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PERFORMANCE OF THE INDIAN STOCK MARKET IN RELATION TO MACROECONOMIC INDICATORS DURING THE PRE-CORONA PANDEMIC PERIOD

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Abstract *Purpose: This study examines the performance of macroeconomic variables in gaining profits from stock investments in India's stock market during the pre-corona pandemic period. Design/Methodology/Approach: The data was gathered from the Indian Economy's Handbook of Statistics for six years, from 2014 to 2019. To examine the relationship between macroeconomic factors and stock indices, the OLS regression model, ADF test, and Granger causality technique were used. The VECM technique was used to determine the link between the variables' switching performance during the pre-corona epidemic phase. Findings: This study finds a substantial association between the factors and the stock market. During the pre-corona pandemic phase, the link is also bidirectional with the stock market. Implications: This study will assist investors in making critical decisions in the sphere of investment and investment diversification. Originality: The current study gives important hints for investors who want to build a well-defined, diversified portfolio. Since it is critical to maintain control over the psychological impact of socio-economic limitations on investors, it is recommended that investors keep their eyes open when making investment selections.*

Keywords: *Macroeconomics, OLS Model, ADF Test, VAR Model, VECM, Indian Stock Market*

INTRODUCTION

Identifying and verifying the existing link between macroeconomic factors and stock markets throughout the world has been a professional and insurmountable task for scholars, stock market practitioners, investors, and other investment organisations. The problem is that no one can predict when macroeconomic variables will affect a country's stock market share prices. The macroeconomic factors are the hidden tools in an empty magic box that have the potential to impact the values of stocks and other securities. This notion was initially raised in Fema's head in his research in 1981. Chen et al. (1986), Pearce and Roley (1988), Fema (1991), Poon and Taylor (1992), and others have investigated and confirmed the existence of a causal relationship between asset prices and real economic activities such as production rate, productivity, GNP growth rate, yield multiplication, unemployment rate, inflation rate, interest rate, and dividend yields, among others. Many academics believe that an efficient stock market serves as the foundation for all economic and political actions, with securities values changed based on the most up-to-date information available. The tools provided for up-to-date information in the Indian stock market may assist one in making rapid guesses about market development and share indicator movements.

The stock indicators are extremely sensitive to macroeconomic factors of both local and international socio-economic and political practices inside the country, and they are mobilised quickly by them. Budgetary, monetary, and fiscal statements by the government, as well as statements by nations across the world, can be used to gauge the stock market's sensitivity. Thus, one can readily grasp what is the key to all economic indicators and how they may be responded to with the performance of business sectors, corporate activities, and corporate profits in the country using the economic theory. If stock prices are properly correlated with the underlying functions, then the stock price, not the other way around, should be considered the key indicator of the country's economic progress.

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Now, the most important aspect of this empirical study is to determine the influence of macroeconomic variables on gaining profits from stock investments in India's stock market during the pre-corona pandemic period.

The paper is organised as follows: Section 1 covers the introduction to the study, section 2 describes the literature review, and section 3 provides the research methodology. Section 4 reports the data analysis and interpretation, section 5 describes the findings of the study, and section 6 concludes the whole discussion.

LITERATURE REVIEW

Pachiyappan and Chandrakala (2022) studied the influence of macroeconomic factors on the fluctuations in the gold price in India taking the monthly observations over five years, from 1 January 2015 to 31 December 2019. The study empirically found that ER, WPI, UR, and S&P BSE SENSEX have a positive influence on the gold price, while LTIR has a negative influence.

Islam and Habib (2016) investigated the impact of various macroeconomic variables on the Indian stock market based on the Arbitrage Pricing Theory (APT) propounded by Ross in 1976. The results of the study showed that only the exchange rate has a significant negative impact on stock returns. The other macroeconomic variables do not significantly affect stock returns.

Kothari and Pathak (2020) examined the relationship and effect of each macroeconomic variable on the others. The study is based on secondary data collected from eia.gov (Energy Information Administration and Official Energy Statistics from the U.S. Government), gold.org (the official website of The World Gold Council which is the market development organisation for the gold industry), and fxtop.com (a website where we can convert one currency to another) for the study period of 11 years, from April 2005 to March 2016. The study found a bi-directional causality between Dubai and Oman average crude oil price and Brent crude oil price, as well as gold price and exchange rate.

Saima, Mehta and Mishra (2022) studied the market dynamics of Sensex, the share index in Mumbai, India, and its performance pre-election and post-election. They found that the investors were swayed by projections of election outcomes or other unprecedented events and may try to time the market during that period.

Thaker and Mand (2020), in their study, looked into the long- and short-term linkages, correlations, volatilities, temporal frequency domains, and lead-lag analyses of the relationship between BTC and Asian Stock Indices, from July 20, 2010, to April 26, 2019, using the techniques VECM, Granger causality, M-GARCH, and Wavelet analysis. They found that three markets (KOR, STI, and HK) had a negative correlation with BTC, while two other markets had a positive association (i.e. JPN and PHIL). These results are in line with what VECM predicted.

Umar et al. (2020) empirically looked into how well-known stock markets and crypto currencies integrate. The asymmetric dynamic conditional correlation between the stock indices and crypto currency markets throughout the indicated period is first detected using the ADCC model. The findings demonstrate that while there is often no connection between stock markets and crypto currencies, there are time-varying correlations among the bulk of the chosen crypto currency-stock market index combinations. The results suggest that in most instances negative shocks are far more important than positive shocks of the same magnitude when it comes to asymmetry property.

Reddy, Nayak, Nagendra and Ashwith (2019) looked into crude oil price, gold price, silver price, exchange rate, inflation, and interest rate using BSE sectoral indices like S&P BSE BANKEX, S&P BSE Oil and Gas, S&P BSE Consumer Durables, S&P BSE Capital Goods, S&P BSE Realty, S&P BSE PSU, and S&P BSE Power. The study's findings revealed a positive link between GP, rate of exchange, consumer price index, and interest rate with four indices, but only a favourable link between crude oil and silver prices and three indices.

Sudhakaran and Balasubramanian (2019) investigated the money supply (MS), foreign direct investment (FDI), inflation rate (IR), industrial production index (IIP), foreign exchange reserve (FER), and foreign portfolio investment on the BSE Bankex. The results of using the unit root test, multiple regressions, and multi-collinearity technique on data from 2005 to 2015 revealed the existence of a substantial link between macroeconomic factors and the BSE Bankex.

Abdullah et al. (2014) compared consumer price index, exchange rate, short-term interest rate, rate of export, government bond yield, and the Kuala Lumpur composite stock index. The monthly data is considered from January 1996 to September 2013, resulting in the following external variables: government bond yields, short-term rate of interest, and Kuala Lumpur indices, with the short-term rate of interest representing the most important variable for this analysis.

Giri and Joshi (2017) used the ARLD bounds testing strategy, VECM technique, and variance decomposition methods to investigate the inter-relationship between several macroeconomic factors and the price of stocks in the Indian economy over a short and long timeframe. They looked at data from 1979 to 2014 and discovered a long-term link between macroeconomic indicators and stock prices. The

authors claim that economic growth, rate of exchange, and inflation all have beneficial effects on stock prices, whereas the price of crude oil causes stock prices to fall. The authors concluded that there is a unidirectional causation between economic development, foreign direct investment, and stock prices in India based on the VECM calculation.

Abbas, McMillan and Wang (2018) used GARCH models and multivariate vector auto-regressive models to examine the effect of the stock market and macroeconomic variables in G-7 nations, from July 1985 to June 2015. The findings have shown the presence of a modest causal association between macroeconomic indicators and market turbulence in G-7 nations at the individual level. The combined influence of the indicators, on the other hand, is unexpected for the research. They have also highlighted the bidirectional causation for G-7 nations, except the United Kingdom.

Hasanzadeh and Kianvand (2012) used Johansen's co-integration method and the VECM model to examine the effects of the nominal effective exchange rate, GDP index, gold price, money supply, and housing sector investment on the Iranian stock market from 1996 to 2008. The authors stated that while the increase in the gross domestic product and money supply is good, the stock market in Iran is negatively influenced by the price of gold, housing sector private investment, and nominal effective exchange rates.

Hunjera et al. (2014) investigated the effects of currency exchange rates, inflation, GDP, and interest rates on the Pakistan stock market. The co-integration approach of Johansen and the Granger causality approach are used to analyse data from 1 January 2001 to 31 December 2011. The findings revealed that while there is little correlation between stock prices and macroeconomic indicators in the short run, there is a robust relationship between them in the long run.

The association between selected macroeconomic indicators and the Korean stock market was investigated by Brahmasrene (2018). For this investigation, data was collected from January 1986 to October 2016. The authors discovered the long-run association of the Korean stock market with macroeconomic factors using the ADF test, Johansen co-integration methods, VECM approach, impulse response functions, and structural break analysis. According to the VECM methodology, money supply and short-term rate of interest are unrelated to stock values. The rate of exchange, on the other hand, is positively associated with stock prices, while the industrial output index and the rate of inflation are adversely associated with Korea's stock market in the short term.

The data obtained from the Saudi Arabian stock market, as well as the rate of exchange, industrial output, oil price, money supply, and consumer index price, was studied by Kalyanaraman and Tuwajri (2014). For this investigation, the ADF test, Johansen co-integration method, and VECM models are used on data input from January 1994 to June 2013. In the long term, there is causation between macroeconomic variables and the Saudi Arabia stock market, according to the authors. According to the impulse response approach, industrial output unexpectedly drove the stock market upwards, while the consumer price index unexpectedly drove it lower.

Based on data from 2006 to 2013, Mohanamani (2014) investigated the functional relationship between the rate of exchange (both in Indian rupee and US dollar), money supply, foreign institutional investment, call money rate, industrial productivity, and whole shell price index and the BSE SENSEX. The results of the studies revealed that money supply, whole shell price index, and industrial productivity are positively connected with the stock market of India, using the ADF test, Pearson's correlation matrix, and the Granger causality technique.

Mutuku and Ngeny (2015) experimentally investigated the dynamic link that exists between macroeconomic factors and the share price of the Kenyan market. The analysis is based on quarterly data collected from 1997 to 2010. They found that the nominal rate of exchange, nominal gross domestic product, Treasury bill rate, and stock prices all had positive connections when using the VAR model and VECM method. In the long run, however, the consumer price index is negatively associated with the stock price in Kenya.

Shahzadi et al. (2012) examined the relationship between the price of gold and the Karachi stock exchange's share market using data from 2006 to 2010. The use of methods such as Johansen co-integration and Granger causality revealed that the gold rate and the Karachi stock exchange 100 indexes are negatively connected.

Ray (2012) used the linear regression model and the Granger causality technique to examine the relationship between market capitalisation and foreign exchange reserves in India. The lessons' findings demonstrated that there is unidirectional causation between them. In India, there is a positive relationship between foreign exchange reserves and stock market capitalisation.

The association between NSE and BSE and disposable revenue, interest rate, government policy, rate of inflation, and rate of exchange was investigated by Sarika and Bharti (2019). On monthly data from 2006 to 2016, the ADF test (Augmented Dickey-Fuller test), correlation matrix, multiple regression approach, and Granger causality approaches were used. The findings revealed that changes in preference variables might have a negative impact on changes in the share price of both the Indian exchanges, removing the possibility of significant links between disposal revenue, government policy, exchange rate, and share prices.

Lekobane et al. (2014) studied the relationship between the US stock market index and macroeconomic variables such as long- and short-term interest rates, ten-year US government bond yields, GDP, diamond price, inflation rate, money supply, rate of exchange, and foreign exchange reserve. The data was gathered quarterly from 1998 to 2012 and was processed using the VECM (vector error correction model) approach. The model demonstrated the presence of a link between macroeconomic factors and the US stock market index.

Mukhuti (2018) looked at the correlations between Indian stock indexes and domestic gold prices. The result indicates the existence of a positive connection between the prices of gold with both the exchange in India and the data obtained using correlation statistics, the multiple regression method, and the Granger causality technique on data gathered from January 2008 to August 2018. The Granger causality technique revealed a poor relationship between gold prices and the SENSEX and NIFTY indexes.

Wang (2011) investigated the link between macroeconomic indicators such as real gross domestic product, consumer price index, short-term interest rate, and stock market prices in China. To evaluate the causal link between macroeconomic factors and China's stock price, he employed the E-GARCH (exponential generalised autoregressive conditional heteroscedasticity) and lag augmented VAR models. There was no evidence of a causal association between stock price and actual GDP, according to the research. In China, bidirectional causation is discovered between inflation and stock price fluctuations.

RESEARCH GAP

From the abovementioned review of literature, it has been revealed that a considerable number of researchers have identified the extent of the relationship between the macroeconomic sectors and the stock market returns. The present study is one of its kind that analyses the significance of macroeconomic investment assets in protecting investors from the losses of stock market returns with the occurrence of unforeseen crises. This study also involves examining and identifying new avenues that can protect the investors from the impact of the decisions of the government to overcome the crisis, i.e., the performance of the Indian stock market regarding macroeconomic indicators during the pre-corona pandemic period.

OBJECTIVES OF THE STUDY

The broad objectives of the study are:

- To investigate the pre-corona pandemic influence of certain macroeconomic factors on the behaviour of the Indian stock market.
- To determine the nature of the relationship between the Indian stock market and macroeconomic factors during the pre-corona pandemic period.

HYPOTHESES OF THE STUDY

The hypothesis of the study is:

- During the pre-corona pandemic period, there was a substantial correlation between certain macroeconomic factors and the Indian stock market.

RESEARCH METHODOLOGY

Data Source: The secondary data was gathered from the RBI's annual report.

Periodicity: The data for the study was collected for six years, from April 2014 to March 2019.

Tools & Techniques: In this study, statistics like mean and standard deviation are utilised to show the consistency of the data. The ordinary least squares model (OLS) is used to evaluate the existing linkages among the macroeconomic factors and their effects on the Indian stock market. The data's stationarity was determined using the Augmented Dickey-Fuller test (ADF test). The VECM and Granger causality test are used to assess the influence and existing lead-lag connection between the factors on the performance of the stock market during the pre-corona pandemic era, utilising accessible datasets.

ANALYSIS AND INTERPRETATION

Seven variables from the macroeconomic environment are considered in this study: crude oil price (COP), exchange rate (ER), foreign institutional investments (FII), gold price (GP), industrial production index (IIP), gross fiscal deficit of government (GFD), and foreign exchange reserve (FER). Two stock exchanges from India's stock market are considered. The study spans the period of April 2014 to March 2019 (see Table 1), with a total of 60 observations.

Table 1: Descriptive Statistics

	COP	ER	FII	GP	IIP	GFD	FER	CNX NIFTY	SENSEX
Count	60	60	60	60	60	60	60	60	60
Mean	3914.50	65.61	3255.95	28821.22	146.61	46928.43	2.42	9051.05	9267.89
Std.	1107.17	3.22	11457.86	1921.62	27.72	69268.19	2.95	1270.57	1363.10
Min.	2004.00	59.31	−25774.00	25207.38	113.70	−206132.00	1.84	6754.74	6776.54
25%	3069.53	63.76	−2350.75	27088.65	122.58	18695.00	2.26	8098.91	8251.66
50%	3629.03	65.36	1552.00	28820.63	132.55	46739.50	2.44	8652.24	8812.33
75%	4486.30	67.36	10111.50	30170.62	175.63	80765.75	2.63	10322.88	10656.90
Max.	6471.05	73.63	40576.00	33216.50	198.70	205622.00	2.90	11498.44	11786.67

The data are shown in Table 1 as mean, minimum, and maximum values, as well as percentiles such as 25%, 50%, and 75%, and standard deviation. As a result of this observation, we discovered that the government's gross fiscal deficit has the greatest average index, while the foreign exchange reserve has the lowest average index of all the variables studied.

Preliminary Tests

OLS is the most influential model among the several descriptive statistical models for estimating the coefficient of each variable to discover cross-sectional concerns in the investigation. It serves to highlight the essential reverse causality that exists between the variables detected through the data put into the research for this reason.

Table 2: Preliminary Tests (Ordinary Least Square)

R-Squared	0.999		Coeff.	Std. Error	T-Value
Adj. R-squared	1.0	Intercept	1637.8851	254.738	6.43
F-statistic	5308.0	COP	−0.01	0.01	−1.10
Log-Likelihood	−315.9	ER	−27.81	4.30	−6.46
Durbin-Watson	0.8	GP	−0.01	0.01	−1.67
Jarque-Bera (JB)	0.4	FII	0.00	0.00	−0.66
Prob (JB)	0.8	IIP	−2.09	0.41	−5.12
Omnibus	0.5	GFD	−1036.35	0.00	−0.91
Prob (Omnibus)	0.8	FER	0.00	$9.38*10^5$	4.18
Skew	−0.2	CNXNIFTY	1.02	0.01	71.43
Kurtosis	2.9				
AIC	649.8				
BIC	668.7				

SENSEX is the dependent variable, CNX NIFTY is the independent variable, and the macroeconomic variables are the independent variables in this OLS model research. The coefficient from the OLS model revealed that COP, ER, GP, FII, IIP, and GFD have a negative link with SENSEX performance; however, FER and CNX NIFTY had a positive link. The value of both R-square and adj. R-square is 0.999, indicating that macroeconomic variables account for 99.9% of SENSEX variance and factors outside the model account for 0.1 per cent of SENSEX variance. As a result, SENSEX returns are extremely susceptible to macroeconomic factors. Durbin-Watson's value is 0.783, and JB is likewise 0.438, indicating that there is a significant causal association between the variables included in this study.

Correlation Matrix of Residuals

The residual correlation revealed that the rate of exchange, industrial production index, and foreign exchange reserves are all negatively correlated with SENSEX performance, whereas crude oil prices, foreign institutional investment, gold prices, the government's gross fiscal deficit, and the CNX NIFTY are all positively correlated with SENSEX performance (Table 3).

Table 3: Correlation Matrix

	COP	ER	FII	GP	IIP	GFD	FER	CNX NIFTY	SENSEX
COP	1.00	0.28	−0.08	0.06	0.00	0.17	0.45	0.07	0.07
ER	0.28	1.00	−0.58	0.00	0.00	0.12	0.43	−0.61	−0.64
FII	−0.08	−0.58	1.00	0.06	0.23	−0.23	−0.14	0.63	0.63
GP	0.06	0.00	0.06	1.00	−0.02	0.08	0.45	0.05	0.03
IIP	0.00	0.00	0.23	−0.02	1.00	−0.59	0.14	−0.02	−0.03
GFD	0.17	0.12	−0.23	0.08	−0.59	1.00	−0.01	0.17	0.15
FER	0.45	0.43	−0.14	0.45	0.14	−0.01	1.00	−0.03	−0.05
CNX NIFTY	0.07	−0.61	0.63	0.05	−0.02	0.17	−0.03	1.00	0.99
SENSEX	0.07	−0.64	0.63	0.03	−0.03	0.15	−0.05	0.99	1.00

Unit Root Tests Results

The ADF test is critical for determining the data's unit root, since it is required to produce meaningful results from the statistics chosen for this observation. The regression result cannot be used against the null hypothesis if the null hypothesis is not rejected and the series is not stationary. At its most basic level, the Unit Root (ADF) test is used.

Table 4: Unit Root Tests (ADF)

	T-Statistics	P-Value	CV at 1% Level	CV at 5% Level	CV at 10% Level	Series is
COP	2.53	0.11	3.56	2.92	2.60	Non-stationary
ER	1.51	0.53	3.56	2.92	2.60	Non-stationary
FII	6.68	0.00	3.56	3.92	2.60	Stationary
GP	1.37	0.60	3.56	2.92	2.60	Non-stationary
IIP	1.37	0.60	3.56	2.92	2.60	Non-stationary
GFD	1.49	0.54	3.59	2.93	2.60	Non-stationary
FER	1.44	0.56	3.56	2.92	2.60	Non-stationary
CNX NIFTY	1.23	0.66	3.56	2.92	2.60	Non-stationary
SENSEX	1.29	0.63	3.56	2.92	2.60	Non-stationary

Except for FII, the null hypothesis is not rejected for all other macroeconomic variables, such as crude oil price (COP), exchange rate (ER), gold price (GP), industrial production index (IIP), government gross fiscal deficit (GFD), and foreign exchange reserve (FER), with CNX NIFTY and SENSEX, as shown in Table 4.

Unit Root (ADF) Test at First Difference

Table 5: Unit Root (ADF) Test at First Difference

	T-Statistics	P-Value	CV at 1% Level	CV at 5% Level	CV at 10% Level	Series is
COP	4.47	0.00	3.56	2.92	2.60	Stationary
ER	5.63	0.00	3.56	2.92	2.60	Stationary
FII	5.22	0.00	3.58	2.92	2.60	Stationary
GP	6.74	0.00	3.56	2.92	2.60	Stationary
IIP	10.38	0.00	3.56	2.92	2.60	Stationary
GFD	9.36	0.00	3.59	2.93	2.60	Stationary
FER	5.53	0.00	3.56	2.92	2.60	Stationary
CNXNIFTY	5.53	0.00	3.56	2.92	2.60	Stationary
SENSEX	5.67	0.00	3.56	2.92	2.96	Stationary

Note:

1. The critical values for Unit Root at the 1%, 5%, and 10% significance levels are presented in the table.
2. The first difference also reflects the statistical significance at 0.05 levels of significance.

However, the null hypothesis is rejected for the selected variables from the macroeconomic environment and the stock exchanges of India in the first difference at its 0.05 significance level, on T-statistics, and from the P-values during the pre-corona pandemic period in Table 5, indicating that the variables in the series are stationary.

RESULTS OF CO-INTEGRATION TEST

This test is used to determine the significance of the test statistics value at 1% level of significance.

Table 6: Co-Integration Test

r0	r1	Test Statistics	Critical Value
0	9	250.4	228.2
1	9	188.6	187.2
2	9	141.2	150.1

Another improvement test is Johansen's co-integration test, which avoids the problems of selecting a dependent variable as well as the problems that arise when mistakes are carried over from one stage to the next. This test may now be used to detect co-integrating relationships between macroeconomic factors and stock index indices, which may be quantified using a trace test. The test statistics value in trace tests r0 = 0 and r0 = 1 is bigger than the crucial value, which specifies the null hypothesis negative reaction at its level of significance. The value of the test statistics is below the critical value at r0 = 2, which fails to reject the null hypothesis, since the P-value is above the critical value; this supports the null hypothesis and does not contradict this co-integration rank.

Results of VECM (Vector Error Correction Model)

VECM is a specific methodology over VAR for variables that are particularly comical in analysing the co-integrated correlations between the chosen variables and stock market indices in India. The VECM result is more effective for making judgments during the pre-corona pandemic era and the function of macroeconomic factors on the stock market. Once the data series are co-integrated and are not stationary at their level of significance, this technique of investigation is used. The VECM model may be seen as a constrained VAR model for assessing the existing lead-lag relationships between the chosen factors and the Indian stock market during the pre-corona pandemic era.

Results of Loading Coefficient (Alpha)

Table 7: Vector Error Correction Model

Variables	Coefficient Value	Standard Error Value	Z Statistics
COP ec1 (α_1)	−0.09	0.04	−2.06
COP ec2 (α_2)	−16.13	40.60	−0.40
COP ec3 (α_3)	0.00	0.01	0.07
COP ec4 (α_4)	0.16	0.05	2.97
COP ec5 (α_5)	8.60	3.44	2.50
ER ec1 (α_1)	0.00	0.00	1.44
ER ec2 (α_2)	−0.29	0.08	−3.54
ER ec3 (α_3)	0.00	0.00	−1.83
ER ec4 (α_4)	0.00	0.00	−0.81
ER ec5 (α_5)	−0.01	0.01	−0.99
FII ec1 (α_1)	0.15	1.51	0.10
FII ec2 (α_2)	2573.73	1450.86	1.77
FII ec3 (α_3)	−0.58	0.19	−3.13
FII ec4 (α_4)	2.11	1.88	1.12
FII ec5 (α_5)	208.17	122.98	1.69
GP ec1 (α_1)	0.14	0.10	1.41
GP ec2 (α_2)	80.41	98.09	0.82
GP ec3 (α_3)	−0.01	0.01	−0.80
GP ec4 (α_4)	−0.20	0.13	−1.60
GP ec5 (α_5)	−7.14	8.31	−0.86
IIP ec1 (α_1)	0.00	0.00	0.72
IIP ec2 (α_2)	2.46	1.46	1.69
IIP ec3 (α_3)	0.00	0.00	1.85
IIP ec4 (α_4)	0.00	0.00	−1.31
IIP ec5 (α_5)	−0.16	0.12	−1.33
GFD ec1 (α_1)	7.41	9.48	0.78
GFD ec2 (α_2)	0.00	9087.45	−2.07
GFD ec3 (α_3)	2.07	1.16	1.79
GFD ec4 (α_4)	−12.60	11.77	−1.07
GFD ec5 (α_5)	−1057.99	770.31	−1.37
FER ec1 (α_1)	−11.00	4.24	0.01
FER ec2 (α_2)	−3944.94	4060.36	0.33
FER ec3 (α_3)	0.76	0.52	0.14
FER ec4 (α_4)	−0.44	5.26	0.93

Variables	Coefficient Value	Standard Error Value	Z Statistics
FER ec5 (α_5)	151.66	344.18	0.66
CNXNIFTY ec1 (α_1)	0.03	0.03	1.02
CNXNIFTY ec2 (α_2)	−54.08	32.97	−1.64
CNXNIFTY ec3 (α_3)	0.00	0.00	0.63
CNXNIFTY ec4 (α_4)	0.01	0.04	0.17
CNXNIFTY ec5 (α_5)	−2.86	2.80	−1.02
SENSEX ec1 (α_1)	0.04	0.04	1.04
SENSEX ec2 (α_2)	−62.36	35.06	−1.78
SENSEX ec3 (α_3)	0.00	0.00	0.84
SENSEX ec4 (α_4)	0.00	0.05	−0.09
SENSEX ec5 (α_5)	−3.68	2.97	−1.24

Table 7 shows the result of the co-integrating vector (), which aids in understanding the current pace of adjustment when the connection deviates from the variables' relationships in this study. The restrictions in the adjustment matrix are the result of the loading coefficient of each of the five co-integrating vectors '1', '2', '3', '4', and '5'. The alpha matrix, on the other hand, is critical in determining the link between each variable and the disequilibrium relationships with the stock market used in the analysis. As a result, in the pre-corona pandemic period, there was a substantial link between CNX NIFTY and SENSEX and selected macroeconomic factors.

Result of co-integration relation (Beta) for the loading coefficient of co-integrating vector (α_5) of each variable selected for the study.

Table 8: Co-Integration Relation (Beta)

Variables	Coefficient Value	Standard Error Value	Z Statistics
COP	−1.891e−16	0	0
ER	0	0	0
FII	3.686e−17	0	0
GP	6.592e−17	0	0
IIP	1.0000	0	0
GFD	−0.0031	0.005	−0.652
FER	0.0005	51.805	9.78e−06
CNXNIFTY	−0.4596	7.862	−0.058
SENSEX	0.3633	0.243	1.497

This is the outcome of the co-integration relation (Beta) for each of the variables' loading coefficient vector (5), along with their coefficient, standard error, and Z statistics. In a beta matrix, the contributions of coefficient findings of the variables indicate whether or not there is a substantial association between them. This reveals that there was a bidirectional link between CNX NIFTY and SENSEX, as well as certain macroeconomic factors, during the pre-corona pandemic era.

Table 9: Granger Causality Test

	COP	ER	FII	GP	IIP	GFD	FER	CNX NIFTY	SENSEX
COP	1.00	0.12	0.10	0.00	0.10	0.00	0.00	0.00	0.00
ER	0.00	1.00	0.00	0.00	0.04	0.02	0.00	0.00	0.00
FII	0.01	0.00	1.00	0.00	0.00	0.00	0.00	0.06	0.09
GP	0.01	0.01	0.00	1.00	0.00	0.00	0.00	0.06	0.05
IIP	0.02	0.00	0.00	0.00	1.00	0.00	0.08	0.00	0.00
GFD	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00
FER	0.00	0.00	0.00	0.00	0.05	0.00	1.00	0.00	0.00
CNXNIFTY	0.19	0.00	0.00	0.00	0.00	0.02	0.00	1.00	0.00
SENSEX	0.26	0.00	0.00	0.00	0.00	0.01	0.00	0.00	1.00

The Granger causality approach estimate demonstrates that all variables have shown causation with CNX NIFTY and SENSEX, except crude oil price, which has shown weak Granger causality with both exchanges during the pre-corona pandemic era.

FINDINGS

From the empirical evidence, macroeconomic investment assets have a significant impact on the Indian stock

market, indicating a bidirectional relationship between macroeconomic investment assets and the Indian stock market, i.e., in the short run and the long run as well.

However, the degree of synergy between the selected macro-environmental factors and the stock market indices is highly considered in this work. Furthermore, the coefficient from the OLS model revealed that COP, ER, GP, FII, IIP, and GFD have a negative link with SENSEX returns, while FER and CNX NIFTY had a positive link.

Durbin-Watson's result is 0.783, and the value of R-square and adj. R-square is 0.999, indicating that macroeconomic variables account for 99.9% of the volatility in the SENSEX. On the other hand, the 0.1 per cent shift in SENSEX may be seen as being explained by variables outside the model. As a result, SENSEX results are extremely susceptible to macroeconomic factors. The Granger causality approach estimate demonstrates that all variables have shown the existence of causality with CNX NIFTY and SENSEX. Crude oil price, on the other hand, reveals weak Granger causality with both exchanges. Each of the variables' Beta (β) of the loading coefficient column 5 (ec5), as well as their coefficient, standard error, and Z statistics revealed that there is a substantial association between the selected variables and the indices of the Indian stock market. In a beta (β) matrix, the contributions of coefficient findings of the variables indicate a substantial association between them. This implies that during the pre-corona pandemic period, there was a bidirectional association between CNX NIFTY and SENSEX and selected macroeconomic indicators.

CONCLUSION

The current study gives important hints for investors who want to build a well-defined, diversified portfolio. Since it is critical to maintain control over the psychological impact of socio-economic limitations on investors, it is recommended that investors keep their eyes open when making investment selections. Before developing a policy, it is critical that the government and other regulatory authorities, who are the formulators of the essential implications for them, detect the adverse influence of the variables chosen and shield the country against external barriers.

The findings of this study will assist investors in making critical decisions in the sphere of investment and investment diversification. After all, the observation's outcome demonstrates that the diversification decisions are based on extremely strong conclusive data. Apart from the topics discussed above, there are still some known and unknown elements that may have an impact on the performance of stock indexes and the ability of firms to generate performance, which might be investigated further.

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