

# Dynamic linkages between the monetary policy variables and stock market in the presence of structural breaks: evidence from India

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## Abstract

**Purpose** – The study aims to determine the long and short-term causal relationships between the variables associated with the adjustment of monetary policy and the stock market in India in the presence of structural breaks.

**Design/methodology/approach** – The study employed the autoregressive distributed lag (ARDL) bounds test and the Error Correction Model to assess long- and short-term causal relationships. The study also used non-frequentist Bayesian inferences for the validity of estimation robustness. The Bai–Perron test is used to identify breakpoint dates for the Indian stock market index, and the Granger Causality test is employed to ascertain the direction of causality.

**Findings** – The F-bounds test reveals cointegration among the variables throughout the examined period. Specifically, the weighted average call money rate (WACR), inflation (WPI), currency exchange rate (EXE), and broad money supply (M3) exhibit statistical significance with precise signs. Furthermore, the study identifies the negative impact of the COVID-19 outbreak in March 2020 on the Indian stock market.

**Research limitations/implications** – Although the study provides significant insights, it is not exempt from constraints. A significant limitation is selecting a relatively limited time period, specifically from April 2008 to September 2023. The limited time frame of this study may restrict the applicability of the results to more comprehensive economic settings, as dynamics between the monetary policy and the stock market can be influenced by multiple factors over varying time periods. Furthermore, the utilisation of the Weighted Average Call Money Rate (WACR) rather than policy rates such as the Repo rate presents an additional constraint as it may not comprehensively account for the impacts of particular policy initiatives, thereby disregarding essential complexities in the connection between monetary policy variables and financial markets.

**Practical implications** – The findings of the study suggest that investors and portfolio managers should consider economic issues while developing long-term investing plans. Reserve Bank of India should exercise prudence to prevent any discretionary measures that may lead to a rise in interest rates since this adversely affects the stock market. To mitigate risk, investors should closely monitor the adjustment of monetary policy variables.

**Social implications** – The study has important social implications, especially regarding the lower levels of financial literacy among investors in India. Considering the complex nature of the study's emphasis on monetary policy adjustments and their impact on the stock market. Investors face the risk of significant losses due to unexpected adjustments in monetary policy. Many individuals may need help understanding how policy changes impact their investments. Therefore, RBI must consider both price and financial stability when

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**Erratum:** It has come to the attention of the publisher that the article, Moizz, A. and Akhtar, S.M.J. (2024), “Dynamic linkages between the monetary policy variables and stock market in the presence of structural breaks: evidence from India”, *Asian Journal of Economics and Banking*, Vol. ahead-of-print No. ahead-of-print. <https://doi.org/10.1108/AJEB-01-2024-0005> failed to include the JEL codes, these have now been added. The publisher sincerely apologises for this error and for any inconvenience caused.



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formulating monetary policies. Furthermore, market participants should consider the potential impact of fluctuating monetary policy variables when devising their long-term investment strategies. Given that adjustments in interest rates can markedly affect stock market dynamics, investors must carefully assess the implications of monetary policy decisions on their portfolios.

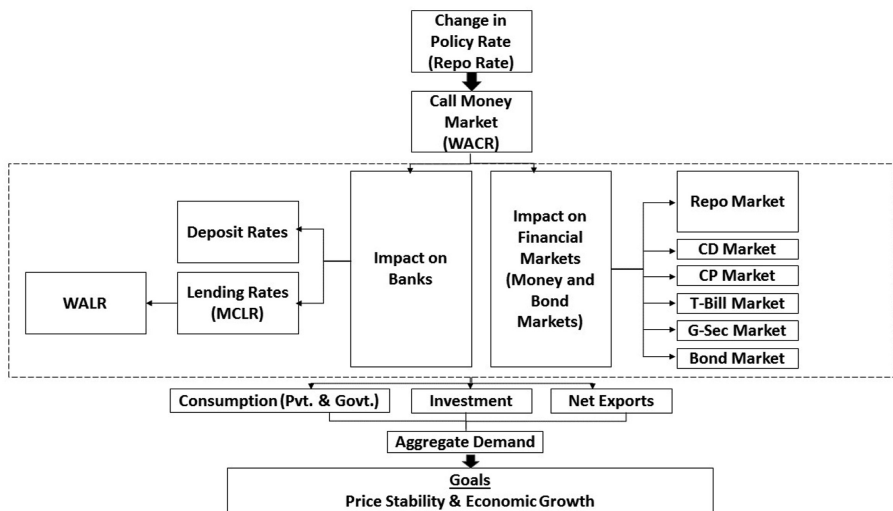
**Originality/value** – The study uses dummy variables in the ARDL model to represent structural breaks that emerged from the COVID-19 pandemic (as determined by the Bai–Perron multiple breakpoint test). The study also used the Perron unit root test to find out the stationarity of the series in the presence of structural breaks. Additionally, the study also employed Bayesian inferences to affirm the robustness of the estimates.

**Keywords** Monetary policy, Weighted average call money rate, Stock market, Nifty50, Structural break, COVID-19, Cointegration, ARDL model

**Paper type** Research paper

### Introduction

The financial system plays a vital role in any economy. The financial system collects the savings of individuals in a pool and encourages the process of technology and innovation by ensuring that these savings are directed from the least productive sectors to the most productive sectors. (Çeştepe *et al.*, 2022; Çetin *et al.*, 2023). The financial markets are the most crucial part of this financial system, and the Central banks possess the ability to exert influence on these financial markets by employing monetary policy, with the ultimate aim of attaining their objectives of upholding price stability in the economy and fostering economic growth. Therefore, the issues associated with the formulation of an effective monetary policy are relevant to everything that has been published in the macroeconomic literature because money is the only good that is traded in all markets, and any policy intended to affect the supply of money will unavoidably have effects on market activities. Monetary policy refers to the methods employed to regulate money supply in an economy. It refers to the actions taken by central banks or monetary authorities to achieve macroeconomic goals, such as controlling inflation, ensuring the stability of interest rates and currency exchange rates, and fostering economic growth (Dinçer *et al.*, 2019). In recent years, due to major economic events, there has been a significant use of monetary policies all over the world, and it has become essential to emphasise how adjustments in the monetary policy impact the movement of stock prices. Figure 1 illustrates the monetary policy transmission mechanism via the interest rate channel.



**Figure 1.** Transmission of monetary policy in India via the interest rate channel

Source(s): Authors

When the Reserve Bank of India changes the policy rate, i.e. the repo rate, it affects bank borrowing costs, influencing the rate of interest in the call money market, i.e. Weighted average call money rate (WACR), as depicted in the figure. This change in the rates has a ripple effect on the money market, as well as on the bond market. When the repo rate changes, it also affects the deposit and lending rates of banks, which ultimately impacts the aggregate demand in the economy. In this way, through the implementation of monetary policy, the Reserve Bank of India endeavours to regulate aggregate demand in the economy, thereby working towards the dual objectives of sustaining price stability and fostering economic growth (Bhattacharjee and Das, 2023). As we can see, these adjustments in the monetary policy can also profoundly impact the financial markets. This proves that financial Markets are sensitive to monetary policy, and mere anticipation of potential central bank monetary policy announcements influences the markets (Sehgal *et al.*, 2015). Therefore, a more thorough analysis is required to find out the impact of adjustment in the monetary policy on the stock market in the presence of various economic events. The motivation of this study is driven by the necessity to explore further the association between monetary policy and dynamics in the stock market, especially within the framework of diverse economic events in India. This inquiry aims to provide valuable perspectives into the sophisticated interaction between monetary policy and the stock market's performance in the presence of various structural breaks and guide more astute decision-making by policymakers, bankers, government and investors. Further, the study also makes a valuable contribution to existing literature regarding monetary policy variables and the stock market by incorporating structural breaks in the model. For this, the multiple breakpoint test given by Bai and Perron (1998) is employed that helps to identify and understand shifts in the data under the period of consideration. Structural breaks are commonly observed in macroeconomic variables and finance data, and failing to account for them can lead to inaccurate conclusions and unreliable forecasts. Detecting these breaks in models is essential for a deeper understanding of the relationship between monetary policy and the stock market. The paper employed Autoregressive Distributed Lag (ARDL) model given by Pesaran *et al.* (2001), Pesaran and Shin (1999) to explore dynamic, i.e. short-term and long-term relationships among the monetary policy and stock market variables. Along with that, the paper also employed the non-frequentist Bayesian regression, and finally, to ascertain the direction of causality among the variables, the Granger Causality test (Granger, 1969) is used.

The structure of the paper proceeds as follows. Section 2 presents the theoretical background, Section 3 contains a review of the literature, and Section 4 explains the data and methodology. Section 5 contains the empirical results, while the final section briefly concludes.

### Theoretical background

Since the year 2008, the flagship benchmark index of the National Stock Exchange in India, NIFTY50 has been subject to a series of noteworthy events. These significant events encompassed the 2007–2008 financial crisis, followed by a bull run and a bullish trend both prior to and following the 2014 general elections, indicating its sensitivity to political developments. Other significant events include demonetisation, changes in the Indian tax structure through the implementation of the GST, the global outbreak of the Coronavirus (COVID-19) pandemic, and the geopolitical tensions arising from the Russia-Ukraine War. Therefore, it is crucial to examine the dynamic linkages between monetary policy variables, including the interest rates, supply of money, inflation, foreign exchange rate, and the prices

of indices in the Indian stock market in the presence of structural breaks that appeared due to these events. In particular, we will examine how monetary policy variables influence the stock market in the presence of structural breaks.

Central banks around the world generally employ interest rates as one of their monetary policy instruments to combat inflation. Since interest rate fluctuations have an effect on the economic development of a country through the financial markets, the determination of interest rates is a crucial decision that must be evaluated regularly (Pallegedara, 2012). In theory, interest rates play a pivotal role in influencing stock prices. Firstly, when interest rates increase, the present value of the future dividend income declines, which may result in a decline in the prices of the stock index. Conversely, the opportunity cost of borrowing decreases when interest rates are low. Lower interest rates stimulate investments and economic activity, leading to an increase in the prices of the stocks (Hamrita and Trifi, 2011). Secondly, high interest rates on fixed-income securities, such as bonds, signal to market participants that investing in fixed-income securities yields a higher return than investing in equities. As a result, the structure of their portfolio investments changes, resulting in less demand for stocks and a decline in stock prices (Hamrita and Trifi, 2011; Jawaid and Ul Haq, 2012).

The adjustment in monetary policy changes the supply of money in the economy, subsequently impacting the stock market. The quantity theory of money (QTM) formalises how the amount or supply of money affects stock prices. When the supply of money in the economy increases, an excess amount of money is available, and this encourages individuals to demand more shares on the market, thereby driving up share prices (Bissoon *et al.*, 2016). The Monetarists and Keynesians also believe that money supply could affect stock prices in the economy. According to the monetarist, rising stock prices result from expansionary monetary policy; as the optimal money supply in the economy increases, demand for equity also rises. The Keynesianism theory posits that a drop in interest rates makes fixed-income instruments like bonds less attractive compared to equities. Furthermore, A rise in money supply causes a decline in interest rates, which leads to an increase in investment and a rise in GDP, all of which increase stock prices (Tiryaki *et al.*, 2019).

Furthermore, the phenomenon of rising inflation in the economy leads to changes in the monetary policy. According to Fisher's hypothesis, inflation and stock markets have a direct relationship (Singh and Balasubramanian, 2022) because nominal returns on investment will provide a complete hedge against the rate of inflation. From the perspective of producers, if inflation rates are high in an economy, it results in lowered purchasing power, returns on investments and company profitability as the real value of money declines (Eldomiaty *et al.*, 2020). Thus, inflation negatively affects stock prices.

The fluctuations in exchange rates also influence the stock market. In the flow-oriented model given by Dornbusch and Fischer (1980), a decline in the value of a country's currency, also known as depreciation, can lead to a situation where its exports become more affordable for foreign buyers compared to other currencies. This can potentially increase demand for the country's products in foreign markets, leading to increased export revenues for companies. If companies experience higher export revenues, their profits may increase, which can positively affect their stock prices (Sui and Sun, 2016). However, if the country is an import-dominant economy, stock prices will be negatively affected by the depreciation of the home currency.

### Literature review

The dynamic linkage or the relationship between monetary policy variables and the stock market in the presence of structural breaks poses a puzzling question in macroeconomics,

resulting in a vast collection of literature. The findings of previous investigations are compiled in this section.

Yoshino *et al.* (2014) conducted an analysis spanning from 1998 to 2013, utilising quarterly data to explore the question of how the shocks in monetary policy affect stock prices in Tehran. The study employed vector error correction, variance decomposition, and forecast error variance techniques. The results indicated a sustained increase in stock prices following an external easing of monetary policy. Okpara (2010) investigated a study of the Nigerian stock market. By employing the Two Stage Least Squares Method (2SLS), Vector Error Correction Model (VECM), and Forecast Error Decomposition Analysis. The findings revealed that monetary policy has a significant impact on the performance of the stock market in the long term. The investigation by Salehi *et al.* (2021) delved into the interrelationships among structural shocks in monetary policy, stock prices, and the real exchange rate utilising quarterly data; the study applied the structural vector autoregressions model. The findings suggested that structural shocks influencing monetary policy exerted an adverse impact on the stock price index. Muktadir-al-mukit (2013) assessed the impact of monetary policy variables on the performance of the stock market in Bangladesh. The author used monthly data from January 2006 to July 2012 and used the repo rate, money supply, inflation rate, and three-month Treasury bill rate as independent variables. They applied the Cointegration approach, the Granger Causality, and the error correction model. The findings showed that in the long run, the market index is positively impacted by the money supply, inflation, and T-bills but negatively impacted by the repo rate. The Granger causality analysis revealed the presence of a unidirectional causal link between market indexes and inflation, money supply, and T-bills. In another empirical study, (Mohamadpour *et al.*, 2012) estimated the association between monetary policy variables and stock market performance in Malaysia from 1991 to 2011. They used quarterly data and employed the Vector Error Correction Models (VECM) and Cointegration analysis. They found the possibility of a single long-run equilibrium relationship between the Kuala Lumpur Composite Index with respect to real interest rates and money supply. The author found that the Kuala Lumpur Composite Index would increase over the long term by increasing the money supply. Thu *et al.* (2024) explored the presence of a cointegrating relationship between monetary policy variables and the Vietnamese stock index by employing Autoregressive Distributed-Lag (ARDL) bounds tests and the error correction model and conducted robustness tests to validate the model's stability. The data was taken from August 2000 to December 2018. The results revealed that the Vietnam Stock Index was significantly affected by variables. Han *et al.* (2014) investigated the correlation between monetary policy and the stock market by studying data from the Shanghai and Shenzhen Composite Index. The analysis utilised a linear model incorporating a dummy variable and a modified Markov-switching model. The results suggest that significant effects on stock returns are only associated with unexpected changes in monetary policy. Furthermore, the research discovered that while monetary policy strongly influences stock returns during market declines, its impact is minimal during periods of market growth. Chen and Wu (2013) observed a non-linear association between the rate of interest and the Chinese stock market index. The authors used a threshold regression model, an error correction model and a cointegration test. The empirical study revealed an inverse U-shaped link between interest rates and stock indexes, and stock prices are strongly and significantly linked with interest rates when they begin to rise or fall. In another empirical study related to

developed and developing countries, the author found that the influence of monetary policy is quite limited in developed economies (Belke and Wiedmann, 2018). They analysed three emerging and five developed economies using a Cointegrated Vector Autoregressive (CVAR) model. According to empirical findings, the widely believed assessment that in developed economies, the linkage between monetary policy and stock prices is quite limited is true. Prabu *et al.* (2020), examined the causal linkage between the sectoral indices of the Indian stock market and the monetary policy of the US and India by using a heteroscedasticity approach. The empirical findings showed that monetary policy had varying effects on stock prices in various sectors. A recent study (Tomar and Kesharwani, 2022) used Non-linear Autoregressive Distributive Lag (NARDL) and ECM to study the causal relationship between monetary policy and different sectors of the Indian stock market. Their findings showed that analysing the positive and negative values of monetary policy variables provided valuable insights into each sector. Rahman and Serletis (2023) used weekly adjustments in the size of the balance sheet of the Federal Reserve as a policy tool for unconventional monetary policy and attempted to find out its relationship with US stock returns. They used structural VAR and found compelling evidence that the unconventional expansionary monetary policy is successful in stimulating the stock market, given its favourable and statistically significant effect on stock returns. Saini and Sehgal (2023) examined the interaction between monetary policy and the stock market across 41 developed and developing economies through the GMM-Panel VAR model, revealing the dominance of the discount rate channel of monetary policy in influencing stock prices after the 2008 financial crisis. Chen *et al.* (2022) examined the relationship between monetary policy and the stock market in the United Kingdom and China by employing the Taylor rule. The Research findings suggest that the influence of monetary policy in these nations has a limited impact on the stock market. Moreover, structural breaks are often found in macroeconomic and financial time series. Therefore, it is crucial to incorporate structural breaks into econometric models so they can significantly improve the accuracy of the models. Shahbaz *et al.* (2023) investigated the interlink between financial development and information and communication technology (ICT) from 1986 to 2018 in the Turkish economy under structural breaks. They used the autoregressive distributed lag (ARDL) model, the dynamic ordinary least squares (DOLS), Hatemi-J cointegration test, fully modified least squares (FMOLS), and canonical cointegrating regression (CCR). The empirical results revealed that ICT, technological innovation, economic growth, and financial globalisation are cointegrated with financial development under structural breaks. Financial development is adversely affected by ICT and technological innovation when a structural break is present. Another study (Plakandaras *et al.*, 2022) used a structural heterogeneous vector autoregressive (SHVAR) model that incorporates identified structural breaks in order to assess the influence of conventional and unconventional monetary policies on the volatility of the U.S. stock market. They discovered that contractionary monetary policy increases the volatility of the stock market and that monetary policy shocks account for a larger proportion of the variance in stock market volatility over shorter time horizons compared to medium to longer time horizons. Avci and Cetin (2022) investigated the association between financial development and financial globalisation. Through the application of Hatemi-J and ARDL bounds testing procedures, they discovered that financial development is positively impacted by economic growth and financial globalisation in the long term. In contrast, inflation and natural resource rent have the opposite effect under structural breaks.

The existing body of empirical literature pertaining to the influence of monetary policy adjustments on the stock market reveals mixed and divergent findings, making it difficult to comprehend their relationship. Furthermore, existing research has indicated that this relationship is not static and tends to change over time. Additionally, the number of studies considering structural breaks is limited. Given these complexities, our study employs advanced econometric methods and techniques to adopt a comprehensive approach. By conducting this study, this study aims to gain important insights into the complex and ever-changing relationship between monetary policy variables and the NIFTY50. These findings will contribute to the existing corpus of knowledge, providing policymakers, investors, and researchers with valuable information and possibly revealing previously overlooked patterns and nuances.

### Data and methodology

The data used is from 2008M04–2023M09. The data from April 2008 is selected to incorporate the various significant economic and political events that led to changes in the various macro and financial variables. The aftermath of the Global Financial Crises of 2007–08, then the crash of the stock market due to rising NPAs of banks, then the post-bull run in the stock market after the 2014 elections, in which the NDA (National Democratic Alliance) won a historic victory, stock market crashes due demonetisation drive in November 2016 and implementation of GST in July 2017, the COVID-19 outbreak in 2020 and finally the war between Russia and Ukraine. By considering all these events, the chosen time frame will provide more robust findings regarding the association between monetary policy and NIFTY50, the benchmark index of the Indian stock market. The dependent variable (NIFTY) represents the National Stock Exchange Nifty 50 index. The data for the Nifty 50 index is derived from the National Stock Exchange (NSE) website. The independent variables in the study are weighted average call money rate (WACR), inflation proxied by wholesale price index (WPI), broad money supply (M3), and foreign exchange rate (EXE) in terms of USD/INR rate, data for independent variables derived from the database of Indian economy (DBIE), Reserve Bank of India. All variables have undergone log transformation for the purpose of analysis.

The Autoregressive Distributed Lag (ARDL) Bounds Test, introduced by Pesaran and Shin (1999), Pesaran *et al.* (2001), is employed in the current study. The ARDL analysis is used to examine the long-run and short-run dynamics between variables in a time series framework. The series under inquiry have a mixed order of integration, and none of the regressors is integrated at the order I (2), making this test appropriate. The following equation can specify the ARDL model:

$$\Delta y_t = \alpha_0 + \sum_{i=1}^p \beta_i \Delta y_{t-i} + \sum_{i=1}^p \delta_i \Delta x_{t-i} + \sum_{i=1}^p \varepsilon_i \Delta z_{t-i} + \lambda_1 y_{t-1} + \lambda_2 x_{t-1} + \lambda_3 z_{t-1} + \mu_t \quad (1)$$

Here,  $y_t$  is the dependent variable. The parameters  $\lambda_1$ ,  $\lambda_2$ , and  $\lambda_3$  represent the long-run relationship and  $\beta_i$ ,  $\delta_i$  and  $\varepsilon_i$  are short-run dynamics coefficients.  $\alpha_0$  and  $\mu_t$  are constant and error terms, respectively. Typically, the ARDL analysis is conducted in two steps:

In the first stage of cointegration analysis, The F-bounds test is used to evaluate the cointegration of the variables. Cointegration implies a relationship between variables in the long run, indicating that they advance together in the long run despite fluctuations in the short term. Equation (2) reveals the relationship in short-term and long-term dynamics.

$$\begin{aligned} \Delta \ln SM = & \alpha_0 + \sum_{i=1}^p \beta_{1i} \Delta \ln SM_{t-i} + \sum_{i=1}^p \beta_{2i} \Delta \ln WACR_{t-i} + \sum_{i=1}^p \beta_{3i} \Delta \ln WPI_{t-i} \\ & + \sum_{i=1}^p \beta_{4i} \Delta \ln MS_{t-i} + \sum_{i=1}^p \beta_{5i} \Delta \ln EXE_{t-i} + \lambda_1 \ln SM_{t-1} + \lambda_2 \ln WACR_{t-1} \\ & + \lambda_3 \ln WPI_{t-1} + \lambda_4 \ln MS_{t-1} + \lambda_5 \ln EXE_{t-1} + \mu_t \end{aligned} \quad (2)$$

The dependent and independent variables specified in the model represent: *SM* denotes the monthly closing prices of the Nifty50 index; *WACR* corresponds to the weighted average call money rate; *WPI* refers to the wholesale price index, *MS* represent the supply of money and *EXE* corresponds the USD-INR exchange rate. *ln* signifies logarithm;  $\Delta$  represents the first difference operator; the constant term is denoted by  $\alpha_0$ , short-term parameters are represented by  $\beta$ , and the long-term parameters are represented by  $\lambda$ ; Finally,  $\mu_t$  is the term of error.

The null hypothesis ( $H_0$ ) asserts the absence of cointegration, while the alternative hypothesis ( $H_1$ ) contends that cointegration is present.

$$H_0. \beta_1 = \beta_2 = \beta_3 = 0$$

$$H_1. \beta_1 \neq 0, \beta_2 \neq 0, \beta_3 \neq 0$$

In the second stage, the least squares technique is used to estimate how quickly adjustments move towards the long-term equilibrium through the error correction model. It quantifies the degree to which the dependent variable adapts to any deviation from the equilibrium relationship. It indicates the speed with which the system adjusts to short-term disturbances, as well as the magnitude and direction of the adjustments. The error correction term also enables the identification of the short-run impact of the independent variables on the dependent variable. The general model for the ECM is specified in equation (3).

$$\begin{aligned} \Delta \ln SM = & \alpha_0 + \sum_{i=1}^p \beta_{1i} \Delta \ln SM_{t-i} + \sum_{i=1}^p \beta_{2i} \Delta \ln WACR_{t-i} + \sum_{i=1}^p \beta_{3i} \Delta \ln WPI_{t-i} \\ & + \sum_{i=1}^p \beta_{4i} \Delta \ln MS_{t-i} + \sum_{i=1}^p \beta_{5i} \Delta \ln EXE_{t-i} + \delta ECM_{t-1} + \mu_t \end{aligned} \quad (3)$$

Where all coefficients pertain to the short-term dynamics of convergence to equilibrium,  $ECM_{t-1}$  is the error correction term, and  $\delta$  represents the speed of adjustment after short-term shock.

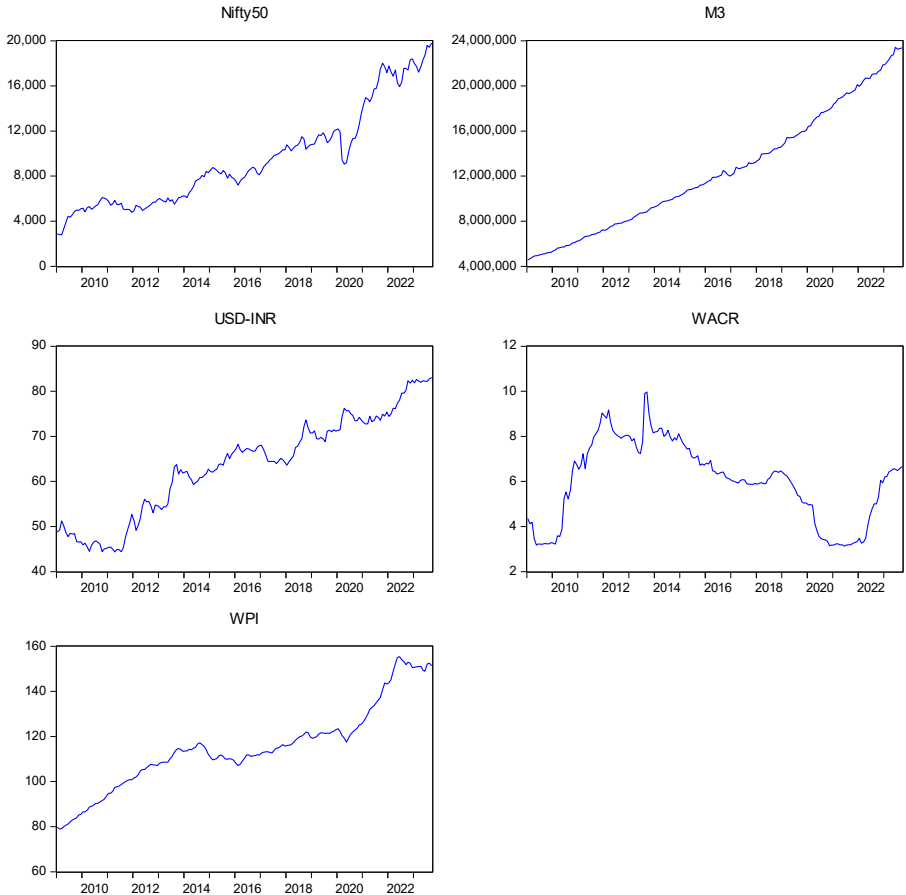
Before performing the ARDL test, whether the time series of variables are stationary or not, the unit root test with structural breaks proposed by Perron (1989) was used. Many econometric models, notably the ARDL model, rely on the assumption of stationarity. Nonstationarity can result in spurious regression results and unreliable inference. Furthermore, conventional unit root tests such as Phillips-Perron (PP) and Augmented Dickey-Fuller (ADF) may produce biased results when a structural break occurs in a time series. Therefore, before performing the ARDL test, it is imperative to check the stationarity of variables in the presence of structural breaks.

We also have employed the Bai-Perron test to investigate the existence of structural breakpoints or significant changes in stock market data. These structural breakpoints will be taken into account during further analysis using regression modelling. By incorporating these identified structural breaks, the study aims to develop a more stable and reliable model. This approach ensures that the model captures the changing dynamics and improves its overall stability, leading to a more robust analysis of the stock market data.

In addition to using the well-established frequentist statistical methods, this study broadens its scope by incorporating Bayesian techniques, which are fundamentally based on Bayes' probability theorem (Bayes, 1763). Bayesian analysis is a statistical technique that employs probabilistic statements to address research questions pertaining to uncertain parameters within statistical models. The utilisation of Bayes rule is a fundamental criterion in Bayesian methodologies, allowing for the derivation of the posterior distribution of model parameters. The posterior distribution is obtained by incorporating the prior knowledge of model parameters with the information provided by the observed data (Ngoc *et al.*, 2021). The Bayesian methodology offers several distinct benefits compared to conventional frequentist statistical methods. Bayesian methodologies facilitate the incorporation of prior knowledge or assumptions into the analysis, thereby enhancing the relevance and customisation of the outcomes based on existing information. Further, in contrast to frequentist approaches that concentrate on the likelihood of data observation under a hypothesis, Bayesian methodologies assess the probability of a hypothesis's validity given the observed data, presenting a more intuitive interpretation of outcomes. Additionally, Bayesian approaches offer a versatile framework for revising beliefs or knowledge with the arrival of new data, proving to be particularly valuable in research settings characterised by evolving information (Briggs, 2023). The advantages of Bayesian analysis have led to its growing importance in the field of social sciences, especially in economics, for instance (Block and Wagner, 2014; Cerqueti and Ventura, 2015; Kalia, 2024; Nguyen *et al.*, 2019a, b; Nguyen and Thach, 2019; Simionescu *et al.*, 2017; Sriboonchitta *et al.*, 2019; Svitek *et al.*, 2019; Thach, 2020; Tuan *et al.*, 2019; Zhao, 2021). According to van Doorn *et al.* (2021), the Bayesian analysis in research consists of four sequential stages, including planning, execution, interpretation, and reporting. The current study is in the third stage, as it interprets and checks the robustness of estimates. In this study, we first create a strategy for Bayesian linear regression that involves formulating default or non-informative prior beliefs regarding the relationship between the Weighted Average Call Money Rate (WACR), which serves as a proxy for the interest rate, and the Nifty50. These beliefs are subsequently merged with assumptions regarding the probability of detecting the provided data, resulting in a posterior distribution. Then, to examine the posterior distribution of parameters, the study utilises Markov Chain Monte Carlo (MCMC) simulation, generating a total of 12,500 samples. The first 2,500 samples are discarded to guarantee that the analysis is reliable and converges correctly. The study also utilised trace plots to validate the convergence of the parameters, assessing the mixing and temporal patterns within the chains of individual parameters. Furthermore, the Granger causality test originally introduced by Granger (1969) has been used to find out the causal inferences.

### Empirical findings

In Figure 2, it can be seen that the prices of the Nifty50 index, the weighted average call money rate (WACR), and inflation proxied by the Wholesale Price Index (WPI) have all been volatile in recent years. It is clear that these series may experience a structural break, most especially in the month of 2020. The supply of money (M3) series has been stable throughout the years. The exchange rate (USD-INR) series is showing an increasing behaviour.



**Figure 2.**  
Nifty50, M3, USD-INR,  
WACR and WPI  
variables

**Source(s):** Authors

As the series exhibits indications of structural breaks, it is advisable to employ unit root tests with structural breaks to ascertain the stationarity of the series.

The application of the ARDL bound test is justified by [Table 1](#), which demonstrates that variables NIFTY, WACR, WPI, and M3 are stationary at the first difference I(1), and the variable EXE is stationary at the level I(0).

**Table 1.**  
Unit root test and  
structural breaks

Variables	Year of break	Level		First difference		
		<i>t</i> -stat	<i>t</i> -calc	Year of break	<i>t</i> -stat	<i>t</i> -calc
NIFTY	2010M12	-5.7191	-4.9328	2009M05	-5.7191	-14.4890*
WACR	2010M02	-5.7191	-4.4662	2009M01	-5.7191	-11.7517*
WPI	2014M08	-5.7191	-2.9674	2020M05	-5.7191	-7.9124*
M3	2013M02	-5.7191	-4.3595	2009M04	-5.7191	-14.5321*
EXE	2011M07	-5.7191	-5.2518**	-	-	-

**Source(s):** Authors

**Bai Perron test**

The Bai-Perron test identified Three specific dates as breakpoints: April 2011, October 2014, and March 2020. The April 2011 breakpoint corresponds to the Reserve Bank of India continuously hiking policy rates due to rising inflation. The October 2014 breakpoint coincides with the post-bull run after the 2014 elections, in which the NDA (National Democratic Alliance) won a historic victory, while the breakpoint in March 2020 corresponds to the COVID-19 outbreak that led to Nifty falls to 8,597 marks from 11,201. These three breakpoints are incorporated into the analysis using binary dummy variables to assess the long-term and short-term effects of these breakpoints (see Table 2).

Break test	<i>F</i> -statistics	Scaled <i>F</i> -statistics	Critical values	Break dates
0 vs 1 *	34.28261	171.4130	18.23	2011M04
1 vs 2 *	12.23924	61.19620	19.91	2014M10
2 vs 3 *	11.634211	3.171053	20.99	2020M03
3 vs 4	0.634211	3.171053	21.71	–

Source(s): Authors

**Table 2.**  
Sequential *F*-statistics  
determined breaks

**ARDL bound test**

If the calculated *F*-statistic surpasses the upper bound critical value, the F-bounds test indicates cointegration among the variables. Conversely, if the estimated *F*-statistic is below the lower bound critical value, it suggests no cointegration. In cases where the *F*-statistic falls between the upper and lower bound critical values, cointegration is inconclusive. Table 3 reveals that, at 10%, 5%, and 1% significance levels, the computed *F*-statistic (6.754057) exceeds the upper bound critical values. Consequently, it can be inferred that there exists a cointegration between the benchmark index of the stock market (NIFTY) and monetary policy variables, indicating a long-term equilibrium relationship between them.

Null hypothesis no levels relationship				
<i>F</i> -statistics	6.754057	10%	5%	1%
Critical values	Lower Bound	1.92	2.17	2.73
	Upper Bound	2.89	3.21	3.9

Source(s): Authors

**Table 3.**  
F-bounds test

**The long-run estimation model and Bayesian results**

Table 4 illustrates the findings of long-run estimation. The interest rate (WACR) and foreign exchange rate (EXE) are statistically significant and adversely related to NIFTY in the long run. The value of long-run coefficients implies that a 1% increase in interest rate (WACR) corresponds to a 0.264% decrease, as aligned with the majority of the studies such as Alzoubi (2022), Humpe and Mcmillan (2020), Misati and Nyamongo (2012), Mukhtadir *et al.* (2012), Okpara (2010), Tursoy (2019) and a 1% increase in the depreciation of the Indian rupee against the US dollar (EXE) corresponds to a 0.46% decrease in the NIFTY supported by the study of Areli *et al.* (2018), Salehi *et al.* (2021), Sreenu (2023), Umar and Mohammed (2014). The coefficient of inflation proxied by (WPI) and broad money supply (M3) are positive and statistically significant and show that a 1% increase in inflation (WPI) leads to a 1.02% increase in the stock market index (NIFTY); this positive relationship supported by the Fisher

hypothesis. Moreover, a 1% increase in money supply (M3) leads to a 0.80% increase in the stock market index (NIFTY), aligned with the studies of [Eldomiaty et al. \(2020\)](#), [Li et al. \(2021\)](#), [Muktadir-al-mukit \(2013\)](#), [Qingyang and Khurshid \(2017\)](#). Among all the three dummy variables, only (DUMMY3) is significant and negative, which shows that COVID-19 has a larger negative impact on the NIFTY and caused a structure change. The other two dummy variables are not significant. [Table 4](#) also reports the regression results from the Bayesian linear regression analysis. The findings regarding the directional impact of various monetary policy variables on the stock market were similar to the frequentist ARDL model. To illustrate, the posterior mean of the variables interest rates (WACR), the exchange rate (EXE) proxied by USD/INR, DUMMY1, which shows the April 2011 breakpoint corresponds to the Reserve Bank of India continuously hiking policy rates due to rising inflation, and DUMMY3 represented the breakpoint in March 2020 corresponds to the Covid-19 outbreak were found to impact the stock market index negatively. On the other hand, the posterior mean of the variables money supply (M3), inflation (WPI) and DUMMY 2 breakpoint that coincides with the post-bull run after the 2014 elections were found to impact the stock market index positively. The outcomes of all the variables remained consistent with the frequentist ARDL Bound Test findings. In addition to this, the study also used more normal priors such as  $N(0.10)$ ,  $N(0.100)$ , and  $N(0.1000)$  to check robustness; the findings are similar in terms of impact sign.

**Table 4.**  
ARDL long-run  
coefficients and  
Bayesian regression

Dependent Variable: Nifty variables	Coefficient	Standard error	t-statistics	p-value	Posterior mean	95% Cred. Interval
WACR	-0.264728	0.069402	-3.814402**	0.0002	-0.15	[-0.21, -0.09]
WPI	1.021915	0.415398	2.460085**	0.0151	2.36	[2.09, 2.63]
M3	0.808269	0.196829	4.106449**	0.0001	0.53	[0.43, 0.61]
EXE	-0.467825	0.232248	-2.014338**	0.0458	-1.10	[-1.26, -0.92]
DUMMY1	-0.105015	0.061272	-1.713908	0.0887	-0.27	[0.23, 0.30]
DUMMY2	0.074519	0.070489	1.057174	0.2922	0.27	[-0.32, -0.22]
DUMMY3	-0.148698	0.053356	-2.786909**	0.0060	-0.12	[-0.18, -0.74]
C	-6.423822	1.610180	-3.989506**	0.0001	-5.94	[-6.05, -5.81]

Source(s): Author

### The error correction model and short-run dynamics

[Table 5](#) shows short-term and error correction model (ECM) coefficients. The error correction term ECM (-1) of -0.3601 suggests that the system responds to any short-term shock from the previous month in the current month at a mild speed of 36%. The negative sign means that the system will bring itself back to long-run equilibrium at a rate of 36% if it was moving out of equilibrium in one direction in the previous month.

We also discover that the stock market index prices (NIFTY) are highly impacted by the interest rate (WACR) with two-month lags, inflation (WPI) with a month lag, exchange rate (EXE), and dummy variable (DUMMY3), which is a proxy for Covid-19. Short-term elasticities indicate that a 1% increase in interest rates (WACR) with two months lags, inflation (LNWPI) with one month lag, exchange rate (EXE) and Covid-19 breakout (Dummy3) depresses the stock market index (NIFTY) rate by 0.214%, 1.28%, 1.21% and 0.25% in the short run. Furthermore, NIFTY is favourably impacted in the short term by the dummy variable 2 (Dummy2) by itself and with a one-month lag that is proxying for the bull run, followed by the 2014 general election in which NDA wins and comes into power.

Table 5.

Short run dynamics

Dependent Variable: Nifty variable	Coefficient	Standard error	<i>t</i> -statistics	<i>p</i> -value
D(WACR(-2))	0.214363	0.057962	3.698319	0.0003
D(WPI(-1))	-1.286072	0.608026	-2.115161	0.0361
D(EXE)	-1.215701	0.182241	-6.670835	0.0000
D(DUMMY2)	0.088354	0.042857	2.061602	0.0410
D(DUMMY2(-1))	0.090268	0.042861	2.106073	0.0369
D(DUMMY2(-3))	0.103509	0.043083	2.402541	0.0175
D(DUMMY3)	-0.255279	0.044245	-5.769609	0.0000
D(DUMMY3(-1))	0.091662	0.045409	2.018594	0.0454
CoIntEq(-1)*	-0.360140	0.044976	-8.007327	0.0000

Source(s): Authors

### Pair wise Granger causality test

Table 6 presents the results of the Granger Causality Test. It is noted that there is a unidirectional causal relationship between the interest rate (WACR) and NIFTY50, the NIFTY50 and inflation (WPI), the overall broad money supply (M3) and NIFTY50, the interest rate (WACR) and inflation (WPI) as well as between the inflation (WPI) and the exchange rate (EXE).

Null hypothesis	Obs	<i>F</i> -statistics	<i>p</i> -value
WACR does not Granger Cause LNNIFTY	171	4.60587	0.0113
NIFTY does not Granger Cause LNWACR		1.32322	0.2691
WPI does not Granger Cause LNNIFTY	171	2.36992	0.0966
NIFTY does not Granger Cause LNWPI		3.24584	0.0414
M3 does not Granger Cause LNNIFTY	171	8.65700	0.0003
NIFTY does not Granger Cause LNM3		0.19464	0.8233
EXE does not Granger Cause LNNIFTY	171	8.09109	0.0004
NIFTY does not Granger Cause LNEXE		10.1705	0.9836
WPI does not Granger Cause LNWACR	171	2.52274	0.0833
WACR does not Granger Cause LNWPI		9.66047	0.0001
M3 does not Granger Cause LNWACR	171	2.08694	0.1273
WACR does not Granger Cause LNM3		1.06793	0.3406
EXE does not Granger Cause LNWACR	171	1.86763	0.1577
WACR does not Granger Cause LNEXE		1.17764	0.3106
M3 does not Granger Cause LNWPI	171	1.86763	0.1577
WPI does not Granger Cause LNM3		1.17764	0.3106
EXE does not Granger Cause LNWPI	171	0.10249	0.9026
WPI does not Granger Cause LNEXE		4.87052	0.0088

Source(s): Authors

Table 6.  
Granger causality test

### Residual diagnostic

To ensure the reliability and validity of the estimated results and avoid getting inaccurate outcomes, it is crucial to evaluate the robustness of the analysis. Table 7 presents the findings of robustness tests. Different diagnostic tests are performed to investigate different aspects of the data. The Breusch-Godfrey Serial Correlation LM test, the Jarque-Bera test and the Breusch-Pagan-Godfrey test are employed to assess serial correlation, normalcy and

heteroscedasticity, respectively. These diagnostic tests are essential for ensuring the accuracy of the analysis and the reliability of the results.  
All the tests are statistically significant.

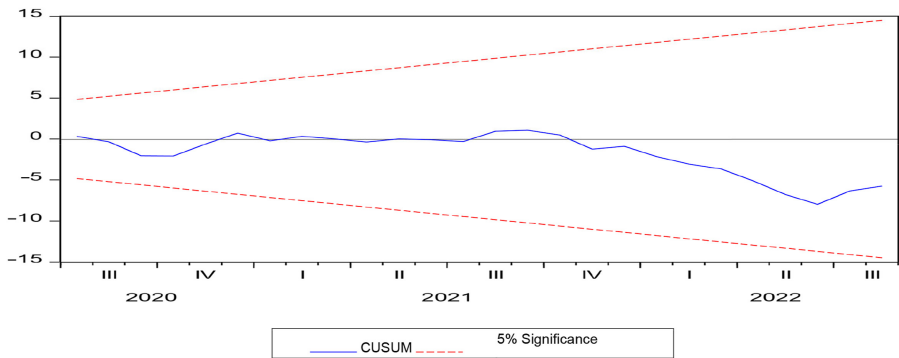
**Table 7.**  
Residual diagnostic

	<i>F</i> -statistics	<i>p</i> -value
Autocorrelation	0.743192	0.4774
Heteroscedasticity	0.025229	0.8740
Normality		0.153627

**Source(s):** Authors

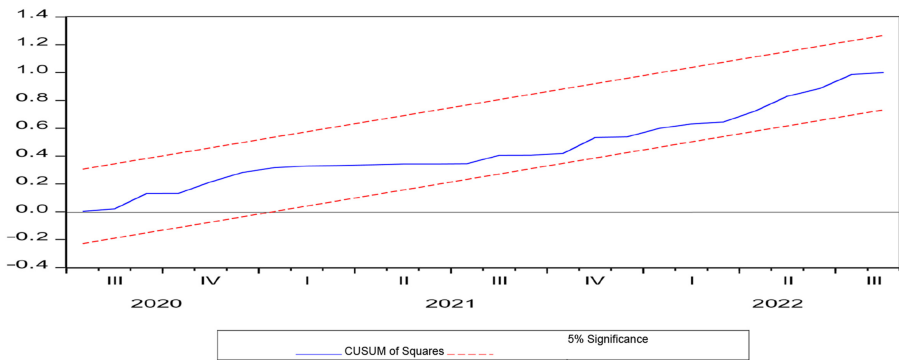
**Test for stability**

As suggested by Pesaran and Shin (1999) analyses, the CUSUM and CUSUMsq are employed to assess the stability of parameters within the chosen error correction ARDL model. Diagrammatic representations of the outcomes of the CUSUM and CUSUMsq tests are presented in Figures 3 and 4, respectively. The stability of the model's parameters is demonstrated by the fact that both plots are within the crucial bounds of the 5% significance level.



**Figure 3.**  
CUSUM test

**Source(s):** Authors

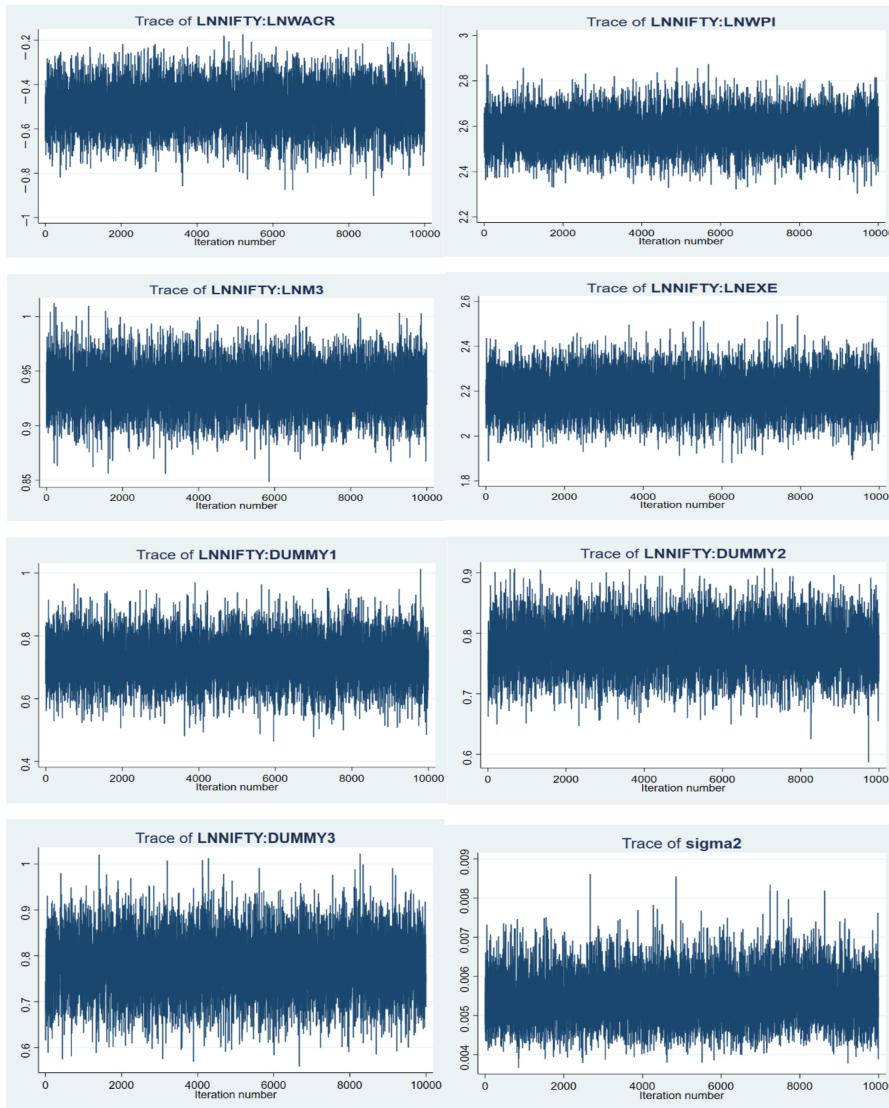


**Figure 4.**  
CUSUM of squares test

**Source(s):** Authors

**MCMC convergence**

The convergence of Markov Chain Monte Carlo (MCMC) is of great significance in MCMC simulations. The validity of Bayesian inference relies on the convergence of the Markov chain (Thach, 2023). Therefore, it is essential to confirm the convergence for each parameter within the model. Figure 5 illustrates the trace plots of all the variables in the study. A trace plot illustrates the simulated values of a parameter in relation to the iteration count. In the case of a parameter exhibiting mixing properties, its trace plot is expected to promptly span the posterior domain while upholding a stable mean and variance.



Source(s): Authors

**Figure 5.**  
Trace plots for MCMC  
convergence

Figure 5 illustrates the trace plots generated to evaluate the convergence of the Markov Chain Monte Carlo (MCMC) algorithm across the parameters under investigation. The chains for all variables demonstrate robust mixing, indicating rapid convergence of the MCMC algorithm.

### Conclusion and discussion

The weighted average call money rate (WACR), a pivotal indicator of monetary policy, demonstrates a statistically significant inverse relationship with the NIFTY50, aligning with findings in most related studies. This emphasises the influence of monetary policy adjustment on the stock market. When the Reserve Bank of India (RBI) increases the repo rate as a standard monetary measure to combat inflation, it triggers a decline in stock market prices. This is attributed to the fact that the elevation of interest rates, such as the Weighted Average Call Money Rate (WACR) in our study, reduces the intrinsic value of the business as rising interest rates diminish the present value of future cash flows in terms of the current value of rupee. Furthermore, higher yields are anticipated in risk-free investment instruments such as treasury bills and bonds as a result of the repo rate hike. Consequently, bonds and Treasury bills attract investors, which causes a change in stock market portfolios. The reorganisation of the portfolio leads to a subsequent decline in stock prices. This observation is supported by the findings of [Alzoubi \(2022\)](#), [Chen and Wu \(2013\)](#).

The present study also uncovered that with the rise of the money supply in the economy, prices of stock also rise. As the money supply expands, the liquidity of the financial system increases. This means more capital is available for investment purposes, such as stock purchases. With a larger pool of available funds, investors have more capital to allocate to equities, thereby increasing demand and stock prices. An increase in the supply of money by expansionary monetary policy may also stimulate consumer expenditure and economic activity. Individuals with more money are more likely to spend more on products and services, boosting corporate profits. This enhanced financial performance has the potential to increase stock prices as investors anticipate higher profits and dividends. The findings of [Qingyang and Khurshid \(2017\)](#), [Eldomiaty \*et al.\* \(2020\)](#), [Chen \(2021\)](#) support this conclusion.

Additionally, contrary to the findings of a majority of studies, the analysis finds that the inflation rate and NIFTY50 have a significant positive relationship, which is supported by Fisher's hypothesis. The study ([Olawale and Ojo, 2020](#)) also supports this. A reasonable level of inflation indicates that consumer demand is strong and economic activities are accelerating. This optimistic economic forecast may raise investor confidence and entice them to buy equities, which could increase activity in the stock market and drive up stock prices. Additionally, inflation has the potential to depreciate fixed-income assets like bonds and cash. The purchasing power of money gradually declines as inflation rises. Because of this, investors may look for alternate investment opportunities, such as stocks, to maintain the value of their money.

An additional noteworthy finding of the current study is about the relationship between the prices of NIFTY50 and the exchange rate, represented by the INR-USD exchange rate. The results supported the study of [Areli \*et al.\* \(2018\)](#), [Umar and Mohammed \(2014\)](#). The observed negative linkage is unsurprising, given that India's economy is import-driven and heavily reliant on foreign inputs for production. As INR depreciates against the USD, the price of importing foreign inputs rises. This increase in the import of foreign inputs by domestic companies has adversely affected its earnings, profitability, as well as the stock price.

The study also found that the COVID-19 outbreak in March 2020 negatively influenced the Indian stock market, and NIFTY fell 29.3% in that quarter, which was the sharpest quarterly fall since 1992. The structural break that appeared due to the COVID-19 pandemic is significant and negative.

Finally, the research exhibited distinctiveness in its methodology by incorporating Bayesian regression analysis, a methodology that diverges from the frequentist approach, alongside conventional classical methods and trace plots used to assess MCMC convergence. The outcomes of all the variables remained consistent with the conventional ARDL Bound Test findings, and the chains pertaining to all variables exhibit strong mixing, suggesting a swift convergence of the MCMC algorithm.

While the RBI's objective is to stabilise prices by increasing interest rates during periods of excessive inflation, it is important to note that such actions can adversely affect the stock market, as we observed the significant negative relationship between them. Therefore, the RBI should exercise caution before implementing interest rate hikes. While it is true that the RBI's primary objective is combating inflation, it is essential to acknowledge that this focus on price stability comes at the expense of financial stability. Stock prices are greatly affected by changes in interest rates, making it imperative for the RBI to consider both aspects of price stability and financial stability when formulating monetary policies. Therefore, besides focusing on price stability, the RBI should also aim for financial stability. Furthermore, market participants should consider the potential impact of fluctuating monetary variables when devising their long-term investment strategies. Given that adjustments in interest rates can markedly affect stock market dynamics, investors must carefully assess the implications of monetary policy decisions on their portfolios.

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### Further reading

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