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Macroeconomic Analysis of Capital Good Industry Performance: Evidence from Indian Stock Market

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Abstract

Purpose: With the heightened volatility of the stock market, there is a need to analyse variables that have a significant impact on the performance of the industry stocks. One of the most important factors that have been identified is the macroeconomic conditions of the invested country. Many researches assume that changes in the monetary indicator such as exchange rate, inflation rate and the money supply may bring change in the equity prices. Moreover, the effect these variables have specific industry may vary. Thus, the objective of the paper is to analyse the relationship between selected macroeconomic variables and specific industry performance in the stock market. **Prior Literature:** The previous literature provides a diverse opinion on the relationship between macroeconomic variables and equity returns. Dasgupta, (2012) and Naik and Padhi (2012) investigated the association of macroeconomic variables such as gross domestic product, rate of exchange, money supply, manufacturing production and national income, with stock market performance of equity shares conclude a positive and significant relationship between the selected variables. Whereas, Mishra (2004) did not find any long haul association but concluded that there exists a unidirectional relation between equity returns and some variables such as rate of exchange. **Research Methodology:** The monthly data has been collected for a period of eighteen years from March, 1999 to December, 2017. In this research, the relationship between five economic variables: Inflation Rate, Exchange Rate, Index of Industrial Production, International Crude Oil and Money Supply and selected BSE indices: S&P BSE Capital Goods has been analysed. The time series data has been subject to unit root test to check the stationarity of the data. To better understand the relation, the log value of the macroeconomic variables has been used. The long term impact has been studied using the Toda & Yamamoto (1995), test and the Johnsen Cointegration Test for checking the robustness of the equation. **Findings:** The estimates of Block Exogeneity Wald test shows chi-square distribution with 4 degrees of freedom (Lag Length = 4) and the corresponding Probability. The results suggest that only exchange rate has a unidirectional causal relation with closing value of the capital good index. While Pairwise Granger casualty shows a significant unidirectional association with closing index value. The long term relation between the index prices and macroeconomic variables was further subject to Johansen Cointegration Trace Test which suggests that there are four cointegrating equations. **Suggestions:** Stability in the rate of exchange between US Doller and Indian Rupee is very significant for the growth of the Capital Good Industry. The Capital Good Industry includes a wide variety of manufacturing goods which are important auxiliaries to trade and increase the contribution of these specific industries to the gross domestic product of the country. **Original Contribution:** There have been several studies on the relationship between S&P BSE Sensex and macroeconomic variables, yet very few studies have tried to understand the relation between specific industries and macroeconomic variables, which will provide a comprehensive view of the performance of the stock market, where few listed companies with extremely high performing stocks mask the actual economic situation of the economy.

Keywords: Granger causality, Johansen Cointegration, Macroeconomic variables, Toda and Yamamoto Causality

1. Introduction

As India is emerging as the world's fastest-growing large economy, the demand for capital goods has been increasing in the past decade. However almost one third of the demand is being met by imported machinery worth more than 30 billion US dollar in 2015. Thus, this sector is the backbone of manufacturing sector, yet

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it is a severely underdeveloped. The financial system of a country is considered a yardstick of its economic prosperity. There are numerous factors such as social environment, economic conditions, and political endeavours which can influence the performance of the equity market. Yet, these factors are intertwined in such a complex manner that it crucial to study this possible explanation to the stock market changes. In the recent years, as the investments in the stock markets have increased manifold, the volatility in the stock market returns has also increased. Thus, the role of macroeconomic variables causing this volatility in the share prices has been crucial. It is presumed that the changes in macroeconomic indicators such as the exchange rate, inflation rate, and money supply cause variation in equity prices. However, Luintel and Khan (1999) using bi-directional causality test between financial development and economic growth found that the financial markets do in fact affect economic growth. Moreover, Levine and Zervos (1996) have suggested that the liquidity in the stock market has a positive and significant relation with present and expected rate of economic growth, capital regeneration, and improvement in productivity even when the political, economic and other factors were controlled.

The literature available on the subject demonstrates that investors depend on the monetary and macroeconomic conditions, which in turn, can sway the stock prices in unexpected direction. Hence, the economic conditions have a major impact on the decisions made by the investors. This thought has persuaded many researchers, academician and financial connoisseurs to examine the relationship between macroeconomic variable and the changes in the stock market (Gan, Lee, Yong, & Zhang, 2006). According to Chaudhuri and Smiles (2004), the stock returns oscillate as per the changes in the macroeconomic variables and rumours regarding the economic conditions. The returns rely on the foreign direct investments, inflation rate, exchange rate, money supply etc. (Ahmed, Vveinhardt, and Meenai, 2015).

In the present scenario, with the investors becoming more financially literate, the impact of the economic conditions has an impact on the investment decisions undertaken by them either on their own or by consulting financial analysts. Therefore, the study has been undertaken to investigate the impact of these variables on certain selected industrial indices.

1.1 Objectives of the Research

This research has been undertaken to understand the nature of association between the macroeconomic variables and stock prices. This study attempts to scrutinize how the stock prices move along with the macroeconomic variables. The objectives of the research is to examine the long term relationship between selected S&P BSE Capital Good index and macroeconomic variables.

1.2 Significance of the Research

The research is significant in numerous ways in comparison to the previous work undertaken by researches. The previous studies have highlighted the impact on the indices such as S&P BSE Sensex which comprise of 30 well established companies of selected industries. Thus, the studies do not signify the impact on the basic industries of the country. In the past months, the volatility of the rupee to dollar exchange rate, low performance of the manufacturing industries have all accounted for fluctuating prices. Yet, in July, the S&P BSE Sensex reached a high benchmark of 37000 points. This high closing point was attributed to few selected large capitalisation banks which convinced the investors to invest in certain industry. Thus, the closing points of an index do not insure the safety of investments. This it is important to highlight the impact of these macroeconomic variables on certain industries which are an important part of the economic cycle.

2. Theoretical Background

The literature available on the relationship between macroeconomic variables and equity returns does not establish any particular causal relation between the variables. Many researchers have unidirectional impact between macroeconomic variables and equity prices, while some could not establish any such relation. The following research work highlight the study undertaken in India with respect to the casual relation between the selected variables.

Kumar and Singh (1998), while observing the joint impact of trading volume, rate of exchange and the rate of gold standard, conclude a highly significant impact of the said variables on S&P BSE index. Further, they conclude that the exchange rate and gold rate have a highly significant relation with stock prices, but no impact of trading volume was found to be significant. A study conducted by Naka,

Mukherjee and Tufte (1998), employing vector error correction model, concluded that domestic inflation had a deterrent effect on the performance of the stock market.

Seshaiah et al. (2003) concluded that in short-run the impact of macroeconomic variables post-liberalisation on real rate of return of stock was negative. One of the most prominent studies is the re-examination of the relationship between stock prices and key macroeconomic variables by Chakravarty (2005) for the period re-examined the relationship between stock price and some key macroeconomic variables in India for the period 1991 to 2005 using monthly time series data. The study establishes a unidirectional effect of Index of industrial Production and inflation rate on stock prices using granger causality test. However, no relation was found between exchange rate and stock prices. Hassan (2013) established that the inflation rate and exchange rate are negatively related to stock prices while investigating the relation between the economic factors and stock performance for the period of January 1979 to December 2011. Furthermore, the researcher concluded that the money supply did not have a strong impact on stock prices movements.

Another prominent research undertaken was the study of relationships between S&P BSE and five macroeconomic variables, namely, industrial production index, wholesale price index, money supply, treasury bills rates and exchange rates over the period 1994 to 2011 by Naik and Padhi (2012). They applied Johansen's co-integration and Vector Error Correction Model which suggested the positive relation of stock prices to the money supply and industrial production but a negative reaction to inflation rate. A study by Ray (2013) using regression analysis suggested that there may have been a positive and linear relation between stock price and real industrial production. Sireesha (2013) analysed the impact of macroeconomic factors on the movements of the National Stock Exchange (CNX Nifty), gold and silver prices. The economic variables were categorised into internal variables such as inflation, GDP, money supply and industrial production index, and external variables such as exchange rate and Foreign Institutional Investors (FII). The results of the linear regression determined that the performance of internal variables exhibited the interdependence between these variable with returns on stock, gold and silver. The examination of the external variables suggested that the stock returns were significantly influenced by GDP and inflation while gold return was significantly influenced by money supply. Thus, the cited research work do not unanimously suggest any positive or negative relation to stock prices, emphasising the need to study this relation across different time horizons.

3. Empirical Framework

The research undertaken investigates the long term relationship between the equity returns of various industry index and the macroeconomic indicators such as exchange rate, inflation, money supply and international crude oil. The monthly data has been collected for a period of eighteen years from April 1999 to December 2017.

3.1 Research Design

3.1.1 Data Collection and Sample Selection

The macroeconomic indicators of Indian economy are released by Reserve Bank of India annually. Thus, the monthly data has been collected from the website of Reserve Bank of India: https://dbie.rbi.org.in and the annual Economic Survey of India. The exchange rate of rupees to US dollars has been collected from has been collected from https://in.investing.com. While the international crude oil prices rupees per barrel has been collected from: https://www.indexmundi.com. The monthly closing value of the selected index has been taken from the website of Bombay Stock Exchange: https://www.bseindia.com and CMIE PROWESS.

Table 1. Definitions of the Variables

Variables	Notation	Empirical Definition
Inflation Rate	$IN_t = Log(\Delta IN_t)$	Log of Consumer Price Index
Exchange Rate	$Ex_t = Log(\Delta Ex_t)$	Log of Rate of Exchange of Indian Rupee to US Dollar
Index of Industrial Production	$IIP_t = Log(\Delta IIP_t)$	Log of Index of Industrial Production
International Crude Oil	$ICO_t = Log(\Delta ICO_t)$	Log of International Crude oil prices in rupees
Money Supply	$MS_t = Log(\Delta MS_t)$	Log of Money Supply M3
BSE Capital Good Index	$CG_t = \Delta CG_t$	Closing value of the BSE Capital Good index monthly prices

3.1.2 Research Methodology

The following variables have been selected for studying the relationship between Capital Goods Industries and macroeconomic variables as shown in (Table 1).
The following equations will be tested for the study:

$$CG_t = \alpha + \beta_1 IN_t + \beta_1 Ex_t + \beta_1 IIP_t + \beta_1 ICO_t + \beta_1 MS_t + \varepsilon \quad (1)$$

4. Results and Analysis

The stationarity of the time series data was checked in order to determine the appropriate statistical test to be applied for studying the objectives. The lag order for the model was calculated. To analyse the relationship between macroeconomic variables and equity performance, Toda and Yamamoto (1995), test was applied and to check the robustness of the model Johansen multivariate Cointegration has been.

4.1 Descriptive Statistics

The descriptive statistics has been displayed in (Table 2). The monthly closing value of equity prices of the S&P BSE Capital good, shows that an average value of 8594.796; and maximum and minimum returns of 19795.32 and 521.6800, respectively, were recorded in a certain month time period. The series follows the normality pattern as the value of kurtosis is less than 3. The values of skewness show that the time series are leptokurtic, and all the series are negatively skewed except for inflation rate and exchange rate.

Unit Root Test (Augmented Dickey–Fuller)

The determination of the application of an appropriate test, the presence of a unit root in the time series data has to be determined. If the data contains unit root then the data has to be transformed into a stationary series. Thus, the stationarity test of the data collected was conducted using the Augmented Dickey Fuller Test. The results of the augmented Dickey and Fuller test have been depicted in (Table 3).

Table 2 articulates the result of unit root tests. Unit root test is applied to check whether the data is stationary or not, to avoid spurious results. The result of the unit root test suggests that dependent variables selected for the study namely the closing value BSE indices are stationary at level difference while money supply and inflation rate are stationary at second level difference. The remaining macroeconomic variable such as Exchange rate, Index of Industrial production and international crude are stationary at first level difference.

4.2 Lag Order Selection Criteria

The prerequisite for application of econometric is selection of an appropriate lag length for the series. As mentioned

Table 2. Descriptive Statistics

Statistics	Capital Good	Log CPI	Log Exchange	Log IIP	Log Money supply	Log Crude Oil
Mean	8594.796	2.188921	1.694745	1.885479	6.598873	3.420510
Median	9408.235	2.158352	1.672190	1.931072	6.620601	3.473461
Maximum	19795.32	2.459392	1.836311	2.124504	7.122954	3.840535
Minimum	521.6800	1.949390	1.59331	1.609541	5.988705	2.747326
Std. Dev.	6006.139	0.166396	0.063346	0.156122	0.353508	0.259207
Skewness	-0.025843	0.237539	0.793345	-0.332823	-0.113359	-0.34551
Kurtosis	1.602650	1.5644478	2.543187	1.638494	1.649363	2.130984

Table 3. Unit root test- Augmented Dicky-Fuller test

Macroeconomic Variable	T-Statistics Value	Probability	Conclusion
Inflation Rate	-12.16992	0.0000	I(2)
Exchange Rate	-14.3546	0.0000	I(1)
Index of Industrial Production	-3.813839	0.0033	I(1)
International Crude Oil	-9.958148	0.0000	I(1)
Money Supply	-12.7867	0.0000	I(2)
BSE Capital Good Index	-12.66951	0.0000	I(0)

Source: Authors' Calculations

Table 4. Optimal Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-326.6091	NA	1.19e-06	3.381735	3.474886	3.419360
1	1763.346	4115.381	5.58e-15	-15.7912	-15.14011*	-15.52879*
2	1820.277	107.0722	4.61e-15	-15.98420	-14.77323	-15.49507
3	1848.966	52.37661	4.94e-15	-15.91712	-14.14725	-15.20224
4	1897.442	85.83286	4.42e-15*	-16.0315*	-13.70279	-15.09095
5	1925.831	48.70402	4.77e-15	-15.96175	-13.07406	-14.79537
6	1959.750	56.32563	4.99e-15	-15.94266	-12.49607	-14.55053
7	1994.231	55.35874*	5.02e-15	-15.92872	-11.92322	-14.31084
8	2017.071	35.41237	5.76e-15	-15.80799	-11.24358	-13.96436

Source: Authors' Calculations

in (Table 3), the variables selected for the study are stationary at level, first and second level difference. Thus, Toda Yamamoto (1995), is the most suitable econometric test for this time series. In order to select optimal lag length, the Akaike (1969, 1973) Information Criterion (AIC), has been selected, which suggests four lags for the time series data as -16.03.15*, corresponding to the four lags, is the least value of AIC as depicted in (Table 4).

4.3 Granger Causality Ttest

The pair wise Granger (1969), causality test has been used to identify the direction of the causal association among the variables. (Table 5) shows that there is a unidirectional relation between exchange rate, index of industrial production and money supply with prices of the capital good index, at 5% significance level ($p < 0.05$) at 4 lags. Table 5 further establishes that Inflation rate and Crude oil prices do not have any casual relation with the closing index prices in either direction.

4.4 Toda and Yamamoto Wald Causality Technique

The prime objective of the study is to examine the nature of causality and direction of the economic indicator selected in the study. Toda and Yamamoto (1995) proposed a simple procedure to estimate an augmented VAR using asymptotic distribution of Wald statistics (an asymptotic $\chi 2$ –distribution). Since the results of the unit root test clearly show the stationarity of the variable at level, first difference and second difference, the test selected for the is the Toda & Yamamoto Test. This test is an extension of Granger Causality test which neither

Table 5. Pairwise Granger Causility Test

Null Hypothesis	Obs.	F-Statistics	Prob.
Log CPI → Capital Good	**222**	**1.69916**	**0.1513**
Capital Good → Log CPI	**222**	**1.39271**	**0.2375**
Log Exchange → Capital Good	**222**	**2.80379**	**0.0268**
Capital Good → Log Exchange	**222**	**1.35091**	**0.6013**
Log IIP → Capital Good	**222**	**2.81231**	**0.0264**
Capital Good → Log IIP	**222**	**1.35091**	**0.2522**
Log money supply → Capital Good	**222**	**2.82012**	**0.0261**
Capital Good → Log money supply	**222**	**1.79696**	**0.1306**
Log Crude → Capital Good	**222**	**0.67003**	**0.6134**
Capital Good → Log Crude	**222**	**1.33415**	**0.2583**

Note: The rejection of null hypotheses at 5% ($p < 0.05$).
Source: Authors' Calculations

Table 6. Wald Test Causality Analysis

Variables	Chi Square	df	Prob.
Log CPI → Capital Good	3.248000	4	0.5172
Log Exchange → Capital Good	14.00946	4	0.0073
Log IIP → Capital Good	2.308119	4	0.6793
Log Money Supply → Capital Good	4.394317	4	0.3553
Log Crude → Capital Good	2.688049	4	0.6113

Source: Authors' Calculations

binds the variables to a specific order of difference I(0), I(1), I(2), nor to the Cointegration of uninformed order. (Wolde-Rufael 2005). (Table 6) depicts the results of the Toda Yamamoto Casualty Test. The results suggest that only exchange rate significantly has a unidirectional relation with the closing value of Capital Good Industry Index. While the other macroeconomic variable such as inflation rate, Index of Industrial production, Money supply, International crude oil prices do not have causal relation with the closing value of Capital Good industry in either direction.

4.5 The Johansen Cointegration

The robustness of the model has been checked using the Johansen Cointegration technique. The technique verifies the long term relation between the Capital Good Industry and macroeconomic variables. The results from (Table 7) establish that there is a trace of four cointegrating equation which indicates the existence of a long term relation between the equity prices of the Capital Good Industry and inflation rate, exchange rate, money supply, international crude oil and Index of Industrial Production. It further concludes that the trace test rejects

Table 7. Results of Johansen Cointegration (Unrestricted Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None*	0.194301	145.7950	95.75366	0.0000
Almost 1*	0.159284	98.04904	69.81889	0.0001
Almost 2*	0.116725	59.70511	47.85613	0.0026
Almost 3*	0.076274	32.27490	29.79707	0.0254
Almost 4	0.44650	14.74080	15.49471	0.0647
Almost 5*	0.020803	4.646018	3.841466	0.0311

Trace test indicates 4 cointegrating eqn(s) at the 0.05 level
Denotes rejection of the hypothesis at 0.05 level
** MacKinnon – Haung –Michelis(1999) p-values

Table 8. Results of Johansen Cointegration (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None*	0.194301	47.7592	40.07757	0.0057
Almost 1*	0.159284	38.34392	33.87687	0.0137
Almost 2*	0.116725	27.43022	27.58434	0.0523
Almost 3*	0.076274	17.53410	21.13162	0.1483
Almost 4	0.44650	10.09478	14.26460	0.2058
Almost 5*	0.020803	4.646018	3.841466	0.0311

Max-Eigen value test indicates 2 cointegrating eqn(s) at the 0.05 level
Denotes rejection of the hypothesis at 0.05 level
** MacKinnon – Haung –Michelis(1999) p-values

the null hypothesis as the trace value is greater than the critical value with a probability less than 0.05. This model is further checked using maximum eigen value approach. (Table 8), depicts that there are two cointegrating equation as critical cointegrating vectors are present in the model as the maximum eigen value is less than critical value with probability less than 0.05.

5. Conclusion

In the past four years, the government has taken initiative specifically for the manufacturing sector of the country by starting campaigns like 'Make in India' and 'Start up India'. The objective of these campaigns is to increase the growth rate of the manufacturing sector. While the capital good industry is very significant for the development of the economy, for a country with a 2 trillion US dollar economy, this under development presents both significant opportunities and threats.

The time series data selected for the study was subject to stationarity test to determine the appropriate econometric test to be applied. With the stationarity at level, first, second level difference, Toda Yamamoto test has been selected for the analysis with Johansen Cointegration to check the robustness of the model. The results of the study show that there is a long tern association of macroeconomic variables such as Inflation rate, Exchange rate, Index of Industrial Production, Money Supply and International Crude oil with the prices of the Capital Good Index. The causal relation between the selected variables suggests that there is a unidirectional relation between Money supply, Index of Industrial Production and Exchange rate while applying pairwise Granger Causality. However, when Wald Test is applied, the results suggest that only exchange rate has a unidirectional relation with the closing value of the index.

Thus, economic reforms to improve the stability in the exchange rate will have significant impact on the stock performance of the industry. However, improvement in the Money Supply and Index of Industrial Production would also have an impact on the performance of the Index. As per Agrawal and Sengupta (2017), the domestic capital good industry suffers from low investment in technology and talent. Yet these economic reforms are creating new opportunities in the capital-goods sector by reducing the barrier in foreign direct investment as well as and Public-Private partnership. India's ranking on the World Economic Forum's Global Competitiveness Report has improved from 77 to 55 in 2015–16.

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