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An Analysis of Interaction among Macroeconomic Variables through Cointegration and Causality Approach

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Abstract

This paper aims at examining the relationship between stock market prices (Nifty 50) India & macroeconomic variables (Exchange rate, Foreign Institutional Investment and Crude oil prices) for the period 2007-08 Q1 to 2017-18 Q3. In order to achieve the objectives of the study, the researchers employed Granger Causality, multiple regression and Johansen's Cointegration test. The results confirmed that there is a unidirectional relationship between crude oil prices and stock prices. Further the study confirms that FII and Oil prices are individually capable of influencing stock prices. Johansen's Cointegration test exhibits the absence of long run relationship between stock prices and macroeconomic variables (Exchange Rate and Oil prices). However, the findings put forth by the present study affirmed that Foreign Institutional Investment and Oil prices are capable of individually influencing Stock prices of Nifty 50. The null hypothesis of regression model, that is, macroeconomic variables have no impact on stock prices has been rejected because the f-statistic shows that the macroeconomic variables have statistically significant relationship with stock prices (Nifty 50).

Keywords: Crude Oil Prices, FIIs, Nifty-50, Granger Causality

Introduction

Stock markets across countries help in capital formation by receiving funds from surplus units and pave ways to invest in deficit units to bring about expansion in business activities. The stock market is one of the most important indicators as it represents overall market sentiment through a set of stocks. It is a barometer of market behaviour, it reflects market direction and indicates day-to-day fluctuations through stock prices. There are two major indices in India, namely Sensex and Nifty. The returns change rapidly with the changing environment. Various macroeconomic variables can affect stock market returns differently. For instance, Currency appreciation is one of the factors that negatively affects the domestic stock market for an export dominant country and positively affects the domestic stock market for an import dominant country. The relationship between stock prices and macroeconomic variables has been preferred for research by many researchers, particularly in developed countries. Several studies have shown that changes in stock prices are linked with macroeconomic factors. The macroeconomic factors that affect the stock returns could vary from country to country. Since the inception of the economic reforms in June 1991, the implementation of various reform measures in the different segments of the financial markets, particularly since 1991, has brought about a dramatic change in the financial architecture of the

Indian economy. On the whole, the reform of institutions, introduction of new instruments, and widening of network of participants called for a re-examination of the relationship between the financial sector and the economic sector in India. Presently, research is also being carried to understand the current working of economic and financial system in the new scenario. Interesting results are emerging particularly from the developing countries where the markets are experiencing new relationships which were not perceived earlier.

Literature Review

While reviewing previous literature on the subject, it has been observed that theories were the most important means of explaining the relationship between stock prices and economic forces at the macro level. The theoretical linkage can directly be obtained from the present value model or the dividend discount model (DDM) and the arbitrage pricing theory (APT). The present value model focused on the long-run relationship, whereas, the arbitrage pricing theory focused on short-run relationship between the stock market movement and the macroeconomic fundamentals. According to these models, any new information about the essential macroeconomic factors such as, real output, inflation, money supply, interest rate and so on, may influence the stock prices/returns through the impact of expected dividends, the discount rate or both (Chen et al., 1986).

The empirical evidence in the literature provides mechanism for explaining the validity of the relationship between macroeconomic forces and stock returns. Therefore, the review of both theoretical and empirical literature is essential in investigating the relationship between macroeconomic forces and stock returns, as it enables the researcher to know the work done in the subject area by other researchers. It also makes the researchers to identify the macroeconomic factors that can potentially influence the returns of stock (Saeed and Akhter, 2012).

The prior empirical works on the relationship between macroeconomic factors and stock returns can be divided into two broad categories. The first category is such studies which investigated the impact of macroeconomic factors on stock prices and the second category of studies focused on the relationship between the stock market volatility and volatility in the macroeconomic indicators. Since the present study is based on the first category, some of the relevant literatures on the macroeconomic determinants of stock prices have been reviewed.

The researchers have undertaken the review of some of the major studies which has been summarised below. The review has been bifurcated into two parts, in the first part, the researchers have undertaken the review of developed economies and the second part takes care of developing economies.

Impact of Macroeconomic factors on developed countries:-

Cheung and Ng (1998), employed Johansen's Cointegration technique with quarterly data from 1957-1992 for Canada, Germany, Italy, Japan and US, and conclude that there are long term co movements between the national stock index and some specific variables, such as real oil price, real consumption, real money supply and real GNP output in those five countries. Furthermore, the authors found that the real returns on stock indexes are, generally, related to deviations from empirical long-term relationships and to changes in macroeconomic variables.

Maysami and koh (2000) used the Johansen Cointegration test to examine the dynamic relations between Macroeconomic variables and Singapore Stock Market, as well as the association between U.S and Japanese Stock Exchange and Singapore Stock Exchange by using month-end data for the period from January 1988 to January 1995. They examined that inflation, money supply growth, changes in short- and long-term interest rates, and variations in exchange rate do form a Cointegration relation with changes in Singapore's stock market levels. In particular, Singapore's stock market has a positive long-run equilibrium relation with the U.S. and Japanese markets, the largest two in the world.

Ratanapakorn and Sharma (2007) examined the short-term and long-term relationships between the six macroeconomic variables and US stock price index (S&P 500) for the period ranging from 1975 to 1999. They found that the stock prices relate positively to exchange rate and every macroeconomic variable granger causes the stock prices in the long-run but not in the short-run.

Nandha and Faff (2008) examined whether and to what extent the adverse effect of oil price shocks impacts stock market returns. They analysed 35 DataStream global industry indices for the period from April 1983 to September 2005. The findings indicate that oil price rises have a negative impact on equity returns for all sectors except mining, oil and gas industries. Generally, these results are consistent with economic theory and evidence provided by previous empirical studies. Little evidence of any asymmetry is detected in the oil price sensitivities.

Humpe and Macmillan (2009) analyzes the macroeconomic variables that influence stock prices in US and Japan. Cointegration analysis has applied to examine the long term relationship between money supply, industrial production, consumer price index, long term interest rate and stock prices in US and Japan. The study showed that stock prices in US are positively related to industrial production and negatively related to consumer price index and long term interest rate. The result further concluded money supply was insignificant but showed a positive relationship with stock prices in US. For Japan, they found stock prices are positively related to industrial production and negatively related to money supply.

Masuduzzaman (2012) applied Johansen co-integration, error correction model, variance decomposition and impulse response functions on consumer price index (CPI), interest rates, exchange rates, money supply and industrial productions between the periods of February 1999 to January 2011. The Johansen Cointegration tests concluded that the UK (FTSE100 of London stock exchange) and German stock returns (DAX30 of Frankfurt stock exchange) and chosen five macroeconomic variables are cointegrated. The result also indicate that there are both short and long run causal relationships between stock prices and macroeconomic variables.

Shabani (2015) examines the impact of macroeconomic variables on FTSE100 Index. The selected macroeconomic variables are industrial production index (IPI), money supply (M1), consumer price index (CPI) as a proxy for inflation, exchange rate (ER) and interest rate (IR). The study used data of monthly time series from January 1995 to December of 2014. The unit root tests and Johansen Cointegration tests were applied. The findings concluded that industrial production index, money supply and interest rate are cointegrated and have a long run equilibrium relationship. The consumer price index and exchange rate showed positive relationship with the FTSE100 Index over the long run, whereas IPI, money supply and interest rate showed negative long-run relationships with the FTSE100 Index. Granger causality test showed bi-directional causality between CPI and IPI and unidirectional causality between FTSE100 and exchange rate, FTSE100 and IPI, money supply (M1) and interest rate, interest rate and IPI, exchange rate and money supply (M1), money supply (M1) and IPI, exchange rate and IPI.

After reviewing various research articles consistent results have been observed that there is relationship and impact of various macroeconomic variables on stock returns.

Impact of macroeconomic factors on developing countries:

Wongbangpo and Sharma (2002) investigate the role of select macroeconomic variables, i.e., GNP, the consumer price index, the money supply, the interest rate, and the exchange rate on the stock prices in five ASEAN countries (Indonesia, Malaysia, Philippines, Singapore, and Thailand). The study observes long and short term relationships between stock prices and macroeconomic variables, therefore, concluded that macroeconomic variables in these countries are caused by stock prices.

Robert D. Gay (2008) examines the time series relationship between macroeconomic variables (exchange rate and oil price) and the stock market index prices for Brazil, Russia, India, and China (BRIC) from 1999-2006 using the Box-Jenkins ARIMA model. Although no significant relationship was found between respective exchange rate and oil price on the stock market index prices of either BRIC country. Also, there was no significant relationship found between present and past stock market returns, suggesting the markets of Brazil, Russia, India, and China exhibit the weak-form of market efficiency.

Rahman, Sidek and Tafri (2009) explores the interactions between selected macroeconomic variables and stock prices for the case of Malaysia from 1985 - 2008. Upon testing a VECM, they show that changes in Malaysian

stock market index do perform a cointegrating relationship with changes in money supply, interest rate, exchange rate, reserves and industrial production index. Furthermore, Malaysian stock market has stronger dynamic interaction with reserves and industrial production index as compared to money supply, interest rate, and exchange rate.

Hosseini, Ahmad and Lai (2011) investigates the relationships between stock market indices and macroeconomics variables, namely money supply, crude oil price, industrial production and inflation rate in China and India between January 1999 to January 2009. Using the Augmented Dickey-Fuller unit root test, the underlying series are tested as non-stationary at the level but stationary in first difference. The use of Johansen-Juselius (1990) Multivariate Cointegration and Vector Error Correction Model technique, indicate that there are both long and short run linkages between macroeconomic variable and stock market index in each of these two countries.

Naik and Padhi (2012) inquired the relationships between the Indian stock market index (BSE Sensex) and five macroeconomic variables, namely, wholesale price index, industrial production index, treasury bills rates, money supply and exchange rates over the period 1994–2011. Johansen's co-integration and vector error correction model have been applied. The analysis discloses a long-run equilibrium relationship exists between them, it is observed that the stock prices positively relate to the money supply and industrial production but negatively relate to inflation. The exchange rate and the short-term interest rate are found to be insignificant in determining stock prices. By using Granger causality test it was examined that macroeconomic variable causes the stock prices in the long-run but not in the short-run.

Issahaku, Ustarzand Domanban (2013) uses monthly time series data for the period from January 1995 to December 2010 to examine the impact of macroeconomic variables on Ghana stock market, Unit root test, Vector Error Correction (VECM) and Granger Causality test is performed. The study found that neither long run nor short run significant relationship exists between stock returns and exchange rate. Only causal relationship exists from exchange rate to stock returns.

Islam and Habib (2016) applied the multivariate extension of the classical linear regression model and Granger Causality test to re-establish the relationship between macroeconomic variables (inflation, industrial production, exchange rate, money supply, interest rate, and oil price) and stock returns from 2005 to 2015 using monthly observations on Indian Stock Market. The result of this study shows that only exchange rate has a significant negative impact on stock returns. The other macroeconomic variables are not significantly affecting stock returns; however, their impact is in accordance with the economic theory. The Granger Causality test reveals absence of any causal relationship, except in case of oil prices, where we find a unidirectional causal relationship running from stock returns to oil prices.

Ali, Chisti and Sangmi (2013) used granger causality test for the period 2009-2012 to determine whether there exists bidirectional relationship between foreign exchange price and stock market prices or not. The study concluded that there exists no causality relationship between them.

Bhuvaneshwari and Ramya (2017) studied the Cointegration and causal relationship between Indian stock prices and exchange rate, using the monthly data for the period Jan 2006-Dec 2015. The results show the absence of long run relationship between stock prices and exchange rate but by bidirectional causality running from Indian stock prices to exchange rate and vice-versa.

After reviewing various studies on impact of different macroeconomic variables on stock prices, conflicting results have been observed. Some studies concluded the absence of long run relationship and some concluded presence of both long as well as short run relationship.

Research Gap and Objective of the study

After analyzing the review, it has been found that there are various studies that examine the relationship between macroeconomic variables and stock market prices. But not much attention has been given on the impact of

macroeconomic variables on stock prices. The present study is, therefore, aimed at contributing to the existing literature in Indian context by a three-fold objective of research study.

1. To study the causal relationship between Stock market prices (Nifty 50) and macroeconomic variables with the help of Granger Causality Test
2. To check the degree of impact of macroeconomic variables on Stock market prices with the help of Regression.
3. To study the long run relationship between Stock market prices (Nifty 50) and macroeconomic variables with the help of Johansen's Cointegration Test.

Hypotheses

H₀₁: There is no statistically significant causal relationship between stock market prices and macroeconomic variables.

H₁: There is a statistically significant causal relationship between stock market prices and macroeconomic variables.

H₀₂: There is no statistically significant impact of macroeconomic variables on stock market prices.

H₂: There is a statistically significant impact of macroeconomic variables on stock market prices.

H₀₃: There is no statistically significant long run relationship between Stock market prices and macroeconomic variables.

H₃: There is a statistically significant long run relationship between Stock market prices and macroeconomic variables

Data-Base and Research Methodology

To accomplish the research objectives, Quarterly data ranging from April, 2007 (Q1) to December, 2017 (Q3) are obtained. Secondary data used for the study were sourced from different sources. The Dependent variable i.e., Stock market prices (*STPC*) (Nifty 50) were collected from NSE (National Stock Exchange) and IIFL (India Infoline Finance Limited). Descriptions of macroeconomic variables and data sources are presented in Table 1:

Table 1. Data Sources

S. No	Macroeconomic Variables	Symbol	Source	Full Form
1.	Exchange Rate	EX	FRED	Federal Reserve Economic Data
2.	Foreign Institutional Investment	FII	CDSL	Central Depository Services Limited
3.	Crude Oil Prices	OIL	OECD	Organisation for Economic Co-operation and Development
4.	Index Price	NIFTY-50	NSE	The National Stock Exchange of India.

Source: Author's own compilation

Time Series Data

It is a series of data points typically consisting of successive measurements made over a time interval. For Instance, General Price, Income over a period of time, stock prices daily.

Stationary time series

A stationary time series is a stochastic process if its mean and variance remain constant over a period of time. The joint probability distribution of series does not change when shifted with time.

Non-Stationary time series

Non-Stationary time series is a series whose mean and variance or any one of them is a function of time. If a series is a non-stationary one then persistence of shocks will be infinite hence leading to wrong estimation of the terms and can lead to spurious regression.

Unit Root

It is a feature of some stochastic processes that can cause problems in statistical inference involving time series models. A stochastic process has a unit root if 1 is a root of the process's characteristics equation.

Tools & Techniques

Time series data used in this study has been analyzed with the help of following tools and techniques in order to achieve the above set objectives.

Unit Root Test

A unit root test tests whether a time series variable is non-stationary and possesses a unit root. The null hypothesis is generally defined as the presence of a unit root and the alternative hypothesis is either stationary, trend stationary, or explosive root depending on the test used. To test the unit root in a data series different tests are available like Augmented Dickey Fuller (ADF), Philips Perron test (PP), Kwiatkowski Phillips Schmidt Shin (KPSS) test, Elliott-Rothenberg Stock Test, Zivot Andrews Test, etc. ADF is the most commonly used unit root test and the same has been applied for this study.

Augmented Dickey Fuller (ADF)

The ADF test developed by Dickey and Fuller (1979, 1981) is most commonly used unit root test. An augmented Dickey–Fuller test (ADF) tests the null hypothesis that a unit root is present in a time series sample. The alternative hypothesis is different depending on which version of the test is used, but is usually stationary or trend-stationary. It is an augmented version of the Dickey–Fuller test for a larger and more complicated set of time series models. The augmented Dickey–Fuller (ADF) statistic, used in the test, is a negative number. The more negative it is, the stronger the rejection of the hypothesis that there is a unit roots at some level of significance. ADF test has been applied to test the stationary status of the data using E-Views 10 software.

Consider here variable X, methodological discussion relating to the study. If the calculated Augmented Dickey–Fuller (ADF) test- statistics is more than its critical value, then X is said to be stationary or integrated to order zero, i.e., I (0). If this is not the case, then the ADF test is performed on the first difference of X i.e., D(X,2). If D(X,2) is found to stationary then X is integrated order one i.e., I (1). If this is not also the case, then ADF test is performed on the second difference of X i.e., D(X,3). If D(X,3) is found to be stationary then X is integrated of order second i.e., I (2). The ADF test can be carried out using intercept, trend and intercept or none. The following model has been used to carry out the ADF test.

At Level:

When Intercept is used

$$D(X) = \alpha + \beta X(-1) + \varepsilon$$

When Trend and Intercept are used

$$D(X) = \alpha + \beta X(-1) + \theta + \varepsilon$$

When none is used

$$D(X) = \beta X(-1)$$

At 1st difference:

When Intercept is used

$$D(X, 2) = \alpha + D(\beta X(-1)) + \varepsilon$$

When Trend and Intercept is used

$$D(X, 2) = \alpha + D(\beta X(-1)) + \theta + \varepsilon$$

When none is used

$$D(X, 2) = D(\beta X - 1)) + \varepsilon$$

At 2nd difference:

When Intercept is used

$$D(X, 3) = \alpha + D(\beta X(-1), 2) + \varepsilon$$

When Trend and Intercept is used

$$D(X, 3) = \alpha + D(\beta X(-1), 2) + \theta + \varepsilon$$

When none is used

$$D(X, 3) = D(\beta X(-1), 2) + \varepsilon$$

Here,

D = Difference

X = Variable

α = Intercept or Constant

β = Coefficient of variable

θ = Trend

ε = Error term

Granger Causality Test

Engle-Granger (1969) causality model is used to test the causality between the stock market and macroeconomic variables. Granger causality test is applied on a stationary series. To describe the Granger causality, X Granger causes Y when past values of X are able to give explanation of Y. This causality is only associated with time series variables.

In this study the test is based on following two regression equations:

$$X = \beta_1 * X_{t-i} + \beta_2 * Y_{t-j} + \varepsilon_1$$

$$Y = \beta_3 * X_{t-i} + \beta_4 * Y_{t-j} + \varepsilon_2$$

Here,

X and Y = variables

B = coefficient of variables at lag

ε = residual

The null hypothesis that $\beta = 0$ can be tested by using the standard F-test. The E-views 10 software is used for Granger causality test.

There are following four possibilities of cause and effect:

1. Unidirectional causality from X to Y is indicated when X cause Y.
2. Unidirectional causality from Y to X is indicated when Y cause X.
3. Feedback, or bilateral causality is suggested when the sets of X and Y both cause each other.
4. Independence is suggested when none cause each other.

Lag-Length Criteria

Lag length is very important in Granger Causality test. There are many lag length selection criteria such as Akaike Information Criterion, Schwarz Information Criterion, Hannan-Quinn Criterion and Final Prediction Error. In this study lag length is determined on the basis of Akaike Information Criterion.

Regression

In this study, multiple regression is being employed to measure the degree of impact of macroeconomic variables on stock market prices. It is a statistical measure used to determine the strength of the relationship between one dependent variable and a series of other independent variables.

$$Y = a + b_1 * X_1 + b_2 * X_2 + b_3 * X_3 + \dots + b_n * X_n + \varepsilon$$

Here,

Y = Dependent variable

a = constant

b = coefficient of variables

X = Independent variables

ε =Residual

The below model of regression is used in the study:

$$STPC = \alpha + \beta_1 * EX + \beta_2 * FII + \beta_3 * OIL + \varepsilon$$

α = Constant

$STPC$ = Stock prices

β = Coefficient of variables

EX = Exchange Rate

FII = Foreign Institutional Investment

OIL = Oil prices

ε = Residual

Johansen's Co integrating Test

To conduct the co integration test, the Engel and Granger (1987) or the Johansen and Juselius (1990) or the Johansen (1991) approach can be used. The Johansen's test is used in this study because it is the superior test for co integration. With the non-stationary series, co integration analysis has been applied to examine whether the long run relationship exists between variables. When two variables are co integrated, it implies that the two time series cannot wander off in opposite directions for very long. The Johansen approach to co integration test is based on two test statistics, viz., Trace statistic, and Maximum Eigen value statistic to identify number of co-integrating vectors among variables. Trace statistic tests the null hypothesis of r co integrating relations against the alternative of k co integrating relations, where k is the number of variables used in the test whereas Max-Eigen statistic tests the null hypothesis of r co integrating relations against the alternative of $r+1$ co integrating relations.

Results and Analysis

The study aims at examining the statistically significant causal relationship, impact and longrun relationship between Stock prices and various macroeconomic variables like Exchange Rate, Foreign Institutional Investment and Oil prices. With a view to accomplish the objectives of the study various methods have been adopted to derive the results. The results are shown below:

AUGMENTED DICKEY-FULLER TEST

The Augmented Dickey Fuller Test has been used to check whether the time series data has a unit root or not. ADF has been applied on all the variables namely Stock prices (STPC), Exchange Rate (EX), Foreign Institutional Investment (FII) and Oil prices (OIL), each having 43 observations of quarterly data ranging from 2007 to 2017 using E-views 10 software.

The hypotheses for the test are:

H_0 : Variable has a unit root

H_1 : Variable has no unit root.

The objective of the ADF test is to check the stationary of the time series data so that further tests such as Granger causality and regression analysis can be performed on the data and the results obtained are reliable. In this test, for verifying the test type of the time series, graph has been drawn. Schwarz information criterion (SIC) has been used by software (i.e., by default) to choose the lag values. The variables are tested on level and first difference. To test the hypothesis, 5% level of significance is used. The results are depicted in Table 2 and Table 3.

Table 2. ADF on Level Form

Variables	Test type	t-statistic	Critical value	P value	Result
STPC	Trend and Intercept	-2.000289	-3.520787	0.5842	Non-stationary

EX	Trend and Intercept	-2.179157	-3.520787	0.4880	Non-stationary
FII	Trend and Intercept	-5.181747	-3.520787	0.0007	Stationary
OIL	Trend and Intercept	-1.801054	-3.520787	0.6864	Non-stationary

Source: Author's own compilation

Table 3: ADF on 1st Differenced Form

Variables	Test type	t-statistic	Critical Value	P value	Result
STPC	Trend and Intercept	-4.764129	-3.523623	0.0022	Stationary
EX	Trend and Intercept	-6.958756	-3.523623	0.0000	Stationary
OIL	Trend and Intercept	-5.125793	-3.523623	0.0008	Stationary

Source: Author's own compilation

Table 2 indicates that the computed ADF test-statistics of variable FII is greater than the critical value (5% level of significance) and also P value (i.e., probability value) is less than 0.05, therefore null hypothesis is rejected. For other variables, STPC, EX and OIL null hypothesis cannot be rejected because the probability value of ADF test-statistics is greater than 0.05. That means these variables are non-stationary on level, and to make them stationary the data has been converted into 1st difference.

From Table 3, it is apparent that all the variables have ADF test-statistics greater than critical value (5% level of significance) and also P value is less than 0.05. Therefore, the variables in Table 3 at 1st difference become stationary. Now it is possible to apply the Granger Causality Test and Regression Analysis for the study.

GRANGER CAUSALITY TEST

The first step of Granger causality test is to select the optimal level of lag. The lag means that the data is differenced at 1 i.e., t-1. VAR selection criterion has been used to select the lag.

Table 4: VAR Lag Order Selection Criteria

Endogenous Variables: DSTPC DEX FII DOIL

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1060.923	NA*	2.58e+19*	56.04858*	56.22096*	56.10991*
1	-1050.611	17.91015	3.50e+19	56.34795	57.20984	56.65461
2	-1037.361	20.22390	4.17e+19	56.49268	58.04408	57.04466
3	-1028.697	11.40005	6.6e+19	56.87879	59.11969	57.67608
4	-1011.897	18.56853	7.45e+19	56.83668	59.76709	57.87930

Source: Author's own compilation

* indicates lag order selected by the criterion.

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final Prediction error.

AIC: Akaike Information Criterion

SC: Schwarz information Criterion.

HQ: Hannan-Quinn information criterion.

Akaike information criterion (AIC) has been used to select the optimal level of lag for the test. Based on the results depicted in Table 4, AIC chooses the lag with least value i.e., lag 0. While using the lag 0 in the test the software automatically uses the lag 2 because the values of lag 0 are equal to lag 2. Therefore, lag 0 = lag 2.

Granger Causality Test is used to empirically examine the first objective of the study that is, to examine the causal relationship between stock market prices (Nifty 50) and macroeconomic variables. The hypotheses for Granger causality test are:

H₀: Macroeconomic variables do not Granger cause stock prices

Stock prices do not Granger cause macroeconomic variables

H₁: Macroeconomic variables do Granger cause stock prices

Stock prices do Granger cause macroeconomic variables

Table 5: Granger Causality Test

Null Hypothesis	f-statistics	p-value	Result	Relationship
DEX does not Granger Cause DSTPC	0.67885	0.5138	Do not reject null hypothesis	No relationship
DSTPC does not Granger Cause DEX	0.49987	0.6109	Do not reject null hypothesis	
FII does not Granger Cause DSTPC	0.08866	0.9154	Do not reject null hypothesis	No relationship
DSTPC does not Granger Cause FII	0.32722	0.7231	Do not reject null hypothesis	
DOIL does not Granger Cause DSTPC	4.76794	0.0147	Reject null hypothesis	Unidirectional relationship
DSTPC does not Granger Cause DOIL	0.22867	0.7968	Do not reject null hypothesis	

Source: Author's own compilation

From the analysis of the table 5, all the variables except crude oil prices have p-value more than 0.05 for their respective f-statistics, concluded that the null hypotheses are accepted. In case of oil, there exists a unidirectional relationship means that oil prices (DOIL) are Granger causing stock prices (DSTPC) but stock prices (DSTPC) are not Granger causing crude oil prices (DOIL). In India only oil prices can be used to predict the stock prices.

REGRESSION

Multiple regression analysis has been used to examine the impact of macroeconomic variables on stock prices. The hypotheses of the test are:

H₀: Macro economic variables have no impact on stock prices

H₁: Macro economic variables have an impact on stock prices

The below model has been used for the study:

$$DSTPC = \alpha + \beta_1 * DEX + \beta_2 * FII + \beta_3 * DOIL + \varepsilon$$

The results are shown in table 6.

Table 6: Regression Results

Dependent Variable: DSTPC

Variable	Coefficient	Std. Error	t-statistic	Prob.
C	-83.01323	86.68118	-0.957685	0.3443

DEX	-21.50897	32.68187	-0.658132	0.5144
FII	0.027854	0.006175	4.510864	0.0001
DOIL	0.251828	0.091604	2.749098	0.0091
R-squared	0.507718	Mean dependent var	142.6905	
Adjusted R-squared	0.468853	S.D. dependent var	516.3393	
S.E. of regression	376.3072	Akaike info criterion	14.78908	
Sum squared resid	5381069.	Schwarz criterion	14.95457	
Log Likelihood	-306.5707	Hannan-Quinn criter.	14.84974	
F-Statistic	13.06383	Durbin-Watson stat	1.868795	
Prob.(F-Statistic)	0.000005			

Regression exhibit that macroeconomic variables of the model i.e., Exchange Rate, Foreign Institutional Investment and Oil prices have an R^2 value of 50.77% which means only 50.77% of impact is caused by the above mentioned variables and the rest i.e., 49.23% is caused by the external variables not included in the model. The result also shows that only two variables namely, FII and DOIL are statistically significant at 5% level of significance, since the p-value of both of them does not exceeds 0.05. That means FII and DOIL are capable of individually influencing DSTPC of Nifty 50. DEX cannot influence individually DSTPC, since p-value exceeds 0.05 indicates that there is insufficient evidence in the data to conclude that a relationship exists between them. The f-statistics shows a probability of 0.000005 indicating that independent variables in the model have collectively statistically significant relationship with stock prices, means they can jointly influence stock prices. On the bases of above results, null hypothesis is rejected.

Further, the result shows that Foreign Institutional Investment and Oil prices both has positive relationship with stock prices. That means the coefficient of FII indicates that if there is a 1 unit increase in Foreign Institutional Investment (FII), on an average the stock prices (DSTPC) would increase by 0.027854 units and vice versa provided other variables are constant. The result clearly shows that whenever Foreign Institutional Investors have withdrawn money, the stock prices have fallen and vice versa. The FII is increasing now because of various steps taken by the NDA government to encourage foreign investors to take India seriously. India has received net investments of INR 11944.31 crores in the third quarter of 2017 from FIIs. The investment made by foreign investors reflects their confidence and highly favourable sentiment for the Indian market.

The coefficient of oil prices also indicates that if there is a 1 unit increase in oil prices (DOIL), on an average the stock prices (DSTPC) would increase by 0.251828 units and vice versa provided other variables are constant. Conventional wisdom states that there is a negative relationship between oil prices and stock prices. But the study that has been conducted shows that sometimes the prices of stocks and oil move in the same direction, sometimes in opposite directions but on average, it moves in the same direction. It is not possible to track the exact reason for this situation because of different factors that might affect the stock prices.

JOHANSEN's COINTEGRATION TEST

To investigate the long run relationship between stock prices and macroeconomic variables namely EX and OIL Johansen Co integration Test has been employed. This test can only be used on the non-stationary variables in the study. In order to carry out the test, it is necessary to make the assumption regarding the trend underlying the data. Under Deterministic Trend Specification, Intercept (no trend) in CE and VAR has been selected from different options present because in this study variables have some sort of trend. It means the co integrating equations have only intercept but level data have trend. The number of lags has been selected by the Akaike Information Criterion i.e., lag 0. As is concluded by ADF test in Table 2, that all the variables considered except the Foreign Institutional Investment (FII) are I(1), while the FII is I(0). So for the testing of cointegration among the variables, the FII is dropped from the further analysis because it is already stationary means it already has a long run relationship with STPC. The test investigates the presence of cointegration vectors or relations in a non-stationary time series

through two likelihood tests of Trace test and Maximum Eigen value test. Thus, if two variables are found co integrated, it implies some relationship in the long-run.

The hypothesis for the Trace statistic test

H0: $r=0$

H1: $r \leq k$

The hypothesis for the Max-Eigen statistic test

H0: $r=0$

H1: $r= r+1$

Table 7: JOHANSEN's COINTEGRATION TEST

Series: STPC EX

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Trace Statistic	0.05 Critical value	Prob.**
None	4.709364	15.49471	0.8389
At most 1	0.039466	3.841466	0.8425

Source: Author's own compilation

Trace test indicates no co integration at the 0.05 level

*denotes rejection of the hypothesis at the 0.05 level

**Mackinnon-Hang-Michelis (1991) P-values.

Table 8: Unrestricted Cointegration Rank Test (Maximum Eigen value)

Hypothesized No. of CE(s)	Max-Eigen Statistic	0.05 Critical value	Prob.**
None	4.669898	14.26460	0.7828
At most 1	0.039466	3.841466	0.8425

Source: Author's own compilation

Max-Eigenvalue test indicates no cointegration at the 0.05 level

*denotes rejection of the hypothesis at the 0.05 level

**Mackinnon-Hang-Michelis (1991) P-value.

Table 9:

Series: STPC OIL

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Trace Statistic	0.05 Critical value	Prob.**
None	4.418048	15.49471	0.8671
At most 1	0.043505	3.841466	0.8347

Source: Author's own compilation

Trace test indicates no co integration at the 0.05 level

*denotes rejection of the hypothesis at the 0.05 level

**Mackinnon-Hang-Michelis (1991) P-values.

Table 10:

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Max-Eigen Statistic	0.05 Critical value	Prob.**
None	4.374543	14.26460	0.8179
At most 1	0.043505	3.841466	0.8347

Source: Author's own compilation

Max-Eigenvalue test indicates no cointegration at the 0.05 level

*denotes rejection of the hypothesis at the 0.05 level

**Mackinnon-Hang-Michelis (1991) P-value.

From the table 7 and 9, it is clear that the stock prices are not cointegrated with exchange rate and oil prices in the long run. It is concluded that null hypothesis in both Trace Test and Max-Eigen Value Test cannot be rejected because the probability of co integrating vector at none and at most 1 is greater than 0.05. That means neither there is a long run relationship between STPC and EX nor between STPC and OIL. All variables STPC, EX and OIL move in their own directions.

Conclusion

The stock prices are driven by expectation of corporate earnings. The stock prices of Nifty 50 are used in this study to examine the causal relationship, impact and long run relationship of various macroeconomic variables on Stock prices of Nifty 50. The results of the study reflect series of variables except FII used are not stationary at levels but at first difference. The Granger Causality test shows that there is a unidirectional relationship between oil prices and stock prices only. That means only oil prices can be used to predict the stock prices. In order to analyze the impact of macroeconomic variables on stock prices. The researchers employed regression analysis and concluded that only Foreign Institutional Investment and Oil prices are capable of individually influencing Stock prices of Nifty 50. The null hypothesis of regression model, that is, macroeconomic variables have no impact on stock prices has been rejected because the f-statistic shows that the macroeconomic variables have collectively statistically significant relationship with stock prices (Nifty 50).

Johansen's Co integration Test depicts that stock prices are not co integrated with exchange rate and oil prices in the long run.

Limitations

The study analyzes impact on stock market prices (Nifty 50) India in relation to only three macroeconomic variables. The research can be advanced by using more macroeconomic variables and also by extending the period of study.

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