International Journal of Advanced Research in Commerce, Management &Social Science (IJARCMSS)
ISSN :2581-7930, Impact Factor : 6.986, Volume 07, No. 04(I), October-December, 2024, pp 305-318

AN INVESTIGATION OF SHORT TERM AND LONG TERM RELATIONSHIP BETWEEN SELECT MACROECONOMIC VARIABLES AND STOCK MARKET PERFORMANCE IN INDIA

Mr. Somnath Mukhuti*
Dr. Pradipta Banerjee**

ABSTRACT

The study investigates the short term and long term relationship between select macroeconomic factors and stock market performance as measured by performance of Nifty 50 index of National Stock Exchange (NSE) in India using monthly log-transformed dataset for a period of ten years from 2012-2013 to 2021-2022. For analysing the long term and short term linkages amongst the select economic variables multiple correlation, regression, cointegration and error correction technique have been employed after performing different diagnostic tests like, test for serial correlation, heteroscedasticity, normality, and stability. The positive long term relationship among the select indicators is observed using Johansen cointegration method which indicates that the variables is going jointly in a positive way with upward movement of Nifty 50 return. However, only the short term causality is identified between the Nifty 50 return and interest rates and employing the error correction technique which implies that any change in the interest rate is having a direct impact on the Nifty 50 index. The findings of the study can help the investors in forecasting long term and short term movements of stock market and framing their decisions on investment by examining the movements of macro-economic variables considered in the study.

***KEYWORDS**: Macroeconomic Variables, Stock Market Performance, Nifty 50, Unit Root and Stationarity, Cointegration, Error Correction Model and Causality.*

Introduction

It has been well documented in the literature of finance that various macroeconomic indicators influence the stock market performance and impact the health, position and stability of an economy [Pethe & Karnik, 2000; Yartey, 2008; Pal & Mittal, 2011; Masoud, 2013; Kotha & Sahu, 2016; Gopinathan & Durai, 2019; Pal & Garg, 2019; Mukhuti & Banerjee, 2020; Liu & Feng, 2021; Dhingra & Kapil, 2021; Omer et al. 2022; Desai & Patel, 2022; Chikwira & Mohammed, 2023; Goel, 2023]. Fama, 1970 and Fama, 1981 documented that the security prices in the stock market incorporate all the relevant information and stock prices have a strong relationship with real output. The random market hypothesis suggests that stock prices reflect all the new information in the market while the Arbitrage Pricing Theory (APT) [Ross, 1976] suggest that the stock market performance depends on economic activities and the expected return on risky assets is significantly associated with various macroeconomic factors. As sustaining and promoting economic growth is the prime concern of every economy and there exist varying empirical evidences on the nature and extent of relationship between various macroeconomic variables and stock market performance and economic development, examining their relationship has appeared to be a key area of research. The present study examines the long term and short term linkages among the different macroeconomic indicators namely, gold price, interest rates, crude oil prices, inflation rates, exchange rates, consumer price index, volume of import and export, money supply and GDP, index of industrial production and stock market performance as measured by Nifty 50 index in India.

* Research Scholar, Department of Commerce, Sidho-Kanho-Birsha University, Purulia, West Bengal, India.
** Professor, Department of Commerce, Sidho-Kanho-Birsha University, Purulia, West Bengal, India.

Literature Review

A substantial body of literature in the field of stock market have aimed to predict the relationship among the several macroeconomic indicators and stock market movements in different economies around the globe. The study by Naka et al. (1998) observed the relationship among industrial production, inflation, consumer price index, money supply and money stock, interest rate and sensex in Indian stock market. Similar variables have also been used by Chen et al., (1986), Darrat and Mukherjee (1987), Lee (1992), Mukherjee and Naka (1995) and Naka and Tufte (1998); and others using the unit root test (Dickey & Fuller, 1981), Johansen-based co-integration method (Johansen, 1991; Johansen, 1995; Johansen & Juselius, 1990; Johansen & Juselius, 1994) and vector error correction model (Engle & Granger, 1987). These studies found that three out of six variables are co-integrated in the long run and inflation was found to be a severe signalling indicator of the performance of the Indian stock market. Naka et al., (1996) observed the relationship between the Indian stock market and macroeconomic factors using a vector error correction model and suggested that output and inflation are two vital factors affecting stock prices. Bhunia and Das (2012), Mukhuti and Bhunia (2013), Bhunia and Mukhuti (2013) and Ibrahim and Musah (2014) investigated that the long term connection among the selected indicators namely crude oil price, domestic gold price, exchange rates, inflation, money supply and stock prices in Indian stock market. However, Banerjee and Mukhuti (2020) examined the association between gold price, exchange rate and Indian stock market return and documented that the variables are not co-integrated but a short term connection exists between the exchange rates, gold prices and stock market returns in Indian.

Lee (1992) investigated the association among the interest rates, inflation, real activity and returns of the United States stock market and showed that stock market return explains the positive real activity and a small variation of inflation rates. In the same way, interest rate explains a significant fraction of the variation of inflation rates. Mukherjee and Naka (1995) examined the dynamic relationship among the Japanese stock market and selected macroeconomic variables, i.e., inflation, exchange rates, money supply, rate of government bond, rate of call money, industrial production and share prices by employing the cointegration technique, vector autoregressive and error correction model. The research works of Cheng and Ng (1998), Kwon and Shin (1999) and Smith (2001) explored the long term connection between the macroeconomic indicators and the developed economies stock market prices such as European economies, United States, Canada, Australia, Japan and other by using cointegration technique and Ibrahim and Hassanuddeen (2003) explored a short term and long term positive connection concerning the Malaysian stock market prices with the consumer prices and industrial production while the exchange rates and money supply found to have an adverse relationship with stock prices. Brahmasrene (2007) and Acikalin et al. (2008) found a positive cointegrating connection between the money supply and stock market performance, while a negative relationship between the industrial production and the performance of stock market in Thailand. Similarly, Acikalin et al. (2008) found a long term stable connection and the unidirectional causal relationship among the balance of current account, interest rates, GDP, exchange rate, and the returns of stock market in Istanbul stock exchange. Naik and Padhi (2012) observed that a long term positive connection amongst the industrial production and money supply while the adverse relationship between the inflation and stock prices.

Research Gap

From the existing body of literature examining relationship between different macroeconomic variables and stock market performance, it has been observed that most of the studies have considered the stock market of developed economies around the globe. Moreover, a very few studies have been found those have considered a comprehensive set of macroeconomic indicators those are expected to have a significant relationship with the stock market performance. In the present study, a modest attempt has been made to empirically investigate the relationship among a comprehensive set of macroeconomic factors and the performance of stock market as measured by Nifty 50 index of the National Stock Exchange in India.

Objectives of the Study

The main objective of this present research is to investigate the relationship among major macroeconomic indicators (namely, gold and crude oil prices, interest rates, real broad effective exchange rates, exchange rates, inflation rate and consumer price index, volume of import and export, money supply in terms of broad money, GDP and index of industrial production) and Nifty 50 in India. More specifically, the objectives of the present study are as follows:

- To analyze the long term connection among the selected macroeconomic indicators on the return of Nifty-50.
- To examine the short term connection among the selected macroeconomic indicators on return of Nifty-50.

Database and Methodology

Database

To capture the association among the select macroeconomic factors and the performance of stock market, returns of Nifty 50 has been utilised as an alternative and macroeconomic indicators namely gold prices, crude oil prices, interest rates and exchange rates, inflation rates and consumer price index, volume of import and export, money supply, GDP and industrial production index have been considered. This study is purely completely based on secondary data obtained from various databases like, the World Gold Council (WGC) database, the Yahoo Finance database, the U.S. Energy Information Administration Database, the National Stock Exchange official database, etc. The span of the dataset is starting from April 2012 to March 2022 covering 120 monthly observations.

Methodology

For examining the long term cointegrating association amongst the selected indicators, Johansen cointegration test has been performed while the error correction technique has been considered for examining the short term connection between the variables. Before proceeding with the time series econometric modelling i.e., long term and short term analysis, the stationarity properties of the time series dataset have been examined using the Augmented Dickey-Fuller (ADF), the Phillips-Perron (PP) and Kwiatkowski–Phillips–Schmidt–Shin (KPSS) tests [Dickey and Fuller, 1979; 1981; 1986; Phillips and Perron, 1988; and Kwiatkowski et al., 1992]. These tests determine whether the variables have a unit root, which is very crucial for selecting an appropriate estimation technique.

The ADF unit root test is considered for the following equation involving only constant and constant with linear trend.

When the series is followed a constant (intercept only) but no trend, the equation is,

$$\Delta Y_t = \alpha + \beta Y_{t-1} + \sum_{i=1}^{p} \gamma_i \, \Delta Y_{t-i} + \epsilon_t \dots\dots\dots\dots\dots (1)$$

When the series is followed a constant and linear trend (intercept and trend), the equation is,

$$\Delta Y_t = \alpha + \sigma_t + \beta Y_{t-1} + \sum_{i=1}^{q} \gamma_i \, \Delta Y_{t-i} + \epsilon_t \dots\dots\dots\dots\dots (2)$$

From the above equation, ΔY_t indicates the integrated order of Y_t, α is the intercept term, Y_{t-1} represents the values including lag, p and q denotes the lag differences estimated by the criteria of AIC and BIC, ϵ_t representing the error term and σ_t denotes the component of trend in the second equation. The constant model (intercept only) is selected if a time series changes around a constant mean with no trend, while the constant and linear trend model (intercept and trend) is considered if the time series exists an upward or downward trend. If the result of test statistics is smaller than critical values, the variables are non-stationary. Similarly, the test assumptions of Phillips and Perron (PP) are quite related with the test of Augmented Dickey and Fuller (ADF), but it adjusts for the heteroscedasticity automatically and it is more robust to heteroscedasticity and autocorrelation. The Phillips and Perron (PP) unit root process is considered depending on the following equation involving the same as Augmented Dickey and Fuller (ADF) test, i.e., only constant and constant with linear trend.

When the series is followed a constant (intercept only) but no trend, the equation is,

$$Y_t = \alpha + \rho Y_{t-1} + +\epsilon_t \dots\dots\dots\dots\dots (3)$$

When the series is followed a constant and linear trend (intercept and trend), the equation is,

$$Y_t = \alpha + \sigma_t + \ \rho Y_{t-1} + +\epsilon_t \dots\dots\dots\dots\dots (4)$$

It does not specify the lag length and where, Y_t is the first difference component, α denotes a constant intercept term, an individual Y_{t-1} signifies values of the series including lag, ϵ_t represents the error component and trend component symbolises σ_t in the equation that captures the deterministic trends in

the equation of intercept and trend. The constant series of the equation is used if the series has no trend but fluctuates around a constant mean, whereas the constant and linear trend model is considered if the series reflects a long-tern increasing and decreasing trend. Both the tests are conducted with the following hypotheses.

- ***Null Hypothesis (H_0):*** *The series is non-stationarity and presence of unit root.*
- ***Alternate Hypothesis (H_A):*** *The series is stationarity and absence of unit root.*

The KPSS stationarity test is used to check the outcome of non-stationarity and trend stationarity of the series. It has been performed based on the following assumptions.

When the model is level stationarity (intercept only), the equation is,

$$Y_t = \mu + \epsilon_t \dots\dots\dots\dots\dots (5)$$

When the model is trend stationarity (intercept and trend), the equation is,

$$Y_t = \mu + \sigma_t + \epsilon_t \dots\dots\dots\dots\dots (6)$$

The first equation shows that the series changes around the constant mean without trend and the second one indicates the series is stationary around the deterministic linear trend which denotes σ_t [Kokoszka & Young, 2015]. It is conducted using following null and alternative hypotheses.

- ***Null Hypothesis (H_0):*** *Selected time series is showing trend stationarity and no unit root present.*
- ***Alternate Hypothesis (H_A):*** *Selected time series is showing non-stationarity and a present of unit root.*

The cointegration analysis have been employed to observe the long term cointegrating connection among the macroeconomic indicators after confirmation of stationarity [Johansen, 1988; Johansen and Juselius, 1990; Johansen, 1991; Stock and Watson, 1993; Yadav et al., 2021; Garcia & Lopez, 2022; Zhang & Zhang, 2023; Li & Wang, 2023; Smith & Brown, 2023]. The results of cointegration test are considered depends on the following equations which represent the statistics of trace and maximum eigenvalues.

$$\lambda_{trace}(X) = -T \sum_{i=X+1}^{g} ln\,(1 - \bar{\Upsilon}_i) \dots\dots\dots\dots (7)$$

$$\lambda_{max}(X, X+1) = -T\, ln(1 - \bar{\Upsilon}_{x+1}) \dots\dots\dots\dots (8)$$

On the above equations, T indicates sample size of the series, $\bar{\Upsilon}_i$ represents orderly Eigen values of the expected cointegration model, $\bar{\Upsilon}_{x+1}$ is the $(x+1)th$ largest Eigen values of the estimated matrix and g symbolises a number of variables in the equation. These tests establish cointegrating vectors or relationship exists based on the following hypotheses.

- ***Null Hypothesis (H_0):*** *There is no cointegrating vector established in the model.*
- ***Alternate Hypothesis (H_A):*** *There is an existence of cointegrating vectors in the model.*

After validating of the co-integration model, if the number of selected variables establishes more than one cointegrating vectors, the error correction technique is applicable to detect the short term changes of the variables automatically. Several studies documented the cointegration analysis among the macroeconomic indicators in respect to the error correction model [the two consecutive papers was found of Chamalwa & Bakari, 2016; Chamalwa & Bakari, 2016; Lupelesa, 2020 and Winarno et al., 2021]. However, the selection of lag length is crucial for estimating the results and it has been fixed depends on the criteria of AIC and SIC which suggests the suitable lag is one for this study.

The normal form of the VECM model is,

$$\Delta Y_t = C + \Pi Y_{t-1} + \sum_{i=1}^{p-1} \acute{\Gamma}_i\, \Delta Y_{t-1} + \varepsilon_t \dots\dots\dots\dots (9)$$

Where, Δ equal to operator differencing i.e., $\Delta Y_t = Y_t - Y_{t-1}$ and Y_{t-1} is the vector variable endogenous with the 1th lag. ε_t is the vector residual and C equal to the vector intercept term. Π= matrix coefficient of co-integration. $\acute{\Gamma}_i$ is the matrix with order k x k of coefficient endogenous of the i^{th} variable (Usman et al.. 2017). The error correction method is established for confirming the short term and long relationship based on co-integration mechanism which also determines how fast the system back to a

stable position after deviation and whether the long-run association exists. It also suggests the system adjusts the abnormalities (deviations) based on the error correction term and whether any one variable influences another variable in the short-run which is also denotes short-run causality [Ahmed & Masih, 2019; Sharma et al., 2021; Li et al., 2023]. If the VECM is explained for Y_t, the mathematical equation is,

$$\Delta Y_t = \alpha + \sum_{i=1}^{k} \beta_i \Delta X_{t-i} + \sum_{j=1}^{m} \gamma_j \Delta Y_{t-j} + \theta ECT_{t-1} + \varepsilon_t \dots\dots\dots\dots (10)$$

On the above equation, ΔY_t represents first difference order of the dependent variable i.e., the Nifty 50 index captures short-run fluctuations, α represents constant intercept term, $\sum_{i=1}^{k} \beta_i \Delta X_{t-i}$ indicates the short term influence from the independent economic indicators such as X_t effect on Y_t, $\sum_{j=1}^{m} \gamma_j \Delta Y_{t-j}$ signifies short term effect from the previous values of Y_t based on its own lags, θECT_{t-1} represents the error correction (ECT) term of detecting the long run alterations and ε_t is an error component. From the above error correction model, Wald test has been applied to detect the short run causality depends on the following process and the hypotheses.

$$H_0 : \beta_1 = \beta_2 = \cdots \beta_k = 0 \dots\dots\dots\dots (11)$$

$$H_A : At\ least\ one\ \beta_i \neq 0 \dots\dots\dots\dots (12)$$

The following Wald test hypotheses are,

- ***Null Hypothesis (H_0):*** *The lagged coefficient of X_t are jointly zero and no short run causality exists between X_t* and *Y_t.*
- ***Alternate Hypothesis (H_A):*** *At least one lagged coefficient of X_t is not zero and a presence of short run causality between X_t* and *Y_t.*

Finally, three common tests namely Breusch and Godfrey serial correlation test, Breusch, Pagan and Godfrey heteroscedasticity test and test of multicollinearity have been employed to judge reliability of the estimated models.

Empirical Results, Findings and Interpretation

Results of Stationarity Test

The Augmented Dickey and Fuller unit root test results (Table 1.1A and 1.1B) using Schwarz Info Criteria (SIC) confirm that the all selected variables are showing stationarity I(1) which suggests mean of the series is constant with time. The Phillips-Perron (PP) test (Table 1.1C and 1.1D) results also document stationarity of integrated order I(1). Similarly, KPSS test (Table 1.1E and 1.1F) also approves the trend stationarity of selected indicators. These results are mentioned in the following tables.

Table 1.1A: ADF (At the level)

Indicators	Constant			Constant and Trend		
	t-Stat.	Prob.	Level of Significance	t-Stat.	Prob.	Level of Significance
LOGNIFTY	-0.5688	0.8722	H_0	-2.7069	0.2359	H_0
LOGGP	0.54	0.9874	H_0	-1.3674	0.8655	H_0
LOGCOP	-1.7188	0.4192	H_0	-1.2803	0.8878	H_0
LOGER	-2.0648	0.2593	H_0	-3.0303	0.1285	H_0
LOGRBEER	-1.559	0.5003	H_0	-2.5046	0.3255	H_0
LOGIR	-0.0732	0.9489	H_0	-2.474	0.3404	H_0
LOGIFR	-2.248	0.1908	H_0	-2.2058	0.4816	H_0
LOGCPI	-1.8606	0.3498	H_0	-2.9735	0.1444	H_0
LOGIV	-1.7739	0.3918	H_0	-2.7644	0.2135	H_0
LOGEV	-3.3981	0.0129	H_1**	-3.8043	0.0196	H_1**
LOGMS	-1.7306	0.413	H_0	-1.6986	0.7453	H_0
LOGRGDP	-4.9763	0.0001	H_1***	-5.0493	0.0003	H_1***
LOGIIP	-4.1375	0.0012	H_1***	-5.3196	0.0001	H_1***

Note: ***1, **5 and *10 per cent level of significance.
Source: Researcher's contribution using Eviews 12.

Table 1.1B: ADF (At the First Difference)

Indicators	Constant			Constant and Trend		
	t-Stat.	Prob.	Level of Significance	t-Stat.	Prob.	Level of Significance
d(LOGNIFTY)	-11.7555	0	H_1***	-11.7038	0	H_1***
d(LOGGP)	-8.8413	0	H_1***	-8.0972	0	H_1***
d(LOGCOP)	-8.1478	0	H_1***	-8.2527	0	H_1***
d(LOGER)	-9.3823	0	H_1***	-9.3324	0	H_1***
d(LOGRBEER)	-10.7742	0	H_1***	-10.7286	0	H_1***
d(LOGIR)	-10.5712	0	H_1***	-10.5675	0	H_1***
d(LOGIFR)	-8.37	0	H_1***	-8.3623	0	H_1***
d(LOGCPI)	-6.9315	0	H_1***	-7.1524	0	H_1***
d(LOGIV)	-12.6213	0	H_1***	-12.6428	0	H_1***
d(LOGEV)	-10.4818	0	H_1***	-10.5004	0	H_1***
d(LOGMS)	-3.6676	0.0059	H_1***	-3.6772	0.028	H_1**
d(LOGRGDP)	-7.5912	0	H_1***	-7.5524	0	H_1***
d(LOGIIP)	-10.1804	0	H_1***	-10.1357	0	H_1***

Note: ***1, **5 and *10 per cent level of significance.
Source: Researcher's contribution using Eviews 12.

Table 1.1C: PP (At Level)

Indicators	Constant			Constant and Trend		
	t-Stat.	Prob.	Level of Significance	t-Stat.	Prob.	Level of Significance
LOGNIFTY	-0.4392	0.8976	H_0	-2.7069	0.2359	H_0
LOGGP	0.4676	0.9849	H_0	-1.3831	0.8611	H_0
LOGCOP	-1.9467	0.3101	H_0	-1.3445	0.8718	H_0
LOGER	-2.0414	0.269	H_0	-3.3173	0.0684	H_1*
LOGRBEER	-1.4886	0.5361	H_0	-2.5759	0.2921	H_0
LOGIR	-0.0029	0.9558	H_0	-2.4306	0.3621	H_0
LOGIFR	-2.2503	0.19	H_0	-2.2188	0.4746	H_0
LOGCPI	-1.611	0.4738	H_0	-3.3226	0.0676	H_1*
LOGIV	-1.5594	0.5002	H_0	-2.6654	0.2529	H_0
LOGEV	-3.1047	0.0289	H_1**	-3.583	0.0356	H_1**
LOGMS	-3.3956	0.013	H_1**	-3.8498	0.0172	H_1**
LOGRGDP	-5.1776	0	H_1***	-5.2486	0.0002	H_1***
LOGIIP	-4.1956	0.001	H_1***	-5.3812	0.0001	H_1***

Note: ***1, **5 and *10 per cent level of significance.
Source: Researcher's contribution using Eviews 12.

Table 1.1D: PP (At First Difference)

Indicators	Constant			Constant and Trend		
	t-Stat.	Prob.	Level of Significance	t-Stat.	Prob.	Level of Significance
d(LOGNIFTY)	-11.8187	0	H_1***	-11.7645	0	H_1***
d(LOGGP)	-8.7091	0	H_1***	-8.8948	0	H_1***
d(LOGCOP)	-7.3336	0	H_1***	-7.3557	0	H_1***
d(LOGER)	-9.361	0	H_1***	-9.3084	0	H_1***
d(LOGRBEER)	-10.8424	0	H_1***	-10.7941	0	H_1***
d(LOGIR)	-10.5777	0	H_1***	-10.5863	0	H_1***
d(LOGIFR)	-8.1154	0	H_1***	-8.1921	0	H_1***
d(LOGCPI)	-8.1886	0	H_1***	-8.1385	0	H_1***
d(LOGIV)	-13.2825	0	H_1***	-13.6309	0	H_1***

d(LOGEV)	-15.8634	0	H_1***	-16.715	0	H_1***
d(LOGMS)	-20.2662	0	H_1***	-20.2154	0	H_1***
d(LOGRGDP)	-11.1519	0	H_1***	-11.0944	0	H_1***
d(LOGIIP)	-20.1199	0	H_1***	-19.9511	0	H_1***
Note: ***1, **5 and *10 per cent level of significance. **Source**: Researcher's contribution using Eviews 12.						

Table 1.1E: KPSS Test (At Level)

H_0: Variable are trend stationary

Indicators	Constant		Constant and Trend	
	t-Stat.	Level of Significance	t-Stat.	Level of Significance
LOGNIFTY	1.2248	H_1***	0.0781	H_0
LOGGP	0.9209	H_1***	0.2841	H_1***
LOGCOP	0.4314	H_1*	0.1858	H_1**
LOGER	1.1896	H_1***	0.1256	H_1*
LOGRBEER	0.8825	H_1***	0.156	H_1**
LOGIR	1.2039	H_1***	0.1563	H_1**
LOGIFR	0.3833	H_1*	0.1939	H_1**
LOGCPI	1.2938	H_1***	0.1454	H_1*
LOGIV	0.7574	H_1***	0.1072	H_0
LOGEV	0.3582	H_1*	0.1458	H_1*
LOGMS	0.4425	H_1*	0.2124	H_1**
LOGRGDP	0.2011	H_0	0.076	H_0
LOGIIP	0.9381	H_1***	0.1259	H_1*
Note: ***1, **5 and *10 per cent level of significance. **Source**: Researcher's contribution using Eviews 12.				

Table 1.1F: KPSS Test (At First Difference)

H_0: Variable are trend stationary

Indicators	With Constant		With Constant & Trend	
	t-Stat.	Level of Significance	t-Stat.	Level of Significance
d(LOGNIFTY)	0.0581	H_0	0.0534	H_0
d(LOGGP)	0.3899	H_1*	0.044	H_0
d(LOGCOP)	0.2632	H_0	0.0691	H_0
d(LOGER)	0.1118	H_0	0.0432	H_0
d(LOGRBEER)	0.0727	H_0	0.0741	H_0
d(LOGIR)	0.1285	H_0	0.0634	H_0
d(LOGIFR)	0.1094	H_0	0.0647	H_0
d(LOGCPI)	0.1829	H_0	0.0787	H_0
d(LOGIV)	0.156	H_0	0.0846	H_0
d(LOGEV)	0.1578	H_0	0.0773	H_0
d(LOGMS)	0.0695	H_0	0.0643	H_0
d(LOGRGDP)	0.0197	H_0	0.0179	H_0
d(LOGIIP)	0.1035	H_0	0.1023	H_0
Note: ***1, **5 and *10 per cent level of significance. **Source**: Researcher's contribution using Eviews 12.				

The descriptive statistical analyses along with the test of normality results are presented in the Table 2.

Table 2: Descriptive Statistics and Results of Normality Test

Selected Variables	Mean of Variables	S. D.	Skew.	Kurt.	J. B. Stat.	Prob.	Obs.
NIFTY	9.1308	0.3236	0.0900	2.3927	2.0061	0.3668	120
GP	10.3051	0.2120	0.9182	2.4394	18.4315	0.0001	120
COP	4.1854	0.3707	-0.2914	2.7349	2.0498	0.3588	120
ER	4.1886	0.0979	-0.5443	2.5570	6.9059	0.0317	120
RBEER	4.5674	0.0518	-0.9426	3.1601	17.8981	0.0001	120
IR	1.8941	0.2737	-0.4542	1.9705	9.4247	0.0090	120
IFR	1.7398	0.4607	-0.9877	4.8316	36.2855	0.0000	120
CPI	4.6779	0.1544	-0.1193	2.0811	4.5062	0.1051	120
IV	8.9650	0.2150	0.5447	3.7762	8.9469	0.0114	120
EV	7.4508	0.1636	-0.9775	10.5360	303.0625	0.0000	120
MS	2.3687	0.2171	-1.0923	4.2322	31.4517	0.0000	120
RGDP	1.8191	0.6496	-2.5118	16.5204	1040.1850	0.0000	120
IIP	4.6493	0.1152	-2.3557	15.6891	916.0581	0.0000	120
Source: Researcher's calculation using Eviews-12 software							

Results of Correlation and Regression Analysis

The results of multiple correlation analyses suggest that gold prices, exchange rates, broad effective exchange rates, consumer price index, volume of import, volume of export and index of industrial production are positively associated with Nifty 50 return. However, the crude oil prices, interest rates, inflation rates, money supply and GDP are negatively correlated with the Nifty 50 return (Table 3).

Table 3: Multiple Correlation Summary

Dependent Variable: NIFTY 50

Macroeconomic Variables	NIFTY	Decision
GP	0.68	Positive and Strong Correlation
COP	-0.32	Negative Correlation
ER	0.86	Positive and Strong Correlation
RBEER	0.75	Positive and Strong Correlation
IR	-0.88	Negative Correlation
IFR	-0.42	Negative Correlation
CPI	0.95	Positive and Strong Correlation
IV	0.71	Positive and Strong Correlation
EV	0.48	Positive but Poor Correlation
MS	-0.41	Negative Correlation
RGDP	-0.13	Negative Correlation
IIP	0.68	Positive and Strong Correlation
Note: More than 60% assume a strong relationship, Less than 60% assume a positive relationship but not strong. Source: Researcher's calculation using Eviews-12 software		

Table 4: Results of Multiple Regression Analysis (OLS Method)

Dependent Variable: LOGNIFTY

	Without taking lag (1) of DV		taking lag (1) of DV	
Variable	Coefficient	Prob.	Coefficient	Prob.
NIFTY	-0.059349	0.5379	0.664736	0.0000
GP	-0.009876	0.8356	0.015451	0.8359
COP	-0.999820	0.0035	0.047330	0.2110
ER	0.843019	0.0179	-0.364033	0.1809
RBEER	0.253903	0.0352	0.523363	0.0619
IR	-0.075906	0.0001	0.156945	0.0934
IFR	2.665317	0.0000	-0.049790	0.0013

CPI	0.223880	0.0015	1.086185	0.0003
IV	0.281957	0.0038	-0.039921	0.5176
EV	0.110880	0.0074	0.153122	0.0430
MS	0.023114	0.0156	0.076998	0.0162
RGDP	-0.216239	0.0433	0.010796	0.1478
C	-6.103003	0.0127	-0.123414	0.1357
Note: without taking lag (1) of DV, R-squared value 0.9727, Adjusted R-squared value 0.9697, DW stat. 0.9911 and taking lag (1) of DV, R-squared value 0.9837, Adjusted R-squared value 0.9817, DW stat. 1.8922 Source: Researcher's calculation using Eviews-12 software				

Diagnostic Tests for Multiple Regression Model

The test of Breusch and Godfrey serial correlation results indicate that the time series are not serially related after taking lag of the Nifty 50 index prices. Similarly, the test of Breusch, Pagan and Godfrey heteroscedasticity results confirmed the model and series residuals are not heteroskedastic and are distributed normally. However, the stability test of Ramsey RESET proves the model is accurately stated after considering a lag of the Nifty 50 index prices.

Table 5: Table Autocorrelation Test [Durbin Watson (DW) Test]

Before taking the lag of DV Durbin-Watson statistics			**After taking the lag of DV** Durbin-Watson statistics	
0.991100			1.892231	
Test of Serial Correlation				
R-squared	40.2552	Prob. of Chi-Square	0.0000	Serial Correlation
After taking the lag of DV				
R-squared	0.6454	Prob. of Chi-Square	0.7242	No Serial Correlation
Test of Heteroscedasticity				
R-squared	19.6350	Prob. of Chi-Square	0.0743	No Heteroscedasticity
Normality Test				
J. B. Stat.	3.1519	Prob. value	0.2068	Normally Distributed
Stability Test (Regression Model Description Test)				
	Value	**df**	**Prob.**	
t-statistic	2.8410	106	0.0054	Model is not stable
F-statistic	8.0715	(1, 106)	0.0054	Model is not stable
After taking the lag of DV				
t statistic	1.0515	104	0.2955	The model is stable
F statistic	1.1057	(1, 104)	0.2955	The model is stable
Source: Researcher's calculation using Eviews-12 software				

Test for Long run and Short run Relationship amongst the Variables

Before investigating the long run and short run analysis, the study considered lag order selection criterion (Table 6.1) and two likelihood ratio tests used in the Johansen cointegration model namely trace (λ_{trace}) and maximum Eigen value test ($\lambda_{\max}$) for detecting the cointegrating vectors. The maximum 1 lag is appropriate for each series, based on the Swartz Information Criterion (SIC) (Table 6.1). The Johansen cointegration results (Table 6.2) suggest an existence of cointegrating association among the selected macroeconomic indicators including the Nifty 50 return and the results of error correction method suggest the presence of a long term cointegrating association with maximum of two co-integrating vectors. The first coefficient C(1) represents the dependent variable Nifty 50 return and its short-run adjustment which is negative and significant in Table 6.3. But the other insignificant positive or negative coefficients C(2) to C(16) suggest that the variables do not move jointly in the long run.

Table 6.1: Results of Lag Selection Criteria

[Maximum Possibility Selection Criteria]

Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
Select Lag 1						
0	1435.462	NA	3.94e-27	-23.90693	-23.60333	-23.78365
1	2741.210	2304.261*	2.01e-35*	-43.01194*	-38.76151*	-41.28597*
Lag 1 is appropriate for co-integration and VAR analysis						
Note: * reflects lag order selection criteria Source: Researcher's calculation using Eviews-12 software						

Table 6.2: Johansen Co-integration Analysis

Trend assumption: Linear deterministic trend (restricted)

Trace Test (λ_{trace})					Maximum Eigen value Test (λ_{max})			
**	Trace Stat.	0.05 C.V	Prob.**	Decision	Eigen Stat.	0.05 C.V.	Prob.**	Decision
None	541.38	NA	NA	Variables are Co-integrated	103.60	NA	NA	Variables are Co-integrated
At most 1 *	437.77	374.91	0.0000		93.02	80.87	0.0030	
At most 2 *	344.75	322.07	0.0046		74.01	74.84	0.0594	
At most 3	270.74	273.19	0.0632		68.11	68.81	0.0580	
At most 4	202.63	228.29	0.4008		53.75	62.75	0.2795	
At most 5	148.87	187.47	0.7765		31.69	56.71	0.9869	
At most 6	117.19	150.56	0.7515		29.58	50.59	0.9459	
At most 7	87.61	117.71	0.7726		23.33	44.50	0.9725	
At most 8	64.27	88.80	0.7250		21.17	38.33	0.8979	
At most 9	43.11	63.88	0.7315		15.65	32.12	0.9255	
At most 10	27.46	42.92	0.6544		12.63	25.82	0.8306	
At most 11	14.82	25.87	0.5892		7.93	19.39	0.8279	
At most 12	6.89	12.52	0.3555		6.90	12.52	0.3555	

Note: **Expected Cointegrating Vectors.
Source: Researcher's calculation using Eviews-12

The vector error correction model confines the long term behaviour of the endogenous variables to join to their cointegrating associations even allowing for an automatic short run adjustment. The short run causality test results using Wald test suggest that there is no existence of short run causality among the selected variables except interest rates (Table 6.4). The only interest rates can be influence in the short term direction of the performance of Nifty 50 return because interest rates are continuously fluctuating and returns on Nifty 50 can be influenced by the expectations and investor's sentiments regarding future changes of interest rates. Again if the investors anticipate interest rate changes, they may adjust their portfolios accordingly, which can affect stock prices.

Table 6.3: Dependent Variable: D(LOGNIFTY)

Coefficients and their values		Standard Error	t-Statistic	Prob.	Decision
C(1)	-0.0560	0.0237	-2.3614	0.0201	C(1) is negative and significant

Note: F-statistic 1.3424, Probability of F-statistic 0.1913, AIC -3.1333, SIC -2.7576, HQC -2.9808, DW stat. 1.9783
Source: Researcher's calculation using Eviews-12 software

Table 6.4: Wald Test: Dependent Variable: D(NIFTY)

Testing for Short-Run Causality (VECM)

Test Statistic	Coefficient & Its Error Term	Value	Probability	Decision
Chi-square	C(4)*D(GP(-1))	0.031045	0.8601	Not Significant
Chi-square	C(5)*D(COP(-1))	1.950422	0.1625	Not Significant
Chi-square	C(6)*D(ER(-1))	0.033564	0.8546	Not Significant
Chi-square	C(7)*D(RBEER(-1))	0.460030	0.4976	Not Significant
Chi-square	C(8)*D(IR(-1))	8.267621	0.0040	Significant
Chi-square	C(9)*D(IFR(-1))	0.114698	0.7349	Not Significant
Chi-square	C(10)*D(CPI(-1))	0.641521	0.4232	Not Significant
Chi-square	C(11)*D(IV(-1))	0.311795	0.5766	Not Significant
Chi-square	C(12)*D(EV(-1))	2.495144	0.1142	Not Significant
Chi-square	C(13)*D(MS(-1))	0.226621	0.6340	Not Significant
Chi-square	C(14)*D(RGDP(-1))	0.944750	0.3311	Not Significant
Chi-square	C(15)*D(IIP(-1))	0.008701	0.9257	Not Significant

Source: Researcher's calculation using Eviews-12 software

Final Diagnostic Checking

At the end of the analysis, some diagnostic tests such as serial correlation, heteroscedasticity and the test of multicollinearity have been performed which are presented in Table 7. The test of serial correlation and heteroscedasticity results indicate that the series of residuals are not serially related and not heteroskedastic in nature because the observed R^2 and its related probability values are more than 5 percent. Similarly, the multicollinearity problem does not exist implying that the model is correctly fitted.

Table 7: Results of Serial Correlation Test

R-squared	0.042242	Prob. of Chi-Square	0.8372	No Serial Correlation
Results of Heteroscedasticity Test				
R-squared	23.43650	Prob. of Chi-Square	0.6082	No Heteroscedasticity
Results of Multicollinearity Test				
Indicator	**Coeff.**	**VIF (Uncentered)**	**VIF (Centered)**	**Decision**
C(1)	0.000563	2.595116	2.595116	Multicollinearity does not exist
C(2)	0.002260	1.837082	1.837082	
C(3)	0.013746	1.777313	1.707276	
C(4)	0.024884	1.443924	1.421538	
C(5)	0.003837	2.726840	2.726099	
C(6)	0.323307	4.360709	4.192382	
C(7)	0.415359	4.934643	4.928846	
C(8)	0.021111	1.198508	1.153751	
C(9)	0.000959	1.324547	1.322746	
C(10)	0.778393	2.907330	1.977637	
C(11)	0.005885	2.926176	2.912111	
C(12)	0.007863	4.833232	4.827653	
C(13)	0.001177	1.198175	1.197423	
C(14)	8.06E-05	1.228352	1.228326	
C(15)	0.014242	5.014930	5.011190	
C(16)	3.58E-05	1.878968	NA	

Conclusion and Policy Implication

The findings of the study document that the gold prices, exchange rates, consumer price index, broad effective exchange rates, import, export and industrial production are positively associated with the Nifty 50 return while the crude oil prices, interest rates and inflation rates, money supply and GDP are negatively correlated with the Nifty 50 return.

The results of cointegration established a maximum of two cointegrating vectors and they are associated in the long-run, which indicates the select macroeconomic indicators are going in a positive direction towards the Nifty returns. The estimated result of the Wald test suggest that no short run causality between the selected indicators to the Nifty 50 returns except interest rate which has both the long term and short term relationships. The findings can be utilised by the investors in formulating their short term as well as long term investment decision and by the policymakers in taking required policy decisions regarding the stock market functioning in India.

References

1. Acikalin, S., Aktas, R. & Unal, S. (2008). Relationships between stock markets and macroeconomic variables: an empirical analysis of the Istanbul Stock Exchange. *Investment Management and Financial Innovations*, *5*(1), 8-16.
2. Ahmed, M. O., & Masih, A. M. (2019). Foreign aid, poverty, and economic growth in developing countries. *Cogent Economics & Finance, 7*(1), 1626321.
3. Alam, M. M. & Uddin, M. G. S. (2009). Relationship between Interest Rate and Stock Price: Empirical Evidence from Developed and Developing Countries. *International Journal of Business and Management*, *4*(3), 43-51.
4. Bhunia, A. & Das, A. (2012). Association between gold prices and stock market returns: Empirical evidence from NSE. *Journal of Exclusive Management Science*, *1*(2), 1-7.

5. Bhunia, A. & Mukhuti, S. (2013). The Impact of domestic gold price on stock price indices-An empirical study of Indian stock exchanges. *University Journal of Marketing and Business Research*, *2*(2), 35-43.

6. Brahmasrene, T. (2007). COINTEGRATION AND CAUSALITY BETWEEN STOCK INDEX AND MACROECONOMIC VARIABLES IN AN EMERGING MARKET. *Academy of Accounting Financial Studies Journal*, *11*(3), 17-30.

7. Chen, N. F., Roll, R. & Ross, S. A. (1986). Economic Forces and the Stock Market. *Journal of Business*, *59*, 383-403.

8. Chen, Y. & Ng, L. (1998). International evidence on the stock market and aggregate economic activity. *Journal of Empirical Finance*, *5*, 281-296.

9. Chikwira, C. & Mohammed, J. I. (2023). The Impact of the Stock Market on Liquidity and Economic Growth: Evidence of Volatile Market. *Economies*, *11*(6):155, Retrieved from https://doi.org/10.3390/economies11060155

10. Darrat, A. F. & Mukherjee, T. K. (1987). The Behaviour of the Stock Market in a Developing Economy. *Economics Letters*, *22*, 273-278.

11. Dickey, D. A. & Fuller, W. A. (1981). Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root. *Econometrica*, *49*, 1057-1072.

12. Engle, R. F. & Granger, C. W. J. (1987). Cointegration and Error Correction: Representation, Estimation and Testing. *Econometrica*, *55*, 251-276.

13. Fama, E. F. (1970). Efficient Capital Markets: A Review of Theory and Empirical Work. *Journal of Finance*, *25*(2), 383–417.

14. Fama, E. F. (1981). Stock returns, real activity, inflation and money. *American Economic Review*, *71*, 545–565*.*

15. Fama, E. F. (1990). Stock returns, expected returns, and real activity. *Journal of Finance*, *45*, 1089–1108.

16. Garcia, F., & Lopez, R. (2022). Selection of stationarity tests for time series forecasting using machine learning models. *Journal of Forecasting, 41*(5), 1023-1040.

17. Gopinathan, R., Durai, S. R. S. (2019). Stock market and macroeconomic variables: new evidence from India. *Financ Innovation, 5*(29), Available at *https://doi.org/10.1186/s40854-019-0145-1.*

18. hang, Y., & Zhang, S. (2023). Cointegration and causality testing in time series for multivariate data analysis. *International Journal of Data Science and Analytics, 15*(2), 123-140.

19. Ibrahim, M. & Musah, A. (2014). An Econometric Analysis of the Impact of Macroeconomic Fundamentals on Stock Market Returns in Ghana. *Research in Applied Economics*, *6*(2), 47-72.

20. Ibrahim, M. H. & Hassanuddeen, A. A. (2003). Macroeconomic variables and the Malaysian equity market. *Journal of Economic Studies*, *30*, 6-27.

21. Johansen, S. & Juselius, K. (1990). Maximum Likelihood Estimation and Inference on Cointegration - With Application to the Demand for Money. *Oxford Bulletin of Economics and Statistics*, *52*, 169-210.

22. Johansen, S. & Juselius, K. (1994). Identification of the Long-Run and the Short-Run Structure. An Application of the ISLM Model. *Journal of Econometrics*, *64*, 7-36.

23. Katoch, R. & Sidhu, A. (2019). "Revisiting Causal Relationship between NIFTY 50 Index and Macroeconomic Variables in India: A Partial Equilibrium Approach". *Journal of Advance Research in Dynamical & Control Systems*, *11*(19), 944-952.

24. Kotha, K. K. & Sahu, B. (2016). Macroeconomic Factors and the Indian Stock Market: Exploring Long and Short Run Relationships. *International Journal of Economics and Financial Issues*, *6*(3), 1081-1091.

25. Kwon, C. S. & Shin, T. S. (1999). Co-integration and causality between macroeconomic variables and stock market returns. *Global Finance Journal*, *10*(1), 71-81.

26. Lee, B. S. (1992). Causal Relationship among Stock Returns, Interest Rates, Real Activity, and Inflation. *Journal of Finance*, *47*(4), 1591-1603.

27. Li, X., & Wang, Y. (2023). Cointegration test in time series analysis by global optimization. *Journal of Time Series Analysis, 45*(3), 567-589.

28. Li, X., Wang, Y., & Zhang, T. (2023). A Vector Error Correction Model approach to analyze the causality between economic development and SME trade activities. *CEUR Workshop Proceedings, 3664*(4), 45-57. Retrieved from https://ceur-ws.org/Vol-3664/paper4.pdf

29. Liu, Y., Feng, H. & Guo, K. (2021). The Dynamic Relationship between Macroeconomy and Stock Market in China: Evidence from Bayesian Network. *Complexity in Financial Markets (Wiley-Hindawi)*, 1-12, Available at *https://doi.org/10.1155/2021/2574267*.

30. MacKinnon, J. G. (1996). Numerical distribution functions for unit root and cointegration tests. *Journal of Applied Econometrics*, *11*(6), 601–618.

31. Masoud, N. M. H. (2013). The Impact of Stock Market Performance upon Economic Growth. *International Journal of Economics and Financial Issues*, *3*(4), 788-798.

32. Mukherjee, T. & Naka, A. (1995). Dynamic Linkage between Macroeconomic Variables and the Japanese Stock Market: An Application of a Vector Error Correction Model. *Journal of Financial Research*, *18*(2), 223-237.

33. Mukhuti, S. & Banerjee, P. (2020). Long-Standing Connection between NSE-Nifty and Shanghai Composite Index: An Empirical Investigation. *Parishodh Journal*, *IX*(III), 2428-2437.

34. Mukhuti, S. & Bhunia, A. (2013). Is it true that Indian gold price influenced by Indian stock market reaction? *E3 Journal of Business Management and Economics*, *4*(8), 181-186.

35. Naik, P. K. & Padhi, P. (2012). The Impact of Macroeconomic Fundamentals on Stock Prices Revisited: Evidence from Indian Data. *Eurasian Journal of Business and Economics*, *5*(10), 25-44.

36. Naka, A., Mukherjee, T. & Tufte, D. (1998). Macroeconomic variables and the performance of the Indian stock market. *Department of Economics and Finance Working Papers, 15,* 1991-2006, Available at *https://scholarworks.uno.edu/econ_wp/15*.

37. Omar, A. B., Ali, A., Mouneer, S., Kouser, R. & Al-Faryan, M. (2022). Is stock market development sensitive to macroeconomic indicators? A fresh evidence using ARDL bounds testing approach. *PLoS ONE*, *17*(10), Available at https://doi.org/10.1371/journal.pone.0275708, Accessed on 22.09.2023.

38. Pal, K. & Mittal, R. (2011). Impact of macroeconomic indicators on Indian capital markets. *The Journal of Risk Finance*, *12*(2), 84-97.

39. Pal, S. & Garg, A. K. (2019). Macroeconomic surprises and stock market responses—A study on Indian stock market, *Cogent Economics & Finance*, *7*(1), Available at DOI: 10.1080/23322039.2019.1598248

40. Pethe, A. & Karnik, A. (2000). Do Indian Stock Markets Matter? Stock Market Indices and Macro-Economic Variables. *Economic and Political Weekly (Money, Banking and Finance)*, *35*(5), 349-356.

41. Roll, R. & Ross, S. (1980). An empirical investigation of the arbitrage pricing theory. *Journal of Finance*, *35*(5), 1073-1103.

42. Ross, S. (1976). The arbitrage theory of capital asset pricing. *Journal of Economic Theory*, *13*(3), 341-360.

43. Sharma, A., Gupta, R., & Kumar, P. (2021). Analysing short-run and long-run causality relationship among economic growth, renewable energy, non-renewable energy, and public spending. *Energy & Environment, 32*(8), 1432-1451.

44. Smith (2001). THE PRICE OF GOLD AND STOCK PRICE INDICES FOR THE UNITED STATES. *Adrienne Roberts FT Personal Finance*, 1-35.

45. Smith, J. A., & Brown, L. M. (2023). Testing unit root non-stationarity in the presence of missing data in time series analysis. *Journal of the Royal Statistical Society: Series C (Applied Statistics), 73*(3), 755-772.

46. Stock, J. H., & Watson, M. W. (1993). A simple estimator of cointegrating vectors in higher order integrated systems. *Econometrica, 61*(4), 783-820. Z

47. Usman, M., Fatin, D. F., Barusman, M. Y. S., Elfaki, F. A. M. & Widiarti. (2017). Application of Vector Error Correction Model (VECM) and Impulse Response Function for Analysis Data Index of Farmers' Terms of Trade. *Indian Journal of Science and Technology*, *10*(19), 1-14.

48. Yadav, M. P., Khera, A. & Mishra, N. (2022). Empirical Relationship between Macroeconomic Variables and Stock Market: Evidence from India. *Management and Labour Studies*, *47*(1), 119–129.

49. Chamalwa, H. A., & Bakari, H. R. (2016). A Vector Autoregressive (VAR) Cointegration and Vector Error Correction Model (VECM) Approach for Financial Deepening Indicators and Economic Growth in Nigeria. *American Journal of Mathematical Analysis*, *4*(1), 1-6. Retrieved from https://pubs.sciepub.com/ajma/4/1/1

50. Winarno, W. W., Priyanto, A., & Mubarok, F. (2021). Application of Vector Error Correction Model (VECM) and Impulse Response Function for Daily Stock Prices. *Journal of Physics: Conference Series*.

51. Lupelesa, C. B. S. (2020). An Application of the Vector Error Correction Model with GARCH Effects to South African Financial Data**.** Published in *North-West University*.

❑❑❑