An Empirical Investigation Of The Macro Determinants Affecting India's Stock Market : Evidences from NSE

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ABSTRACT

This study investigates the impact of six macroeconomic variables, such, exchange rates, inflation rates, interest rates, money supply, industrial production index and international oil price on stock market Index in India NSE(NIFTY 50). The period covered in this study is between April 2000 to March 2018. Using the Augmented Dickey-Fuller unit root test, the series are tested as non-stationary at the level but stationary in first difference. The use of the Johansen cointegration test, indicates that macroeconomic variables and stock market index are co-integrated. This implies that a long run relationship exists between the specified macroeconomic variables and stock market index in India. The multivariate Ordinary Least Square (OLS) and the Error Correction Model (ECM) also shows that inflation rate, interest rate, money supply, industrial production index and oil price do influence stock market index either in the short-run or the long-run. The Granger causality test unveils both unidirectional and bidirectional relationships. There is a bidirectional causality between oil price and stock market index; money supply and stock market index while a unidirectional causality running from industrial production to stock market index; interest rates to stock market index are found. Therefore, predicting stock price via changes in macroeconomic variables becomes possible and this can aid economic forecast, planning and growth. The major conclusion of this study is that macroeconomic variables cannot be ignored in accounting for the dynamics of stock market behavior in India. The adoption of appropriate macroeconomic policies that are favorable to stock market index (proxy for stock prices) and this in turn will stimulate the growth of the stock market in India.

***KEYWORDS**: Stock Market Index, Macroeconomic Variables, Johansen Co-integration Test, Granger Causality Test*

INTRODUCTION

The macroeconomic variables affect stock market behavior is a well established theory in the financial economics literature. In the past two decades there is a growing effort made by researchers to empirically calibrate these macroeconomic effects. More studies are focused on the developed markets such as the US, UK and the Japanese. Examples of these studies are Fama (1981) and Chen (1991) for the US market, Hamao (1988) on Japanese market, and Poon and Taylor (1992) on the UK market. The performance of the stock market is gauged through movements in its index which is influenced by many factors such as companies' specific factors, domestic factors (macroeconomic, social & political) and international factors.

This paper extends the literature to address whether domestic macroeconomic variables affect stock market index within

the context of an emerging market. Emerging markets seem to have distinguished features from those of the developed markets. Given the different political and economic structures, the risk and return profiles in these markets seem to differ. For instance risks and returns in the emerging stock markets are found to be higher relative to the developed stock markets (Errunza, 1983; Claessens Dasgupta and Glen 1993; Harvey, 1995). In the recent years, there seems to be more empirical evidence to suggest that emerging markets are segmented from the developed markets

(Goetzmann and Jorion, 1999; Bilson , Brailsford and Hooper 2001). The studies lend support to the view that emerging markets now represent a feasible investment option for international investors witnessing massive capital inflows into these markets. The investors carefully watch the performance of stock markets by observing the stock market index, before investing funds.The stock market index provides a historical stock market performance, the yardstick to compare the performance of individual portfolios and also provides investors for forecasting future trends in the market.

The objective of this study is to test whether economic factors explain the behavior of the Indian stock market Index with reference to NSE(Nifty 50). The study uses monthly data from April 2000 to March 2018 to investigate the impact of six macroeconomics variables, such as; money supply, manufacturing index (proxy for economic activity), oil price, inflation, interest rate and exchange rates on Indian stock market Index NSE (Nifty 50). The finding of this study would extend the existing literature by providing some meaningful insight to the policy makers and the practitioners as far as the developing country like India .

Literature Review

Several empirical studies have been conducted to validate whether macroeconomic variables has a favorable impact or otherwise on stock market index

Chen et al. (1986) explored a set of macroeconomic variables as systematic influence on stock market returns by modeling equity return as a function of macroeconomic variables and non-equity assets returns for the US. They empirically found that the macroeconomic variables such as industrial production, anticipated and unanticipated inflation, yield spread between the long and short term government bonds significantly explained the stock returns. The authors showed that the macroeconomic variables systematically affect the stock return via their effect on future dividends and discount rates

Mukherjee and Naka (1995) applied Johansen's (1988) VECM to analyze the relationship between the Japanese Stock Market and exchange rate, inflation, money supply, real economic activity, long-term government bond rate, and call money rate. They concluded that a co-integrating relation indeed existed and that stock prices contributed to this relation.

Islam (2003) replicated the above studies to examine the short-run dynamic adjustment and the long-run equilibrium relationships between four macroeconomic variables (interest rate, inflation rate, exchange rate, and the industrial productivity) and the Kuala Lumpur Stock Exchange (KLSE) Composite Index. His conclusions were similar: there existed statistically significant short-run (dynamic) and long-run (equilibrium) relationships among the macroeconomic variables and the KLSE stock returns.

Nishat and shaheen (2004) examines the effect that macroeconomic factors have on the Karachi Stock Exchange Index in Pakistan. Industrial production index, consumer price index, money supply (M1), and the money market rate (short term interest rate) are examined for relationships with the stock exchange index using a vector error correction model (VECM) for the data from January 1973 to April 2004. All variables were found to have a significant co-integrating relationship with the stock market. Industrial production was found to have the largest positive influence on the stock market, while inflation affected the stock market in the most negative influence. It was also found that macroeconomic variables Granger cause stock price movements with significant lag lengths between the fluctuations in the stock market and the real economy being applicable in the short term.

Gan, Lee, Young and Zhang. (2006) investigated the relationships between the New Zealand stock market index and a set of seven macroeconomic variables from January 1990 to January 2003 using co-integration and Granger causality tests. The analysis revealed a long run relationship between New Zealand's stock market index and the macroeconomic variables tested.The Granger causality test results showed that the New Zealand's stock index was not a leading indicator for changes in macroeconomic variables. However, in general, their results indicated that the New Zealand stock market was consistently determined by the interest rate, money supply and real GDP.

Robert (2008) conducted a study on the effect of macroeconomic variables on stock market returns for four emerging economies of Brazil, Russia, India and China affirmed that there was no significant relationship between
present and past market returns with macroeconomic variables, suggesting that the markets of Brazil, Russia, India and China exhibit weak form of market efficiency. Also, no significant relationship was found between respective exchange rate and oil price on the stock market index prices of the four countries studies

Sharma and Mahendru (2010) studied the impact of macroeconomic variables on Bombaystock exchange (BSE). The explanatory variables included in study were inflation rate, foreign exchange reserves, exchange rates and gold prices.

Explained variable was the stock prices of BSE. Simple regression analysis had been applied to study the relation. Results of the study revealed that exchange rates have high negative correlation with stock prices; inflation rate has low negative correlation with stock prices and does not affect the stock prices. Foreign exchange reserves have positive correlation while the gold prices have moderate correlation with stock prices.

Hosseini, Ahmad and Lai (2011) on stock markets indices of China and India. The selected macroeconomic variables in the study were crude oil price, money supply, industrial production and inflation rate of China and India. Findings disclosed that in the long run, crude oil price, money supply and industrial production have a positive impact on China stock market index but negative in case of India. However, the rise in inflation rate negatively affects the stock market index in case of both countries. Moreover, in the short run, crude oil price has a positive impact on Bombay stock market (India) while it is negative but also insignificant when considered the Shanghai stock market (China). Money supply has a positive impact on Chinese stock market index and negative on Indian stock market index, however, in both countries, these effects are insignificant. Inflation has a positive significant effect on Chinese stock market but has negative insignificant relation with the index of Indian market.

Hsing (2011) investigates the impact of Macroeconomic variables on stock market index in Brazil, Russia, India, China and South Africa. He employed the Exponential GARCH model to study the impact of various economic variables that cause fluctuation in South Africa's stock market index. Findings of the study were that index of South Africa stock market has positive relation with growth in real GDP, US market index and the ratio of M3 money supply to GDP but has the negative relation with government deficit to GDP ratio, the domestic real interest rate and the inflation rate, the nominal effective exchange rate and the U.S. government bond yield.

Data and Methodology

Data Description and Sources

This study makes use of monthly time series data from April 2000 to March 2018. Data used in this study consist of stock market index (NSE NIFTY 50). Six macroeconomic variables real economic activity proxy in this study by the growth rate of manufacturing index (MAI), change in consumer price index as a proxy for inflation (INF), growth rate of narrowly defined money supply (M1), growth rate of international crude oil price(OIL) which is a proxy for international risk factor, change in exchange rate (EXR), and interest rate (INTR) proxy in this study by time deposit rates. Data on the macroeconomic variables and stock market performance are sourced from various issues of the Reserve Bank of India. EVIEWS 9 has been used for the econometric modelling.

Tools used for Analysis

In attempting to establish the relationship between macroeconomic factors and stock market index in Nigeria, the study employed econometric techniques such as; Johansen co-integration test, this enables us establish a long-run relationship between the macroeconomic variables and stock market index and as a basis for causality (Engle and Granger,1987). If variables are co-integrated, it means causality exist (Granger, 1991, Miller and Russek, 1990).Error-Correction Mechanism (ECM) is employed for analysis since it contains full information on the dynamic short run interactions among the cointegrating variables. However, since most time series are prone to unit root problems. Therefore, before carrying out a co-integration test and ECM analysis, the unit root test is conducted on the series using Augmented Dickey Fuller (ADF) unit root test. This enables us to test for stationary of the variables included in the model.

Analysis

Unit Root Test

The paper employed the Augmented Dickey Fuller (ADF) unit root test to determine whether the series are stationary or not. The results of the unit root test of the variables are shown below:

Table 4.1: Unit Root Test Result

Variables	At level	First Difference	Order of Integration
NSE	-2.0681***	-3.9460*	I (0)
EXR	-2.6996***	-10.4374*	I (0)
INF	-3.2299**	-3.2299**	I (0)
INT	-2.2341	-13.4856*	I (1)
MI	-2.2341	-12.7981*	I (1)
MAI	-1.2138	-4.7993*	I (1)
OIL	-1.5642	-8.4161*	I (1)

*, **, *** significant at 1%, 5% and 10% level respectively.

The results in table 4.1 above indicates that all the variables are none stationary in levels (apart from All Share Index, Exchange rate and Inflation that are reported as stationary by the ADF test). After first differencing, the results show that all the variables became stationary. The hypothesis of unit roots among the time series cannot be rejected since each of the variables is shown to be integrated of the first order. Therefore, the variables in our model specifications are stationary.

Johansen Co-integration Test

The variables are characterized by a unit root process, then a test for co-integration between NSE(NIFTY 50) and the regressors' (INF, EXR, MAI, INT, M1, and OIL) is done. The results of the Johansen co-integration test are shown in the table below:

Table 4.2: Johansen Cointegration Test Result

Unrestricted Hypothesized No of CE(s)	Cointegration Eigen value	Trace stat.	5% critical value	Prob.
None*	0.4253	196.9187	125.6154	0.0000
At most 1*	0.2880	126.6293	95.7536	0.0001
At most 2*	0.2363	83.4775	69.8188	0.0028
At most 3*	0.1781	49.2393	47.8561	0.0368

* rejection of the hypothesis @ the 0.05 level

Unrestricted Hypothesized No of CE(s)	Cointegration Eigen value	Max-Eigen stat	5% critical value	Prob.
None*	0.4253	70.3494	46.2314	0.0000
At most 1*	0.2880	43.1517	40.0775	0.0219
At most 2*	0.2363	34.2382	33.8768	0.0453

* rejection of the hypothesis @ the 0.05 level

The above tables show the co-integration test results both trace and maximum Eigenvalue statistics indicate 3 cointegrating equations at 5% significance level. As both the trace statistic and maximum-Eigenvalue statistics are at this level greater than the 5% critical value respectively. Thus, the results indicate the existence of cointegration among the variables, and as such, a long run equilibrium relationship exists among them. This finding is in confinement with similar studies in both developed and under developed countries which have found long run relationship between share price and macroeconomic variables.

Error Correction Model Analysis

The short run adjustment dynamics can be represented by an error correction model. According to Engel and Granger (1987), once a set of variables are stationary in first difference I(1) and a cointegration has been established, any dynamic analysis should incorporate the error correction mechanism, which measure deviation from the long-run equilibrium. Also, it is able to determine the speed (rate) at which the explained variable returns to equilibrium after a deviation has occurred. The result from the parsimonious ECM is presented in Table 4.3 below:

Table 4.3: Parsimonious Error Correction Model (ECM) result

Dependent Variable: DNSE

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2152.336	3585.975	-0.6002	0.5495
DEXR	-16.3823	23.2820	-0.7036	0.4830
DINF	-202.5956	56.2530	-3.6015	0.0005
DINT	270.9208	129.8878	2.0858	0.0391
DM1	-0.0017	0.0003	-5.0069	0.0000

DMAI	178.6834	60.4469	2.9560	0.0037
DOIL	474.8855	18.9326	25.0828	0.0000
ECM(-1)	-0.9114	0.0394	-23.0776	0.0000
R-squared		0.945099		
Adjusted R-squared		0.941974		
F-statistic		302.4830		
Durbin-Watson stat		1.800184		

The table above shows that the overall fit is strong with an R- Squared of 94%. Thus 94% of the systematic variations in stock market index are explained by the explanatory variables. The F-statistic of 302.4830 is significant at 5% level and the Durbin Watson Statistic of 1.8002 shows the absence of first order serial correlation. Exchange rate is negatively related to stock market index. From our ECM result exchange rate is inversely related to stock market index, though not statistically significant. Inflation and money supply negatively and significantly impact stock market index (NSE) at 5% level and 1% level of significant. From the result we can deduced that a 1% increase in inflation rate and money supply will lead to 202.6% and 0.002% decrease in stock market index respectively. On the other hand, interest rate, manufacturing index and oil price are positively and significantly related to stock market index at 3% level for INT and MAI 1% level for oil price. We can infer from the result that a 1% increase in interest rate, manufacturing index and oil price will lead to 270.9%, 178.7 and 474.9% increase in stock market index respectively.

The result shows that the coefficient of the ECM is significant with the appropriate (negative) sign. It shows that over 91 percent disequilibrium in NSE in the previous year is corrected in the current year. The strong significance of the ECM is an indication of the existence of a strong long run equilibrium relationship between NSE and the explanatory variables. The absolute value of the ECM is less than one; hence this indicates a stable error which eventually converges to the long run equilibrium when there is a departure from short run equilibrium level. The negative coefficient of the ECM confirms the existence of long run equilibrium relationship of the model.

Long Run Analysis

The long run relationship between the dependent variable (NSE) and the regressors (MI, MAI, EXR, OIL, INF, INT) is estimated using Ordinary Least square (OLS) technique. The result is presented in table 4.4 below:

Table 4.4: Long Run Analysis Result

Dependent Variable: DNSE

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-5844.649	8160.845	-0.7161	0.4752
EXR	-13.7364	53.5565	-0.2564	0.7980
INF	-187.1740	126.1155	-1.4841	0.1403
INT	506.3955	298.3976	1.6970	0.0922
M1	-0.0019	0.0008	-2.3930	0.0182
MAI	143.1523	139.3198	1.027509	0.3062
OIL	516.5945	43.2377	11.9477	0.0000
R-squared		0.707159		
Adjusted R-squared		0.693102		
F-statistic		50.30873		
Durbin-Watson stat		2.208102		

The result shows that about 70% of the systematic variation in stock market index (ASI) in the long run has been explained by all the regressors namely Exchange Rate (EXR), Inflation Rate (INF), Interest Rate (INT), Manufacturing Index (MAI) and Oil Price. This is indicated by the coefficient of determination (R-square) of 0.70 while about 30% of the systematic variations in stock market index (NSE) were left unexplained by the model which has been captured by the error term. This implies that other factors apart from these macroeconomic variables also affect Indian stock market index in the long-run. After adjusting for the degree of freedom the model explain about 69% of the total systematic variations in stock market index (NSE) as shown by the adjusted R-squared of 0.693.

On the basis of the overall statistical significance of the model as shown by the Fstatistics, it was observed that the overall model was statistically significant since the F-value of 50.3 was significant at 5% level of significance. Thus, all the explanatory variables jointly have a significant impact on Indian stock market index in the long run and the existence of the hypothesis of a significant relationship between the dependent variable (NSE) and all the independent variables in the long-run

is validated. The Durbin-Watson statistic shows that there is no autocorrelation in the model.

On the basis of the individual statistical significance of the model, as shown by the tratios, the result showed that three of the macroeconomic variables (that is, interest rate, money supply, and international oil price) are significant at 10%, 1% and 5% level of significant respectively, while exchange rate, industrial production index and inflation had no significant impact on Indian stock market index in the long run. We can deduce from the result that a 1% increase in interest rate and exchange rate will lead to 506.4% and 516.6% increase in stock market index, while a 1% increase in money supply will lead to 0.002% decrease in stock market index. The long-run result also revealed that four of the macroeconomic variables; inflation (INF), money supply (M1), industrial production index (MAI) and exchange rate (EXR) confirm the a priori expectation while the others did not.

Granger Causality Test

Granger causality is employed to test for the causal relationship between two variables (Granger 1969). In order to determine the direction of causality which prevails between the selected macroeconomic variables and stock market index, we conducted a Granger Causality analysis to enable us detect which macroeconomic variable(s) causes stock market index and vice versa. The result from the Granger causality analysis is presented in the table 4.5 below.

Table 4.5: Result of Granger Causality Test

Null Hypothesis	Observation	F-statistic.	Prob
NSE does not Granger cause OIL OIL does not Granger cause NSE	130	3.58989 3.06424	0.0305 0.0502
NSE does not Granger cause MAI MAI does not Granger cause NSE	130	1.54240 3.48157	0.2179 0.0338
NSE does not Granger cause M1 M1 does not Granger cause NSE	130	6.34433 2.33195	0.0024 0.1013
NSE does not Granger cause INT INT does not Granger cause NSE	130	0.11596 2.69385	0.8906 0.0715
NSEdoes not Granger cause INF INF does not Granger cause NSE	130	1.38452 0.33266	0.2543 0.7176
NSE does not Granger cause EXR EXR does not Granger cause NSE	130	0.10617 0.40072	0.8994 0.6707

The results of the granger causality test indicate that there is a bidirectional relationship between NSE and OIL, as well as between NSE and MI. The bidirectional relationship in terms of NSE and OIL shows that changes in stock market index (NSE) are caused by OIL and that of OIL are in turn induced by movement in stock market index (NSE).This also hold for stock market index (NSE) and money supply (M1). A unidirectional relationship is found running from industrial production index (MAI) to stock market index (NSE), interest rate (INT) to stock market index, meaning that the direction of causality is from MAI to NSE, INT to NSE. No causal link is however found in the relationship between NSE and the following variables; exchange rate (EXR) and inflation rate (INF).

Findings and Suggestions

The findings are that inflation rate, interest rate, money supply, industrial production index and oil price significantly influence stock market index either in the short-run or the longrun while there are discrepancies between short-run result (Table 4.3) and long-run results (Table 4.4), there are also areas where they confirm each other.

- Inflation is negatively related to the stock market index in both the short run and long run, but it is only significant in the short run (Table 4.3) at a 5% level of significance.
- Exchange rate is negatively related to the stock market index in both the short-run and the long-run. They have been found to be consistently not statistically significant.
- Interest rate is positively and significantly related to the stock market index in both short run and long run.
- Money supply is negatively and significantly related to stock market index in both the short-run and long-run
- Industrial production index is not significant in the long run but is significant in the short run at 5% level.
- International oil price is positively and significantly related to the stock market index in both short-run and long-run.
- The Granger causality test indicates a bi-directional causality between oil price,money supply and stock market index.
- Interest rate causes stock market index but no causality from stock market index to interest rate
- A unidirectional causality was found running from industrial production to stock market index
- From the above findings the Indian stock market is responsive to changes in macroeconomic factors. Hence, predicting stock price via changes in macroeconomic variables becomes possible and this can aid economic forecast, planning and growth.

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