

Keswani, Sarika; Puri, Veerma; Jha, Rimjhim

Article

Relationship among macroeconomic factors and stock prices: cointegration approach from the Indian stock market

Cogent Economics & Finance

Provided in Cooperation with:

Taylor & Francis Group

Suggested Citation: Keswani, Sarika; Puri, Veerma; Jha, Rimjhim (2024) : Relationship among macroeconomic factors and stock prices: cointegration approach from the Indian stock market, Cogent Economics & Finance, ISSN 2332-2039, Taylor & Francis, Abingdon, Vol. 12, Iss. 1, pp. 1-20, <https://doi.org/10.1080/23322039.2024.2355017>

This Version is available at:

<https://hdl.handle.net/10419/321493>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



<https://creativecommons.org/licenses/by/4.0/>

Relationship among macroeconomic factors and stock prices: cointegration approach from the Indian stock market

Sarika Keswani, Veerma Puri & Rimjhim Jha

To cite this article: Sarika Keswani, Veerma Puri & Rimjhim Jha (2024) Relationship among macroeconomic factors and stock prices: cointegration approach from the Indian stock market, Cogent Economics & Finance, 12:1, 2355017, DOI: [10.1080/23322039.2024.2355017](https://doi.org/10.1080/23322039.2024.2355017)

To link to this article: <https://doi.org/10.1080/23322039.2024.2355017>



© 2024 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group



View supplementary material [↗](#)



Published online: 03 Jun 2024.



Submit your article to this journal [↗](#)



Article views: 9508



View related articles [↗](#)



View Crossmark data [↗](#)



Citing articles: 8 View citing articles [↗](#)

Relationship among macroeconomic factors and stock prices: cointegration approach from the Indian stock market

Sarika Keswani^a , Veerma Puri^b and Rimjhim Jha^c

^aSymbiosis Centre for Management Studies (SCMS), Symbiosis International University (SIU), Nagpur, India; ^bSykm's NMIMS Deemed-to-be University, School of Business Management, Navi Mumbai, Maharashtra, India; ^cSymbiosis Institute of Business Management, Nagpur Campus, Symbiosis International (Deemed University), Pune, India

ABSTRACT

The performance of a stock market is intrinsically linked to the broader financial and economic landscape of a country. Stock prices, as integral indicators, not only mirror the financial health and collective economic circumstances of a nation but also serve as crucial barometers of tangible financial activities. This research paper aims to undertake a comprehensive exploration of the intricate relationship between specific macroeconomic determinants and the stock market within the context of India. Moreover, this study conducts an exhaustive analysis to assess the relative significance of these variables and their contributions to the predictive capacity of stock prices. This investigation harnesses a dataset consisting of monthly observations of the chosen macroeconomic variables. The outcomes of the cointegration analysis illuminate a robust and statistically significant long-term association between Indian stock prices and the selected macroeconomic factors. The results of the cointegration test affirm a lasting nexus between stock returns and crucial economic indicators, namely Gross Domestic Product (GDP), disposable income, and the participation of Foreign Institutional Investors (FII) in the market. Furthermore, this study underscores the enduring negative relationship between stock returns and factors, such as interest rates, government policies, exchange rates, and inflation. These findings provide valuable insights into the interplay between the stock market and macroeconomic forces in the Indian context.

IMPACT STATEMENT

This study comprehensively examines the intricate relationship between macroeconomic variables and the Indian stock market from 2009 to 2019. Utilizing a monthly dataset and rigorous statistical techniques, such as cointegration analysis and the VECM Granger causality test, the research elucidates a significant long-term relationship between macroeconomic variables like GDP, disposable income, and Foreign Institutional Investor (FII) participation, and Indian stock prices. The empirical results reveal a negative correlation with interest rates, government policies, exchange rates, and inflation, and a positive long-term correlation with GDP, disposable income, and FII involvement. The cointegration tests substantiate these findings, reaffirming the enduring nature of these relationships. Furthermore, the VECM Granger causality test highlights the substantial impact of changes in these macroeconomic variables on short-term stock price fluctuations. The study's conclusions shed new light on the dynamic relationship between macroeconomic factors and the stock market in India. By identifying the predictive capacity of key economic indicators on stock price movements, this research contributes to more informed and strategic decision-making for policymakers, investors, and economists, thereby enhancing the efficacy of economic planning and investment strategies.

ARTICLE HISTORY

Received 5 July 2023
Revised 30 April 2024
Accepted 9 May 2024

KEYWORDS

Disposable income;
economic growth (GDP);
exchange rates; FII;
government policies;
interest rate; inflation

REVIEWING EDITOR

Xibin Zhang, Monash
University, Australia

SUBJECTS

Economics;
Macroeconomics; Finance

JEL CLASSIFICATION CODES

E2; E4; E6

1. Introduction

The relationship between macroeconomic factors and stock prices has long been a subject of interest and investigation in both economic theory and empirical research. Studies have consistently recognized stock prices and market indices as reliable indicators for assessing economic dynamics (Abbass et al., 2022). Over the past two decades, there has been a surge in scholarly interest in this area, reflecting a growing understanding of the complex interplay between real economic factors and equity market fluctuations (Anser et al., 2021; Fabozzi et al., 2022).

Theoretical and empirical work, such as that by Chen et al. (1986), has shown that fluctuations in macroeconomic variables can significantly impact future dividend rates, discount rates, and, consequently, stock prices. Additionally, empirical evidence supports the notion that economic variables influence price changes in capital markets, establishing a clear link between equity prices and innovations in economic factors (Hong et al., 2021; Goswami & Jung, 1997).

Government agencies and policymakers hold a vested interest in these studies due to the pivotal role played by the stock market in maintaining macroeconomic stability (Magbondé & Konté, 2022). While theoretically, stock markets exhibit correlations with a nation's macroeconomic variables, the generation of higher revenues within the stock market is influenced by specific macroeconomic indicators (Joshi & Giri, 2015). Economic conditions within a country significantly affect stock market prices (Riaz et al., 2022). Macro variables, such as GDP, interest rates, exchange rates (ER), and inflation also have a substantial impact on the stock market (Gyamfi et al., 2021).

Establishing a long-term relationship between selected macroeconomic factors and stock returns is of paramount importance (Keswani & Wadhwa, 2017, 2019a, 2019b). The presence of stock exchanges within a market is recognized to have enduring implications for financial activities, particularly concerning government policies and macroeconomic indicators (Biglarkhani et al., 2023; Ho & Lyke, 2017; Patel, 2012).

While many studies have explored the impact of individual macroeconomic factors on stock prices, fewer have examined the joint effect of multiple factors, often focusing on developed economies to the exclusion of emerging market economies (Awokuse, 2008; Contractor et al., 2014; Ho & Lyke, 2017; Paul & Benito, 2018).

Macroeconomic variables, such as inflation, interest rates, and exchange rates, are critical indicators of a country's economic health. These variables, in turn, affect the stock market, impacting its unpredictability (Narayan et al., 2014; Srinivasan, 2012; Trivedi & Behera, 2012). This study seeks to determine whether changes in these macroeconomic variables are causal or consequential to movements in Indian stock market indices. Specifically, the research explores how inflation, interest rates, GDP, and unemployment rates influence stock prices and aims to identify any discernible patterns or trends in the data (Huy et al., 2020, 2021).

In contrast to traditional research, this paper employs the Jenson Cointegration and VECM methodology to investigate the long-term and short-term stability between macroeconomic variables and Indian stock prices. VECM-based Granger causality is used to establish the direction of causal relationships among the variables, and Variance Decomposition (VDC) is employed to gauge the degree of exogeneity of the variables under study. The analysis draws on monthly data spanning from 2009 to 2019.

This research is pivotal as it aids investors in making informed decisions about stock market investments and helps policymakers comprehend how macroeconomic policies influence stock prices and, subsequently, the broader economy. Its insights are invaluable for investors, policymakers, and other stakeholders in financial markets.

1.1. Motivation of the study

Notably, none of the existing studies have delved into a critical variable, namely, disposable income. The omission of this variable is significant because theoretically, it plays a substantial role in influencing the stock market. An increase in disposable income is expected to have a direct impact on stock market dynamics, potentially resulting in higher stock valuations and, consequently, a boost in the overall market value. Disposable income, defined as the portion of household income available for expenditure and savings after income taxes have been deducted, holds a pivotal position in economic decision-making.

When disposable income experiences an upswing, households are presented with the choice to either save or spend more. Increased disposable income typically leads to heightened consumption, which has a cascading effect on various aspects of the economy. This surge in consumption can trigger an upswing in corporate sales and earnings, in turn enhancing the value of individual stocks. Such an increase in the valuation of individual shares may have a ripple effect, ultimately contributing to an overall market upturn. In essence, this scenario can stimulate a financial upswing, benefiting various market participants.

Conversely, a decline in disposable income limits households' spending capacity, necessitating more prudent consumption choices. This decrease in consumption can negatively impact corporate sales and overall corporate income, potentially leading to a reduction in the value of individual stocks. Therefore, the dynamics of disposable income play a pivotal role in shaping stock market movements and warrant a thorough examination in the context of stock market research.

1.2. Contribution of your proposed study

In this study, an attempt is made to establish a connection between these two events. However, unlike the conventional studies, in this paper, the Jenson Cointegration and VECM approach was used to examine the long run and short run stability between the macroeconomic variables and Indian stock prices. The study also uses VECM based granger causality to check the direction of causal relationships between variables. Variance Decomposition (VDC) is used to explore the degree of exogeneity of the variables involved in this study. For the purpose of analysis, monthly data starting from the year 2009 to 2019 was used.

Research into the relationship between macroeconomic factors and stock prices in India is of paramount significance for multiple compelling reasons. Firstly, it serves as a crucial tool for investment decision-making, aiding both individual and institutional investors in making informed choices for wealth generation and preservation. Secondly, it contributes to effective risk management by providing insights into how macroeconomic variables, such as inflation and interest rates, impact stock prices, enabling investors to mitigate potential financial risks. Moreover, it plays a pivotal role in economic policy formulation, offering policymakers valuable insights into the consequences of their policies on stock market performance. Furthermore, such research is instrumental in ensuring financial stability, allowing regulators to identify vulnerabilities and take preventive measures. It also enhances market forecasting accuracy and aids businesses in resource allocation and long-term planning, all of which are vital for economic growth and stability. Additionally, this research fosters international comparisons and enriches economic knowledge. Lastly, it empowers individuals through improved financial literacy, enabling them to make well-informed financial decisions. In conclusion, research on this subject is indispensable for investors, policymakers, businesses, and the broader economy, contributing to financial stability and informed investment strategies.

1.3. Purposes of the study

The purposes of this study are as follows:

- i. To understand the long- and short-term relationships between government policies, FII, GDP, disposable income, ER, inflation, interest rate, and Indian stock prices.
- ii. To see the relative importance of macroeconomic variables in predicting the prices for Indian shares.

2. Literature review

Fifield et al. (2002) assessed the influence of both global and local economic factors on stock market returns in Thirteen Emerging Market Economies (EME). Using a principle component analysis, the study discovered that global economic variables, including World Industrial Production (WIP) and World Inflation (WI), significantly explained stock market returns in six EMEs (Greece, Korea, Mexico, Portugal,

Singapore, and Thailand). However, local economic variables were found to significantly impact stock market returns only in India and Greece. Notably, for countries like Chile, Hong Kong, Malaysia, the Philippines, and South Africa, neither global nor local factors could account for variations in stock market returns.

Pal (2005) examined stock market volatility and foreign institutional investors in India. Many studies have found that FIIs are the main players in the Indian stock market. FII trading and domestic stock market sales suggest that FIIs are on the rise because of the rising proportion of stock prices in India.

Altwaijri (2006) focused on the factors that affect Saudi Arabia's stock market and found that oil prices, national incomes, the supply of money, inflation rates (INF), and IR are the most important factors that influence the Saudi stock market.

Chakraborty (2007) analyzed the bivariate causal relationship between FIIs and contemporary stock market returns for the Indian stock market for eight consecutive years from April 1997 to March 2005 by applying pair-wise Granger Causality tests. The results of the study indicated the reverse causal relationship between FII inflows and stock market returns, contradicting the age-old perception of the positive effect of FII inflows on stock market returns. Such findings suggested the return-chasing behaviour of foreign investors and supported the theory of 'cumulative informational disadvantage'.

Cunningham (2007) concluded that the provisional and final release dates for GDP usually cause greater changes in stock prices than the average. Most investors and people were concerned that the market was still reacting to this GDP release because the course and often the size of the GDP release can be accurately predicted based on the source data released after the advance announcement. However, news on GDP reported about shares prices appear do not affect stock prices significantly because the true news can be measured in the released data and some offsetting effects occur.

Chuang et al. (2007) investigated the existence of significant budget deficits, money supply, and predicted stock prices in Singapore, Taiwan, South Korea, and Hong Kong. Quarterly information on stock price indices, budget deficit, and money supply was used for the research. The study observed that using the VAR model, there is a long-term connection among budget deficit, money supply, and stock prices. Stock prices did not necessarily change rapidly and in short-term adjustments, either in the economic or monetary policy. The results were therefore discovered to be consistent with the relevant macroeconomic literature.

Ahmed (2008) examined the causal relationship between stock prices (namely, Sensex and NIFTY) and key macroeconomic variables in India, such as exchange rates, foreign direct investment (FDI), index of industrial production (IIP), export rates, money supply, and interest rates. The author employed J-J cointegration and ARDL bounds testing techniques to test for long-term robustness. Engle-Granger causality was used to investigate long-term causal linkages, while ARDL test was utilized to analyze short-term dynamics. The study's findings indicate a strong association between stock market development and economic growth. Engle-Granger causality estimation confirms a bidirectional causality between stock market development and economic growth in the long-term. However, in the short-term, there is only a unidirectional causality from stock market development to economic growth.

Yu et al. (2008) examined the potential for recessions in a stock market based on macroeconomic factors. Empirical evidence was evaluated from the monthly data of S&D 500 price index. The study discovered that INF and stock returns were the most useful predictors in US recessions among the macroeconomic variables considered.

Chang et al. (2009) analyzed the predictability of various macroeconomic variables, viz, interest rate, dividend yield, and default premium, in the stock market movement of US S&P 500 index from January 1965 to July 2007, in both stable and volatile states using the regime-switching GARCH Model. The authors found that the time-invariant impact of three economic variables on the stock market returns and the ability to predict the stock movements is far better in a volatile state than in a stable state.

Humpe and Macmillan (2009) contrasted the US/Japanese equity relations with industrial production (IP), INF, money supply (M1), and long-term IRs. The data were taken from January 1995 to June 2005

using cointegration. In the US, stock prices were found to be strongly affected by IP, CPI, M1, and long-term interest rates. For Japan, the stock prices were discovered to be favorably linked to M1, IP, long-term IR, and CPI. The Granger causality was not determined.

Kutty (2010) examined the association of stock price and ER in Mexico by using the weekly frequency data of the Bolsa Mexico Equity Index between 1989 and 2006; the leading 35–40 stocks of the market capitalization index and Mexican peso per US dollar rate. The Granger test of causality confirmed that the stock prices Granger-cause ER, indicating one-way causality. The author used 849 observations for the study. However, the causality was limited to a one-time delay, which implied that the effect can be only instant and would decrease in the long term.

Al-Shubiri (2010) studied the determinants of the movement of stock prices using a case study on commercial banks in Jordan for the Amman Stock Exchange. It was shown that market prices are related to the net asset value per share and that the price did not lead to inflation and the interest rate.

Olweny and Omondi (2011) studied the impact on stock exchange volatility of Nairobi's ER, IR, and INF. They analyzed monthly time-series data using EGARCH and TGARCH thresholds from 2001 to 2010. The results indicated that Kenya's stock market volatility was affected by IR, INF, and ER. Foreign ER too had a significant but rather low impact on stocks.

Attari and Javed (2013) explored the correlation among macro-economic volatility and stock market volatility in Pakistan. The research examined at the following macroeconomic variables that influence stock prices: interest rates, inflation, and GDP. The EGARCH model with an exponential function was applied in this study. The monthly time series data was collected between December 1991 and August 2012, and it was tested for stability and homogeneity using the ADF and ARCH tests. The study discovered no link between GDP and stock market returns. According to the results of the causality test, however, unidirectional causality was observed between the rate of inflation and economic growth, as well as between economic growth and government spending.

Mlambo et al. (2013) utilized GARCH to assess the impact of exchange rate (ER) volatility on the Johannesburg Stock Exchange in South Africa. The study analyzed monthly data from 2000 to 2010 and found a weak link between ER volatility and stock volatility.

Sahu and Bandopadhyay (2013) analyzed the dynamic relationship between FII and the stock returns for Indian stock indices from 2000 to 2013. Various statistical tools like Johansen's cointegration test, Vector Error Correction Model (VECM), and Impulse Response Functions analysis were applied to understand the relationship, direction, and persistence between FIIs and stock market returns. The results of the study confirmed the significant, positive, and the long-run relationship between FIIs and stock market returns. Further, the test results confirmed the insignificant impact of FIIs on stock market returns. In contrast, the results strongly suggested the chasing trend of FIIs in the Indian stock market.

Laichena and Obwogi (2015) investigated the impact of macroeconomic variables, namely interest rates, currency exchange rates, gross domestic product (GDP), and inflation rates, on stock returns in East Africa. The study employed panel data from three East African countries, namely Kenya, Uganda, and Tanzania, spanning from 2005 to 2014. The research discovered a significant relationship between stock returns in East Africa and the macroeconomic variables analyzed. The authors recommended that policymakers in East Africa should take measures to enhance the region's macroeconomic conditions to boost stock returns.

Ramadan (2016) attempted to provide insight into the link between the system of stock trading and the macroeconomic variables in two emerging countries Egypt and Tunisia between January 1998 and January 2014. Results indicated that in Egypt there was a causal connection among advertising lists, CPIs, converting scale, money supply, and credit costs and share prices. The same was true for Tunisia except for the CPI, which had no causal link to the market list. Results also showed that financial markets were correlated with four macroeconomic sectors in both nations.

Riyanto et al. (2017) examined the impact of macroeconomic factors on sector wise Indonesian stock market indices using weekly data from 2005 to 2014. The results showed that INF, XR, and IR have a major impact on the indices of Indonesia's emerging economic sectors. The inter-interest rate and the indexes in each sector except for a few sectors were partly significantly negative. Also, inflation growth

in part had no major effect on any of the sectors listed. On the other hand, the ER had to a certain degree a major effect.

Jamaludin et al. (2017) investigated the macroeconomic parameters of SR that were inspected both in conventional and Islamic stock in the three ASEAN countries. Weekly data for the years 2005 to 2015 were taken for analysis. The findings showed that INF and XR affect both SMs substantially. The provision of money did not have a big effect though. The findings also showed that inflationary growth had more negative effects on stock market returns.

Okoye et al. (2018) analyzed the relationship between macroeconomic factors and market capitalization in emerging economies. The findings showed that the macroeconomic factors affect the market capitalization in emerging economies. The authors collected data from 1988 to 2012 for the Nigerian Bourse Index. The results also showed that unemployment rate, INF, IR, and loan rate had negative effects on market capitalization but no significant connection between them was identified.

Mohamed and Ahmed (2018) based on annual stock return data and quarterly data about macroeconomic factors, examined the effect of six macroeconomic factors on Jordanian stock market returns from 1976 to 2016. The ARDL model was used for the analysis. It was found that industrial production has a statistically significant effect on the returns of shares. Furthermore, the MS also impacted Jordan's stock returns favorably and substantially. The import prices had a negative but important effect on the returns on Jordanian stocks.

Demir (2019) examined some prominent macroeconomic factors for their effect on the Borsa Istanbul-100 (BIST-100) index. The results of the four-monthly ARDL-bound test showed that the stock market index was boosted by economic growth, portfolio investments, domestic currency, and foreign direct investment (FDI). while interest rate (IR) and crude oil prices had a negative impact on the index.

Banda et al. (2019) inspected the ties between industrial shares and macro aspects, such as IR, economic outcomes XR, INF, and the emerging economies. They used data between 1995 and 2017. The results showed that INF has had a significant and optimistic effect on stock prices. The relations between IR and stock prices were found to be negative whereas XR had a positive relationship with stock prices and industrial growth did not correlate with stock price.

Demir (2019) examined the impact of some major macroeconomic factors on the BIST-100 index. The stock market index has risen, supported by economic development, domestic currency, foreign direct investment, and portfolio investments. The index was influenced by prices of crude oil and IR.

Hypotheses: The following hypotheses are proposed:

H_{0,1}: The macro economic variables are not integrated.

H_{0,2}: There is a significant and positive long-term relationship between disposable income, FII, Economic growth (GDP), and NIFTY stock returns.

H_{0,3}: The changes in the selected macroeconomic variables explain the significant variation in the NIFTY stock prices in short run.

3. Research methodology

The present study uses a descriptive research design to understand the influence of macroeconomic factors like disposable income (DI), Exchange Rate, government policies (GP), Interest Rate, and Inflation Rate on the Indian stock market (ISM) efficiency. A descriptive study strategy thus serves to understand the impact of the macroeconomic factors listed above on stock returns in the Indian National Stock Exchange (NSE).

3.1. Setting of the study

Secondary data was compiled from a variety of websites and databases, including the Reserve Bank of India, the World Bank, and the Prowess database.

3.2. Macroeconomic variables

The dependent variable in this study is the stock market index, which represents the value of a particular segment of the stock market. This value is determined by calculating the price of stocks, usually by taking a weighted average. Investors and financial managers utilize this tool to assess the market and evaluate the return on a specific investment. Alternatively, the stock market index can also be defined as the total value obtained by combining various stocks or investment vehicles with the underlying asset as of a particular date. Since stock indices encompass the entire stock market, they provide a measure of market changes over time.

3.3. Data collection

The study is based on secondary data analysis. The details of the various macroeconomic variables are given below in Table 1.

Table 1. Details of data sources of variables under study.

Variable name	Definition	Data sources	Period (monthly data)
Dependent variable NIFTY stock returns	The list is weighted by market capitalization and comprises the top 50 stocks that are most actively traded on the national stock exchange.	NSE website	Monthly data from April 2009 to March 2019
Independent variables Economic growth (GDP)	Economic growth refers to the increase in the production of goods and services in an economy over time.	Website of the World Bank	Monthly data from April 2009 to March 2019
Inflation (CPI)	The consumer price index (CPI) is the inflation rate that is most commonly acknowledged. With a high score, the index range from 0 to 100 implies elevated inflation.	Website of the RBI	Monthly data from April 2009 to March 2019
Interest rate (IR)	The money market rate serves as a proxy for interest rates and is represented by the monthly average of daily interbank lending rates (%).	Prowess database	Monthly data from April 2009 to March 2019
ER	The exchange rate used in this context is the Indian rupee's value against the US dollar.	Prowess database	Monthly data from April 2009 to March 2019
Government policies (GP)	Government policies refer to the rules and regulations established by the government to control or stimulate the economic indicators of a country. One of these policies includes tax rate policies, which are considered as a part of government policies.	Website of the Income Tax Department of India	Monthly data from April 2009 to March 2019
Disposable income (DI)	Disposable income is the amount of money that a person or household has left over after paying taxes and essential expenses, such as rent, mortgage, bills, and other necessary living costs. This money is available for spending or saving.	Prowess database	Monthly data from April 2009 to March 2019
Foreign institutional investor (FII)	FII stands for Foreign Institutional Investor, which refers to an individual or organization that invests money in the financial markets of a country other than their own. FIIs typically invest in stocks, bonds, and other securities in the country's market where they wish to gain exposure.	Website of NSE	Monthly data from April 2009 to March 2019

All values were converted into log values to make the regression relation more linear.

3.4. Analytical models

For the analysis of this research augmented Dickey-Fuller (ADF) and Phillips–Perron tests, preliminary tests, stability tests, cointegration analysis, vector error correction model (VECM), and variance decomposition technique (VAD) were used to examine the association among selected variables.

3.4.1. Model specification

This study has utilized the following general specification to conduct an empirical analysis of the impact of fundamental macroeconomic variables on the stock market.

$$LNSE = \alpha_0 + \alpha_1 LGDP + \alpha_2 LITR + \alpha_3 LINR + \alpha_4 LDI + \alpha_5 LFII + \alpha_6 LGP + \alpha_7 LER + \varepsilon_t$$

The relationship between various economic factors can be expressed through a regression model, where each variable is logged for analysis. Let $LNSE$ represent the logarithm of the National Stock Exchange index, $LGDP$ denote the logarithm of Gross Domestic Product, $LITR$ signify the logarithm of the interest rate, $LINR$ stand for the logarithm of the inflation rate, LDI indicate the logarithm of disposable income, $LFII$ represent the logarithm of foreign institutional investors' activity, LGP symbolize the logarithm of government policies, and LER denote the logarithm of the exchange rate. The model also includes an error term, ε_t , to account for unexplained variability.

3.4.2. Unit root tests

ADF test was used to evaluate the root unit. A stationary ADF test was used for the normal checks. The p -value for the variables is taken into consideration at 5% significance level. It is lower than 0.05, then the null hypothesis will be rejected and vice versa. This test is very important to do because if the variables in the regression model are not stationary, then it can be proved that the standard assumptions for asymptotic analysis will not be valid.

3.4.3. Preliminary tests

3.4.3.1. Multicollinearity test. Multicollinearity generally occurs when the independent variables in a regression model are correlated with each other. This correlation is not expected as the independent variables are assumed to be independent.

3.4.3.2. Auto correlation/serial correlation. Autocorrelation refers to the correlation between the same variables observed in two successive time intervals, as suggested by Koutsoyiannis and Fofoula-Georgiou (1993).

3.4.3.3. Normality check. This check is used to check if the data follow a normal probability distribution.

3.4.3.4. Testing for heteroscedasticity. Heteroskedasticity (or heteroscedasticity) occurs when the standard deviations of a predicted variable, observed across various values of an independent variable or over previous time periods, are not constant.

It indicates that the regression model is well-defined, implying that the dependent variable's performance is well-explained.

3.4.3.5. Residual diagnostics test. The residual tests are done to make the residuals white noise. The residuals do not contain any systematic data, as if they do, this data is an assumption that is not included in the model.

3.4.4. Stability tests

In the process of model development, performance metrics are initially computed on a development sample, and subsequently on validation samples, which could either be another sample from the same timeframe or samples shifted in time. If the performance metrics demonstrate consistency across all

samples, the model is considered stable and robust. And if over the test period, the parameters of the model are volatile, then the model could not even represent how the series developed during the sampling period. For this two tests were conducted they are:

3.4.4.1. Ramsey reset test. Statistics indicate that in the Ramsey Regression Equation Specification Error Test (RESET) the general specification test of the linear regression model is used. In particular, it tests whether non-linear combinations of values have helped to clarify the reaction variable.

3.4.4.2. CUSUM test. The cumulative amount (CUSUM) of deviations from the target value of each sample value is displayed in a CUSUM graph. Because the CUSUM graph is cumulative, even minor drifting in the process mean will constantly increase (or decreasing) cumulative deviation values.

3.4.5. Bound test procedure

3.4.5.1. Vector error correction model (VECM) and cointegration tests. Vector Error Correction Model (VECM) is important for studying the relationship between macroeconomic factors and stock prices in the Indian Stock Market.

VECM is based on the concept of cointegration, which examines the long-term relationship between non-stationary time series variables. In the context of this study, it helps determine whether there is a stable, long-term connection between the macroeconomic variables and stock prices. Cointegration indicates that these variables move together over time, and it's essential for understanding their interdependence. VECM is a dynamic model that accounts for both short-term and long-term effects. It helps capture the equilibrium relationship between the macroeconomic factors and stock prices, considering how they adjust to deviations from this equilibrium in the short run. This is crucial for understanding the market's response to various economic factors over time. VECM allows for Granger causality testing. This is significant in determining the direction of causality between macroeconomic variables and stock prices. It helps answer questions like whether changes in macroeconomic variables lead to stock price movements or vice versa. Understanding causality is important for predictive modeling and policy implications. The error correction term in VECM captures the short-term adjustments required to bring the variables back to their long-term equilibrium when a deviation occurs. This term is particularly relevant for understanding how quickly the system corrects itself after a shock, which is crucial for traders and investors who want to predict short-term market movements.

Understanding the cointegration relationship and Granger causality helps policymakers and investors make informed decisions. For instance, if it is found that changes in certain macroeconomic variables significantly impact stock prices, policymakers may adjust economic policies accordingly.

Cointegration assessment was carried out once the order of integration was decided for each variable. For this research, VECM was applied after finding a long-term association. VECM Granger causality test was also applied to find the casual relationship.

3.4.5.2. VECM-Granger causality test. For the evaluation of the association between two or more variables in terms of causality, the Granger causality test was used. Each variable can be examined in the Granger causality test through a causal short-run relation among the variables. What is Granger causality test and its relevance in financial economics?

Granger causality testing assesses whether a linear relationship exists between two variables, and determines whether one variable can be considered a dependent variable while the other can be considered an independent variable, whether the relationship is two-way, or whether there is no functional relationship at all (Enders et al., 1995).

3.4.5.3. Variance decomposition technique. Variance decomposition enables researchers to determine the proportion of variability in the dependent variable that can be explained by the independent variable's lagged variance. Furthermore, it helps to identify which independent variable is more effective in explaining the variations in the dependent variable over time.

4. Results and discussion

4.1. ADF unit root test analysis

This study used ADF statistics, which are generally negative numbers. The more negative the ADF statistic, the stronger it is to rejection that Unit root exists with a certain level of confidence. This study considered the level variables and the first differences.

$H_{0,a}$: Data is not stationary at level.

4.1.1. Interpretation

Table 2 indicates that the data at the level is not stationary and cannot be rejected because the p -value is above 0.05 ($p > 0.05$). It does not imply integration.

$H_{0,b}$: Data is not stationary at the 1st difference.

4.1.2. Interpretation

Table 2 indicates that the data at the level cannot be rejected since the p -value is < 0.05 ($p < 0.05$), indicating that the 1st difference data are stationary. This means that they are integrated at first difference.

4.2. Preliminary tests

4.2.1. Multicollinearity test

Variance Inflated factor (VIF) was used to test multicollinearity. The rule of thumb for this approach states that if the explanatory variance inflation factor is between 1 and 10, then variables are described as collinear.

4.2.1.1. Results of multicollinearity for the macroeconomic variables (NIFTY).

$H_{0,c}$: All selected macroeconomic variables are not multicollinear in nature.

4.2.1.2. Interpretation. Table 3 indicates the null hypothesis is not rejected since VIF is < 10 , suggesting that there is no multicollinearity in the case of NIFTY. The results of the NIFTY VIF are shown in Table 3 which shows that VIF is < 10 for all variables and that there is no multicollinearity among the macroeconomic variables. The explanatory variables in Table 3 show that these are not collinear. This is in line with results from a related study of multicollinearity tests done in Kenya. Similar findings are reported by Kirui et al. (2014), Olweny and Kimani (2011), and Aroni (2011).

4.2.2. Residuals tests

4.2.2.1. Summary of residuals tests. Table 4 indicates the null hypotheses cannot be rejected since the p -value exceeds 0.05, which means that in the case of NIFTY there is no issue of serial correlation, heteroscedasticity and residuals are also distributed normally and the model does not have any neglected nonlinearities.

Table 2. Summary of unit root test.

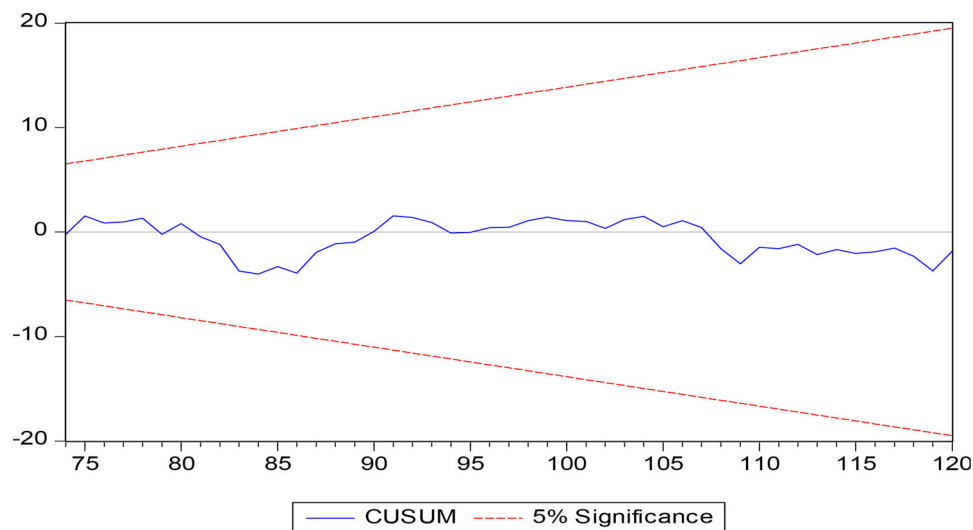
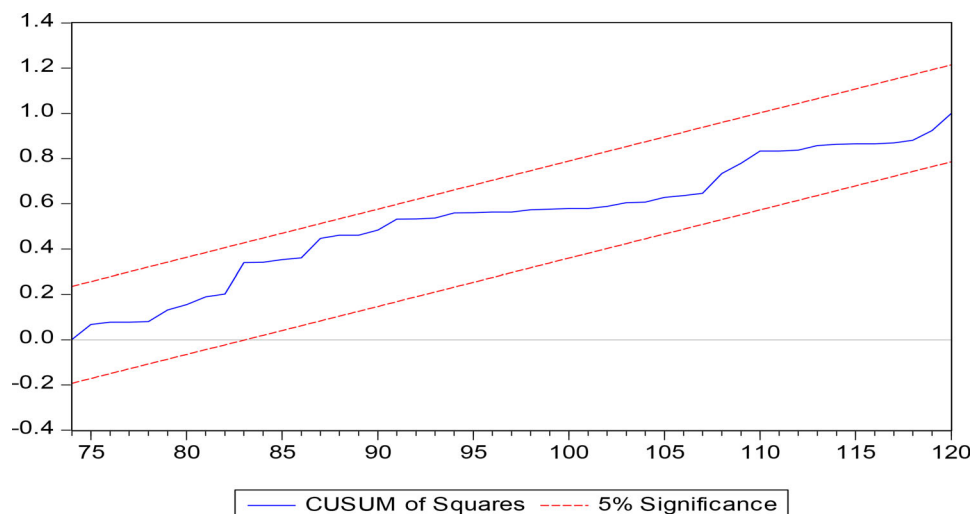
Variables	t -Statistics	ADF at level	t -Statistics	ADF at 1st difference
FII	−3.50	0.12	−11.48	0.00
Disposable income	0.96	0.99	−12.17	0.00
Economic growth (GDP)	−2.36	0.15	−10.77	0.00
Interest rate	−1.58	0.48	−10.78	0.00
Government policies	−0.21	0.93	−10.94	0.00
ER	−0.19	0.93	−8.37	0.00
Inflation rate	−3.49	0.11	−13.29	0.00
Stock prices	−1.15	0.69	−11.13	0.00

Table 3. Result of multicollinearity test.

Variable	VIF
Disposable_income	1.22
ER	1.54
FII	2.08
Interest rates	1.77
Economic growth	1.06
Govt policies	1.71
Inflation	1.68

Table 4. Residuals tests.

Null hypotheses	Test	<i>p</i> -Value	Result
No serial correlation exists	Serial correlation	0.13	Not significant
Residuals are distributed normally	Normality test: Jarque-Bera	2.83	Not significant
		0.92	
There is no heteroskedasticity in case of NIFTY	Heteroskedasticity	0.78	Not significant
The model does not have any neglected nonlinearities	Stability tests: Ramsey reset test	0.53	Not significant

**Figure 1.** CUSUM test (NIFTY).**Figure 2.** CUSUM of a square (NIFTY).

4.2.3. CUSUM test

The CUSUM graph (Figures 1 and 2) displays the cumulative amounts (CUSUMs) of deviations from the target value of each sample value. Because the CUSUM plot is cumulative, even a small drift in the process mean will continuously increase (or decrease) the cumulative deviation value. The square tests CUSUM (CUSUMSQ) and CUSUM are used to check the structural stability of the model.

The Cumulative Sum Test (CUSUM) was used in the current study of long-term and short-term stability parameters. At 5%, the cumulative amount (CUSUM) below the critical limit is important. This shows that long-term and short-term stability characteristics affect India's stock index. The model is stable and appears to be well-defined.

4.3. Co-integration and vector error correction model

4.3.1. Co-integration test

Co-integration was found to be essential because it could lead to a false assumption of the association of two variables if it does not occur due to non-stationary time series data. This is called a false regression of Stock and Watson (2006).

The rule of thumb is that the series should be cointegrated if two or more series in themselves are not fixed, but the linear time series combination is stationary. When there are more than two variables the selection of the Johansen-Juselius test is convenient as it has six different elements, namely: stock price, disposable income, interest rate, Governments' policies, inflation, ERs, FII, and economic growth (GDP).

4.3.1.1. Johansen co-integration test results.

$H_{0,d}$: The variables are not integrated.

4.3.1.2. Interpretation. In Table 5 of this research study, it has been observed a rejection of the null hypothesis, a significant outcome attributed to $p < 0.05$ (0.0001 and 0.0275). The research also encompasses a cointegration assessment, disclosing the co-integration of two vectors in the context of the NIFTY (NSE) index. This finding is substantiated through the utilization of the trace likelihood ratio, where the outcome supports the rejection of the null hypothesis positing the absence of cointegration between variables at a 5% significance level, owing to the surpassing of critical values.

This rejection of the null hypothesis implies the presence of two integrated equations, elucidating a linear long-term relationship among various variables. Specifically, these integrated equations signify a sustained relationship between the NIFTY index, disposable income, government policies, inflation, exchange rates (ERs), foreign institutional investments (FII), Gross Domestic Product (GDP), and interest rates. Notably, this analysis reveals the cointegration of all the aforementioned variables, suggesting a coherent and stable long-term relationship among them.

Table 5. Co-integration estimate (NIFTY).

Trace test					Maximum eigen value test				
Null hypothesis	Alternative hypothesis	<i>T</i> statistics	95% Critical value	Sig value	Null hypothesis	Alternative hypothesis	Maximum eigen value statistics	95% Critical value	Sig value
$r = 0$	$r \geq 1$	184.89	159.52	0.00	$r = 0$	$r \geq 1$	55.18	52.36	0.02
$r = 1$	$r \geq 2$	129.70	125.61	0.02	$r = 1$	$r \geq 2$	52.98	46.23	0.00
$r = 2$	$r \geq 3$	76.71	95.753	0.48	$r = 2$	$r \geq 3$	22.48	40.07	0.89
$r = 3$	$r \geq 4$	54.23	69.81	0.45	$r = 3$	$r \geq 4$	19.89	33.87	0.76
$r = 4$	$r \geq 5$	34.34	47.85	0.48	$r = 4$	$r \geq 5$	14.01	27.58	0.82
$r = 5$	$r \geq 6$	20.32	29.79	0.40	$r = 5$	$r \geq 6$	11.75	21.13	0.57
$r = 6$	$r \geq 7$	8.57	15.49	0.40	$r = 6$	$r \geq 7$	6.33	14.26	0.57
$r = 7$	$r \geq 8$	2.23	3.84	0.13	$r = 7$	$r \geq 8$	2.23	3.84	0.13

Table 6. NIFTY lag length.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	−880.22	NA	0.00	15.86	16.05	15.93
1	−20.22	1581.78	7.19*	1.64*	3.39*	2.35*
2	23.14	73.57	1.06	2.01	5.31	3.35
3	87.86	100.55	1.09	2.00	6.85	3.97
4	150.01	87.67*	1.22	2.03	8.44	4.63
5	212.93	79.77	1.43	2.05	10.01	5.28
6	282.47	78.22	1.62	1.95	11.47	5.81
7	362.41	78.51	1.70	1.67	12.73	6.16
8	439.49	64.69	2.18	1.43	14.05	6.55

*Indicates lag order selected by the criterion.

Table 7. Vector error correction model.

	Coefficient	Std. error	t-Statistic	Prob	Significant/not Significant
ECM (−1)	−1.17	0.12	−9.17	0.00	Significant
NIFTY (−1)	0.19	0.09	2.14	0.03	Significant
Disposable income (−1)	1.12	3.19	3.52	0.00	Significant
FII (−1)	2.34	5.13	4.56	0.00	Significant
Economic growth (GDP) (−1)	0.02	0.01	2.65	0.01	Significant
Government policies (−1)	−0.03	0.01	−2.48	0.01	Significant
Interest rates (−1)	−0.03	0.01	−2.06	0.04	Significant
ERs (−1)	−1.10	0.28	−3.91	0.00	Significant
Inflation (−1)	−0.01	0.01	−2.43	0.01	Significant
C	−0.01	0.01	−1.22	0.22	Not Significant

NIFTY Prices = −1.17 + 1.12DI + 2.34FII + 0.02GDP − 0.03GP − 0.03IR − 1.10ER − 0.01INF − 0.01.

4.3.2. NIFTY lag length

Before applying the VECM model, it is important to identify the lag length so according to Table 6 lag length is 1.

4.3.2.1. Interpretation. In this phase, the model shall be evaluated and placed on a scale to determine the number of relationships that are part of it. For the general VAR model, the SIC and AIC information criteria were used to determine the selection of the model with a 1 Lag selection. It is aimed at identifying several parameters which will minimize the evaluation of data criteria. To prevent the VAR from showing repeat autocorrelation, AIC was selected as a key point of reference. The lag length of the model is shown in Table 6 as 1.

4.3.3. Vector error correction model

The VECM model and the Granger causality approach identify long-term and short-term interactions among their co-integrated factors. Table 6 presents the long-term of the vector corrections model.

Table 6 displays the VECM results for the NIFTY (NSE). The adjusted R-squared for the regression model is 0.60, which is considered reliable with time-series data. While it would be preferable to have a higher R-squared, VECM is a method that accounts for the non-stationarity properties of time series data, resulting in a relatively lower R-squared compared to other methods like OLS. The R-squared value is dependent on the predictive power of selected macroeconomic variables on stock market volatility. This study aims to identify key macroeconomic variables that are predictors of stock market volatility. Therefore, researchers are exploring various macroeconomic variables to identify the ones that contribute the most to stock market volatility.

H_{0,e}: There is a significant and positive long-term relationship between disposable income, FII, Economic growth (GDP), and NIFTY stock returns.

Results in Table 7 revealed that there is a significant long-term association between the selected macroeconomic variables and stock returns at NIFTY because ECM shows the long-term association among the variables ($p < 0.05$, i.e. 0.000).

The results also suggest a substantial and favorable long-term association between disposable income, FII, Economic growth (GDP), and NIFTY stock returns. This indicates that an increase in GDP, disposable income, and FII may lead to a decline in the likelihood of NIFTY exhibiting negative performance. Moreover, it has been observed that government policies, inflation, interest rates, and ERs have a negative long-term correlation with stock returns, suggesting that an upswing in ERs, government policies, inflation, and interest rates may result in a reduction in stock market volatility for NIFTY. Long-term fluctuations in stock returns may arise due to changes in disposable income, interest rates, government policies, FII, inflation, economic growth (GDP), and ER. Therefore, all these factors can have a long term impact on Indian stock prices.

4.4. Summary of results

4.4.1. Exchange rate

The findings of this research were confirmed by the fluctuations in exchange rates that influenced stock-market volatility (Abdi et al. (2014), Javed and Farooq (2009), Olweny and Shipho (2011), and Omorokunwa and Ikponmwosa (2014a)). The effect of the foreign exchange rate on stock prices was analyzed by Alagidede et al. (2011) and a clear adverse link between stock prices and exchange rates was found. Huang and Yang (2000) examined the link between exchange rate and stock volatility in South Korea's data spanning from 1997 to 2000. The study discovered a notable association between the exchange rate and stock volatility.

The theory of the relationship between stock returns and exchange-rate is not accepted by Mishra (2004).

Empirical results generally indicate that in most nations, there is no long-term equilibrium between stock returns and exchange rates (Tabak, 2006). Choi et al. (2008) discovered the link between exchange rate movement and stock price volatility to be very weak or no relationship.

4.4.2. Interest rate

Kadir et al. (2011), Mandimika and Chinzara (2012), Olweny and Shipho (2011), Omorokunwa and Ikponmwosa (2014b), Waweru et al. (2008), and Zakaria and Shamsuddin (2012) have all confirmed the findings of this research, which suggest that changes in interest rates are negatively related to stock market returns and volatility.

Several explanations have been put forward by researchers to explain the causal impact of interest rates on stock market volatility. Bernanke and Kuttner (2005) identifies two reasons why interest rates affect stock market volatility. Firstly, investors use interest rates as a discount rate when valuing shares, and higher interest rates decrease the present value of future dividends, leading to a drop in share prices. Secondly, higher interest rates lead to investors selling shares and investing in fixed-income tools, which decreases stock demand and causes stock prices to drop. Teker and Alp (2014) argue that higher interest rates can also affect household expenditure and company revenues, ultimately leading to a decrease in stock value.

The present value model explains how the rise of the long-term interest rate can be explained by using the prevailing market interest rate as a discount rate when calculating the current value of a share. As the interest rate increases, the capital cost and reduction rate also increase, leading to a decrease in the actual value of future cash flows and a drop in stock prices. According to arbitrage theory, an increase in the real interest rate leads to a lower present value of future cash flows, resulting in a drop in stock prices.

4.4.3. Inflation

The research discovered that the performance of the Indian stock market is negatively connected to the consumer price index. Mutuku and Kirwa (2014) explored the dynamic connection of stock prices to four of these macroeconomic factors. The investigation goes beyond the argument that the stock market can protect itself from inflation.

The results of the research are compatible with Fama (1981), Mukherjee and Naka (1995) as well as Maysami and Koh (2000). The results show that inflation and stock prices are negatively correlated. The

Table 8. VEC Granger causality.

Dependent variable: NIFTY				
Variables	Chi-sq	df	Prob	Granger causality or not
Disposable income	12.46	1	0.0004	Yes
Exchange rate	15.31	1	0.0001	Yes
FII	20.78	1	0.0000	Yes
Interest rate	4.25	1	0.0391	Yes
Economic growth (GDP)	6.95	1	0.0084	Yes
Government policies	6.21	1	0.0127	Yes
Inflation	6.18	1	0.0129	Yes
All	46.03	7	0.0000	Yes

Table 9. Variance decomposition (VDC) analysis (NIFTY).

Variance decomposition of NIFTY									
Period	S.E	NIFTY	Disposable income	ER	GDP	Govt policies	Inflation	Interest rate	FII
1	0.06	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.09	93.62	1.21	0.21	3.56	0.44	0.49	0.36	0.07
3	0.12	90.99	1.11	0.44	4.50	0.50	1.54	0.39	0.49
4	0.15	88.66	1.15	0.55	5.41	0.63	2.32	0.38	0.87
5	0.17	87.11	1.13	0.62	5.91	0.68	2.95	0.35	1.21
6	0.20	85.98	1.12	0.67	6.26	0.73	3.40	0.33	1.48
7	0.22	85.16	1.11	0.70	6.50	0.76	3.74	0.31	1.68
8	0.23	84.54	1.11	0.72	6.68	0.78	3.99	0.30	1.84
9	0.25	84.07	1.10	0.73	6.82	0.79	4.19	0.29	1.97
10	0.26	83.70	1.10	0.75	6.92	0.80	4.34	0.28	2.06

negative connection could be caused by the reduction of the value of the money owing to inflation and the resulting reduction of the people's purchasing power which results in an adverse impact on the saving and investment activities stock exchange.

Bajo-Rubio et al. (2009) noted the reasons why inflation has an adverse effect on equity prices and negatively correlated with expected real economic growth. Thus investors are moving their portfolios to real assets if anticipated inflation rates become extremely high.

But many studied found there is no relationship between inflation and stock prices in both case cases short term and long term.

4.5. VEC Granger causality

$H_{0,f}$: There are changes in the selected macroeconomic variables that explain the significant variation in the NIFTY stock prices in short run.

Table 8 indicates that at 5%, changes in the selected macroeconomic variables are significant. This means that all selected macroeconomic variables explain the short-term variation in the NIFTY stock prices.

4.5.1. Overall outcome

The Chi-square result for all variables is 46.03422, with a p -value of 0.0000, as shown in Table 8. This means that in the short term, all selected variables explain the changes in stock market volatility as a whole.

4.6. Variance decomposition (VDC) analysis (NIFTY)

4.6.1. Interpretation

The variance decomposition demonstrates the contribution of one variable due to innovation shocks caused by the forcing factors (Pesaran et al., 2001). The variance decomposition shows how much one variable contributes to the other variables in autoregression. It determines how much of each variable's future error variance can be explained by exogenous shocks to the other variables. The results of the VDC are shown in Table 9. According to empirical evidence, its own innovative shocks account for 83.70% of stock price change. Economic growth (GDP) shock, inflation, and FII shock all describe stock

prices by 6.93, 4.35, and 2.07%, respectively. All three can be used to forecast stock price movement. The contribution of other variables is negligible.

5. Findings

1. The findings are useful in understanding the pricing mechanism of the Indian stock exchange. All variables are stationary at the 1st difference and the residues are distributed normally. Also, there are no multicollinearity, heteroskedasticity, or serial correlation. It was discovered that the model is fit and stable for understanding the Indian stock market.
2. The cointegration results show a strong long-term relationship between the selected macroeconomic variables and stock price in the Indian stock market.
3. There are two integrating equations indicating a linear long-term relationship between the variables, and the estimated regression coefficients can be regarded as equilibrium values.
4. The result of VECM revealed that the long-term link between DI, FII, GDP, and stock returns in the Indian stock market has been significant and positive, implying that an increase in available income, GDP, and FII has eroded prospects of positive performance on the Indian stock market. Changes in disposable revenues, GDP, and FII may result in some long-term stock return movement.
5. There is a significant but negative long-term relationship between stock returns and ER, IR, government policies, and INF, implying that if any of these changes, stock returns will be negatively affected in the long term. As a result, an increase in the ER, IR, government policies, and INF reduces stock market volatility in the case of the NIFTY.
6. Granger's causality analysis was used to check the short-term causality among the variables and it was discovered that fluctuations in DI, FII, government policies, INF, ER, GDP, and IR are significant at 5% level. This implies that in the short term, the variation in stock prices in the Indian stock market is explained by these variables.
7. The VDC test was used to determine which variable contributed most in predicting stock prices in the Indian stock market. According to the VDC results, its own innovative shocks account for 83.70% of stock price change. FII, GDP, and INF shock describe the stock price by 6.93, 4.35, and 2.07%, respectively. GDP shock, inflation shock, and FII can all be said to predict stock price movement. The contribution of other variables is negligible.

6. Implications of the study

The findings of this study have both theoretical and practical implications. They indicate that devaluation of domestic currency increases exports, improving cash flow, and splitting the payoffs for Indian export-related companies, thus negatively affecting the relationship between real and stock market growth. This may also serve fund managers involved in the global distribution of assets or investment risks. The adverse impact of actual effective ERs on Indian stock markets showed that the currency would need to be controlled to thoroughly improve India's stock market because of the elastics of imports and exports that result in stock stabilization.

According to the empirical results, inflation has a negative influence on stock prices. Therefore, effective policies should be developed to balance inflation within the country. The research also shows that competent authorities should take necessary measures to monitor inflation and ultimately to control uncertainty in the stock market. Financial regulators and policy-makers should consider the impacts of these important macroeconomic factors in the formulation of fiscal and economic policies.

7. Conclusion

This study explores the relationship between macroeconomic factors and the Indian stock market over a 10-year period (2009–2019). The research examining the connection between NSE returns and various macroeconomic variables, including disposable income, CPI inflation, exchange rate, interest rate, government policies, FII, and GDP. Various statistical tests are applied to the data, such as the ADF unit root test to check for stationary properties, VECM testing for cointegration, and VECM Granger causality to

determine causality. The study also assesses the stability of the variables using tests like Ramsey, CUSUM, and CUSUMQ.

The results indicate that there is no issue with multicollinearity, heteroskedasticity, or serial correlation. Co-integration results show a strong and significant long-term relationship between macroeconomic variables and stock prices at NSE. Specifically, disposable income, economic growth (GDP), FII, and stock returns at Nifty have a significant and positive long-term relationship. However, there is a significant but negative long-term relationship between stock returns and exchange rates, interest rates, government policies, and inflation. The VECM Granger causality test suggests that changes in disposable income, government policies, inflation, exchange rate, GDP, FII, and interest rate significantly impact short-term variations in Nifty stock prices. The VDC test shows that GDP and inflation can forecast changes in stock prices more effectively than other factors.

8. Limitation and further research

The use of monthly data in this study may have missed short-term variations in the relationship between stock prices and macroeconomic factors. High-frequency data, such as daily or weekly data, are needed for research to capture these fluctuations.

In conclusion, the need for a comprehensive analysis of the combined effect of multiple factors on stock prices in both developed and emerging market economies limits this research on the relationship between macroeconomic factors and stock prices. Research that uses high-frequency data to capture short-term fluctuations in the relationship and takes into account the effect of structural breaks is also needed.

Disclosure statement

No potential conflict of interest was reported by the author(s).

About the authors



Dr. Sarika Keswani is an Assistant Professor of 'Finance and Accounting' at Symbiosis Centre for Management Studies, Nagpur, Maharashtra. She holds a Ph.D. in Finance from Symbiosis International (Deemed) University Pune. Her research interests are in the areas of 'Stock Market', 'Behavioral Finance', and 'Mutual Fund'. She has also presented papers at several international and national level professional conferences. She has published more than 15 research articles in reputed journals and conferences in the domain of Accounting, Finance, and Economics. She has contributed in idea conceptualization, contributed data or analysis tools, and performed the analysis.



Dr. Veerma Puri is an Assistant Professor of 'Finance and Accounting' at NMIMS Navi Mumbai, Maharashtra. She holds a Ph.D. in Finance from The Business School, University of Jammu, Jammu & Kashmir. Her research interests are in the areas of 'Corporate Finance', 'Corporate Governance', and 'Corporate Disclosures'. She has also presented papers and chaired sessions at several international and national level professional conferences. She has contributed in contributed data or analysis tools, performed the analysis, and wrote the Literature review.



Dr. Rimjhim Jha is Currently working as an Assistant Professor at Symbiosis Institute of Business Management, Nagpur (Symbiosis International University, Pune). Published Research papers in various journals of national and international reputation. Ph.D. in Human Resource Management from Amity University Gwalior. Her research area is Organizational Development & Change, Conflict Management, Negotiation, International Human Resource Management, Human Resource Management, Entrepreneurship, E Commerce. She has contributed in data collection.

ORCID

Sarika Keswani  <http://orcid.org/0000-0002-2191-3103>

References

- Abbass, K., Sharif, A., Song, H., Ali, M. T., Khan, F., & Amin, N. (2022). Do geopolitical oil price risk, global macroeconomic fundamentals relate Islamic and conventional stock market? Empirical evidence from QARDL approach. *Resources Policy*, 77, 102730. <https://doi.org/10.1016/j.resourpol.2022.102730>
- Abdi, D., Cade-Menun, B. J., Ziadi, N., & Parent, L. É. (2014). Long-term impact of tillage practices and phosphorus fertilization on soil phosphorus forms as determined by ^{31}P nuclear magnetic resonance spectroscopy. *Journal of Environmental Quality*, 43(4), 1431–1441. <https://doi.org/10.2134/jeq2013.10.0424>
- Ahmed, S. (2008). Aggregate economic variables and stock markets in India. *International Research Journal of Finance and Economics*, 14, 141–164.
- Alagidede, P., Panagiotidis, T., & Zhang, X. (2011). Causal relationship between stock prices and exchange rates. *The Journal of International Trade & Economic Development*, 20(1), 67–86. <https://doi.org/10.1080/09638199.2011.538186>
- Al-Shubiri, F. N. (2010). Analysis the determinants of market stock price movements: An empirical study of Jordanian commercial banks. *International Journal of Business and Management*, 5(10), 137.
- Altwaitjri, H. (2006). *Influential factors in the Saudi stock market (Working paper, Forum and the first exhibition to the Saudi stock market)*. King Saud University.
- Anser, M. K., Khan, M. A., Zaman, K., Nassani, A. A., Askar, S. E., Abro, M. M. Q., & Kabbani, A. (2021). Financial development during COVID-19 pandemic: The role of coronavirus testing and functional labs. *Financial Innovation*, 7(1), 9. <https://doi.org/10.1186/s40854-021-00226-4>
- Aroni, J. M. (2011). Factors influencing stock prices for firms listed in the Nairobi stock exchange. *International Journal of Business and Social Science*, 2(20), 303–311.
- Attari, M. I. J., & Javed, A. Y. (2013). Inflation, economic growth and government expenditure of Pakistan: 1980–2010. *Procedia Economics and Finance*, 5, 58–67. [https://doi.org/10.1016/S2212-5671\(13\)00010-5](https://doi.org/10.1016/S2212-5671(13)00010-5)
- Awokuse, T. O. (2008). Trade openness and economic growth: Is growth export-led or import-led? *Applied Economics*, 40(2), 161–173. <https://doi.org/10.1080/00036840600749490>
- Bajo-Rubio, Ó., Díaz-Roldán, C., & Esteve, V. (2009). Deficit sustainability and inflation in EMU: An analysis from the Fiscal Theory of the Price Level. *European Journal of Political Economy*, 25(4), 525–539. <https://doi.org/10.1016/j.ejpoleco.2009.04.001>
- Banda, K., Hall, J. H., & Pradhan, R. P. (2019). The impact of macroeconomic variables on industrial shares listed on the Johannesburg Stock Exchange. *Macroeconomics and Finance in Emerging Market Economies*, 12(3), 270–292. <https://doi.org/10.1080/17520843.2019.1599034>
- Bernanke, B. S., & Kuttner, K. N. (2005). What explains the stock market's reaction to Federal Reserve policy? *The Journal of Finance*, 60(3), 1221–1257. <https://doi.org/10.1111/j.1540-6261.2005.00760.x>
- Biglarkhani, R., Beytari, J., & Sefidbakht, E. (2023). The effect of macroeconomic indicators on the financial stress index in the members of the organization of the petroleum exporting countries. *International Journal of Finance & Managerial Accounting*, 8(29), 195–209.
- Chakraborty, T. (2007). Foreign institutional investment flows and Indian stock market returns—A cause and effect relationship study. *Indian Accounting Review*, 11(1), 35–48.
- Chang, P. C., Liu, C. H., Lin, J. L., Fan, C. Y., & Ng, C. S. (2009). A neural network with a case based dynamic window for stock trading prediction. *Expert Systems with Applications*, 36(3), 6889–6898. <https://doi.org/10.1016/j.eswa.2008.08.077>
- Chen, N. F., Roll, R., & Ross, S. A. (1986). Economic forces and the stock market. *Journal of Business*, 59, 383–403.
- Choi, D. F. S., Fang, V., & Fu, T. Y. (2008). Volatility spillovers between stock market returns and exchange rate changes: The New Zealand case. *International Journal of Modern Economics*, 2(1), 64–83.
- Chuang, I. Y., Lu, J. R., & Tswei, K. (2007). Interdependence of international equity variances: evidence from East Asian markets. *Emerging Markets Review*, 8(4), 311–327. <https://doi.org/10.1016/j.ememar.2007.08.001>
- Contractor, F. J., Lahiri, S., Elango, B., & Kundu, S. K. (2014). Institutional, cultural and industry related determinants of ownership choices in emerging market FDI acquisitions. *International Business Review*, 23(5), 931–941. <https://doi.org/10.1016/j.ibusrev.2014.02.005>
- Cunningham, C. R. (2007). Growth controls, real options, and land development. *Review of Economics and Statistics*, 89(2), 343–358. <https://doi.org/10.1162/rest.89.2.343>
- Demir, C. (2019). Macroeconomic determinants of stock market fluctuations: The case of BIST-100. *Economies*, 7(1), 8. <https://doi.org/10.3390/economies7010008>
- Enders, D., Breuer, K., Raabe, G., Runsink, J., Teles, J. H., Melder, J., Ebel, K., & Brode, S. (1995). Preparation, structure, and reactivity of 1,3,4-Triphenyl-4,5-dihydro-1H-1,2,4-triazol-5-ylidene, a new stable carbene. *Angewandte Chemie International Edition in English*, 34(9), 1021–1023. <https://doi.org/10.1002/anie.199510211>

- Fabozzi, F. J., Focardi, S., Ponta, L., Rivoire, M., & Mazza, D. (2022). The economic theory of qualitative green growth. *Structural Change and Economic Dynamics*, 61, 242–254. <https://doi.org/10.1016/j.strueco.2022.02.005>
- Fama, E. F. (1981). Stock returns, inflation, and money. *The American Economic Review*, 71(4), 545–565.
- Fiffild, S. G., Power, D. M., & Sinclair, C. D. (2002). Macroeconomic factors and share returns: An analysis using emerging market data. *International Journal of Finance & Economics*, 7(1), 51–62. <https://doi.org/10.1002/ijfe.173>
- Goswami, G., & Jung, S. (1997). Stock market and economic forces: Evidence from Korea. Retrieved from www.bnet.fordham.edu/public/finance/goswami/korea.pdf
- Gyamfi Gyimah, A., Addai, B., & Asamoah, G. K. (2021). Macroeconomic determinants of mutual funds performance in Ghana. *Cogent Economics & Finance*, 9(1), 1913876. <https://doi.org/10.1080/23322039.2021.1913876>
- Ho, S. Y., & Iyke, B. N. (2017). Determinants of stock market development: A review of the literature. *Studies in Economics and Finance*, 34(1), 143–164. <https://doi.org/10.1108/SEF-05-2016-0111>
- Hong, H., Bian, Z., & Lee, C. C. (2021). COVID-19 and instability of stock market performance: Evidence from the US. *Financial Innovation*, 7(1), 12. <https://doi.org/10.1186/s40854-021-00229-1>
- Huang, B. N., & Yang, C. W. (2000). The impact of financial liberalization on stock price volatility in emerging markets. *Journal of Comparative Economics*, 28(2), 321–339. <https://doi.org/10.1006/jcec.2000.1651>
- Humpe, A., & Macmillan, P. (2009). Can macroeconomic variables explain long-term stock market movements? A comparison of the US and Japan. *Applied Financial Economics*, 19(2), 111–119. <https://doi.org/10.1080/09603100701748956>
- Huy, D. T. N., Dat, P. M., & Anh, P. T. (2020). Building an econometric model of selected factors' impact on stock price: A case study. *Journal of Security & Sustainability Issues*, 9, 77–93.
- Huy, D. T. N., Loan, B. T. T., & Pham, T. A. (2020). Impact of selected factors on stock price: A case study of Vietcombank in Vietnam. *Entrepreneurship and Sustainability Issues*, 7(4), 2715–2730. [https://doi.org/10.9770/jesi.2020.7.4\(10\)](https://doi.org/10.9770/jesi.2020.7.4(10))
- Huy, D. T. N., Nhan, V. K., Bich, N. T. N., Hong, N. T. P., Chung, N. T., & Huy, P. Q. (2021). Impacts of internal and external macroeconomic factors on firm stock price in an expansion econometric model—A case in Vietnam real estate industry. *Data Science for Financial Econometrics*, 898, 189–205.
- Jamaludin, N., Ismail, S., & Ab Manaf, S. (2017). Macroeconomic variables and stock market returns: Panel analysis from selected ASEAN countries. *International Journal of Economics and Financial Issues*, 7(1), 37–45.
- Javed, Z., & Farooq, M. (2009). Economic growth and exchange rate volatility in the case of Pakistan. *Pakistan Journal of Life and Social Sciences*, 7(2), 112–118.
- Joshi, P., & Giri, A. K. (2015). Fiscal deficits and stock prices in India: Empirical evidence. *International Journal of Financial Studies*, 3(3), 393–410. <https://doi.org/10.3390/ijfs3030393>
- Kadir, H. A., Rahmani, N., & Masinaei, R. (2011). Impacts of service quality on customer satisfaction: Study of online banking and ATM services in Malaysia. *International Journal of Trade, Economics and Finance*, 2(1), 1–9. <https://doi.org/10.7763/IJTEF.2011.V2.71>
- Keswani, S., & Wadhwa, B. (2017). Effect of macroeconomic variables on stock market: A conceptual study. *International Journal of Management, IT & Engineering*, 7(10), 85–106.
- Keswani, S., & Wadhwa, B. (2019a). An empirical analysis on association between selected macroeconomic variables and stock market in the context of BSE. *The Indian Economic Journal*, 66(1–2), 170–189. <https://doi.org/10.1177/0019466219876492>
- Keswani, S., & Wadhwa, B. (2019b). Evaluating the impact of macroeconomic variable on Indian stock market. *International Journal of Engineering and Advanced Technology*, 8(6), 4427–4434. <https://doi.org/10.35940/ijeat.F8972.088619>
- Kirui, E., Wawire, N. H., & Onono, P. O. (2014). Macroeconomic variables, volatility and stock market returns: A case of Nairobi securities exchange, Kenya. *International Journal of Economics and Finance*, 6(8), 214–228. <https://doi.org/10.5539/ijef.v6n8p214>
- Koutsoyiannis, D., & Fofoula-Georgiou, E. (1993). A scaling model of a storm hyetograph. *Water Resources Research*, 29(7), 2345–2361. <https://doi.org/10.1029/93WR00395>
- Kutty, G. (2010). The relationship between ERs and stock prices: The case of Mexico. *North American Journal of Finance & Banking Research*, 4(4), 1–12.
- Laichena, K. E., & Obwogi, T. N. (2015). Effects of macroeconomic variables on stock returns in the East African community stock exchange market. *International Journal of Education and Research*, 3(10), 305–320.
- Magbondé, G. K., & Konté, M. A. (2022). Developing countries' economic fundamentals and FDI inflows: The moderating role of institutions. *Cogent Economics & Finance*, 10(1), 2028976. <https://doi.org/10.1080/23322039.2022.2028976>
- Mandimika, N. Z., & Chinzara, Z. (2012). Risk–return trade-off and behaviour of volatility on the South African stock market: Evidence from both aggregate and disaggregate data. *South African Journal of Economics*, 80(3), 345–366. <https://doi.org/10.1111/j.1813-6982.2012.01328.x>
- Maysami, R. C., & Koh, T. S. (2000). A vector error correction model of the Singapore stock market. *International Review of Economics & Finance*, 9(1), 79–96. [https://doi.org/10.1016/S1059-0560\(99\)00042-8](https://doi.org/10.1016/S1059-0560(99)00042-8)
- Mishra, A. K. (2004). Stock market and foreign exchange market in India: Are they related? *South Asia Economic Journal*, 5(2), 209–232. <https://doi.org/10.1177/139156140400500202>

- Mlambo, C., Maredza, A., & Sibanda, K. (2013). Effects of ER volatility on the stock market: A case study of South Africa. *Mediterranean Journal of Social Sciences*, 4(14), 561. <https://doi.org/10.5901/mjss.2013.v4n14p561>
- Mohamed, I. A., & Ahmed, S. (2018). The effects of macroeconomic variables on stock returns in the Jordanian stock market. *Global Journal of Management and Business*, 5(2), 087–093.
- Mukherjee, T. K., & Naka, A. (1995). Dynamic relations between macroeconomic variables and the Japanese stock market: An application of a vector error correction model. *Journal of Financial Research*, 18(2), 223–237. <https://doi.org/10.1111/j.1475-6803.1995.tb00563.x>
- Mutuku, C., & Kirwa, L. N. (2014). Macroeconomic variables and the Kenyan equity market: A time series analysis. *Business and Economic Research*, 5(1), 1. <https://doi.org/10.5296/ber.v5i1.6733>
- Narayan, P. K., Narayan, S., & Singh, H. (2014). The determinants of stock prices: New evidence from the Indian banking sector. *Emerging Markets Finance and Trade*, 50(2), 5–15. <https://doi.org/10.2753/REE1540-496X500201>
- Okoye, P. U., Mbakwe, C. C., & Igbo, E. N. (2018). Modeling the construction sector and oil prices toward the growth of the Nigerian economy: An econometric approach. *Economies*, 6(1), 16. <https://doi.org/10.3390/economies6010016>
- Olweny, T. O., & Kimani, D. (2011). Stock market performance and economic growth: Empirical evidence from Kenya using causality test approach. *Advances in Management and Applied Economics*, 1(3), 177.
- Olweny, T., & Omondi, K. (2011). The effect of macro-economic factors on stock return volatility in the Nairobi stock exchange, Kenya. *Economics and Finance Review*, 1(10), 34–48.
- Olweny, T., & Shipho, T. M. (2011). Effects of banking sectoral factors on the profitability of commercial banks in Kenya. *Economics and Finance Review*, 1(5), 1–30.
- Omorokunwa, O. G., & Ikponmwosa, N. (2014a). Exchange rate volatility and foreign private investment in Nigeria. *Asian Journal of Business Management*, 6(4), 146–154. <https://doi.org/10.19026/ajbm.6.5157>
- Omorokunwa, O. G., & Ikponmwosa, N. (2014b). Macroeconomic variables and stock price volatility in Nigeria. *Annals of the University of Petroșani. Economics*, 14, 259–268.
- Pal, P. (2005). Volatility in the stock market in India and Foreign institutional investors: A study of the post-election crash. *Economic and Political Weekly*, 40(8), 765–772.
- Patel, S. (2012). The effect of macroeconomic determinants on the performance of the Indian stock market. *NMIMS Management Review*, 22, 1–11.
- Paul, J., & Benito, G. R. (2018). A review of research on outward foreign direct investment from emerging countries, including China: What do we know, how do we know and where should we be heading? *Asia Pacific Business Review*, 24(1), 90–115. <https://doi.org/10.1080/13602381.2017.1357316>
- Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, 16(3), 289–326. <https://doi.org/10.1002/jae.616>
- Ramadan, I. Z. (2016). EVA and the impact of the macroeconomic variables: Evidence from the Jordanian manufacturing companies. *Asian Journal of Finance Accounting*, 8(1), 13–22.
- Riaz, F., Parveen, S., & Khan, A. A. (2022). Fiscal consolidation and, current-account dynamics in South-Asian countries. *Journal of Contemporary Macroeconomic Issues*, 3(2), 13–29.
- Riyanto, S., Sutrisno, A., & Ali, H. (2017). The impact of working motivation and working environment on employees performance in Indonesia stock exchange. *International Review of Management and Marketing*, 7(3), 342–348.
- Sahu, T. N., & Bandopadhyay, D. (2013). An empirical study on the dynamic relationship between foreign institutional investments and Indian stock market. *Vidyasagar University Journal of Economics*, XVII, 47–62.
- Srinivasan, P. (2012). Determinants of equity share prices in India: A panel data approach. *The Romanian Economic Journal*, 46(6), 205–228.
- Stock, J. H., & Watson, M. W. (2006). Forecasting with many predictors. In *Handbook of economic forecasting* (Vol. 1, pp. 515–554). Elsevier. [https://doi.org/10.1016/S1574-0706\(05\)01010-4](https://doi.org/10.1016/S1574-0706(05)01010-4)
- Tabak, B. M. (2006). The dynamic relationship between stock prices and exchange rates: Evidence for Brazil. *International Journal of Theoretical and Applied Finance*, 9(8), 1377–1396. <https://doi.org/10.1142/S0219024906003974>
- Teker, D. L., & Alp, E. A. (2014). Granger causality relation between interest rates and stock markets: Evidence from emerging markets. *European Journal of Business and Social Sciences*, 2(10), 63–73.
- Trivedi, P., & Behera, S. R. (2012). Macroeconomic fundamentals as determinants of equity prices: An empirical analysis for India. *IUP Journal of Applied Finance*, 18(3), 5–30.
- Waweru, N. M., Munyoki, E., & Uliana, E. (2008). The effects of behavioral factors in investment decision-making: A survey of institutional investors operating at the Nairobi Stock Exchange. *International Journal of Business and Emerging Markets*, 1(1), 24–41. <https://doi.org/10.1504/IJBEM.2008.019243>
- Yu, L., Chen, H., Wang, S., & Lai, K. K. (2008). Evolving least squares support vector machines for stock market trend mining. *IEEE Transactions on Evolutionary Computation*, 13(1), 87–102.
- Zakaria, Z., & Shamsuddin, S. (2012). Relationship between stock futures index and cash prices index: Empirical evidence based on Malaysia data. *Journal of Business Studies Quarterly*, 4(2), 103–112.