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# Cointegration Influence of Macroeconomic Indicators on Stock Market Index in India

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**Abstract:** Purpose of the Study: The present paper investigates how stock market index in India is practically being shocked by two commodity indicators, GDP growth rate and exchange rates. Background: Financial theory and empirical studies confirm that market index is one of the paramount indicators of changes in macroeconomic movement and that's why in the last twenty three years by reason of the mounting credence those genuine macroeconomic movements habitually shock on stock price indices in India. Methodology: The study is based on secondary data obtained from RBI database, BSE database and Index Mundi database for the period between 1991 and 2013 with 23 observations using ADF unit root test and Johansen cointegration test. Results: The empirical results illustrate that there is significant long-term cointegration unwavering relationships exist. Findings: Indian stock market index is very depending upon the price of international crude oil price, gold price, exchange rates and GDP growth.

**Keywords:** Gold Price, Crude Oil Price, GDP Growth Rate, Exchange Rates, India, Sensex, ADF Unit Root Test, Johansen Cointegration Test

## 1. Introduction

Over the precedent few decades, the interface of share returns and the macroeconomic variables has been a subject of interest among different academicians, practitioners and researchers. Stock prices should be employed as leading indicator of future economic behavior if stock prices precisely replicate the core fundamentals. Therefore, the fundamental relationships among macroeconomic variables and stock prices are significant in the formulation of nation's macroeconomic policy. Presently the performance of Indian stock market is analyzed carefully by large number of global players; this motivates us for exploring research in Indian stock market and macroeconomic indicators to determine the Indian stock market efficiency to give new approach to the overseas investor, strategy maker, agents, domestic investors and rational investigators (Tripathy, 2011). The even improvement procedures in Indian stock markets continues to be breath taking from 3,739.69 points on March 31st 1999, with in nine years; Bombay Stock Exchange (BSE) Sensitivity Index (SENSEX) had already touched to 21,000 points in January, 2008. But this shock doesn't last extended as it was exaggerated by the recent global financial crisis of 2008-09 and budding euro-crisis (Ahuja et al, 2012). The effect of psychological factors is characteristic for the short-term and medium-term investment horizon, while a long-term investor should pay attention mostly to elementary factors and grasp the fundamentals on which he/she was incoming the position. It is the fundamentals and their consequence on the value of a particular title that are the most well-known causes over the long run. King (1966) articulated that share prices are affected by macroeconomic issues up to 50% on average (so 50% is left for micro-economic and psychological factors, author's note). The global economic chaos is likely to motivate ambiguity in gold prices, which has previously prepared it a risky asset for investors in India. Many researchers have been identified the long-run and short-run relationships between stock price index and gold price in developed and developing nations. Experiential results explain that gold price can to a great extent influence the stock market (Yahyazadehfar and Babaie, 2012). Keeping in view of this, this paper investigates how stock market index in India is practically being shocked by two commodity indicators, GDP growth rate and exchange rates.

## 2. Review of Literature

Numbers of studies have been conducted to examine the effects of macroeconomic variables on stock market of industrialized economies. In the study of Nath and Samanta (2003) it was observed that, there exists vibrant relationship between the foreign exchange and stock markets for India. The data used in this empirical study are daily stock market index (S&P CNX NIFTY of National Stock Exchange) and exchange rate (expressed in Indian Rupee per U.S. dollar) for India for the period March 1993 to December 2002. Chakravarty (2005) has also examined positive relationship between industrial production and stock prices using Granger causality test and observed unidirectional from industrial production to stock prices in India. Balance of trade has also been taken by many researchers to analyze its effects on stock exchange prices; however it is observed that it has no significant effects on stock exchange prices, for instance, Bhattacharya (2002) found negative relationship between trade balance and stock exchange prices in India. Sharma and Mahendra (2010) performed a study to calculate the long-term relationship between BSE and Macro-economic variables (foreign exchange reserve, inflation rate, exchange rates and gold price) for the period from January 2008 to January 2009 using multiple regression models. The study result discloses that gold price and exchange rate persuades the stock prices in India. Wang (2010) confirmed in his study that there is a two-sided association between inflation and stock prices, at the same time as a unidirectional association survives from stock prices to the rate of interest. However no noteworthy association between stock prices and real GDP was establish. Le et al (2011) have made a study using financial econometrics to examine the relationships between the prices of gold and oil in terms of index of US dollar by using monthly data from January, 1986 to April, 2011. From the empirical results of the study showed that there is a long-run relationship existing between the prices of oil and gold and the oil price can be used to predict the gold price. In the research paper of Reddy (2012) it was evident from the stock prices of major companies in Indian stock market and the market indices as S&P CNX Nifty, SENSEX etc; the various indicators of economy as GDP, IIP, balance of payment that after the stimulus packages announcement and their flow in the economy the Indian stock market as well as the Indian economy has revitalized after the depression. Naik and Padhi (2012) explored the associations between Sensex and selected five macroeconomic variables in terms of index of IIP, producer price index, money supply, rates of treasury bills and exchange rates for the period between April 1994 and June 2011 with the application of Johansen's multivariate cointegration and VECM technique and they examined that the stock prices optimistically be connected with the money supply and index of IIP however pessimistically affect inflation. The exchange rate and the rate of interest in the short-run are establish to be irrelevant in seminal stock prices. Samanta and Zadeh (2012) investigate the subsistence of co-integration, universal trend and volatility spillover for these macro variables using daily data for over twenty years. Kaliyamoorthy and Parithi (2012) have prepared a study to observe the relationship between gold price and stock market for the time span from June 2009 to June 2010. In their study, it was proved that there is no relationship exists with the stock market and gold price and stock market is not responsible for rising gold price. Reddy and Agrahari (2012) investigated the upshot of the incentive wraps up declared by different governments athwart the world as well as India on their stock markets and furthermore their economies in the midst of particular importance on Indian economy. It is obvious from the stock prices of most important companies in Indian stock market and the market indices seeing that CNX Nifty, Sensex and all that; the different pointers of economy in terms of gross domestic product, index of industrial production, balance of payment so as to later than the incentive wraps up declaration in addition to their surge in the economy the Indian stock market over and above the Indian economy has rejuvenated following the downturn. Empirical support of the study recommended that the mean statistic earlier than the incentive is less than the mean statistic later than incentive signifying the optimistic consequence of the incentive wraps up. What's more the regression investigation between the net FII inflows and Sensex association demonstrated the interdependent between net FII inflows and Sensex. Sireesha (2014) observed the relationship between stock market returns in India and selected ten macroeconomic variables based on monthly time series data obtained from Yahoo Finance, index mundi and trading economics for the period between January 1993 and December 2012 with 240 observations with the applications of financial econometrics. She concluded that on a standard 55% to 64% of sub periods demonstrate optimistic returns for stocks, gold and silver. Since stock returns are considerably persuaded by inflation, GDP, USD-INR and JPY-INR, stock returns perhaps employed to circumvent alongside these variables. Again gold returns are notably persuaded by money supply, the entire currencies' exchange rates, gold returns possibly employed to circumvent alongside these variables. Furthermore silver returns are appreciably persuaded by money supply and EUR-INR, silver returns perhaps utilized to hedge only against these variables. Returns from stocks, gold and silver have an opposite association with inflation; index of industrial production and money supply and GDP explains an undeviating connection with stock return as well as a contrary affiliation with gold and silver returns.

### *2.1. Research Gap*

The crucial sum of the conventional appraisal of interrelated literature fashioned till date on the accessible subject matter reveals extensive space for the strength. Nor has any earlier study reviewed the usefulness of the selected macroeconomic variable in terms of GDP growth, exchange rates (dollar vs. rupee), crude oil price, domestic gold price and its influence on stock market index in India. The study in this fashion has also not been made in any of the papers

reviewed above. In approximately each and every one papers there is supplementary possibility for further empirical research.

### *2.2. Research Question*

Obviously the main research question might be:

Null hypothesis: There is no cointegration persuade of macroeconomic indicators on stock market index in India;

Alternative hypothesis: There is a significant conintegration persuade of macroeconomic indicators on stock market index in India.

## 3. Materials and Methods

### *3.1. Data source and Variables Used*

The present research study is based on secondary data collected from BSE database, RBI database, index mundi database and world gold council database used for 1991 to 2013 with a number of 23 observations.

In this effort, yearly crude oil price and yearly Indian gold price have been as commodity indicators at the same time as significant importing indicators, GDP growth rate has been used as economic growth of India, exchange rates in terms of dollar versus rupee has been as a signal of dollar demand in India as well as trade deficit position and daily stock market index of Bombay stock exchange (the closing price) has been taken as economic mirror of India for the preferred periods.

### *3.2. Tools Used*

On the way to examine, descriptive statistics, test of stationarity in the course of ADF unit root technique and Johansen cointegration technique have been working in this research effort.

### *3.3. Hypotheses Taken*

To fulfill the research objectives, the following methodological hypotheses were taken for the present study.

Hypothesis-1

$H_0$: Chosen time series data are non-stationary.

$H_1$: Chosen time series data are stationary.

Hypothesis-2

$H_0$: Chosen time series data are not associated in the long run.

$H_1$: Chosen time series data are significantly associated in the long run.

### *3.4. Descriptive Statistics*

Descriptive statistics encircle the portrayal of mean, median, standard deviation; kurtosis, skewness and J-B statistics with probability for the chosen macroeconomic indicators and stock market index in India which is depicted in table-1. It is reported that mean and standard deviation of the meticulous series have highest mean. Skewness, kurtosis and Jarque-Bera statistic with probability allows that all the series are not normally distributed (Bhunia, 2013).

***Table-1.*** *Descriptive Statistics*

| | LER | LGDP | LGP | LOP | LSX |
|---|---|---|---|---|---|
| Mean | 3.687878 | 1.731277 | 8.902839 | 3.752569 | 8.760734 |
| Median | 3.774942 | 1.840550 | 8.548692 | 3.556776 | 8.518357 |
| Maximum | 3.993179 | 2.351375 | 10.31228 | 4.590868 | 9.928623 |
| Minimum | 2.977716 | 0.095310 | 8.150756 | 2.833801 | 7.554256 |
| Std. Dev. | 0.224654 | 0.518486 | 0.696611 | 0.531318 | 0.794712 |
| Skewness | -1.440697 | -1.363062 | 0.952596 | 0.225692 | 0.319370 |
| Kurtosis | 5.321845 | 5.229585 | 2.473107 | 1.729154 | 1.578598 |
| Jarque-Bera | 13.12284 | 11.88601 | 3.744566 | 1.743012 | 2.327189 |
| Probability | 0.001414 | 0.002624 | 0.153772 | 0.418321 | 0.312361 |
| Observations | 23 | 23 | 23 | 23 | 23 |

## 4. Empirical Results and Analysis

### *4.1. Unit Root Test Results*

Johansen cointegration technique is enormously supportive to observe the cointegration relationship among the chosen variables in the long run moreover it is practicable if all the variables are unsurprising or stationery whatever happens. In this research effort, preferred indicators, that is to say, crude oil price, Indian gold price, GDP growth rate and exchange rates may be linked in the long run by sensex on the condition that they are not volatile or stationery. For the principle of stationarity test, this study apply ADF unit root test, both at levels and at 1st differences, mentioned in hopethesis-1 above.

***Table-2.*** *ADF Unit Root Test*

| | At levels | | | | 1st differences | | | |
|---|---|---|---|---|---|---|---|---|
| | 1% | 5% | 10% | t-stat | 1% | 5% | 10% | t-stat |
| LER | -3.77 | -3.00 | -2.64 | -3.91 | -3.77 | -3.01 | -2.64 | -7.53 |
| LGDP | -3.77 | -3.00 | -2.64 | -5.08 | -3.78 | -3.01 | -2.65 | -6.72 |
| LGP | -3.77 | -3.00 | -2.64 | -1.77 | -3.79 | -3.01 | -2.64 | -3.98 |
| LOP | -3.77 | -3.00 | -2.64 | -0.56 | -3.81 | -3.02 | -2.65 | -4.73 |
| LSX | -3.77 | -3.00 | -2.64 | -1.03 | -3.77 | -3.01 | -2.64 | -6.03 |

Table 2 demonstrate the ADF unit root test results both at levels and 1st differences while it validates that exchange rates, GDP growth and sensex are stationary both at levels and 1st differences but crude oil price and gold price are not stationary at level but stationary at 1st difference. The unit root test additionally corroborates that constant variance is observed in case of error terms so as to designates statistical reliance.

### *4.2. Johansen Cointegration Test Results*

Because chosen variables are stationary either a level or 1st difference, consequently, johansen cointegration technique can be useful to identify the cointegration association among the variables in the long run. Simultaneously, this technique can be determined the cointegration vectors. For the reason that we recognize, two likelihood ratios, to be exact, the Trace Test and the Maximum Eigen Value test can determine the cointegration vectors. At the time of test, this study presumes linear deterministic trend unrestricted with intercepts without trends in view of use a lag of 1 to 4 at 1st differences based on Swartz Information Criterion (SIC) for the preferred under the study.

***Table-3. J**ohansen Cointegration Test*

| **Unrestricted Cointegration Rank Test (Trace)** | | | | |
|---|---|---|---|---|
| **Hypothesized** | | **Trace** | **0.05** | |
| **No. of CE(s)** | **Eigenvalue** | **Statistic** | **Critical Value** | **Prob.**** |
| None * | 0.714284 | 78.45679 | 69.81889 | 0.0087 |
| At most 1 * | 0.641627 | 52.14892 | 47.85613 | 0.0187 |
| At most 2 * | 0.505664 | 30.59910 | 29.79707 | 0.0403 |
| At most 3 * | 0.435842 | 15.80375 | 15.49471 | 0.0449 |
| At most 4 | 0.164846 | 3.782925 | 3.841466 | 0.0518 |
| Trace test indicates 4 cointegrating eqn(s) at the 0.05 level | | | | |
| * denotes rejection of the hypothesis at the 0.05 level | | | | |
| **MacKinnon-Haug-Michelis (1999) p-values | | | | |
| Unrestricted Cointegration Rank Test (Maximum Eigenvalue) | | | | |
| Hypothesized | | Max-Eigen | 0.05 | |
| No. of CE(s) | Eigenvalue | Statistic | Critical Value | Prob.** |
| None | 0.714284 | 26.30787 | 33.87687 | 0.3023 |
| At most 1 | 0.641627 | 21.54982 | 27.58434 | 0.2444 |
| At most 2 | 0.505664 | 14.79535 | 21.13162 | 0.3035 |
| At most 3 | 0.435842 | 12.02083 | 14.26460 | 0.1099 |
| At most 4 | 0.164846 | 3.782925 | 3.841466 | 0.0518 |
| Max-eigenvalue test indicates no cointegration at the 0.05 level | | | | |
| * denotes rejection of the hypothesis at the 0.05 level | | | | |
| **MacKinnon-Haug-Michelis (1999) p-values | | | | |

Table-3 shows the Johansen cointegration test results so as to provides security concerning relationship among crude oil price, Indian gold price, GDP growth rate, exchange rates and sensex in the long run for the reason that trace statistics is more than critical value in case of both the likelihood ratio test, specifically, the trace test and the maximum eigenvalue test. Consequently, Johansen cointegration test results reject the null hypothesis. This test as well established the number (two) of cointegration vectors. It is moreover representing that two common stochastic trends or a degree of market integration are there.

## 5. Conclusions

The main finding of this research work is that chosen variables are stationery, to be exact; it is a pointer of the relationship among all the variables under the study and sensex in the long run. Johansen cointegration technique indicates that safe cointegration association between the preferred variables under the study is greatly present in the long run. This finding is not contradicted with the policy of economy as well as the results of empirical studies approved by RBI (as working papers), to be exact, this research effort is linked with the thinking of policymakers of the Indian government. Indian stock market index is very depending upon the price of international crude oil price, gold price, exchange rates and GDP growth. This study is not free from certain limitation, to be exact, this research work do not consider inflation rates and trade deficits. Because of huge import bill, Indian trade deficit has been increased commendably, as a result, inflation rates have been increased significantly whose influences do not consider here.

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