIP and money supply were positively correlated with stock market performance represented by Sensex. The WPI represented as inflation was negatively correlated with Sensex. Finally, short term interest rate and exchange rate were not the significant predictors of Sensex. Srivastava (2013) considered the variables FIIs and Sensex and Nifty. The study revealed that Sensex and Nifty had a moderate relationship with FIIs.

Agarwal, Singh, and Tandon (2014) studied the relationship of mutual fund with Sensex ; where the study found that Sensex was found to be a significant predictor of mutual fund investments. Padhan (2007) examined the relationship between stock market and economic activity by using the Johansen-Juselius co-integration tests. The results suggested that there was bi-directional causality between stock prices and economic activity during the post-liberalization period, which means that a well-developed stock market could enhance economic activity and vice-versa. Pal and Mittal (2011) examined the long run relationship between Indian capital markets and macro-economic variables such as interest rate, inflation, gross domestic saving rates, and exchange rates. The results suggested that there was a long run relationship between the stock market and macro economic variables. Inflation rate had a significant impact on Sensex ; whereas, interest rate was found to have a significant impact on S&P CNX Nifty only.

Several studies have been conducted with reference to the world economy. Hsing (2011a) studied the Czech Republic index in relation to the GDP, the domestic real interest rate, CZH/USD exchange rate, inflation rate, and

euro government bond rate. The study concluded the positive relation with stock market index and macroeconomic indicators. The authors used the GARCH model. Similar studies were conducted in the context of Croatia (Hsing, 2011b), the U.S. market index (Hsing, 2011c), Romania (Hsing, 2011d), Central European Country (Hsing,2011e), Palestine (Abu - Libdeh & Harasheh, 2011), and the Turkish economy (Cagli, Halac, & Taskin, 2010).

Joshi and Saxena (2011) analytically studied the impact of FIIs on stock market with special reference to BSE Sensex. The study concluded that FIIs had a positive impact over the Indian stock market. Studies were also conducted in order to find out the cause & effect relationship among stock market indices and macroeconomic variables (Deb & Mukherjee, 2008; Patel, 2012; Rafay, Naz, & Rubab, 2014). Ahmad and Sinha (2015) examined the relationship between BSE Sensex and GDP & exchange rate and found the GDP to be significant and exchange rate to be an insignificant predictor of the BSE Sensex.

Research Methodology

(1) Data Collection : Data collection is secondary in nature. The study considers three macro-economic variables such as foreign direct investment *(FDI)*, index of industrial production *(IIP)*, and wholesale price index *(WPI)* into the study. The required data was collected from the various sources via CMIE Prowess, websites of BSE and RBI. The abbreviations such as *FDI* (foreign direct investment), *SnX* (BSE Sensex), *IIP* (index of industrial production), and *WPI* (wholesale price index) have been used in the study. SnX data were collected from the reports and archives of the BSE ; whereas, data of IIP and WPI were collected from the official website of RBI and CMIE Prowess database. The sample period of the study spans from 2002-2013.

(2) Tools and Techniques : To analyze the collected data, the statistical tools such as correlation and regression analysis were used. Correlation coefficient is a statistical tool that measures the degree of association between two variables. Correlation coefficient value ranges from -1 to +1 which indicates the positive and negative correlation between variables. On the other hand, the multiple regression analysis is a statistical technique used to evaluate the impact of two or more independent variables on single independent variables. In this paper, an attempt has been taken to analyze the impact of *FDI, IIP,* and *WPI* on *SnX*.

(3) Model/Hypotheses Formulation : To study the impact of macro variables - *FDI, IIP,* and *WPI* on *SnX,* one model was framed.

Model 1: This model depicts the *FDI, IIP,* and *WPI* as an independent variable and *SnX* as the independent variable. The hypotheses framed for this model are:

- ✎ **H0a :** IIP is not a significant predictor of BSE Sensex.
- ✎ **H1a :** IIP is a significant predictor of BSE Sensex.

- ✎ **H0b :** FDI is not a significant predictor of BSE Sensex.
- ✎ **H1b :** FDI is a significant predictor of BSE Sensex.

- ✎ **H0c :** WPI is not a significant predictor of BSE Sensex.
- ✎ **H1c :** WPI is a significant predictor of BSE Sensex.

To prove the hypotheses, the following equation is formulated.

$$SnX_t = c + b_1FDI + b_2IIP + b_3WPI + e \hspace{3cm} (1)$$

where,

SnX = value of BSE Sensex in the given period t,

c = Coefficient,

IIP = Index of Industrial Production,

WPI = Wholesale Price Index,

e = error term.

Data Analysis and Interpretation

(1) Descriptive Statistics : The Table 3 shows the descriptive statistics of the model. The mean value is the average of the variables over a period of time. The standard deviation is high in case of Sensex, which implies the high volatility in the stock market index.

(2) Correlation Matrix : The correlation coefficients are shown in the Table 4 which offers a bivariate relationship among variables SnX, FDI, IIP, and WPI. The first column of the Table shows the intercorrelation between all the dependent and independent variables. As per the results, all the predictors/independent variables *(IIP, FDI,* and *WPI)* are positively correlated with criterion *(SnX)* variable. But *IIP* has a very high degree of positive correlation with *SnX*. This correlation is found to be significant at the 0.1% significance level.

(3) Multiple Regression Analysis : The results for the regression analysis are shown in Tables 5, 6, and 7. The Table 5 shows the model summary. *R* represents the multiple correlation coefficient, shows the linear correlation between all the independent and dependent variables. The maximum is the value of *R*, there will be a strong relationship between the predictor and criterion variables. In this study, the value of *R* is .939, which is very high, representing a strong correlation among the variables. *R*-Square is a squared value of multiple correlation coefficients. Higher the value of *R*-square, the higher will be the explanatory power of the model (Hair, 2010). The value of *R*-square is .882, which depicts that 88.2% of the variance in *SnX* can be predicted through *IIP, FDI,* and *WPI*. The adjusted *R* square should ideally be equal or close to the value of *R* square. In the given, the value of

Table 3. Descriptive Statistics

	Mean	Std. Deviation	*N*
SENSEX	1.2615E4	6003.37780	48
IIP	1.33460E2	32.732271	48
FDI	3899.25	2874.479	48
WPI	1.2448E2	27.93922	48

Table 4. Correlation Matrix

		Sensex	*IIP*	*FDI*	*WPI*
Pearson Correlation	Sensex	1.000			
	IIP	.937	1.000		
	FDI	.735	.738	1.000	
	WPI	.869	.930	.643	1.000

Table 5. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the estimate
1	.939[a]	.882	.874	2127.19125

Table 6. ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.495E9	3	4.983E8	110.116	.000
	Residual	1.991E8	44	4524642.601		
	Total	1.694E9	47			

a.Predictors: (Constant) WPI,FDI, IIP
b.Dependent variable: SENSEX
Note: Level of Significance: 0.05

adjusted R square is .874, which is near to the value of R square, which indicates the fitness of the model.

The ANOVA Table 6 evaluates the acceptability of the model from a statistical view point. The regression row indicates information about the variation accounted by the model. The residual row displays information about the variation that has not been accounted by the model. This explains how much of the variation in the Sensex can be explained by the *IIP, FDI,* and *WPI.* The Table 6 shows that combination of predictors significantly predict the dependent variable or not. The value of $F = 110.116$ at $p < 0.001$, which indicates about the acceptability of the significance level.

(4) Tests for Coefficients : The Table 7 depicts the coefficients between variables when multiple regression analysis is applied. Beta coefficient reflects the change in the dependent variable for each unit change in the independent variable. It can be used to compare the relative strength of various predictors within the model. Larger will be the beta coefficient, the smaller will be the significance level. As per the Table 7, *IIP* (Beta=.855, $p<.001$), *FDI* (Beta= .096, $p <.001$), and *WPI* (Beta=.013, $p<.001$) has largest beta coefficient, which is statistically significant at the 1% and 0.1% significance level.

(5) Testing the Hypotheses

(i) The Table 7 shows the coefficients of the model. Here, the beta coefficient for *IIP* is .855. It implies that unit increase in *IIP* will lead to 85.5% increase in Sensex. The p-value for the *IIP* is .000, which is significant and leads to rejection of null hypothesis (H0a). It means that *IIP* is a significant predictor of the Sensex.

(ii) The beta coefficient for *FDI* is .096. It means that unit increase in *FDI* will lead to 9.6% increase in Sensex. Also, the p-value is .226, which is greater than 0.05. Hence, the null hypothesis (H0b) is accepted ; meaning that FDI is not a significant predictor of Sensex.

(iii) The beta coefficient for *WPI* is .013. It means that unit increase in *WPI* will lead to 91.3% increase in Sensex. Also, the p-value is .927, which is greater than 0.05. Hence, the null hypothesis (H0c) is accepted, meaning that *FDI* is not a significant predictor of Sensex.

Table 7. Coefficients

| Model | Unstandardized Coefficients | | Standardized coefficients | | |
	B	Std. Error	Beta	t	Sig.
1 (Constant)	-9430.000	1568.821		-6.011	.000
IIP	156.726	29.723	.855	5.273	.000
FDI	.199	.163	.096	1.227	.226
WPI	2.815	30.661	.013	.092	.927

Note: Level of Significance: 0.05

Discussion and Conclusion

In this paper, an attempt has been made to find out the relationship between the *Sensex* and *IIP*, *FDI,* and *WPI*. The macroeconomic indicators are represented by index of industrial production *(IIP)*, foreign direct investment *(FDI)*, and wholesale price index *(WPI)*. IIP, FDI, and WPI are one of the important indicators of the economy since *IIP* represents the growth in industrial production, which, in turn, reflects the development of the economy, while *FDI* represents the rate at which foreign investments are made in an economy, which depicts the development of the economy at the international level, and *WPI* depicts the rate of inflation in the economy. The results reveal that *IIP* is a significant predictor of Sensex (p -value is .000). *IIP* is the index representing the industrial production. The Indian stock market is dominated by manufacturing driven companies ; hence, any slight change in *IIP* would have a rather greater impact on the BSE Sensex. On the other hand, *FDI* is a global factor and is limited in certain areas ; so, its impact is least seen in stock market performance. Inflation is the rise in prices of a basket of commodities. Hence, it may highly impact the commodity market rather than the stock market due to its very nature.

The results are supported by similar studies which proves *IIP* to be a significant factor (Patel, 2012; Parmar, 2013 & Naik, 2013) and inflation is a significant factor (Patel, 2012; Pal & Mittal, 2011 ; Sabunwala, 2012; Singh, Triptahi, & Lalwani, 2012). Kapoor and Sachana (2015) empirically analyzed the relationship between *FDI* and *FII* on Sensex and NIFTY and found similar results as *FDI* is a significant predictor of the BSE Sensex. The study answers the question whether the *IIP, FDI,* and *WPI* are the significant predictors of the Sensex. The results would be useful in understanding the relationship with the Indian stock market. The study concluded that *IIP* is a significant predictor of Sensex ; while, *FDI* and *WPI* are not a significant predictor of the Sensex.

The data was collected from various secondary sources on a quarterly basis and was further analyzed by using different statistical tools such as correlation matrix and regression model. Here, one independent variable *(SnX)* and three dependent variables : *IIP, FDI,* and *WPIs* had been entered into the spreadsheet.

Research Implications

The study would be quite useful in understanding the relationship between the Indian stock market and various other macro economic variables. Sensex is the benchmark index of the Indian stock market representing 30 bluechip companies. The study would help the investors in taking rational investment decisions considering the changes in the macro scenario of the economy. The stock market is influenced by various micro and macro factors, which affect the stock prices to a great extent. The findings of the study would help the investors in making a linkage between the stock market and macro economic variables influencing the performance of the stock market. Hence, the results of the present study will help the investors in maximizing their gains while investing in the market.

Limitations of the Study and Scope for Further Research

The study considers only three macro economic variables namely, *FDI* (foreign direct investment), *IIP* (index of industrial production), and *WPI* (wholesale price index). Macro economic variables consider various other variables such as gold price, crude oil price, exchange rate, foreign portfolio investment, foreign institutional investment, and so forth, which are not considered in the study due to time constraints. Another limitation is that the study is only conducted on the BSE Sensex while the S&P CNX NIFTY is also one of the important indices in India, which has not been considered in the study.

Future research studies can :

(i) Examine the relationship between stock market performance and various other macro economic variables not considered in the study.

(ii) Econometric techniques can be applied to test the relationship between the stock market performance and macro-economic variables.

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