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# Fed rates and movement of bank stocks in India

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Asian Journal of Economics and Banking

# Fed rates and movement of bank stocks in India

Subhash Karmakar
*Department of Management Studies, Bank of India, Kolkata, India*



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## Abstract

**Purpose** – The purpose of this paper is to identify the changes in the stock market prices of banks in India with changes in FED rates in long run.

**Design/methodology/approach** – Using both bivariate granger causality and ANOVA along with binomial logistic regression the influence of changes in FED rates on stock market prices of both major public sector and private sector banks have been derived.

**Findings** – Private banks with higher shareholding of Foreign Institutions investors are influenced significantly as compared to public sector banks.

**Research limitations/implications** – The changes in FED rates and its influence over the stock prices are related directly to the shareholding pattern of Foreign Institutional Investors. The results suggest that changes in the FED rates have a direct impact on the financial sector stock prices, where a positive relationship is observed.

**Practical implications** – For investors this provides a decisive signal for market-related investments in public sector vis-a- vis the private sector banks and for the policy makers this may open the door for policies related to foreign investments as well as policies related to managing liquidity positions.

**Originality/value** – By using real datasets and granger causality analysis this paper will help in understanding the relationship between the banking stocks in India and changes in FED rates.

**Keywords** Fed rates, Granger causality, FDI, Public sector banks, Private banks, Repo rate, Reverse repo

**Paper type** Case study

## 1. Introduction

Interest rates play a key role in the development of the economy and controlling the economic operations of a State. The changes in interest rates provide an important tool through which the central bank in a country takes the lead in the management of inflation as well as market operations and, of course economic growth. Interest rates also impact the flow of credit in the economic system.

The movement of interest rates has direct implications for the financial markets including stock markets. In India the Reserve Bank of India (RBI), the Central Bank regulates the economy using the Cash Reserve Ratio (CRR), repo rates, reverse repo rates, Statutory Liquidity Ratio (SLR) etc. The RBI also determines the Government Bond Rates that are floated by the Central and State Governments and provide a good investment opportunity for retail investors as well as for banks and financial institutions to meet SLR requirements.

**JEL Classification —** E42, E47, E52, G10, G18, G11

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Another important feature of the bond market is that it has an inverse relationship with stock prices, so when stock prices rise bond prices fall and vice versa.

To meet liquidity requirements in the banking system, commercial banks borrow from RBI by selling their securities to the central bank which is also termed as repo. So, when there is a hike in the repo rate, the cost of borrowing for banks and other financial institutions increases, and it plays a major role in the increasing interest rates for various loans and advances.

Similarly, the Federal Fund Rate is set by the Federal Reserve, U.S., which refers to the rate at which commercial banks borrow and lend their excess reserves to each other overnight. By monitoring the FED rates the growth of the economy is monitored, which is decided by the Federal Open Market Committee (FOMC). FED rates are usually reduced when the economy begins to struggle to decrease the borrowing cost. When the economy is over-heated, FED may decide to increase rates, to increase the cost of credit throughout the economy. This change can significantly impact the bond and capital markets. For example when FED rates increase, the stock market may become relatively less attractive.

FED rates are also have an impact on stock markets in India, where a rise or decline causes changes in stock markets. When the borrowing rate is low, an investor borrows in the U.S. market and infuses the capital in the Indian market. Conversely, when there is an interest hike that has a positive impact on the U.S. treasury yield, the money moves from Indian markets.

The changes in the FED rates do not occur overnight but the news starts moving in the markets months before any announcement and accordingly the equity markets are affected.

Foreign direct investment in various sectors in India plays an important role. According to the Invest India site (investindia.gov.in) the total FDI equity inflow during FY: 2022–23 was $70.97bn and the total FDI equity inflows was at $46.03bn. The countries with greatest contributions to FDI equity inflows for FY: 2022–2023 are Mauritius (26%), Singapore (23%), the USA (9%), the Netherlands (7%) and Japan (6%).

Amongst, the sector which is having the highest investment in FDI equity inflow during FY: 2022–23 are finance, banking, insurance and other services which accounts for 16% of the total investment. So, it becomes very important to study the impact of FED rates on Banking Sector in India, since it is one of the most preferred sector for investment.

India is an attractive destination for foreign investors due to its greater growth in the banking sector, good asset quality etc. According to Islam and Beloucif (2023) the size of a market determines FDI followed by openness, infrastructure quality, labor cost, macroeconomic stability, human capital and the growth prospects of the host country.

Doytch (2022) while studying the impact of COVID 19 which caused an economic crisis for a prolonged duration investigated the impact of output growth on acceleration and deceleration. They carried out a study on the FDI data of 34 OECD countries during the period of 1995–2019 and concluded that in financial services FDI inflows are countercyclical, while manufacturing FDI outflows are procyclical. They observed that FDI in transport services is determined by various factors, such as the control of corruption in the home country.

FDI in the private banking sector is allowed up to 74% according to the guidelines of RBI and the government and the majority of the investors who hold it are concentrated in India's largest private sector banks of which the top investee banks are the ICICI Bank, the HDFC Bank and the Kotak Mahindra Bank (S&P Global Market Intelligence 24th September, 2023).

Considering the facts and figures it is pertinent that FDI in private Sector banks play a pivotal role in the coming days and it becomes very important to study the impact of changes in FED rates and changes in stock market prices on investor's sentiments.

The purpose of this paper lies in the fact that very few studies are available focusing the impact of changes in FED rates and changes in stock prices of major banking stocks in India, over the long term. Although financial services account for around 36% (As on 31st October, 2023) in terms of weightage in NIFTY 50, which is considered the conglomerate of top 50 stocks according to market capitalization. Moreover, four banks are in the top ten companies and approximately accounting for 27% weightage (As on 31st October, 2023) in terms of market capitalization in NIFTY 50. Therefore, it is of prime importance to study the long -term

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impact of changes in the stock prices of the major banking stocks and FED rates in order to decipher the pattern of investments in these stocks influenced by FED rates.

The objective of this paper is manifolds; firstly, the paper attempts to reveal the mechanism regarding how changes in FED rates influences the major banking stocks in India on a long run. Secondly, the paper also focusses on the inherent role of FED rates in the foreign direct investments particularly banking stocks.

The paper is based on the hypothesis whether any change in the stock market prices follows the change in FED rates or vice versa where in the present context bivariate Granger causality models as substantiated from different studies have been used to determine relationship between changes in interest rates and stock market prices in different categories of Banks.

The contributions of this work are as follows. Firstly, though papers are available where stock returns have been correlated to changes in FED rates but their impact on banking stocks particularly in emerging economies like India have been rarely discussed. Moreover, the role of changes in FED rates and their ramifications in the banking sector in India being dominated by the public sector and private sector banks have been discussed. These observations provide an arena for determining the performance of stock returns of the banks with hike in FED rates.

Secondly, this paper has made the first attempt to relate how FDI in banks have been playing a major role particularly under a well-regulated financial system where private banks with good performance in terms of parameters are greatly benefited. This may open the doors for FDI in other banks not only to improve the efficiency of the banks but to improve the performance on a global platform to become global banks. So, from an investor's point of view the role of changes in FED rates are important.

### *1.1 Primary distinction between this study and prior research*

According to our survey of the literature, it is found that literature are mainly focused on changes in interest rates and changes in stock market prices or sectoral indices and it is sometimes based on how FED rates impact our economy as a whole. Some of the recent papers (Growing impact of U.S. monetary policy on emerging financial markets-Evidence from India by Lakdawala) pointed out that U.S. monetary policy decisions play a significant role in the Indian Stock markets before the use of unconventional tools and that effects are becoming stronger over time. Apart from these facts, very few studies have investigated the impact of FED rates on banking stocks in India, particularly in long run. There are also few papers related to how foreign institutional investors are being impacted through changes in FED rates. In this context, this paper has made an attempt to bridge the gap in literature where shareholding pattern particularly the shareholding pattern of Foreign Institutional Investors (FII) have been correlated with changes in FED rates. Furthermore, very nascent literature are also available to reveal impact of changes in the FED rates on overall stock markets and in particular financial markets. This paper may be beneficial to policymakers and all stakeholders considering how FED rate interventions may affect financial firms in India and will help in formulation of policies related to FDI and develop a better framework for investment in public sector banks in India to improve the competitiveness and performance of these banks as compared to their private peers.

The rest of the paper is organized as follows: section 2 present some of the related literature reviews. Section 3 describes the research framework and methodology, section 4 presents the findings and include relevant discussions. Section 5 highlights the conclusion of this research and policy implications.

Table 1 provides the meaning/definitions of some of the terms used in this paper.

## 2. Related literature

The available literature have focused on various methodologies used for deriving the relationship between stock markets and interest rates across different continents. We have classified the literature review into the following sections:

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**Table 1.** Definitions/descriptions of the terms

| Term | Definitions/Descriptions |
|---|---|
| FED Rates | Federal Funds Rate is set by the Federal Reserve, U.S. which refers to the rate at which commercial banks borrow and lend their excess reserves to each other overnight |
| Granger Causality | The Granger causality is defined in terms of whether historical information set on a variable can predict another variable |
| Foreign Direct Investment (FDI) | Foreign Direct investment is the investor of a foreign company/firm or ownership in a company which is of other country |
| Public Sector Banks (PSBs) | Public Sector Banks are those banks where majority ownership lies with the state |
| Private Sector Banks | Private sector Banks are those banks where majority of the stake is held by individuals/groups |
| Cash Reserve Ratio(CRR) | It is the percentage of the certain position of deposits which are to be maintained with the Central Bank in order to maintain the liquidity position of the banks |
| SLR(Statutory Liquidity Ratio) | It is the investment that a bank makes in liquid assets like Government Securities (G-Sec), gold instead of cash to maintain the solvency of the banks |
| Repo Rate(Repurchase Rate) | It is the rate which financial institutions pays to the Central Bank/Reserve Bank of India for loans secured by securities. The RBI changes the rates in order to regulate the interest to be charged in loans and deposits and influences the borrowing cost of banks |
| Reverse Repo Rate | It is the rate which is paid by the Central Bank/Reserve Bank Of India when banks park their excess liquidity/money with RBI |
| Nifty 50 | The Nifty 50 is a diversified 50 stock index accounting for 13 sectors of the economy. The Nifty 50 Index represents about 59% of the free float market capitalization of the stocks listed on NSE(National Stock Exchange) as on September 29, 2023.(Source: nse.india.com) |
| Nifty Bank Index | It refers to the diversified stock index of Banks (Public Sector Banks and Private Sector Banks) |

**Source(s):** Table by author

Mukherjee (2007) found that the Indian stock market was having low levels of robustness and efficiency when compared with other stock markets like those in New York, Tokyo and Hong Kong. Gu *et al.* (2022) were of the view that average interest rates have their negative impact on the returns of the stock market based on the studies on Chinese markets. They suggested that the policymakers should go for marketization of the interest rates.

On the same lines, Sahu and Pandey (2020) suggested that in the Indian market, money supply and stock market prices are closely related and having a significant positive impact based on their studies on Indian stock market from 1996 to 2016. While studying the impact of interest rates on the stock markets Ramsharan (2019) found that they were inversely related.

Batrancea *et al*. (2021) while studying the economic growth of African countries suggested that economic growth is proxied by GDP growth rates and other indicators like imports, exports and gross domestic savings.

Ugurlu *et al*. (2021) while studying the relationship among investor's sentiments, monetary policies and stock markets in the U.S. derived a significant negative form in terms of uncertainty in monetary policies. Kim (2023) identified that a sharp hike in the FED rates leads to movement of investors in the emerging markets.

Kaur *et al*. (2023) while working on BRICS economy noted that foreign investments, commodity prices and money supply are the key factors for greener growth in BRICS economies.

Hillier and Loncan (2019) noted that a market integration improves the well-governed firms. Acharya *et al*. (2020) investigated the transmission of Central Bank's liquidity to

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bank deposits and loan spreads in Europe for the period of January 2006 to June 2010 and were of the view that during easing of the monetary policies puts constraints on the banks capital base.

Conrad (2021) while studying the impact of impact of interest rates and monetary policy on the stock market noted that any decrease of interest rates may have a direct impact on the share prices of the firm. Their conclusions were in line with extreme expansive monetary policy with low, zero or negative interest rates encourage financial bubbles on the stock market.

Hirota (2023) while working on how the money supply in the economy influences demand for stocks found that during the COVID phase the changes in money supply and monetary policy may have the disconnect between stock market and real economy. Thorbecke (2023) while working during the same period noted that changes in monetary policies by the FED had influenced on the stock markets and in particular the volatility of the stock markets increased during the pandemic period with the changes in policies.

Garga *et al*. (2022) investigated the inflation targeting of Reserve Bank of India (RBI) during 2015 and how the market perceived such changes in the monetary policies have been discussed. On the same lines again Lakdawala *et al*. (2023) investigated how the bond market responded to Reserve Bank of India's monetary policy at the start of pandemic and they noted that due to measures taken by RBI the interest rates in long term bond markets had remained high during the early phase of the COVID 19 pandemic.

Kedia and Vashisht (2017) while deciphering the relation between interest rates and stock markets stressed upon the fact that there is no relationship regarding inflation, policy interest rates and exchange rates.

Kumuda *et al*. (2016) analyzed the relationship between interest rates and stock prices in the context of India for a 10 year period from 2005 to 2014 where they observed that six sectors (auto, bank, FMCG, financial services, IT and Pharma) out of 11 sectors were significantly impacted by the policy interest rates.

Batrancea (2021) while studying the impact of financial performance on the assets and liabilities of banks in Europe during 2006–2020 recorded that there is a strong impact on the banks assets and liabilities related to financial indicators.

Lakdawala (2021) while studying the impact of US monetary policies on the Indian stock market derived significant effects which have become robust over the period of time. They also found that the decisions regarding investments were mainly driven by the foreign institutional investors, which also play an important role in the stock market.

Kaur *et al*. (2021) identified various literature related to study of macroeconomic variables on the economic growth of BRICS countries where GDP has been proxied as measure of economic growth; to study the macroeconomic variables affecting the stock market of BRICS nations through content analysis. The study has helped to fulfill the research gaps that confine the influence of macroeconomic variables and restrict the growth of BRICS countries.

Guo *et al.* (2022) concluded that impact of Federal funds rate (FFR) is mostly powerful when sentiment-driven overvaluation is followed by a correction. They suggested that monetary easing surprises during sentiment-waning phases boost the stock market by alleviating investors' fear.

Balci *et al*. (2022a) used geometric coarse graining method on stock market indices to show changes across the markets during three financial crisis periods.

Balci *et al*. (2022b) used network induced soft sets to investigate the efficacy of these methods during various economic stress periods to study the interaction in stock markets.

Ni (2023) while studying the impact of increase in the FED rates noted that any increase in the rates had a negative impact on the economic activities and investments moves out from foreign countries. So, if the FED rates remain increasing the foreign countries may compensate the outflows through changes in their monetary policies.

Batrancea *et al*. (2023) while studying corruption perception index impacts the countries and their boundaries.

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*2.1 Empirical literature and hypotheses development*

In order to define the relationship between the policy interest rates, inflation, exchange rates and money supply or other factors which emanate from changes in monetary policies and the stock markets various authors have adopted various methodologies like Granger Causality models, Johansen`s approach of co-integration and Toda and Yamamoto Granger causality test etc. Depending upon the nature of the study and type of data co-integration methods have been used the most but Granger causality models have also yielded good results. Some of the papers have relied upon the autoregression models to have significant results. Various authors have used Bayesian regression models as well as some have used panel cointegration tests for good results. First of all it is required to establish the nature of the variables, depending upon various test results like autocorrelation test and multicollinearity tests, proper methods for further analysis are to be selected. In this paper, the combination of binomial regression and cointegration tests have been carried out in order to establish the results which have been obtained through ANOVA. Since, ANOVA results may not be as useful and robust as compared to binomial regression based on proportions or probability and cointegration methods, both these tests have been carried out. Furthermore, to check robustness of the results omnibus likelihood tests have been also carried out so find out the variables which are important.

The details of methodologies adopted in various papers may be summarized as:

If we take a closer look at Table 2 it is envisaged that modern papers rely upon not only the cointegration techniques but also on the probability based regression models. So, considering the various models proposed by various authors, in this paper Granger Causality model along with panel cointegration methods have been used. Apart from cointegration models, binomial logistic regression has been used being a probability-based approach.

## 3. Methodology

The Methodology used in paper may be depicted in form of flowchart as Figure 1 (By Author).

Based on the literature reviews, Bivariate Granger Causality model with Box and Cox transformation have been used after Binomial logistic regression. The Durbin and Watson's statistic have been calculated with *p* values to detect whether any autocorrelation exists in the data or not. The detailed discussions on the methodology used and its implications are elaborated in this section.

*3.1 Granger's causality*

The Granger causality is defined in terms of whether historical information set on a variable can predict another variable. In theory, the traditional Granger causality test is a joint restriction test and strictly relies on the assumption that the underlying data generating process is stationary.

Correlation may be defined as the mutual relationship between two variables or two or more processes based and it is not expected by chance alone.

Causality which may be referred to cause and effect, is the relationship between two processes, the first of which (the cause) is partially or totally responsible for the second, while the second is partially or totally dependent on the first. (Rossi, 2013).

The causal effect of two variables X and Y can be determined with the use of the Granger *causality test*, named after the British econometrician Sir Clive Granger. This test makes use of Student's t-statistic and F-statistic tests and identifies whether the values of the variable X provide statistically significant information about the evolution of the future values of the variable Y assuming that X and Y are having stationary time series of data (Stationarity in time series data refers to the fact that statistical properties of the time series do not change over time).

The Granger-causality tests assess the significance of the proposed predictors in a regression of the dependent variable ($y_{t+h}$), onto the lagged predictors ($x_t$), where *h* is the

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**Table 2.** Methodologies in various papers

| Name of the authors | Year | Model used and period of study | Purpose of study | Results |
|---|---|---|---|---|
| Sampene *et al.* | 2021 | Johansen Multivariate Cointegration Method (2000–2019) | Relationship between Interest rate, rate of Inflation, Exchange rate and Money Supply and stock market index | Significant long run co-integration among interest rates and Ghana Composite stock index |
| Chaudhary, Bakhshi and Gupta | 2020 | Generalized Autoregressive Conditional Heteroscedasticity (GARCH) (January–June2020) | Impact of COVID 19 on return and volatility of stock market | Positive and significant impact found in all the indices in the market |
| Ahmed | 2008 | Johansen`s approach of co-integration and Toda and Yamamoto Granger causality test (March 1995–March 2007) | Relationship between stock market prices and key macroeconomic variables | Interest rate seems to lead stock prices |
| Aggrawal and Agarwal | 2017 | Granger Causality Model and Johansen`s approach of co-integration test(January 2008 to December 2013) | Relationship between interest rates and stock markets | Interest rates and stock markets move together in long run |
| Yadav *et al.* | 2021 | Vector Error Correction Model and Cointegration test (2000–2020) | Relationship between stock market prices and key macroeconomic variables | There is a long run association between macroeconomic variables and stock markets |
| Sun and Yang | 2018 | Markov switching vector auto regression (MS-VAR) model | Identification of asymmetric effects of China's monetary policies on stock markets | China's monetary policy has stronger effects on the bull market than bear market |
| William M. Briggs | 2023 | Bayesian modelling | Classical economic problems | Partial solution to replication crisis |
| Anita Kalia | 2024 | Bayesian regression | Relationship between promoter's share pledging and company's dividend payout policy | Significant negative association promoter's share pledging and company's dividend payout policy |

**Source(s):** Table by author

forecast horizon. The Granger-causality test is a simple *F*-test on the parameter vector $\alpha_h$ where:

$$y_{t+h} = \alpha' h\, x_{t+\beta' h} z_{t+} \varepsilon_{t+h}, \text{where } t = 1, \ldots.., T \text{ and } Zt \text{ are control variables with lags of } y : yt, yt + 1$$

It is assumed that the regressors are suitable predictors when the statistical tests reject the null hypothesis that the regressors are insignificant (i.e., when the *F*-test for testing the hypothesis $\alpha_{h=0}$ rejects at standard significance levels).

*3.1.1 The stationarity in the time series data can be analyzed with the help of two important statistical tests.*

(1) Augmented Dickey Fuller Test (ADF): The Dickey Fuller Test (DF) is used to determine where any autoregressive model is having a unit root which implies that the data is not stationary. The null hypothesis of DF test is that there is a unit root in the time

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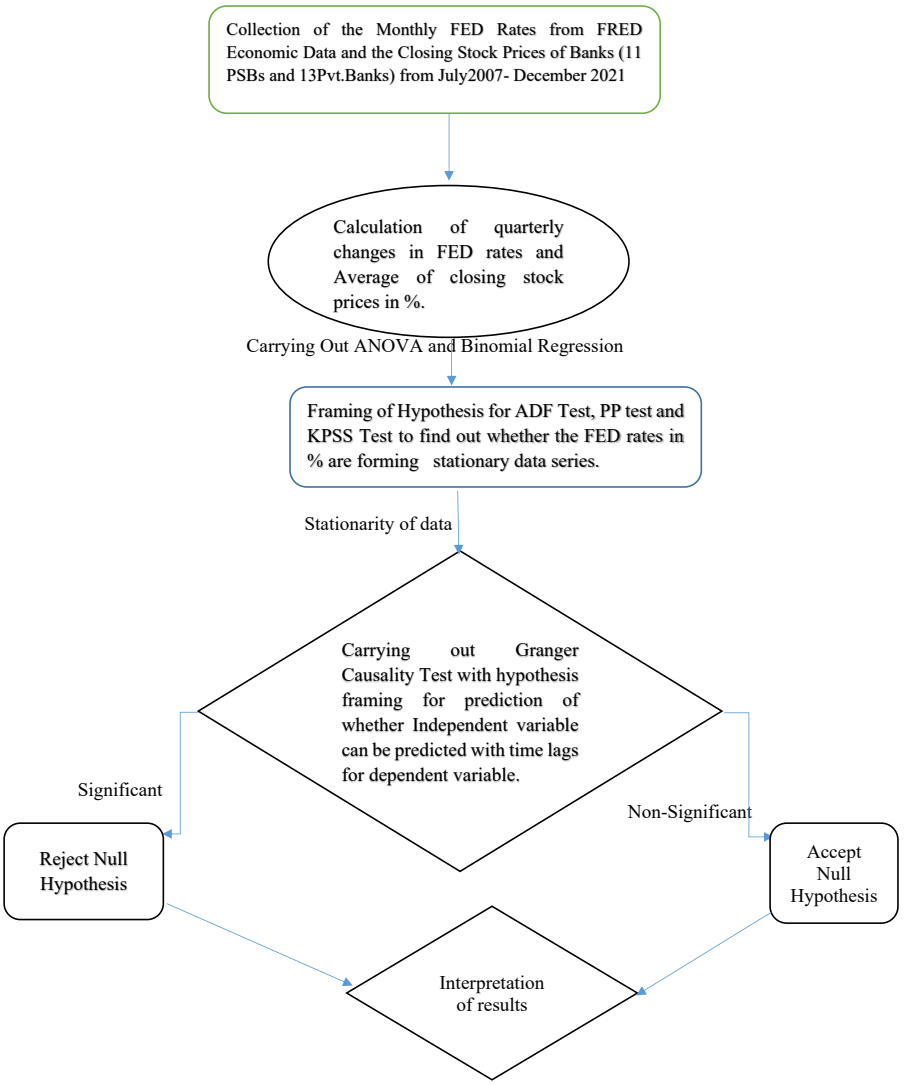


**Figure 1.** Outline of paper. Source: By author

series data which implies that the data series is not stationary. The alternative hypothesis is that the data is stationary.

(2) Phillips–Perron Unit Root Tests (PP)

The Phillips-Perron (PP) unit root test mainly deals with serial correlation and heteroskedasticity in the errors. In particular, where the ADF tests use a parametric auto regression to approximate the ARMA structure of the errors in the test regression, the PP tests ignore any serial correlation in the test regression.

Hypothesis: Ho: The process has a unit root.

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H1: The process does not have a unit root.

(3) Kwiatkowski Phillips Schmidt and Shin (KPSS) Test

KPSS test is a standard unit root tests and it is not affected by seasonal dummies Phillips.

Hypothesis: H0: The series is stationary

H1: The series is not stationary

The test statistic is given by: LM $= \sum_{T=1}^{t} (s^2 t / \sigma\text{^}2 t)$

Where $St = \sum_{t=1}^{T} €\text{^t}$ and $\sigma\text{^}2 t$ is the variance of the process €^t.

In our case we are having two variables which are to be tested, the independent variable, that is the FED Rates (Changes in quarterly percentages) and the changes of average of the quarterly closing prices of the stock of various Banks (Both Private and Public Sector Banks) operating in India being the dependent variable.

The sample of banks used in the study refers to those Public Sector Banks and Private Banks where data for the entire sample period is available to provide a realistic view and relevant observation. We have derived the sample of our study from the National Stock Exchange (NSE) and NIFTY Bank and included all the important banks with historical data for the sample period.

In the following sections we shall discuss some of the important features related to NSE and Indices which are important to our study, The NIFTY 50 index which consists of the major firms in terms of market capitalization consists of various segments. The sector wise representation of different as on 31st October, 2023 may be represented as in Table 3.

From the above Table 3 it is evident that the Financial Services are playing a significant role in determining the movement of the market and an important place in terms of market capitalization.

Now, if we compare the top 10 firms or companies which holds the majority of the market cap in NIFTY 50 we observe that two in the top three are banks and four out of top 10 firms are private banks. The weightage of different companies in NIFTY 50 is depicted in Table 4.

The banks constitute around 27% of the weightage of the top ten firms and hence any movement in the stock prices of the top banks has an impact on the market trends.

Based on the records available from the National Stock Exchange (NSE) site the following financial institutions are in NIFTY 50 (as on 31st October, 2023):

(1) Axis Bank Ltd.

**Table 3.** Weightage of different sectors in NIFTY 50 (as on 31st October, 2023)

| Sector | Weight (%) |
|---|---|
| Financial Services | 35.86 |
| Information Technology | 13.62 |
| Oil, Gas and Consumable Fuels | 11.37 |
| Fast Moving Consumer Goods | 9.49 |
| Automobile and Auto Components | 6.27 |
| Construction | 4.23 |
| Healthcare | 4.03 |
| Metals and Mining | 3.67 |
| Consumer Durables | 3.2 |
| Telecommunication | 2.76 |
| Power | 2.44 |
| Construction Materials | 1.99 |
| Services | 0.75 |
| Chemicals | 0.32 |

**Source(s):** Table by author

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**Table 4.** Weightage of different companies in NIFTY 50 (as on 31st October, 2023)

| Company's name | Weight (%) |
|---|---|
| HDFC Bank Ltd | 13.24 |
| Reliance Industries Ltd | 9.25 |
| ICICI Bank Ltd | 7.66 |
| Infosys Ltd | 5.84 |
| ITC Ltd | 4.53 |
| Larsen and Toubro Ltd | 4.23 |
| Tata Consultancy Services Ltd | 4.12 |
| Axis Bank Ltd | 3.25 |
| Kotak Mahindra Bank Ltd | 3.06 |
| Bharti Airtel Ltd | 2.76 |

**Source(s):** Table by author

(2) Bajaj Finance Ltd.

(3) Bajaj FinServ Ltd.

(4) HDFC Bank Ltd.

(5) HDFC Life Insurance Company Ltd.

(6) ICICI Bank Ltd.

(7) IndusInd Bank Ltd.

(8) Kotak Mahindra Bank Ltd.

(9) SBI Life Insurance Company Ltd.

(10) State Bank of India

In our study we have considered the following Banks operating in India:

*Public Sector Banks (PSBs)*

Bank Of Baroda, Bank of India, Bank of Maharashtra, Canara Bank, Indian Bank, Indian Overseas Bank, Punjab National Bank, State Bank of India, UCO Bank, Union Bank of India.(Data available for the period of study has been considered while considering the sample)

*Private Sector Banks (Pvt. Banks)*

Axis Bank, City Union Bank, DCB Bank Ltd., Federal Bank, ICICI Bank, HDFC Bank, IDFC Bank, IndusInd Bank, Karur Vysya Bank, Kotak Mahindra Bank, South Indian Bank, Yes Bank. (Data available for the period of study has been considered while considering the sample)

The details of the closing stock prices have been collected from the NSE site for the period of July 2007 to December 2021.The selection of the period has been done in such a way that it covers the period of onset of Global Financial Crisis and the Post Covid period.

Out of the sample of 23 banks 10 banks are in the NIFTY Bank index according to market capitalization and 6 banks are in NIFTY 50 index.

The details of the quarterly FED rates have been collected from https://fred.stlouisfed.org/series/FEDFUNDS.

The selection of the Banks have been based on the total market capitalization where we have considered all the public sector banks and as per the NSE data we have considered the Private banks where data for the entire period of study is available. The list of private banks as per market capitalization is available on (https://www.moneycontrol.com/stocks/marketinfo/

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marketcap/nse/bank-private.html) and for PSBs on https://www.moneycontrol.com/stocks/marketinfo/marketcap/nse/bank-public.html.

The period of study has been selected from July 2007 to November 2023 due to the impact on the FED rates during the entire period which can be visualized from the following graph as presented in Figure 2.

The figure no: 2 represents the quarterly changes in FED rates. The Y axis represents the quarterly changes in FED rates in percent and the X axis represents the years from July 2007 to November 2023.The shaded area represents the recession phase.

The shaded area indicates recession period in the U.S. Therefore, we have considered the period prior to the Global Financial Crisis in 2008 and the post-Covid period after 2020 to demonstrate the impact of changes in FED rates and closing stock prices during the recession phase as well as during the pre-recession and post-recession phases.

Therefore, from the analysis it is determined whether there is any relationship between the quarterly change in closing prices and the quarterly change in FED rates from https://fred.stlouisfed.org/series/FEDFUNDS.

From our data we represent the changes in the quarterly FED rates over our period of study in the Figure 3.

Figure 3 represents the quarterly change in FED rate over time. An interesting feature observed is that during the recession phase 2008 Q4 (September–December 2008) the FED rates drastically decreased. Similar reductions are observed during 2020Q1 (January–March 2020) and 2020Q2 (April–June 2020) which indicate the COVID 19 Outbreak.

### *3.2 Development of hypothesis*

According to various studies available, Granger causality tests have generally been used to ascertain the relationship between interest rates and stock market prices. Granger causality tests are also important and powerful tools for forecasting.

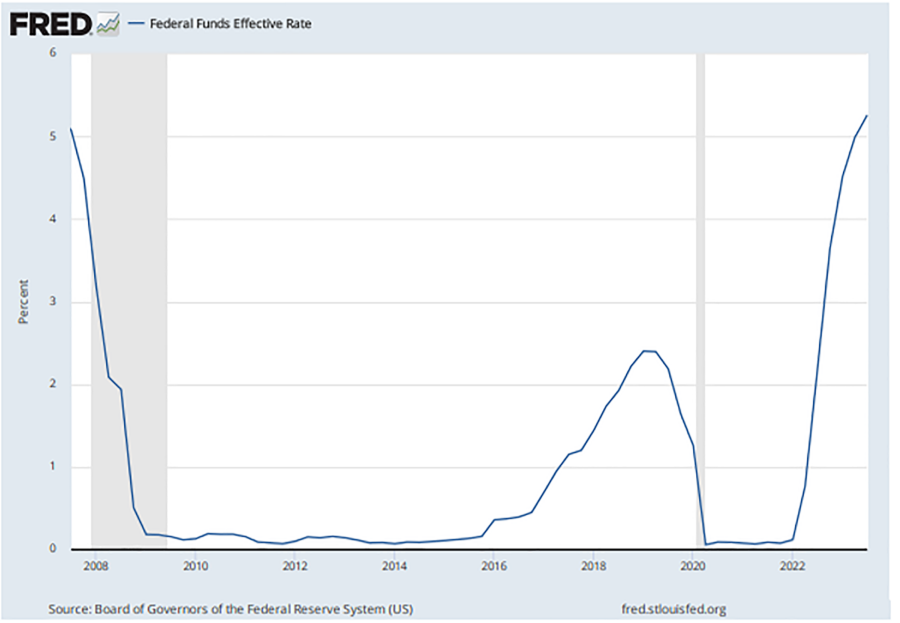


**Figure 2.** FED rates during the period of July 2007–November 2023. Source: Board of Governors of the Federal Reserve System (U.S.)

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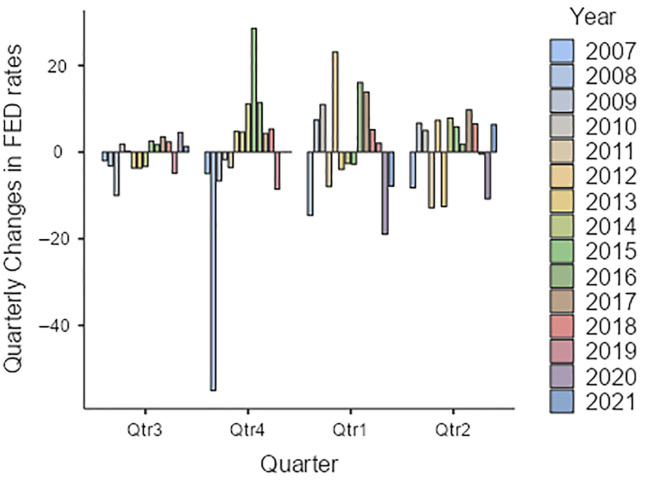


**Figure 3.** Changes in quarterly FED rates for the period of July 2007–December 2021. Source: By author

In this case, considering the fact that any change in the closing stock prices of bank stocks depends on the past value of the quarterly changes in FED rates. The first order equation may be presented as follows:

$$\mathrm{cp}_{t=}\beta\,\mathrm{fedr}_{t-1}+\varepsilon t \tag{1}$$

where $\beta$ is the coefficient of determination of unit root or stationarity. If the value of $\beta$ is less than one changes in closing prices will be transitory. In case it is equal to one then changes are of permanent nature. Equation (1) may be realigned as:

$$\Delta\,\mathrm{cp}_{t}=(\beta-1)\,\mathrm{fedr}_{t-1+}\,\varepsilon t \tag{2}$$

Equation (2) may be written as:

$$\Delta\,\mathrm{cp}_{t}=\rho\mathrm{fedr}_{t-1+}\,\varepsilon t \tag{3}$$

where ρ refers to the coefficient of interest determination of root test or stationarity.

The equations may be written as:

$$\Delta\,\mathrm{cp}_{t}=\alpha_{0+}\rho\,\mathrm{fedr}_{t-1+}\,\varepsilon t\,(\text{with drift}) \tag{4}$$

$$\Delta\,\mathrm{cp}_{t}=\alpha_{0+}\alpha_{1}t+\rho\,\mathrm{fedr}_{t-1+}\,\varepsilon t\,(\text{with drift and trend})$$

In case of Augmented DF test the right hand side of the equation has higher-order lags to capture the higher-order autocorrelation. The right hand side of the equation may be written as:

$$\Delta\,\mathrm{cp}_{t+}\alpha_{0+}\alpha_{1}t+\rho\,\mathrm{fedr}_{t-1+}\Pi_{1}\Delta\,\mathrm{cp}_{t-1}+\Pi_{2}\Delta\,\mathrm{cp}_{t-1+\ldots\ldots\ldots\ldots+}\Pi_{p}\Delta\,\mathrm{cp}_{t-p}+\varepsilon t \tag{5}$$

The null hypothesis that variable X (changes in quarterly FED rates either a rise or fall represented in %) does not Granger-cause variable Y (changes in closing stock prices either a rise or fall represented in %) is accepted when no lagged values of the variable X are retained, after the application of t-statistic and F-statistic tests. Otherwise, we reject the null hypothesis

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in favor of the alternative, and we conclude that variable X Granger-cause variable Y and thus the future values of variable Y are depended on the present values of variable X.

*3.3 Box and Cox transformation and bivariate granger causality*

According to Shojaie and Fox (2022) despite the popularity of the Granger causality Test, for inferring causal relationships among time series, there are limitations in computational tools particularly the applications of Granger causality to primarily simple bivariate vector autoregressive processes.

Regardless of the testing procedure, Granger causality based on only two variables severely limits the interpretability of the findings: Without adjusting for all relevant covariates, a key assumption of Granger causality is violated.

To account for a (potentially large) number of exogenous variables when studying the relationships between small numbers of endogenous variables, a well-known approach is the factor-augmented VAR model of Bernanke *et al.* (2005).

Chen *et al.* (2022) confirmed the Box–Cox power transformation model by developing a penalized maximum likelihood estimate and deriving the consistency, oracle property and asymptotic distribution of this estimate.

This was further confirmed by Gonclaves (2023) that the Box–Cox transformation is a well-known family of transformations used to obtain data suitable for the normality assumption of residuals. However, the positive condition for the Box–Cox (BC) transformation results in a truncated normal (TN) instead of a normal distribution that most practitioners assumed as approximately normal.

## 4. Results and discussion

The raw data related to quarterly changes in closing stock prices of different banks and changes in FED rates were retrieved from the National Stock Exchange Site (NSE) from the historical prices section and FED rates were derived from https://fred.stlouisfed.org/series/FEDFUNDS. Using the daily data of the closing stock prices which are important from the perspective of investor sentiment, the quarterly average was calculated to determine the changes on long term basis. Similarly, the quarterly changes in FED rates corresponding to that quarter which relates to the changes in closing prices have been included in the study to determine the impact of the changes.

*4.1 Firstly, the descriptive statistics have been carried out as follows*

From Table 5 it is observed that data is not normal and since VIF value is below 5, so there is very low correlation among the variables. The DW statistic indicates a positive autocorrelation. Since, autocorrelation and multi collinearity exits in the data, panel cointegration tests are conducted in order to find whether the series is stationary or not. In this paper jamovi software have been utilized.

*4.2 We have carried out ADF test on quarterly changes in FED rates and the results are presented in Table 6*

As the computed *p*-value is lower than the level of significance of 0.05, so we reject the null hypothesis in the first and third cases and accept the alternative hypothesis except in the second case where the *p*-value is higher than the level of significance.

Next, we carried out the PP Test for the quarterly changes in FED Rates, and the results are depicted in Table 7.

As the computed *p*-value is lower than the level of significance of 0.05, so we reject the null hypothesis and accept the alternative hypothesis in case first and third cases except in the case where $r = 1$.

The details of the KPSS Test have been represented in Table 8.

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**Table 5.** Descriptive statistics

| | Percentage change in closing prices (quarterly) | Percentage change in FED rates (quarterly) |
|---|---|---|
| *N* | 58 | 58 |
| Mean | 1.1 | 0.153 |
| Median | 3.09 | 1.52 |
| Standard deviation | 16.9 | 11.4 |
| Minimum | −64.2 | −55.1 |
| Maximum | 34.1 | 28.6 |
| Skewness | −1.01 | −1.7 |
| Std. error skewness | 0.314 | 0.314 |
| Kurtosis | 2.97 | 9.16 |
| Std. error kurtosis | 0.618 | 0.618 |
| Jarque Bera value | 25.9148 | 192.6189 |
| *p*-value | 0.00002 | 0.0002 |
| Shapiro Wilk W | 0.943 | 0.860 |
| Shapiro Wilk p | 0.009 | <0.001 |
| DW Statistic(autocorrelation) | 1.63 | |
| VIF(multicollinearity) | 1.00 | 1.89 |

**Source(s):** Table by author

**Table 6.** Results of the Adjusted Dickey Fuller (ADF) test

| Dickey-Fuller test (ADF(stationary)/k: 4/*N* (r = 0.8)) | | Dickey-Fuller test (ADF (stationary)/k: 4/*N*(r = 1)) | Dickey-Fuller test (ADF (stationary)/k: 4/*N*-0.1*t) |
|---|---|---|---|
| Tau (Observed value) | −3.587 | −2.779 | −4.960 |
| Tau (Critical value) | −0.791 | −0.791 | −0.791 |
| *p*-value (one-tailed) | 0.032 | 0.196 | 0.000 |
| Alpha | 0.05 | 0.05 | 0.05 |

**Note(s):** Test interpretation
H0: There is a unit root for the series
Ha: There is no unit root for the series. The series is stationary
**Source(s):** Table by author

**Table 7.** Results of the Phillips-Perron (PP) test

| Phillips–Perron test (PP(intercept)/Lag: Short/*N*) | | Phillips–Perron test (PP(intercept)/Lag: Short/*N*(r = 1)) | Phillips–Perron test (PP(intercept + trend)/ Lag: Short/*N*-0.1*t) |
|---|---|---|---|
| Tau (Observed value) | −10.836 | −1.690 | −10.779 |
| Tau (Critical value) | −2.891 | −2.891 | −3.456 |
| *p*-value (one-tailed) | *< 0.0001* | 0.433 | *< 0.0001* |
| Alpha | 0.05 | 0.05 | 0.05 |
| Test interpretation | | | |
| H0: There is a unit root for the series | | | |
| Ha: There is no unit root for the series. The series is stationary | | | |

**Source(s):** Table by author

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**Table 8.** Results of the KPSS test

| KPSS test (Level/Lag short/*N*) | | KPSS test (Trend/Lag short/*N* ($r = 1$)) | KPSS test (Trend/Lag short/*N*-0.1*t) |
|---|---|---|---|
| Eta (Observed value) | 0.056 | 0.164 | 0.052 |
| Eta (Critical value) | 0.451 | 0.145 | 0.145 |
| *p*-value (one-tailed) | 0.872 | *0.030* | 0.616 |
| alpha | 0.05 | 0.05 | 0.05 |
| Test interpretation | | | |
| H0: The series is stationary | | | |
| Ha: The series is not stationary | | | |

**Source(s):** Table by author

As the computed p-*p*-value is lower than the level of significance of 0.05, so we reject the null hypothesis and accept the alternative hypothesis in case first and third cases except in cases where $r = 1$.

In the third case, the null hypothesis is rejected and we consider the time series as stationary.

So, considering the above test results it may be considered that the data has stationarity but the Granger causality test particularly the bivariate Granger causality test has certain limitations as discussed in Para 3.3. Furthermore, to confirm the results binomial logistic regression has been also carried out.

First, Analysis of variance (ANOVA) is carried out to determine the relationship between percentage changes in closing prices of banking stocks and percentage changes in FED rates. The ANOVA results have been presented in Table 9.

From the table, it is observed that a significant relationship between the FED rate and Closing price exists in the case of City Union Bank, Federal Bank, ICICI Bank, HDFC Bank, IndusInd Bank, Karur Vysya Bank, Kotak Mahindra Bank and Yes Bank where all of these are private banks. No significant relationship exists in the case of Public Sector Banks (PSB). The FII shareholding in these banks has been 27.40% in City Union Bank, 26.30% in Federal Bank, 49.20% in HDFC Bank, 45.70% in ICICI Bank, 24.70% in IndusInd Bank, 14.80% in Karur Vysya Bank, 32.50% in Kotak Mahindra Bank and 26.70% in Yes Bank (As of February 2025). The R-squared value and Adjusted R-square value have been worked out along with the F-Statistics.

So, from the ANOVA table, we conclude that the following banks have a significant relationship:

> City Union Bank, Federal Bank, ICICI Bank, HDFC Bank, IndusInd Bank, Karur Vysya Bank, Kotak Mahindra Bank and Yes Bank.

But, since multicollinearity and autoregression are present in the data we go for binomial logistic regression to confirm the results of ANOVA. So, secondly, binomial regression is carried out to confirm the results of the ANOVA, since binomial regression is a probability-based test where results are based on two outcomes whether there is a rise or fall in the percentage of closing prices of bank stocks with a rise or fall in FED rates, which is to be tested. In the present case since it is observed that autocorrelation and multicollinearity exist in the data, to get better results and to check the robustness of the results, further the omnibus likelihood test is carried out, to determine how the variables (percentage change in closing prices) are being influenced by fall or a rise in FED rates. The binomial regression has been carried out with the percentage fall in closing prices vis- -a-vis percentage rise in closing prices (individual banking stocks) have been assigned values “2” and “1” respectively, in a similar manner the percentage fall or rise in FED rates have been assigned values “3” and “4”.The overall percentage quarterly fall and rise in closing prices(including all the bank stocks under

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**Table 9.** Results of regression between changes in FED rates and changes in closing prices

| ` | Name of the bank | FII (Foreign institutional investors) Shareholding in %(as of Feb,2025) | Type of bank | *p*-value for regression between changes in FED rates and closing prices(Omnibus ANOVA Test) (Level of significance: 0.05) | *R*-square value | Adj. *R*-square | *F*-test value |
|---|---|---|---|---|---|---|---|
| 1 | Bank of Baroda | 8.90% | PSB | 0.736 | 0.790 | 0.782 | 103.00 |
| 2 | Bank of India | 2.92% | PSB | 0.187 | 0.631 | 0.617 | 46.90 |
| 3 | Bank of Maharashtra | 1.54% | PSB | 0.389 | 0.268 | 0.241 | 9.91 |
| 4 | Canara Bank | 11.10% | PSB | 0.725 | 0.803 | 0.796 | 112.00 |
| 5 | Central Bank Of India | 0.44% | PSB | 0.210 | 0.088 | 0.052 | 2.44 |
| 6 | Indian Bank | 4.78% | PSB | 0.900 | 0.037 | 0.002 | 1.01 |
| 7 | Indian Overseas Bank | 0.02% | PSB | 0.495 | 0.523 | 0.506 | 30.20 |
| 8 | Punjab National Bank | 5.70% | PSB | 0.152 | 0.677 | 0.665 | 57.60 |
| 9 | State Bank Of India | 10.30% | PSB | 0.073 | 0.091 | 0.057 | 2.70 |
| 10 | UCO Bank | 0.02% | PSB | 0.953 | 0.490 | 0.472 | 26.40 |
| 11 | Union Bank of India | 6.46% | PSB | 0.188 | 0.090 | 0.055 | 2.53 |
| 12 | Axis Bank | 47.30% | Pvt. Bank | 0.609 | 0.128 | 0.094 | 3.76 |
| 13 | City Union Bank | 27.40% | Pvt. Bank | *0.001* | *0.625* | *0.611* | *45.80* |
| 14 | DCB Bank | 10.86% | Pvt. Bank | 0.438 | 0.017 | 0.019 | 0.470 |
| 15 | Federal Bank | 26.30% | Pvt. Bank | *0.009* | *0.802* | *0.795* | *111.00* |
| 16 | ICICI Bank | 45.70% | Pvt. Bank | *0.001* | *0.723* | *0.713* | *71.70* |
| 17 | HDFC Bank | 49.20% | Pvt. Bank | *0.028* | *0.654* | *0.642* | *52.10* |
| 18 | IDFC Bank | 27.10% | Pvt. Bank | 0.085 | 0.730 | 0.721 | 74.50 |
| 19 | IndusInd Bank | 24.70% | Pvt. Bank | *0.010* | *0.212* | *0.182* | *7.24* |
| 20 | Karur Vysya Bank | 14.80% | Pvt. Bank | *0.014* | *0.603* | *0.589* | *41.80* |
| 21 | Kotak Mahindra Bank | 32.50% | Pvt. Bank | *0.010* | *0.520* | *0.503* | *29.30* |
| 22 | South Indian Bank Ltd | 11.46% | Pvt. Bank | 0.187 | 0.564 | 0.548 | 35.60 |
| 23 | Yes Bank | 26.70% | Pvt. Bank | *0.028* | *0.289* | *0.263* | *11.20* |

**Source(s):** Table by author

study quarterly) have been assigned the values “5” and “6”. To confirm these results of the omnibus likelihood test, the Granger Causality Test has been conducted. The Granger Causality test has been carried out considering the heterogeneity in the data. Similarly, in the case of binomial regression, the dependent variable is the percentage rise or fall in closing prices and the factors are the percentage fall or rise in closing prices of individual financial institutions/banks as well as the percentage fall or rise in FED rates with their assigned values as discussed earlier in the text. The results of binomial logistic regression with omnibus likelihood test results have been placed in Table 10 (separately for Public Sector Banks and Private Banks).

The results of binomial logistic regression and omnibus likelihood (Table 11 for private banks and Table 12 for public sector banks) test confirm that in the case of Public Sector Banks except for the State Bank of India (SBI), none of the other banks are not influenced by any changes in the FED rates. State Bank of India is the largest bank in India with the largest asset size. The shareholding of Foreign Institutional Investors (FII) in SBI as of December 2024 has been 10.3% and the government shareholding has been also lowest to the extent of around 57% (As of June 2024).

On the contrary, the private bank’s results differ, where Federal Bank, IDFC Bank, IndusInd Bank and Kotak Mahindra Bank are being influenced by changes in FED rates. The FII shareholding of almost all of these banks ranges between 25% and 32% (As of February 2025).

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**Table 10.** Binomial logistic regression results

Model fit measures for public sector banks (binomial logistic regression)
Overall model test

| Model | Deviance | AIC | BIC | $R^2$McF | $\chi^2$ | df | *p* |
|---|---|---|---|---|---|---|---|
| | 9.67E−10 | 26 | 51.6 | 1 | 73.3 | 12 | <0.001 |

Model fit measures for private banks (binomial logistic regression)
Overall model test

| Model | Deviance | AIC | BIC | $R^2$McF | df | *p* |
|---|---|---|---|---|---|---|
| 1 | 16.8 | 44.8 | 72.7 | 0.774 | 13 | <0.001 |

**Source(s):** Table by author

**Table 11.** Omnibus likelihood ratio tests (private banks)

| Predictor | $\chi^2$ | df | *p* |
|---|---|---|---|
| % change in FED rates (2) | 0.8033 | 1 | 0.37 |
| Axis Bank | 0.5367 | 1 | 0.464 |
| City Union Bank | 2.2134 | 1 | 0.137 |
| DCB Bank | 3.0123 | 1 | 0.083 |
| *Federal Bank* | *3.936* | *1* | *0.037* |
| ICICI Bank | 1.3704 | 1 | 0.242 |
| HDFC Bank | 2.66 | 1 | 0.103 |
| *IDFC Bank* | *5.4534* | *1* | *0.02* |
| *IndusInd Bank* | *6.774* | *1* | *0.009* |
| Karur Vysya Bank | 3.4868 | 1 | 0.062 |
| *Kotak Mahindra Bank* | *4.7173* | *1* | *0.03* |
| South Indian Bank | 0.0282 | 1 | 0.867 |
| Yes Bank | 0.23 | 1 | 0.631 |

**Source(s):** Table by author

**Table 12.** Omnibus likelihood ratio tests (public sector banks)

| Predictor | $\chi^2$ | df | *p* |
|---|---|---|---|
| % change in FED rates (2) | 2.78E−13 | 1 | 1 |
| Bank of Baroda | 1.75E−12 | 1 | 1 |
| Bank of India | 2.42E−12 | 1 | 1 |
| Bank of Maharashtra | 9.72E−11 | 1 | 1 |
| Canara Bank | 6.77E−11 | 1 | 1 |
| Central Bank of India | 6.52E−11 | 1 | 1 |
| Indian Bank | 9.75E−11 | 1 | 1 |
| Indian Overseas Bank | 9.66E−11 | 1 | 1 |
| Punjab National Bank | 1.33E−12 | 1 | 1 |
| *State Bank of India* | *12* | *1* | *<0.001* |
| UCO Bank | 7.97E−10 | 1 | 1 |
| Union Bank of India | 1.42E−10 | 1 | 1 |

**Source(s):** Table by author

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To confirm the ANOVA results as well as the binomial regression results bivariate Granger Causality test has been carried out whose details have been discussed in the following paragraphs.

We present the Granger's Causality Test results for different Banks considering the following hypothesis:

*H0.* Any change in the quarterly FED rates (X) either a rise or fall does not granger the quarterly change in Closing stock prices (Y) in % either a rise or a fall.

*H1.* Any change in the quarterly FED rates (X) either a rise or fall does granger the quarterly change in Closing stock prices (Y) in % either a rise or a fall.

The results of the Bivariate Granger Causality Test with Box and Cox transformation and non-seasonal lag of 1 are presented in the following Table 13.

We have carried out a Bivariate Granger Causality test using the URL http://www.wessa.net/rwasp_grangercausality.wasp/with R –Codes. The box and cox transformation has been carried out in the X series and Y series. The non-seasonal time lags are 1 in the test.

From the table, it is amply clear that a significant relationship is there in the case of Private Banks like *Axis Bank, City Union Bank, DCB Bank Ltd., HDFC Bank, Karur Vysya Bank and Kotak Mahindra Bank*. If we take a closer look at all the banks the FII shareholding pattern has been also higher in this group as compared to other banks.

So, from the results of binomial regression and Bivariate Granger causality, we infer that the following are the banks where any quarterly changes in FED rates have a significant impact on changes in stock prices quarterly:

(1) Federal Bank

(2) ICICI Bank

**Table 13.** Results of the bivariate granger causality test

| S No | Banks/Fis | Type of banks | Nifty | *F*-test value | Y = f (X) | *F*-test value | X = f (Y) |
|---|---|---|---|---|---|---|---|
| 1 | Bank Of Baroda | PSB | Nifty Bankex | 3.46 | 0.558 | 0.35 | 0.068 |
| 2 | Bank Of India | PSB | | 0.76 | 0.388 | 1.19 | 0.281 |
| 3 | Bank of Maharashtra | PSB | | 0.00 | 0.953 | 0.38 | 0.751 |
| 4 | Canara Bank | PSB | | 0.09 | 0.767 | 0.83 | 0.368 |
| 5 | Central Bank | PSB | | 0.67 | 0.418 | 0.02 | 0.892 |
| 6 | Indian Bank | PSB | | 1.62 | 0.209 | 2.00 | 0.163 |
| 7 | Indian Overseas Bank | PSB | | 0.03 | 0.862 | 2.59 | 0.114 |
| 8 | Punjab National Bank | PSB | Nifty Bankex | 0.03 | 0.866 | 0.65 | 0.422 |
| 9 | State Bank of India | PSB | Nifty Bankex/Nifty 50 | 0.88 | 0.353 | 3.34 | 0.073 |
| 10 | UCO Bank | PSB | | 1.32 | 0.255 | 0.10 | 0.748 |
| 11 | Union Bank Of India | PSB | | 0.00 | 0.992 | 0.92 | 0.343 |
| 12 | *Axis Bank* | *Pvt Bank* | *Nifty Bankex/Nifty 50* | *0.90* | *0.347* | *8.20* | *0.006* |
| 13 | *City Union Bank* | *Pvt Bank* | | *1.67* | *0.202* | *6.11* | *0.017* |
| 14 | *DCB Bank Ltd* | *Pvt Bank* | | *0.06* | *0.806* | *4.64* | *0.036* |
| 15 | ICICI Bank | Pvt Bank | Nifty Bankex/Nifty 50 | 1.13 | 0.292 | 1.08 | 0.303 |
| 16 | *HDFC Bank* | *Pvt Bank* | *Nifty Bankex/Nifty 50* | *0.06* | *0.810* | *8.13* | *0.006* |
| 17 | IDFC Bank | Pvt Bank | Nifty Bankex | 0.03 | 0.859 | 1.67 | 0.202 |
| 18 | *Karur Vysya Bank Ltd* | *Pvt Bank* | | *0.49* | *0.486* | *4.33* | *0.042* |
| 19 | *Kotak Mahindra Bank* | *Pvt Bank* | *Nifty Bankex/Nifty 50* | *0.74* | *0.394* | *9.93* | *0.003* |
| 20 | South Indian Bank | Pvt Bank | | 0.01 | 0.941 | 3.21 | 0.079 |
| 21 | Yes Bank | Pvt Bank | | 0.12 | 0.727 | 3.04 | 0.087 |

**Source(s):** Table by author

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(3) IndusInd Bank
(4) IDFC Bank
(5) Axis Bank
(6) City Union Bank
(7) DCB Bank Ltd.
(8) HDFC Bank
(9) Karur Vysya Bank
(10) Kotak Mahindra Bank.
(11) State Bank Of India

If we recollect the facts regarding FII in banks which have been discussed in Table 9 is strong enough to predict that stock market prices of banks with the highest FDI are being affected by the quarterly changes in FED rates. On the contrary, since in PSBs, the FDI is meager FED rates fail to predict the stock market prices in that way as in the case of the largest Private Banks. The observations are also favorable for some of the well-managed and well-capitalized banks that direct the NIFTY Bankex and the overall momentum of the financial market since the majority of the banks are in NIFTY 50.

Furthermore, in order to delve into the relationship between the changes in the FED rates and closing stock prices, the probabilities of rise in the closing prices with changes in FED rates have been calculated. The results are presented in the following table.

Table 14 represents the probabilities of percentage rise in closing prices with hike or fall in the FED rates. It is observed that there has been 67% rise in closing prices with hike in FED rates and 33% rise in closing prices with fall in FED rates.

*4.3 Discussions*

The results have been summarized as:

(1) In case of changes in FED rates, quarter-wise has direct implications on the quarter-wise changes in the stock prices of banking stocks particularly the banks having higher market capitalization. Only those banks that have moderate to high Foreign Direct Investment in their capital structure are having an impact. So, in the long run, the four largest private banks operating in India viz. ICICI Bank, Axis Bank, Kotak Mahindra Bank and HDFC Bank's quarterly average stock prices are influenced by the changes in FED rates.

(2) It is observed that stock prices of PSBs except State Bank of India are not influenced by changes in FED rates in the long run and they are totally out of the herd. So, in the case of India, the ownership structure of financial institutions particularly the shareholding of Financial Institutional Investors (FIIs) do have a vital role to play in case of stock

**Table 14.** Estimated marginal means of rise in closing prices

| Change in FED rates | Probability | SE | 95% confidence interval | |
|---|---|---|---|---|
| | | | Lower | Upper |
| Rise in FED rates | 0.67 | 0.0821 | 0.492 | 0.805 |
| Fall in FED rates | 0.33 | 0.0993 | 0.263 | 0.634 |

**Source(s):** Table by author

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market prices in the long run since FDI norms are framed with certain restrictions in investment in PSBs.

(3) Our results also suggest that average quarterly changes in the stock prices of the major banks are influenced by changes in FED rates. So, it is very prominent that changes in FED rates have a profound influence on changes in the stock market prices and any change may predict the future prices of Banks that have a good amount of foreign investment.

## 5. Conclusion

### *5.1 Theoretical implications and policy implications*

The implications may be summarized as:

(1) Quarterly Stock prices of new-generation Private Banks which are well-capitalized are influenced by quarterly changes in FED rates. So, well-managed and well-capitalized new-age technology-driven private banks having the major chunk of the market share are of prime importance which are affected by changes in FED rates. Here, the changes are related directly to the shareholding pattern where investment by Foreign Institutional Investors is important. If put in another way, investors are always interested in those banks that are paying good dividends which in turn is related to the performance of the banks. Furthermore, the results suggest that changes in the FED rates have a direct impact on the financial sector stock prices, where a positive relationship is observed. This positive relationship is based on the theory proposed by Keynesian economists where revenue effects dominate over the cost effects (Garg, 2008).

(2) In the studies, it is observed that ownership structure has a role to play particularly state ownership of financial institutions. Limited studies have been carried out to find out this theory of how the ownership structure of financial institutions has an impact on the stock markets concerning FED rates. The domino effects of changes in the FED rates are reflected in the interest rates and borrowing costs of financial institutions and a sound financial institution.

(3) The FDI has increased manifolds in the last couple of years, particularly in Private Sector Banks where the policymakers have allowed up to 74% FDI and the results are very much evident in our studies where investors are investing through various channels in stable and well-capitalized banks. The policymakers particularly the Reserve Bank of India and other regulators are to make decisions to open doors for FDI in the public banking sector to improve the competitiveness in these banks which may also attract FDI shortly at par with their private sector counterparts.

### *5.2 Managerial and policy contributions*

(1) When we compare the changes in stock market prices of various stocks quarterly with quarterly changes in FED rates, it is observed that the movement of some of the private bank stocks may be predicted from changes in FED rates *inter alia* changes in the shareholding pattern. So, from an investor's viewpoint, this is very important when one may make a judicious decision on having long-term returns from changes in the FED rates and FII investment patterns since the investment patterns are directly correlated to the performance of the banks. Investment managers dealing in investments on behalf of their clients may use these patterns as observed in this paper to take informed decisions based on changes in FED rates.

(2) When we compare the changes in the FED rates and Stock prices we observe that those banks where FII shareholding is highest are being influenced much. It is also important

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to note that prime-performing banks with a good capital base have been able to attract foreign investors and influence the market in long run as compared to others. These results may be pertinent to policy makers, where they may modify policy for investment in public sector banks as well as FDI percentage.

*5.3 Limitations and future research perspectives*

The limitation of the paper lies in the fact that we have compared the data of banks only with FED rates, but there are also some good NBFCs (Non-Banking Financial Companies) and insurance companies which may be also compared. Further research work may be carried out to find out how the changes in FED rates on short run affects the closing prices of the stock. Future Scope lies in the fact how the changes in FED rates are affecting the mutual fund market from where we may get a viewpoint for investors at large.

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**Corresponding author**
Subhash Karmakar can be contacted at: subhashboi@rediffmail.com

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