

IMPACT OF MACROECONOMIC VARIABLES ON INDIAN STOCK EXCHANGE MARKET: AN EMPIRICAL STUDY

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ABSTRACT

The main objective of the paper is to investigate the impact of macroeconomic variables on Indian stock exchange market with the help of the multivariate stepwise regression analysis. Granger's causality test has been applied to analyze the dynamic causal relationship among the variables. The dependent variables in the study includes average monthly closing price of BSE sensex and S&P CNX Nifty while the independent variables are Index of Industrial Production (IIP), Wholesale Price Index (WPI), Money Supply (M3), Interest Rates (IR), Trade Deficit (TD), Foreign Institutional Investment (FII), Exchange rate (ER), Crude Oil Price (CP) and Gold Price (GP). The data used in the study has been considered from January 2016 to December 2017. The empirical result of the study shows significant impact of macroeconomic variables on Indian stock market. There exists requirement for the initiative to be taken by government to reduce interest of investors in yellow metal and enhance the investment in share market.

Keywords: Indian Stock Exchange Market, Multivariate, Regression, Causality Test, Dynamic, Wholesale, Price Index, Metal.

Introduction and Review of Literature

Indian stock exchange market has witnessed spectacular change in the recent decades. The market has undergone huge reform in the past few years. The economic instability in the global and national context has made its influence on the market movement. The linkage of stock market with macroeconomic variables has always been an area of interest among investors and policy makers. The Indian stock market is prone to the macroeconomic uncertainty in the country. Arbitrage Pricing Theory states the relationship between stock market and macroeconomic determinants. The stock markets and their indicators in the form of indices, reflect the potential, the direction and health of the economy. There is extensive group of macroeconomic variables that influences the stock prices in the share market. If a country's economy is performing well and expected to grow at vigorous pace, the market is frequently expected to imitate the situation. The stock market of emerging economics like India carries huge expectations of the investors. The industrial production index reveals the growth of industrial sector of the country. Gold has emerged as one of the lucrative investment opportunity for investors in the recent years. Being one of the immensely developing countries of the world, India has huge prerequisite for energy need. There exists need of crude oil to fulfill this energy need in the country. As one of the importing country of crude, this has become a panic situation to tackle with.

The literature provides plethora of studies performed in international and national context to examine the relationship between stock market and macroeconomic variables.

Kwon & Shin (1999) used Granger causality tests and Engle-Granger co-integration test through vector error correction model and started that Korean stock market index of economic variables such as production; exchange rates, trade balances and the money supply are co-integrated.

Maghayereh (2003) investigated the long run relationship between the Jordanian stock prices and selected macroeconomic variables using cointegration analysis and monthly time series data from January 1987 to December 2000. This study treasures that macroeconomic variables as exports, foreign reserves, interest rates, inflation, and industrial production are reflected in stock prices in the Jordanian capital market. The study concludes that macroeconomic variables are significant in predicting changes in stock prices.

Erdogan & Ozlale (2005) investigated the influence of varying macroeconomic variables on stock return of Turkey and found that industrial production and exchange rates were positively related with the stock return. On the other hand, Circulation in Money (M1) had no any significant impact on stock return. Gan, Lee, Yong and Zhang (2006) examined the relationship between stock prices and macroeconomic variables for New Zealand. The variables are long-run and short-run interest rate, inflation rate, exchange rate, GDP, money supply and domestic retail oil price. Their findings suggest that there exist a long term relationship between stock prices and selected variables in New Zealand. However, the Granger causality test suggests that New Zealand stock exchange is not a good indicator for macroeconomic variables in New Zealand.

Naik & Padhi (2012) studied relationship between the Indian stock market index (BSE Sensex) and various macroeconomic variables as industrial production index, wholesale price index, money supply, treasury bills rates and exchange rates from the time period 1994 to 2011. The analysis reveals that macroeconomic variables and the stock market index are cointegrated and, hence, a long-run equilibrium relationship exists between them.

This study perceived that the stock prices are positively relate to the money supply and industrial production but negatively relate to inflation. The exchange rate as well as short-term interest rate is found to be insignificant in determining stock prices. There is bidirectional causation exists between industrial production and stock prices but unidirectional causation from money supply to stock price, stock price to inflation and interest rates to stock prices is established.

Ray (2013) examined the relationship between macroeconomic variables and stock prices. The Industrial production presents a measure of overall economic activity in a country and moves 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 causal relationship between industrial production and stock price in India is covered for a period, 1990-91 to 2010-11. The findings specified that there exist no significant causal relationship between industrial production and share price in India. The result of regression, of course, suggests that there may have been positive relation between stock price and real industrial production. The increase in production of industry can enhance stock price and vice versa.

Sireesha (2013) examined the impact of macroeconomic factors upon the movements of the Indian stock market index Nifty, gold and silver prices through linear regression technique. Gold returns, Silver returns are selected for the analysis as they are important now a days and are studied along with the stock returns. The performance of internal variables shows the interdependence between these variable with returns on stock, gold and silver. Stock return is significantly influenced by GDP and inflation while gold return is significantly influenced by money supply. External variables show significant impact on dependent variables.

Mishra & Gupta (2016) studied the major factors responsible for up-down movement in Indian stock market. The relationship between Sensex and macroeconomic variables - IIP, WPI, Interest Rate and Morgan Stanley Capital International Index of India during the period from 2006 to 2012. Multiple correlation and multiple regressions is used to analyze the relationship among variables. This study shows highly positive correlation of sensex with macroeconomic variables and is significant during the period of study. Kumar (2014) has performed study including exchange rate and crude oil prices to understand its impact on Indian stock market through including S&P CNX Nifty. The study brings significant positive impact of exchange rate and crude oil prices on stock market. The positive relationship is surprisingly interesting in this study.

Objectives of the Study

The objectives of the study include:

1. To analyze the relationship among macroeconomic variables and Indian stock market.
2. To assess the impact of macroeconomic variables on Indian stock market.
3. To examine the causal relationship between macroeconomic variables and stock exchange market.

The null hypotheses that have been developed in this study include:

H₀: There is no significant impact of macroeconomic variables on Indian stock exchange market.

H₀: There is no any causal relationship among macroeconomic variables and stock exchange market.

Research Methodology

The data have been analyzed using correlation, multivariate stepwise regression analysis and Granger causality test to study the relationship and impact of macroeconomic variable on the stock index of BSE and NSE that includes Sensex and S&P CNX Nifty. The dependent variable is average monthly closing price of CNX Nifty while the independent variables are Index of Industrial Production (IIP), Wholesale Price Index (WPI), Money Supply (M3), 91 days treasury bills as proxy for Interest Rates (IR), Trade Deficit (TD), Foreign Institutional Investment (FII), Exchange rate (ER), Crude Oil Price (CP) and Gold Price (GP). The period of the study includes from January 2016 to December 2017. The monthly data is used in the study to make the study more appropriate. The data have been collected from various sources like RBI website, data base of Indian economy and annual reports of RBI. The proposed models for the study include the following.

$$BSESENSEX = \alpha_0 + \beta_1 IIP + \beta_2 WPI + \beta_3 M3 + \beta_4 IR + \beta_5 TD + \beta_6 FII + \beta_7 ER + \beta_8 CP + \beta_9 GP + \epsilon$$

$$CNXNIFTY = \alpha_0 + \beta_1 IIP + \beta_2 WPI + \beta_3 M3 + \beta_4 IR + \beta_5 TD + \beta_6 FII + \beta_7 ER + \beta_8 CP + \beta_9 GP + \epsilon$$

α_0 = Constant; ϵ = Error term

$\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7, \beta_8$ and β_9 are the coefficients of independent variables IIP, WPI, M3, IR, TD, FII, ER, CP and GP respectively.

Analysis and Interpretation of the Study

The analysis of this study involves correlation, multivariate stepwise regression and Granger's causality test.

Correlation Analysis

The relationships between stock market and macroeconomic variables have been analyzed using Pearson's correlation analysis. The correlation results during the entire period of study reveal the positive association of BSE Sensex of Industrial Production, Wholesale Price Index, Money Supply, Interest Rate, Foreign Institutional Investors and Crude oil Prices while negative with trade deficit and Gold price. But significantly positive relationship is for WPI, M3, FII and ER with BSE Sensex. Thus, these variables have significant association with stock index. The table 1 shows the correlation matrix of BSE Sensex with the selected set of macroeconomic variables. The IIP has significant positive association with FII (0.340).

The highly significant positive association exists among inflation rate and money supply (0.984). As from the Fisher's equation there is relationship among money supply and inflation rates. Significantly positive relationship also exists among inflation and interest rate (0.547). This suggests that inflation and interest rate in the country also increases together. The exchange rate is also highly significantly associated with inflation (0.962). As the value of Indian currency declines with respect to dollars, the inflation rates increases in the country. Gold prices are another variable that exhibits positive association with inflation rate (0.409). With more consumption of gold, the inflation rate would increase as the India has to import the commodity that accounts about 8 to 10% of the import bills.

During the entire period of study, money supply has highly significant positive association with interest rate, exchange rate and gold prices. The short term interest rate has positive association with exchange rate, crude oil prices and gold prices. The exchange rate and gold has highly significant association which is 0.392 at 5% level of significance. The appreciation in the exchange rate leads to the decline in the value of Indian rupee with respect to US dollars. Thus the currency becomes weaker in the international market which is positively related to gold prices in India.

As the second largest country in the world in the consumption of gold after china, India has huge demand of gold in the national market due to several reasons. This commodity has emerged as safe investment avenue for the investors because of its huge return and high liquidity. As an importing country of gold, appreciation in exchange rate would depreciate the value of rupee that would lead to the increase in gold prices. The correlation coefficient also shows the issues of multicollinearity among independent variables which may bring spurious results if they are regressed in a model.

Variables	BSE Sensex	IIP	WPI	M3	IR	TD	FII	ER	CR	GP
BSE Sensex	1									
IIP	0.268	1								
WPI	0.670**	0.082	1							
M3	0.707**	0.139	0.984**	1						

IR	0.122	0.063	0.547**	0.497**	1					
TD	-0.213	-0.292	0.106	0.078	0.036	1				
FII	0.378*	0.340*	0.333*	0.290	0.095	0.241	1			
ER	0.561**	0.076	0.962**	0.944**	0.558**	0.041	0.241	1		
CR	0.021	0.182	-0.017	-0.053	-0.091	0.409**	-0.114	0.201	1	
GP	-0.194	-0.064	0.409**	0.347**	0.392*	0.335*	0.642**	0.385*	-	1
									0.051	

Source: Computed; * Correlation is significant at the 5% level, ** Correlation is significant at the 1% level.

The correlation analysis during the entire period of study exhibits significant positive association of S&P CNX Nifty with IIP, WPI, M3, FII, and exchange rate. There exists negative association of index with TD and GP but the relationship is insignificant. IIP has significant positive association with foreign investments. Price level/inflation rate has significant positive association with money supply, interest rate, foreign institutional investors, exchange rate, and gold price. The money supply has significant positively associated with short term interest rate, exchange rate and gold prices. The short term interest rate has significant positive association with exchange rate, crude prices and gold. The trade deficit has positive relationship with gold. The gold has significant positive association with FII and exchange rate in Table 2.

Variables	CNX Nifty	IIP	WPI	M3	IR	TD	FII	ER	CR	GP
CNX Nifty	1									
IIP	0.320*	1								
WPI	0.654*	0.082	1							
M3	0.699**	0.139	0.984**	1						
IR	0.059	-0.063	0.547**	0.497**	1					
TD	-0.181	-0.292	0.106	0.078	0.036	1				
FII	0.374*	0.340*	0.333*	0.290	0.095	0.241	1			
ER	0.534*	0.076	0.962**	0.944**	0.558**	0.041	0.219	1		
CR	0.027	0.182	-0.017	-0.052	0.409**	-0.114	0.201	-0.091	1	
GP	-0.181	-0.064	0.409**	0.347*	0.335*	0.642**	0.385*	0.392*	0.051	1

Source: Computed; * Correlation is significant at the 5% level, ** Correlation is significant at the 1% level.

Multivariate Stepwise Regression Analysis

The effect of macroeconomic factors on the stock market has been analyzed using regression analysis. As the independent variables have strong association among them that may bring a spurious result, thus multivariate stepwise regression analysis is considered in this study to avoid the problem of multicollinearity among the explanatory variables.

BSE Sensex and Macroeconomic Variables

The year 2016 brings two variables that are included in the model is gold prices and FII. Rest all the selected variables are excluded from the model. The model is best fit as the value of F is

26.89 which are highly significant. The gold price has negative impact on the stock prices that exhibits that gold has negative impact on stock prices.

The hypothesis rejected in case of two variables i.e. GP and FII while accepted in case of all the variables during the year 2016. During the year 2017, gold prices and exchange rate has emerged as two significant variables while all the variables are excluded from the model. The model is best fit as the F value is 15.55 which are highly significant. The R^2 is 0.776 that signifies that model explains 77.6 % variations in the index during the year. The hypothesis rejected in case of two variables i.e. GP and ER while accepted in case of all the variables during 2017.

The result of regression is shown in Table 3. The gold and exchange rate has negative impact on BSE Sensex that signifies that market reacts adversely with the increase in gold prices and exchange rate. As the value of Indian currency deteriorations in the year with the appreciation in exchange rate, the market reacts negatively with this impact. The increasing demand of gold due to high liquidity, safety issues and high return has made it as safe haven for investment. So the investment would shift from stock market to this precious commodity. With the increase in the import of gold, the trade deficit would increase and this would be adverse situation for the market.

Year	R^2	Adjusted R^2	F	P	R^2 change	Regression Models
2016	0.857	0.825	26.89	<0.001	GP = 0.746 FII = 0.111	BSESENSEX = 25397.46 – 0.32 GP + 7.83 FII
2017	0.776	0.726	15.55	<0.001	GP = 0.557 ER = 0.219	BSESENSEX = 9066.41 - 0.79 GP – 270.60 ER

The result of regression analysis of the year 2016 divulges the significant impact of only one variable on S&P CNX Nifty. It suggests that gold has negative effect of the index during the year. The coefficient of determination signifies that 81.9 % of the variation in the index is explained due to this variable. All the other variables are excluded from the model except gold. The null hypothesis rejects for gold prices (GP) while accepts in case of all the variables during the year 2016. The year 2017 shows three significant variables that includes gold price, exchange rate and money supply. The negative impact is due to gold and exchange rates while money supply has its significantly positive effect. The R^2 for the model is 92.4% that signifies that maximum variation in the index has been explained by the significant variables. The regression models for both years are best fit as the value of F is highly significant ($P < 0.001$).

The Hypothesis Rejected In Case Of GP, ER And M3 while accepted In Case of all other Variables during the Year 2017.

The study reveals the significant impact of selected macroeconomic factors on Indian stock exchange market. The macroeconomic variables that have appeared as significant have their impact on the stock indices of BSE and NSE in Table 4.

Year	R ²	Adjusted R ²	F	P	R ² change	Regression Models
2016	0.819	0.801	45.29	<0.001	GP = 0.819	CNXNIFTY = 1731.47 – 0.10 GP
2017	0.924	0.895	32.26	<0.001	jh GP = 0.480 M3 = 0.18 ER = 0.263	CNXNIFTY = 1064.30 - 0.05GP – 146.39 ER + 0.14 M3

The unit root test has been applied to test the stationarity of the data. There exist several test to test the presence of unit root in the series among them, the most commonly used in the literature is the Augmented Dickey-Fuller (ADF) test to analyze stationarity in the time series. The application of unit root test is initial step before proceeding to the Granger's causality test. All the selected variables are not stationary at the level while they all are stationary at the first difference. This analyzes that the series is integrated of order one, I(1). Granger causality test has been applied to check the direction of causation existing among macroeconomic variables and stock indices. As the study includes two set of variables, so there appears the likelihood of either side of relationship in the explained and explanatory variables. There may be three type of relationship among the variables - unidirectional, bidirectional and no relationship existing among the variables.

For BSE Sensex, the null hypothesis of no causal relationship is rejected for exchange rate and trade deficit while accepted all other cases. The hypothesis is rejected in case of exchange rate as unidirectional relationship is running from variable to the stock market. The null hypothesis rejects in case of trade deficit where unidirectional causality is from sensex to the variable. Thus exchange rate do Granger cause index. Any change in exchange rate can be used to predict BSE sensex. There is no any bidirectional relationship among the macroeconomic determinants and BSE Sensex as shown in Table 5. Another unidirectional relationship between index and trade deficit is from index to the variable.

Null Hypotheses	Observations	F-Statistic	Prob.
CP does not Granger Cause BSESENSEX	38	0.64497	0.5312
BSESENSEX does not Granger Cause CP		1.88353	0.1680
ER does not Granger Cause BSESENSEX	38	3.47630	0.0427
BSESENSEX does not Granger Cause ER		1.78837	0.1831
FII does not Granger Cause BSESENSEX	38	1.28560	0.2900
BSESENSEX does not Granger Cause FII		0.23742	0.7900
GP does not Granger Cause BSESENSEX	38	0.23663	0.7906
BSESENSEX does not Granger Cause GP		2.28094	0.1181
IIP does not Granger Cause BSESENSEX	38	0.40855	0.6679
BSESENSEX does not Granger Cause IIP		0.87572	0.4260
IR does not Granger Cause BSESENSEX	38	0.34668	0.7096
BSESENSEX does not Granger Cause IR		0.30672	0.7379
M3 does not Granger Cause BSESENSEX	38	2.30577	0.1155
BSESENSEX does not Granger Cause M3		0.94661	0.3983
TD does not Granger Cause BSESENSEX	38	0.81953	0.4494

BSESENSEX does not Granger Cause TD		3.29235	0.0497
WPI does not Granger Cause BSESENSEX	38	2.73324	0.0797
BSESENSEX does not Granger Cause WPI		0.07843	0.9247

The Granger causality test result in Table 6 shows between causal relationship between CNX Nifty and macroeconomic variables. The causality is running from exchange rate to Nifty, money supply to Nifty. The unidirectional causal relationship is from Nifty to FII. There is no any bidirectional relationship among the variables.

Null Hypotheses	Observations	F-Statistic	Prob.
CP does not Granger Cause CNXNIFTY	38	0.96745	0.3906
CNXNIFTY does not Granger Cause CP		0.28123	0.7566
ER does not Granger Cause CNXNIFTY	38	5.30140	0.0101
CNXNIFTY does not Granger Cause ER		1.10902	0.3419
FII does not Granger Cause CNXNIFTY	38	3.23132	0.0523
CNXNIFTY does not Granger Cause FII		3.93340	0.0294
GP does not Granger Cause CNXNIFTY	38	0.47393	0.6267
CNXNIFTY does not Granger Cause GP		1.73422	0.1922
IIP does not Granger Cause CNXNIFTY	38	0.12312	0.8846
CNXNIFTY does not Granger Cause IIP		0.88875	0.4208
IR does not Granger Cause CNXNIFTY	38	0.74483	0.4826
CNXNIFTY does not Granger Cause IR		0.34645	0.7097
M3 does not Granger Cause CNXNIFTY	38	3.31843	0.0486
CNXNIFTY does not Granger Cause M3		1.86505	0.1708
TD does not Granger Cause CNXNIFTY	38	0.47310	0.6272
CNXNIFTY does not Granger Cause TD		2.87554	0.0706
WPI does not Granger Cause CNXNIFTY	38	2.40357	0.1061
CNXNIFTY does not Granger Cause WPI		0.05722	0.9445

Thus, null hypotheses of no causal relationship among macroeconomic determinants and stock market is rejected for exchange rate, money supply and foreign institutional investment. The hypotheses gets accepted for rest other variables.

CONCLUSION

Indian stock exchange market is associated with the macroeconomic factors during the phase of study. The empirical results exhibit significant impact of macroeconomic determinants on Indian stock market. There has been significant impact of gold, money supply, exchange rates and foreign institutional investors on the stock market. The study reveals adverse effect of gold on Indian stock market that shows the increasing interest of investors in the yellow metal. The investors need to remain attached with the stock market for which market needs to perform upon the expectations of the investors. The lucrative investment opportunity in gold would create huge burden on import of India as the precious metal accounts nearly 8 to 10 % of the import bills. The investors are more attracted from the glitter of this commodity that is unhealthy situation for the market. The exchange rate has the adverse impact on the stock market. With the strengthening of dollar, Indian currency depreciates in the international market.

The stock market declines due to decrease in the value of rupee with respect to US dollar. The appreciation in the value of Indian rupee with respect to US dollar needs to recover so as to enable bullish trend in the Indian market. The study exhibits positive impact of money supply on the stock market which shows the large money in circulation has favorable impact on stock market during the period of study. Thus money supply has its favorable effect on the stock market. The inflow of foreign capital is healthy sign for the market as it has significant positive impact over stock market. The FIIs need to be facilitated in the country that would support stock market. Therefore, foreign investors need to sustain in the Indian market as their movement effects the stock prices since FII has become one of the eminent factors to accelerate the stock prices.

The gold prices are used as best alternative for investment which hampers the performance of Indian Stock market. Granger causality test signifies that there exists unidirectional causal relationship from exchange rate to stock market.

Thus, any movement in the value of exchange rate has influence on stock market. Another unidirectional causality is from money supply to S&P CNX Nifty which signifies the influence of variable on the stock market. The causality is running from index to the variables in case of trade deficit and foreign institutional investors. There exists requirement for the initiative to be taken by government to reduce interest of investors in yellow metal and enhance the investment in share market through improving the confidence level investors in the Indian stock market.

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