Impact of monetary policy on Stock & Foreign Exchange markets: Evidence from India

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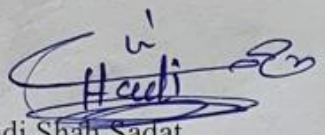
DECLARATION BY STUDENT

I hereby declare that the data presented in this Internship report entitled, "Impact of Monetary Policy on Stock & Foreign Exchange Markets: Evidence from India" is based on the results of investigations carried out by me in the discipline of financial services at the Gao business School, Goa University under the supervision of Dr Narayan Parab and the same has not been submitted elsewhere for the award of a degree or diploma by me. Further, I understand that Goa University or its authorities will not be responsible for the correctness of observations / experimental or other findings given the internship. I hereby authorise the University authorities to upload this internship to the internship repository or anywhere else as the UGC regulations demand and make it available to anyone as needed.



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Seat no: 22P0300018

Date: 29th-04-2024

Place: Goa University

COMPLETION CERTIFICATE

This is to certify that the internship report "Impact of Monetary Policy on Stock & Foreign Exchange Markets: Evidence from India" is a Bonafide work carried out by Mr Said Hadi Shah Sadat under my supervision in partial fulfilment of the requirements for the award of the degree of Master of Business Administration in financial services in the Discipline MBA F.S at the Goa Business School, Goa University.

29/04/24

Dr. Narayan Parab

~~Date~~ Signature of Dean of the School/HoD of Dept

Date: 9/5/2024

Place: Goa University

Goa Business School ★ Goa University ★

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Place: Goa University

Goa Business School ★ Goa University ★

CERTIFICATE GIVEN BY THE ORGANIZATION

Model Infra Corporation Pvt. Ltd.

Date : 16/04/2024

INTERNSHIP CERTIFICATE

This is to certify that Mr. Said Hadi Shah Student of Goa Business School, undergoing MBA-in financial services has successfully completed Internship between 15th February 2024 till 12th April 2024 at Model Infra Corporation Pvt. Ltd. Plot No. L-13, Verna Industrial Estate, Verna , Salcette , South Goa Goa 403722. He actively participated in the activities during the period of internship and learned the skills needed for various activities such as accounting entry passing in the navision system, issue of debit and credit note, sale invoice preparation issue of purchase order etc.

We wish him success in his future endeavours.

For Model Infra Corporation Pvt. Ltd.

(Navin Naik)

Manager HR & Admin.

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PREFACE

The central banks play an important role in the country's financial system and the financial system plays a critical role in the country's economic development. A stable and efficient financial system facilitates the flow of funds between investors and businesses, which fuels economic growth. However, the interplay between monetary policy decisions and the financial markets can be complex. This internship explores this exact topic, specifically focusing on the long-run relationship between monetary policy instruments (real interest rate and broad money supply m3) and two key financial indicators: the nifty 50 stock market index and the real effective exchange rate.

My primary motivation for undertaking this research was to gain a deeper understanding of how the Reserve Bank of India's (RBI) monetary policy (interest rate and money supply) decisions influence the Indian financial system in the long term. By examining the co-integration between interest rates, money supply, the stock market, and the exchange rate, this study aims to show relationships between the mentioned variables.

This knowledge can be valuable for various stakeholders within the Indian economy. Investors (especially foreign investors in India, Indian investors who invest abroad and investors who deal with exports and imports) can leverage this understanding to make more informed decisions by considering the potential impact of monetary policy changes on their investments. Similarly, policymakers at the RBI can use these findings to formulate more effective monetary policies that achieve desired economic outcomes, considering both stock market performance and exchange rate stability.

This internship is organized into four chapters, chapter one is the introduction, background, aims research question and hypothesis, chapter two is the literature review, chapter three is the methodology and finally, chapter five is the results and conclusion.

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to my supervisor, Dr. Narayan Parab, and Program director Dr. Harip Khanapuri for their valuable guidance and support throughout this project. Their expertise and insights were instrumental in shaping this research.

I am also grateful to my family and friends for their encouragement and understanding during this time. Their support helped me stay motivated and focused on my work.

Finally, I would like to thank all faculty and members of the MBA F.S discipline, Goa Business School, and all of Goa University for providing the resources and facilities necessary to complete this research.

ABSTRACT

Purpose: This paper aims to investigate the impact of monetary policy on stock and exchange markets in the long run in India.

Methodology: Empirical analysis is executed using the data from October 2007 to March 2024, employing Johansen co-integration and vector error correction models to find out the long-run relationship between the variables and to find the correction speed we employed the VCEM model.

Findings: there is a long-run positive relationship between the exchange rate and interest rate which means when the interest rate increases the Rupee appreciates and when the interest decreases Rupee depreciates, whereas findings show there is a negative relationship between broad money supply (M3) and the exchange rate which means if the money supply increases the Rupee will depreciate and vice a versa. Whereas there is no long-term relationship between Nifty_50, interest rate and M3.

Practical implications: The findings have direct relevance for fund managers, portfolio analysts, investors, and financial market regulators.

Keywords: Monetary policy, interest rate, M3, stock, exchange rate, central bank.

BACKGROUND

MODEL INFRA CORPORATION PVT. LTD.: A RENOWNED METAL FABRICATION POWERHOUSE

Established legacy (since 2000) Model Infra Corporation Pvt. Ltd. (MIC) boasts a rich history dating back to 2000. Over the years, they've established themselves as a trusted supplier of metal fabrications, catering to diverse industries like construction, railways, agriculture, energy, and defence. Their commitment to quality and on-time delivery has earned them a stellar reputation within these sectors.

MIC's journey began as a single customer-oriented setup in Dharwad. Through dedication and strategic partnerships, they've evolved into a reliable partner for marquee companies across various end-user markets. They continuously strive to enhance their capabilities by collaborating with renowned names in the industry.

MIC goes beyond just fabrication. Their design and engineering capabilities empower clients to develop products specifically tailored to the demanding performance needs of the Indian market. This value-added service allows clients to hit the ground running with optimized solutions.

MIC prioritizes quality by adhering to stringent international standards. Their certifications in ISO 9001:2015 (Quality Management Systems), ISO 3834-2 (Welding Procedure Standard), EN 15085 (Railway Vehicle Welding), and ISO 14001 (Environmental Management Systems) are testaments to their commitment to excellence. Additionally, their ESG (Environmental, Social, and Governance) disclosure demonstrates their dedication to sustainable practices.

Robust process controls and comprehensive reporting systems enable MIC to operate optimally. This translates to minimal wastage and ensures timely project completion. They further enhance their capabilities through a robust network of trusted vendor partners,

subcontractors, and strategically located warehouses. This infrastructure allows them to quickly ramp up production capacity whenever client demands necessitate it.

With a workforce exceeding 1500 employees, MIC boasts a team well-trained in design, manufacturing, and management. This skilled workforce, combined with their strategically located 8 facilities across India, positions them for aggressive expansion and continued industry leadership.

My experience during my corporate internship at Model Infra Corporation (MIC), a leading metal fabrication company in Verna, Goa, provided valuable insights into the real-world implications of monetary policy on businesses. understanding firsthand how fluctuations in interest rates and money supply can impact project costs and investment decisions within the manufacturing sector informed my research question on the long-term effects of monetary policy on stock markets."

CHAPTER 1

INTRODUCTION

Monetary policy is one of the most important tools central banks use to manage the economy. It involves setting interest rates and managing the money supply. Monetary policy can have a significant impact on financial markets, including stock markets, bond markets, and foreign exchange markets.

Monetary policy can affect stock markets in several ways. First, interest rates are a major factor that investors consider when deciding whether to buy or sell stocks. Lower interest rates make stocks more attractive than other investments, such as bonds. Second, the money supply can also affect stock markets. Increasing the money supply can lead to inflation when the central bank increases the money supply. Inflation can erode corporate earnings' value, making stocks less attractive to investors.

Monetary policy also has a significant impact on bond markets. Bond prices are inversely related to interest rates. This means that when interest rates rise, bond prices fall. Conversely, when interest rates fall, bond prices rise.

Monetary policy can also affect foreign exchange markets. When a central bank raises interest rates, it makes its currency more attractive to investors. This can lead to an appreciation of the currency. Conversely, when a central bank cuts interest rates, it makes its currency less attractive to investors. This can lead to a depreciation of the currency.

There has been a large body of research on the impact of monetary policy on financial markets. Some of the key findings of this research include:

(Beirne et al., 2023) found that a US interest rate cut causes Asian stock prices to increase.

Interest rates are a major factor that investors consider when making investment decisions. A few studies have found that a decrease in interest rates leads to increased bonds and stock

prices. For example, a study by (Brzeszczyński et al., 2023) and (Wu, 2016) the most sensitive markets to monetary policy are Bond markets and foreign exchange markets respectively while the stock market is less sensitive than bonds and foreign exchange while Interest rate and money supply are the most influential factors.

The Central Bank's announcement can also affect financial markets. Several studies have found that a Central Bank's announcement leads to changing investors' ideas about inflation and market experts' expectations of inflation. For example, a study (Montes & Nicolay, 2015) found that financial market experts' expectations change based on the information provided by the central bank. For example, announcements can worsen expectations during times of instability, but they can also reduce inflation expectations when inflation is under control. These findings support the idea that the credibility of inflation targeting is essential for determining inflation expectations.

Bond prices, foreign exchange and unconventional monetary policy are inversely related Several studies have found that unconventional monetary policy leads to a decrease/ increase in bond prices. For example, a study (Lutz, 2015) found that Unconventional monetary policy shocks that lower the yield on the 10-year Treasury by 25 basis points cause the dollar to depreciate against the euro and the pound.

Monetary policy can also affect foreign exchange markets. A few studies have found that an increase in interest rates in a country leads to an appreciation of its currency. For example, a study by (Cepoi et al., 2023) found that a decrease in the central bank's target interest rate can lead to an appreciation of the currency in a flexible exchange rate regime, but a depreciation of the currency in a fixed exchange rate regime.

Monetary policy can have a significant impact on financial markets. Investors should carefully consider the implications of monetary policy decisions when making investment decisions.

this study focused on the monetary policy (interest rate and money supply M3) impact on stock and exchange rates in India.

CHAPTER 2
LITERATURE REVIEW

The Central Bank's announcement is also one of the major factors investors consider when making investment decisions. Several studies have found that changes in monetary policy like interest rate money supply etc lead to an increase in stock prices. For example, according to (Brzeszczyński et al., 2023) and (Wu, 2016), monetary policy has the greatest impact on bond and foreign exchange markets, followed by the stock market. Interest rates and money supply are the most important factors in determining the impact of monetary policy on financial markets.

Economic uncertainty makes central banks more cautious. during high uncertainty periods, especially around the financial crisis of 2008, led central banks to raise interest rates less aggressively. The type of uncertainty mattered: inflation concerns were a bigger factor early in 2003 and 2007-2008, while uncertainty about the financial system became more important later in 2008-2009. (Naidoo & Raputsoane, 2015).

Interest rate changes by the central bank are the most reliable signal of future inflation, while unexpected financial events are the main culprits behind stock market ups and downs. (Dery & Serletis, 2021).

Lowering interest rates (a traditional tool) helped stabilize Greek banks during the crisis, but more creative measures (like buying government bonds) had less impact, the ECB's toolbox had mixed results, Simple tools worked better in a tough situation. (Petrakis et al., 2022).

(Beirne et al., 2023)found that a US interest rate cut causes Asian stock prices to increase.

The money supply can also affect stock markets. Several studies have found that an increase in the money supply leads to an increase in stock prices. For example, a study (Montes & Nicolay, 2015) found that when the money supply in Brazil increases, stock prices also tend to increase.

When more money floods the economy, borrowing costs will reduce this is because people and businesses might already have enough cash on hand (less need for loans), or because banks with more money to lend compete, driving down interest rates. (Khan et al., 2023)

When the central bank unexpectedly raises interest rates (tightening), it can trigger a shake-up in the financial markets. Stocks tend to lose some of their shine as borrowing becomes more expensive, making bonds with their increased yields a more tempting option for investors. This shift can push stock prices down. Bond yields, particularly for those with longer maturities like 10-year government bonds, also typically rise in response to a rate hike. This is because these bonds become more attractive compared to their previously issued counterparts with lower yields. (Kubota & Shintani, 2022)

Raising interest rates (tightening) can be a double-edged sword for financial inclusion. On the downside, it might discourage people from saving with banks, potentially pushing them out of the financial system. However, the upside is that banks might be incentivized to open more branches in underserved areas to attract new depositors, making financial services more accessible. The negative impact was stronger after the financial crisis. Ultimately, the effect of interest rates on financial inclusion depends on the specific strategy used by policymakers and what aspect of financial inclusion is being measured. (Ozili, 2023).

Changing reserve requirements can be another tool, alongside interest rates and managing foreign exchange, to help keep the economy stable. (Lubis et al., 2022)

(Irani et al., 2023) found that changes in US interest rates (when they increase) affect Mexican tourism stock prices positively.

a study by (Montes & Nicolay, 2015)found that financial market experts' expectations change based on the information provided by the central bank. For example, announcements can worsen expectations during times of instability, but they can also reduce inflation expectations when inflation is under control. These findings support the idea that the credibility of inflation targeting is essential for determining inflation expectations.

Bond prices are inversely related to interest rates. Several studies have found that a decrease in interest rates leads to increased bond prices. For example, a study by (Pavlov et al., 2020)found that a 100-basis point cut in interest rates in the United States leads to a 5% increase in bond prices.

Monetary policy can also affect foreign exchange markets. Several studies have found that an increase in interest rates in a country leads to an appreciation of its currency. For example, a study by (Cepoi et al., 2023)found that a 100-basis point increase in interest rates in the European Union leads to a 1% appreciation of the euro against the US dollar.

MPE (monetary policy efficiency) isn't always the same. It's less effective during crises when the economy is more sensitive to shocks. But it's more effective during recoveries. FD also has a role to play, but it's complicated. It turns out that the development of financial markets hurts MPE, while the development of financial institutions helps it. The depth of financial institutions and the efficiency of financial markets are the most important factors in determining FD's impact on MPE. (Miranda-Agrippino & Nenova, 2022)

The ECB's monetary policies don't affect everyone the same way. That's because there are a lot of factors that influence how these policies work, such as the health of the banking industry, the state of the economy, and government regulations. Some sectors and countries may even

be hurt by the ECB's policies, but overall, they tend to have a positive impact on markets. (Agba et al., 2022)

Access to credit and borrowing from abroad (external debt) can boost investment in infrastructure which is a key driver of economic growth.(Mehar, 2023).

The impact of monetary policy on the financial market and financial development is not constant. It can fluctuate over time, for instance, a study by(Ho, 2022) and (Aye et al., 2015) found that monetary policy is less effective during economic crises due to various internal and external disruptions. It recovers during economic recoveries, which means as the economy stabilises, the central bank's ability to influence the economy and achieve its goals improves.

Financial development can have a complex relationship with monetary policy effectiveness; the development of financial institutions (FIs) has a positive impact on monetary policy effectiveness (MPE) like the amount of loans and deposits. This suggests that a robust financial system with strong institutions enhances the effectiveness of monetary policy. In contrast, the development of financial markets harms MPE, particularly the efficiency of financial markets (FMs) like how smoothly transactions occur. This might be because highly efficient markets can react quickly to policy changes, potentially making it harder for the central bank to control the economy. (Ho, 2022).

Central banks play an important role in market liquidity a study by (Mullings, 2023) found that the European Central Bank's views on the economic outlook have a bigger impact on money market liquidity (short-term loans between banks). Positive economic outlook messages tend to improve money market liquidity.

Also, The ECB's stance on monetary policy (hawkish or dovish) has a more significant effect on broader market liquidity (currency, stocks, and bonds). Hawkish messages (tighter policy) can reduce liquidity in these markets. (Mullings, 2023)

Central bank's monetary policy affects stock markets differently in developed and developing countries, in developing countries, expansionary policy (printing more money) can help these economies recover from slowdowns and help the stock market to grow in the following year. Whereas in developed countries lowering interest rates is more effective in boosting their stock markets. (Sova & Lukianenko, 2022)

When the US and EU print more money (quantitative easing), it can significantly impact financial markets in BRICS countries, as BRICS countries are more financially connected to the US and tend to feel the effects of US money printing (QE) more intensely. Out of all the unusual monetary policies, printing money (QE) seems to have the strongest effect on BRICS financial markets. (Lubys & Panda, 2021)

The actions taken by the central bank to control interest rates and money supply can significantly influence overall stock market performance. But different sectors of the stock market respond differently the banking and real estate sectors tend to be more sensitive to changes in interest rates set by the central bank compared to other industries. Adjustments to interest rates have a bigger impact on the stock market than changes in the money supply through quantitative easing (printing more money),(Parabu et al., 2020).

unexpected events can impact the economy and stock market. A sudden increase in money supply boosts economic activity, inflation, and stock prices, though interestingly, demand for stocks goes down. Similarly, a rise in government spending increases output and inflation, but hurts stocks, possibly due to competition for investment funds. Finally, a stock market boom itself can fuel economic growth and inflation, suggesting a positive feedback loop. (Siddikee & Rahman, 2021).

Central instruments are more conservative and use capital adequacy as a macroprudential policy instrument are more effective in using macroprudential policy to control bank lending.

This suggests that central bank conservatism is an important factor in implementing macroprudential supervision in OIC countries. (Shahchera, n.d.).

Banks in less competitive areas lend less overall, and while surprise interest rate hikes can increase lending in competitive markets, they hurt lending in weaker banks. During low-interest rates, banks prefer attracting deposits (building liquidity) since holding extra cash is cheap. (Kick, 2022).

Despite the extensive literature on the impact of monetary policy on financial markets, there are still a few areas where further research is needed. Some of these areas include:

The impact of monetary policy on stock and exchange markets in the long run.

The impact of monetary policy on different types of financial markets. Most of the research on the impact of monetary policy has focused on stock and bond markets. However, there is less research on the impact of monetary policy on other types of financial markets, such as foreign exchange markets, commodity markets, and real estate markets.

The literature on the impact of monetary policy on financial markets is extensive, but there are still a few areas where further research is needed. in this paper, I examined the relationship between the stock and exchange market with monetary policy (interest rate and broad money supply M3).

2.1. RESEARCH QUESTIONS & RESEARCH HYPOTHESIS

1- What is the long-term impact of monetary policy on stock markets?

The Indian stock market is a vital part of the country's financial system. This research question explores how the Reserve Bank of India's (RBI) monetary policy decisions, particularly those related to interest rates and money supply, influence the performance of the stock market over an extended period, understanding this relationship can help investors make informed decisions and policymakers formulate effective strategies for economic growth.

2- How does monetary policy conducted by the RBI influence foreign exchange rates in India?

The value of the Indian rupee (foreign exchange rate) plays a crucial role in international trade and investment. This research question investigates the extent to which the RBI's monetary policy decisions, such as interest rate adjustments and money supply fluctuations, affect the exchange rate, analysing this relationship can provide insights into how the RBI can manage the exchange rate to maintain economic stability and promote international trade.

H0: There is no statistically significant long-term relationship between Monetary policy and stock markets.

H1: There is a statistically significant long-term relationship between Monetary policy and stock markets.

H0: There is no statistically significant long-term relationship between monetary policy and exchange rate.

H2: There is a statistically significant long-term relationship between Monetary policy and exchange rate.

2.2. AIMS & OBJECTIVES

1- To analyse the long-term impact of monetary policy on the stock market.

2- To investigate the impact of monetary policy on influencing the exchange rate in India.

2.3. SCOPE

This study focuses on the impact of monetary policy (real interest rate and money supply M3) on the Nifty_50 index and exchange rate, from October 2007 to April 2024. The research employs Johansen Co-integration to find out the long-run relationship between variables and Vector Error Correction Models (VECM) to find out correction speed.

CHAPTER 3

DATA AND METHODOLOGY

The study used secondary monthly time series data for all variables under consideration from October 2007 to April 2024, which is more than 16 years (198 months) number of observations is 198. The data have been sourced from the NSE website, Economic Outlook, and Fred database.

In this paper, I used different Econometric methods in EViews.9 software to discuss and analyse the issue. As econometric methods, I employed Johansen co-integration and vector error correction models to find out the long-run relationship between the variables and to find the correction speed we employed the VCEM model.

The dependent variables in this study are Nifty_50 and the Real effective exchange rate whereas the independent variables are the real interest rate and broad money supply M3. To check the stationarity of data we employed the Unit Root Test.

Money supply M3: includes M1 plus time deposit with the banking system, whereas money supply M1 includes currency held by the public (currency notes and coins), Demand deposits with the banking system (on current and saving bank accounts) and other demand deposits with Reserve Bank of India RBI.

Real Effective Exchange Rate (REER): The regular exchange rate just tells you how much of one currency you need to buy another. The real effective exchange rate (REER) is a more complete picture. It considers what you can buy with a currency (like how much stuff you get for your money), not just how much of another currency you get. It does this by looking at a basket of currencies of your trading partners, weighted by how much you trade with each country, and then factoring in inflation to give you a better idea of a currency's true buying power in the global market.

Cointegration Equations

LNifty50 = β1*LINTEREST (-1) + β2*LM3(-1) + ε_t

Nifty50 represents the Nifty 50 index value.

LINTEREST (-1) represents the lagged Interest Rate, one period behind the Nifty 50 index.

LM3(-1) represents the lagged Money Supply (M3), one period behind the Nifty 50 index.

β1 and β2 are the coefficients to be estimated, representing the long-run impact of interest rate and money supply on the Nifty 50 index.

ε_t is the error term, which is assumed to be a stationary white noise process.

LREER = β1*LM3(-1) + β2*LINTEREST (-1) + ε_t

LREER represents the real effective exchange rate.

LM3(-1) represents the lagged Money Supply (M3), one period behind the exchange rate.

LINTEREST (-1) represents the lagged Interest Rate, one period behind the exchange rate.

β1 and β2 are the coefficients to be estimated, representing the long-run impact of money supply and interest rate on the exchange rate.

ε_t is the error term, which is assumed to be a stationary white noise process.

Interpretation:

This equation suggests a long-run equilibrium relationship between the exchange rate, money supply, and interest rate. The coefficients (β1 and β2) are estimated through cointegration tests.

LREER_t = α + β1*LINTEREST_(t-1) + β2*LM3_(t-1) + Σ γi*ΔLINTEREST_(t-i) + Σ δi*ΔLM3_(t-i) + λ*ECT_(t-1) + ε_t

Dependent Variable:

LREER_t (current log real effective exchange rate)

Independent Variables:

LINTEREST_(t-1) (lagged log interest rate)

LM3_(t-1) (lagged log money supply)

ΔLINTEREST_t (change in current and past log interest rate)

ΔLM3_t (change in the current and past log money supply)

ECT_(t-1) (error correction term)

α: Intercept term.

β1 and β2: Coefficients representing the long-run impact of lagged interest rate and money supply on the current exchange rate. These coefficients are typically derived from a cointegration analysis.

γi: Coefficients capturing the short-run impact of changes in the interest rate at different lags (i) on the current exchange rate.

δi: Coefficients capturing the short-run impact of changes in money supply at different lags (i) on the current exchange rate.

λ: Coefficient of the error correction term (ECT_(t-1)), which reflects the speed of adjustment towards the long-run equilibrium relationship between the variables. A negative and statistically significant λ indicates cointegration and that deviations from equilibrium in the previous period (t-1) influence the current exchange rate (LREER_.t) to move back towards equilibrium.

ε_t: White noise error term.

CHAPTER 4

DATA ANALYSIS

4.1. SUMMARY STATISTICS AND GRAPH

The Nifty 50, with the high standard deviation (4813.6) indicates significant volatility in the Nifty 50 over this extended period. This could be due to various factors, including global financial crises, domestic policy changes, and company-specific events.

Whereas the REER (Real Effective Exchange Rate) with the relatively low standard deviation (4.85) suggests the REER has been more stable compared to the Nifty 50. This might indicate a managed exchange rate regime by the Reserve Bank of India (RBI) during this period.

The interest rate with the negative values (-0.41) suggests there might have been periods of negative interest rates in India. This is an unconventional monetary policy tool used to stimulate borrowing and economic activity. The standard deviation (0.57) indicates some variation in interest rates over time.

The M3 (Money Supply) with the standard deviation (4.20) suggests some fluctuations in the money supply (M3) during this period. The RBI might have used open market operations or cash reserve ratio changes to manage the money supply and influence economic activity.

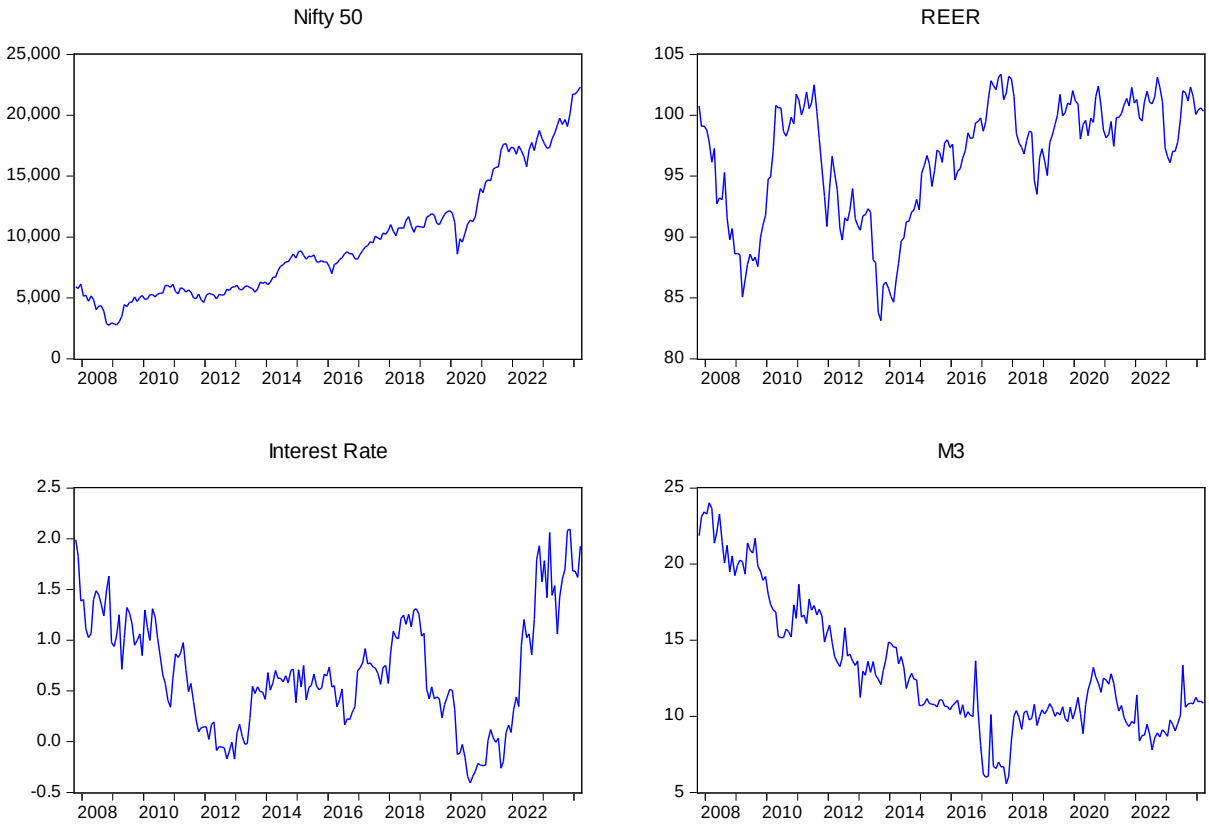
Table 1 shows descriptive statistics of the research variables used in the study and Figure 1 shows the line chart of the variables.

Table 1. Descriptive Statistics

	Mean	Maximum	Minimum	Standard Deviation
Nifty_50	9501.222	22326.90	2755.100	4813.600
REER	96.57313	103.3700	83.12000	4.851016
Interest rate	0.696459	2.094329	-0.407134	0.566921
M3	12.93338	24.03000	5.560000	4.198650

Source: The results are calculated by the author using EViews 9 software.

Line Chart



Source: Author's computation using EViews 9 software

Figure 1

4.2. UNIT ROOT TEST

Stationarity is an important concept that plays an important role when estimating time series analysis. estimation of a time series model requires stationary data. Before conducting the simultaneous tests within the model or regression, all the variables must be found to be individually stationary. Therefore, the first task we must undertake before any regression in secondary time series data is testing for stationarity of data. In the below table, the Augmented Dickey-Fuller (ADF) test is used to check whether the data is stationary or non-stationary.

Table 2.	Unit Root Test	
	At Level	At 1st Difference
Variables	ADF	ADF
Nifty_50	1.605226 0.9995	-13.92384 0.0000
REER	-2.233896 0.1951	-13.02290 0.0000
Interest rate	-2.651068 0.0846	-16.22912 0.0000
M3	-2.405027 0.1417	-18.39435 0.0000

Source: The results are calculated by the author using EViews 9 software.

As we can see, from Table 2 of the ADF results of Nifty_50, REER, Interest rate and money supply M3 the p-value of the variable is not significant since its value is greater than 5%. Therefore, it is possible to accept the null hypothesis, which claims that variables have a unit root at the level. Since the variables have unit roots, it is impossible to estimate the model directly and we need to fix the problem by taking the first difference of the variables and checking again if they are stationary. The original data needs to be changed to its first difference and the ADF test needs to be checked once again. Hence, we continue the analysis by taking the first difference, so that we can determine in which order the variables become stationary. When we look at the results of ADF tests conducted on the 1st difference of the variables on the right-hand side of the table, the null hypothesis of unit root is rejected. Thus, we can conclude that all variables are stationary at the first difference. it is possible to use the Johansen co-integration approach. Once the stationarity test is checked and confirmed, the next step is choosing the optimal lag selection, which determines the number of the co-integrating equation.

4.3. DETERMINATION OF OPTIMAL LAG LENGTH

Before going to check for the multivariate time series analysis, choosing the optimal lag length for the basic VAR model in advance is necessary. The result of the Johansen co-integration test is very sensitive to optimal lag length. To determine the optimal lag length, different information criteria have been employed. The objective of the information criteria (IC) method is to select the number of parameters that minimize the value of the information criteria. The most popular information ICs are the Akaike information criterion (AIC), Schwarz's Bayesian information criterion (SIC), and the Hannan-Quinn information criterion (HQIC). Practically, the optimal lag length, which is selected by most of these criteria, is going to be included in the VAR system. To test co-integration, it is needed to define the number of lags to be included in the model. As stated above, the optimal lag length must be specified by the lag selected by the most information criterion. According to Table 3.1, AIC and FPE criteria choose two lags, Therefore, the optimal lag for the underlying VAR model is one.

According to Table 3.2, LR, FPE and AIC choose four lags so the optimal lag for the underlying VAR model is three. VAR Lag Order Selection Criteria are shown in the below table.

Table 3.1. VAR optimal lag selection (LREER L Interest LM3)

Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	69.10449	NA	7.91e-05	-0.931049	-0.868602	-0.905673
1	472.2962	783.6684	3.07e-07	-6.483045	-6.233257*	-6.381542*
2	481.4999	17.49987	3.06e-07*	-6.485913*	-6.048784	-6.308282
3	487.0437	10.30679	3.22e-07	-6.437235	-5.812764	-6.183475

Source: The results are calculated by the author using EViews 9 software.

Table 3.2. VAR optimal lag selection (Lnifty_50 L interest LM3)

Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	-224.9326	NA	0.004975	3.210319	3.272766	3.235695
1	277.4019	976.3686	4.78e-06	-3.738056	-3.488267*	-3.636552*
2	287.2816	18.78529	4.72e-06	-3.750445	-3.313316	-3.572814
3	295.6832	15.61986	4.76e-06	-3.742017	-3.117547	-3.488258
4	309.9059	25.84126*	4.43e-06*	-3.815576*	-3.003765	-3.485689

Source: The results are calculated by the author using EViews 9 software.

* Indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion

SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

4.4 JOHANSEN CO-INTEGRATION TEST

After completing the unit root test and determining optimal lags to be included in the model, the third step is testing for co-integration. Suppose the variables are found to be co-integrated. In that case, there is a linear, stable, and long-run relationship among them, such that the disequilibrium errors would tend to fluctuate around zero mean. In the literature, co-integration tests, for instance, (Elias et al., 2023) Engle and Granger (1987), Johansen (1988), (Johansen & Juselius, 1990), and (Pesaran et al., 2001), are used to confirm the presence of a potential long-run equilibrium relationship between two variables. The current study used Johansen's technique to establish how many co-integrating equations exist between variables.

The Johansen test can be seen as a multivariate generalization of the augmented Dickey-Fuller test. The generalisation is the examination of linear combinations of variables for unit roots. The Johansen test and estimation strategy is maximum likelihood. This makes it possible to estimate all co-integrating vectors when there are more than two variables. If there are three variables each with unit roots, there are at most two co-integrating vectors. More generally, if there are n variables which all have unit roots, there are at most n1 co-integrating vectors. The summary statistics of both tests are reflected in Tables 4.1 and 4.2 for both models, Table 4.1 shows that there is no co-integration among the variables (Nifty_50, interest rate and M3), to ascertain this we compare the value of trace statistic and critical value in trace test and eigenvalue if the trace statistic value is grater then the critical value we reject the null hypothesis, but as we can see the table 4.1, at all ranks the critical value at 5% is greater than the trace statistic and the P values are greater than 0.05, so we accept the null hypothesis which indicates there is no co-integration among the variables.

Table 4.1		lNifty_50 linterest lM3					
Johansen co-integration test (trace and eigenvalue test)							
		Trace test			Eigenvalue		
Max rank	Eigen values	Trace statistic	Critical values (0.05)	Prob.	Max eigen statistic	Critical values (0.05)	Prob
0	0.102498	23.74118	29.79707	0.2116	16.65349	21.13162	0.1890
1	0.032679	7.087685	15.49471	0.5675	5.116559	14.26460	0.7270
2	0.012718	1.971126	3.841466	0.1603	1.971126	3.841466	0.1603

Source: The results are calculated by the author using EViews 9 software

As mentioned above the study did the same assessment for Table 4.2, in which the trace statistic is greater than the critical value at a 5% level of significance at maximum rank two and the P value is less than 0.05 which indicates significance at 5% level of significance, so here we can reject the null hypothesis of no co-integration.

Therefore, these two tests confirm a co-integration among the Real effective exchange rate (REER), interest rate and money supply M3.

The model should be considered the target model, and the dependent variable of that model should be the target variable of this study. Therefore, from the evidence of the long-run associations, we can run a vector error correction model (VECM).

Table 4.2		lREER linterest lM3					
Johansen co-integration test (trace and eigenvalue test)							
		Trace test			Eigenvalue		
Max rank	Eigen values	Trace statistic	Critical values (0.05)	Prob.	Max eigen statistic	Critical values (0.05)	Prob
0	0.078583	22.09512	29.79707	0.2933	13.25850	21.13162	0.4287
1	0.030084	8.836621	15.49471	0.3807	4.948473	14.26460	0.7483
2*	0.023715	3.888148	3.841466	0.0486	3.888148	3.841466	0.0486

Source: The results are calculated by the author using EViews 9 software
Note: * denotes rejection of the hypothesis at the 0.05 level.

4.5 VECTOR ERROR CORRECTION MODEL (VECM) RESULTS AND ANALYSIS

After the evidence of the co-integration relationship among the variables has been checked, the next step is to run the vector error correction model (VECM) using one less lag length (p-1). p is the optimal lag length determined with vector autoregressive (VAR). Hence, the optimal lag length of the model was two, and therefore the vector error correction model (VECM) requires one lag length to run a regression.

4.5.A. THE LONG-RUN MODEL

From the given findings from Johansen's co-integration test, we understand that LREER, LINTEREST and LM3 are co-integrated in the long run. This study used the co-integrating vector to design the vector error correction model (VECM). Table 5 shows the Vector Error Correction Estimates of total export value as an endogenous variable.

Table 5. Long-run relationship of co-integrated vector

Regressors	**Coefficient**	**Standard deviation**	**t-statistics**
lInterest rate	-0.000734	0.02138	-0.03433
lM3	0.168224	0.04522	3.72001
C	-4.991502		

Source: The results are calculated by the author using EViews 9 software

LREER= -4.991502 C + 0.000734 Linterest - 0.168224 LM3

[-0.03433] [3.72001]

The result of this equation shows that the real interest rate is positive as expected in the literature part and significantly affects the real effective exchange rate in India. This implies that policy measures regarding interest rates have an important role in changes in the exchange rate. The result is in line with the findings of (Cepoi et al., 2023), in that they claim interest has a positive effect on the exchange rate. Also, the result is like that of (Brzeszczyński et al., 2023) where the exchange rate market is the most sensitive market segment, while interest rate and money supply are the most influential types of announcements in Poland. Therefore, with a One per cent increase in L-INTEREST, the dependent variable exchange rate will increase by

0.000734 per cent, keeping other variables constant whereas with a one per cent increase in LM3, the dependent variable will decrease by 0.16224 per cent other variables being constant.

4.5.B. THE SHORT-RUN DYNAMICS FOR VECTOR ERROR CORRECTION MODEL

once the estimation of long-run coefficients is done, the next step is to guesstimate the short-run ECM model. The coefficient of error correction term (ECM) indicates the speed by which any deviation in the short run from nonequilibrium is restored to equilibrium in the dynamic model. The coefficient of the ECM is obtained from the regression of one lagged period residual of the dynamic long-run model. The coefficient of the error correction (ECM) term, thus, shows how fast variables meet their equilibrium.

Table 6. Short-run dynamics of VECM

	Coefficient	**Std. Error**	**t-Statistic**	**Prob.**
CointEq1	-0.070050	0.022657	-3.091790	0.0023*
D (LREER (-1))	0.105943	0.077241	1.371598	0.1721
D (LINTEREST (-1))	-0.002278	0.002811	-0.810465	0.4189
D (LM3(-1))	-0.005223	0.012535	-0.416664	0.6775
C	0.000143	0.001233	0.116021	0.9078
R-squared	0.070601	Mean dependent var		0.000192
Adjusted R-squared	0.047510	S.D. dependent var		0.016255
S.E. of regression	0.015864	Akaike info criterion		-5.419883
Sum squared resid	0.040518	Schwarz criterion		-5.326149
Log-likelihood	454.8503	Hannan-Quinn criter.		-5.381836
F-statistic	3.057547	Durbin-Watson stat		1.878320
Prob(F-statistic)	0.018420			

Source: The results are calculated by the author using EViews 9 software

The short-run relationship between the exchange rate, interest rate and money supply can be shown by the vector error correction model. Moreover, to have this function, it should have a negative sign and be statistically significant at a standard significant level, which means its p-value must be less than a 5% level of significance. According to Banerjee et al. (1993), the highly significant error correction term further confirms the existence of a stable long-run relationship. As reported in Table 6, the error correction coefficient of the estimated result is −0.070050, which is statistically significant because it has the desired negative sign and implies

a high speed of adjustment in which the system is restored to its long-run equilibrium. The coefficient of the speed of adjustment is negative and, as desired, statistically significant, which shows that the deviation by any of the explanatory variables in the short run would be corrected by the speed of 7.005% in the long run per Month. This means that the shocks/deviation of each explanatory variable on the exchange rate would move towards long-run equilibrium by 7.005%.

5. RESEARCH FINDINGS

The analysis did not reveal any co-integration between the Nifty 50 and the monetary policy variables (interest rate and money supply). In simpler terms, this suggests there's no statistically significant long-term connection between these factors. So, changes in interest rates or money supply might not necessarily lead to predictable long-term movements in the stock market.

In contrast to the stock market, a co-integration relationship was found between the exchange rate (REER) and the monetary policy variables. This indicates a statistically significant link in the long run. So the results showed that an increase in the real interest rate leads to an increase in the exchange rate. This suggests that when interest rates go up, the Indian Rupee becomes relatively more attractive to investors, potentially causing its value to appreciate compared to other currencies.

Conversely, an increase in money supply was found to be linked with a decrease in the exchange rate. This implies that when there's more money circulating in the Indian economy, the Rupee might weaken compared to other currencies.

These findings suggest that monetary policy may have a more direct impact on the exchange rate than on the stock market in India. A study (Brzeszczyński et al., 2023) found the same result and they claim that the bond and foreign exchange markets are the indicators of the

financial markets which are the first markets to react to shifts in interest rates and money supply.

6. CONCLUSION

Monetary policy is one of the most important tools central banks use to manage the economy. It involves setting interest rates and managing the money supply. Monetary policy can have a significant impact on financial markets, including stock markets and foreign exchange markets.

This study investigated the long-run and short-run relationship between monetary policy and the stock market and exchange rate in India. The study used monthly time series data for Nifty 50, Real Effective Exchange Rate (REER), interest rate and money supply (M3) from October 2007 to April 2024 (198 months).

The findings of Co-integration tests revealed a long-run relationship between REER, Interest rate and Money supply M3, indicating they influence each other over time. The long-run model suggests higher real interest rates lead to a slightly stronger rupee, while increased money supply leads to a slightly weaker Rupee. These findings suggest that monetary policy may have a more direct impact on the exchange rate than on the stock market in India.

In the short-run, deviations from equilibrium are corrected at a rate of about 7% per Month. Whereas the co-integration test shows that there is no long-run relationship between Nifty_50, interest rate and M3. Understanding this relationship can benefit investors by informing decisions about potential monetary policy impacts on stock prices and exchange rates. Policymakers can also use this knowledge to formulate more effective policies that consider both stock market performance and exchange rate stability. While this study focused on a specific period and a limited set of monetary policy tools, it contributes to a deeper understanding of how these policies influence India's financial system in the long run. This

knowledge can empower investors and policymakers to make better decisions that promote economic stability and growth.

This study only focused on the long-term relationship between the Nify_50 index and the Exchange rate; real interest rate and money supply M3. Whereas further studies can be done on wider financial markets by including bonds, commodities markets and other stock market indices like the Sensex index.

7. MANAGERIAL IMPLICATIONS

This study can give fund managers a toolbox to better manage risk and potentially boost returns. It can help them identify new risk factors, like currency swings or market trends, and use that knowledge to build stronger portfolios. They might also utilise these findings to adjust where they invest their money to reduce the risk and improve returns.

This study can help domestic as well as foreign investors understand the market trends and know how to track the market to find out where to invest and how to invest for instance if investors know the relationship between exchange rate and monetary policy (real interest rate and money supply M3 in this case) they can make better decisions of investment like deciding when to invest in the Indian market and when to invest in foreign market and also when to buy Rupee and when to sell it.

This study can help financial regulators find out how their policies impact the market and overall economy for example it helps the central bank to understand how money supply and interest rate changes can stabilise the Rupee's value against foreign currency and how to use these tools to balance the Rupee value in the market.

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