Interest Rate Determination in India: Analyzing RBI's Post-Covid Monetary Policy Stance Using High Frequency Data

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Abstract

Against the backdrop of the new Monetary Policy Committee (MPC) decisions to maintain the status quo policy rates, we analyse the post-pandemic monetary policy stance in India. Using high-frequency data, the term structure of interest rate is analyzed incorporating monetary aggregates, fiscal deficit, inflation expectations and capital flows. The results revealed that the fiscal deficit does not significantly determine interest rates in the post-pandemic monetary policy stance in India. The long-term interest rates were strongly influenced by the short-term interest rates, which reinforces that term structure is operating in India. The results further revealed that long-term interest rates were also positively influenced by capital flows, and inflation expectations, while it was inversely impacted by the money supply. These inferences have policy implications on the fiscal and monetary policy coordination in India, where it is crucial to analyse the efficacy of high interest rate regime on public debt management. Our results also refute the popular belief that deficits determine interest rates in the context of emerging economies.

Introduction

Against the backdrop of mounting inflation and geo-political uncertainties, the 51st RBI Monetary Policy Committee (MPC) has kept the rates "status quo" at 6.5 per cent on October 9th 2024. The poly- crisis includes the tensions in West Asia, energy price volatility, supply chain disruptions, fluctuating oil prices and mounting global inflation.

The US Fed Reserve has reduced the rate by 50 bps in September 2024, however RBI has given relative significance to the global economic headwinds and geopolitical uncertainties while taking the decisions. This meeting is the first in the series under the new MPC, constituted recently with three new external members for a four year term. All the six members of the new MPC voted to change the monetary policy stance from "withdrawal of accommodative stance "to "neutral" stance. A "neutral stance" refers to a policy stance by the central bank to increase or decrease the interest rates, with dual policy priorities of inflation containment and growth recovery process.

The term structure of interest rates determines the link between the short term and the long term rates of interest. The long term 10-year G-Sec yield rate softened to an average of 6.79 per cent in October (up to October 7) as compared to 6.98 per cent during June – July 2024. The short term rate of interest – the weighted average call rate (WACR) is slightly below the repo rate, averaged at 6.44 per cent during October (up to October 7) as against 6.55 per cent during June – July 2024. Against the backdrop of the new Monetary Policy Committee decisions, we analyse the term structure of interest rates in India.

The paper is organised into 4 sections. Section 1 analyses the empirical review of the structure of interest rates. Section 2 interprets the Indian monetary policy stance data, while section 3 presents the econometric models of term structure of interest rates and interprets the results. Section 4 concludes.

1. The Term Structure of Interest Rates: A review

The term structure of interest rates has been considered an important indicator of an economy's financing environment, which is of a larger concern for the monetary authorities since it also serves as the key channel for monetary policy transmission. Vayanos and Villa (2021) constructed a model for the term structure of interest rates arising from the interaction between investors with preferences for specific maturities and specific maturities and risk-averse arbitrageurs, formalizing the preferred-habitat view. Costain, Nuno and Thomas (2022) extended the term structure model of Vayanos and Villa (2021) to a two-country monetary union for Germany and Italy to analyse the impact of European Central Bank's pandemic emergency purchase programme (PEPP) by decomposing into term premium and credit risk components. The study revealed that the German yields were influenced by the aggregate asset purchases regardless of the cross-country distribution, while on the contrary, the yield curve of Italy was determined by the distribution of asset purchases across countries. Towards analysing the forecasting ability of simple and factor-augmented term structure models, Salachas, Kouretas, and Laopodis (2023) considered the nominal yields of the United States and other developed countries with a focus on the COVID-19 crisis. The study showed improved interest rate forecasts for models with a more comprehensive information set, indicating that term structure models can determine future variations in economic activity, subject to time- and country-specific sensitivities.

An empirical investigation into the determinants of the long-term real interest rate across 17 OECD countries by Orr, Eddy and Kennedy (1995) showed that while the low frequency components of real interest rates are determined by the portfolio returns, return on capital, and the inflation rate among others, the high frequency components are determined by the monetary policy actions and unanticipated inflationary shocks. Following a panel cointegration model for 20 OECD countries over the period 1990-2013, Ciocyte, Muns and Lever (2016) found that nominal long-term interest rate was influenced by expected inflation and potential GDP growth rate while considering the changes in the age structure of the population. In order to empirically test the postulate of loanable funds theory that government borrowings are influenced by long-term interest rates, Palatiello and Pilkington (2022) deployed an ARDL model to decompose the long and short-run relationship in the context of the United States. Adding to the mixed results in the literature, they found that

while the deficits influenced interest rates in the short run, the effects were reversed in the long run. Similarly, an empirical investigation into the determinants of long-term interest rates on the United States Treasury securities was conducted by Akram and Li (2020) using high-frequency monthly data. Following the ARDL framework, the results revealed that the long-term interest rates were determined by the short-term interest rates, the pace of economic activity, and the core inflation, thereby reinforcing the Keynesian perception of the determination of long-term interest rates or the government bond yields. Adhering to the monthly data on six emerging economies of Asia, Kim, Park and Tian (2023) found that the bond yield in the emerging markets were influenced by the inflation in the advanced economies. The findings provide insights into to the increased inflation in the advanced economies due to COVID-19 and the escalating bond yields in the emerging markets.

On the assessment of domestic and external determinants of market determined interest rates in India, Dua and Pandit (2002) revealed the influence of real money supply, real interest rate, foreign interest rate and domestic inflation on the real interest rate. The earlier literature on the relationship between fiscal deficit and interest rate in India, hold the view that fiscal deficit doesn't determine interest rate (Chakraborty, 2002; Das, 2004; and Goyal, 2004). Chakraborty (2012) found that rise in fiscal deficit doesnot lead to a rise in neither the short-term nor the long-term interest rates. The estimates of the vector autoregressive model revealed that the rate of interest was determined by the changes in unanticipated components of reserve money, expected inflation, and the volatility of the capital flows. The recent empirical evidence has further reinforced the stance that fiscal deficit doesn't determine interest rate (Vinod, Chakraborty, and Karun, 2014; and Chakraborty, 2024). In an examination of the empirical evidence for financial crowding out in the context of a financially deregulated interest regime in India, Chakraborty (2024) found that an increase in fiscal deficit doesn't induce the interest rates to rise, while the inflationary expectations significantly influenced the interest rates.

2. Interpreting Data

The new monetary policy framework was introduced in India in February 2016, with inflation targeting framework. Since May 2020, the RBI has kept the policy stance "accommodative", for economic firefighting during the pandemic period. Between May 2020 to May 2022, RBI had kept the repo rate constant at 4 per cent. Since May 2022, the RBI has started increasing the repo rate and has been increased the rate by 250 basis points (bps) to 6.5 per cent by February 2023. Since February 2023, the MPC kept the repo rate unchanged at 6.5 per cent in all the policy review meetings. It is a bold decision by the RBI to transit to "neutral stance", giving equal importance to growth and inflation.

The central bank has emphasised on the success of "new monetary framework" envisioned for India in February 2016, based on Urjit Patel Committee recommendations. The new monetary policy framework envisages "price stability" as the single mandate of RBI, through the flexible inflation targeting framework. As per the flexible inflation target (FIT) framework in India, a nominal anchor of 4% CPI inflation was decided, within a band of + or – 2 per cent.

The MPC is mindful of negative interest rates, if the inflationary expectations are higher than the nominal interest rate. So their decision reflects the reality that a sudden reduction in the policy rates at this moment is not feasible, given the geo-political uncertainties. The RBI Governor has emphasised on "central bank independence" – in terms of "operational independence" - recalling the decision in 2016 to constitute the Monetary Policy Committee (MPC) with internal and external members, instead of RBI Governor unanimously taking decisions on the policy rates. The "operational independence" allow the MPC members to take an independent stance regarding the policy rates based on their voting powers. In the latest MPC meeting, a unanimous decision towards "neutral" policy stance was taken. A majority of 5 out of 6 members voted to keep the policy repo rate unchanged at 6.50 per cent.

The monetary policy corridor is kept "symmetrical", with lower and upper bounds of the corridor equi-distant from the repo rate. The lower bound of the corridor is Standard Deposit Facility (SDF) rate, rate at which the RBI absorbs liquidity from banks (through accepting uncollateralised deposits) on an "overnight" basis, which is kept at 6.25 per cent. The upper bound of the corridor is Marginal Standing Facility (MSF), which is kept at 6.75 per cent. The Marginal Standing Facility (MSF) rate is the rate at which banks can borrow "overnight" from

the RBI. These are Liquidity Adjustment Facility (LAF) mechanism tools of RBI, through which banks borrow or lend money.

Given the volatility in the global financial markets and the downward risks from the geo-political uncertainties, the real GDP growth for Q1:2025-26 is projected at 7.3 per cent. The MPC has projected the real GDP growth for 2024-25 is at 7.2 per cent, with Q2 at 7.0 per cent; Q3 at 7.4 per cent; and Q4 at 7.4 per cent. The CPI inflation for 2024-25 is projected at 4.5 per cent, with Q2 at 4.1 per cent; Q3 at 4.8 per cent; and Q4 at 4.2 per cent. CPI inflation for Q1:2025-26 is projected at 4.3 per cent. The RBI's growth and inflation outlook highlights global resilience, despite geopolitical risks[1]. Table 1 explains the structure of various interest rates in India and the macro-monetary ratios including CRR and SLR.

Table 1: The Monetary-Macro Ratios and Variables, 2024 (in percent)

(Per cent)

Monetary-Macro Ratios and Variables	2023	2024				
	Sep. 29	Aug. 30	Sep. 6	Sep. 13	Sep. 20	Sep. 27
	1	2	3	4	5	6
Ratios						
Cash Reserve Ratio	4.50	4.50	4.50	4.50	4.50	4.50
Statutory Liquidity Ratio	18.00	18.00	18.00	18.00	18.00	18.00
Cash-Deposit Ratio	..	..	5.02	..	4.86	..
	..	..	(5.01)	..	(4.85)	..
Credit-Deposit Ratio	..	..	77.16	..	77.69	..
	..	..	(79.10)	..	(79.63)	..
Incremental Credit-Deposit Ratio	..	..	60.25	..	70.31	..
	..	..	(57.15)	..	(67.28)	..
Investment-Deposit Ratio	..	..	29.43	..	29.58	..
	..	..	(29.62)	..	(29.77)	..
Incremental Investment-Deposit Ratio	..	..	27.57	..	30.43	..
	..	..	(25.78)	..	(28.68)	..
Rates						
Policy Repo Rate	6.50	6.50	6.50	6.50	6.50	6.50
Fixed Reverse Repo Rate	3.35	3.35	3.35	3.35	3.35	3.35

[1] Reserve Bank of India - Press Releases (rbi.org.in)

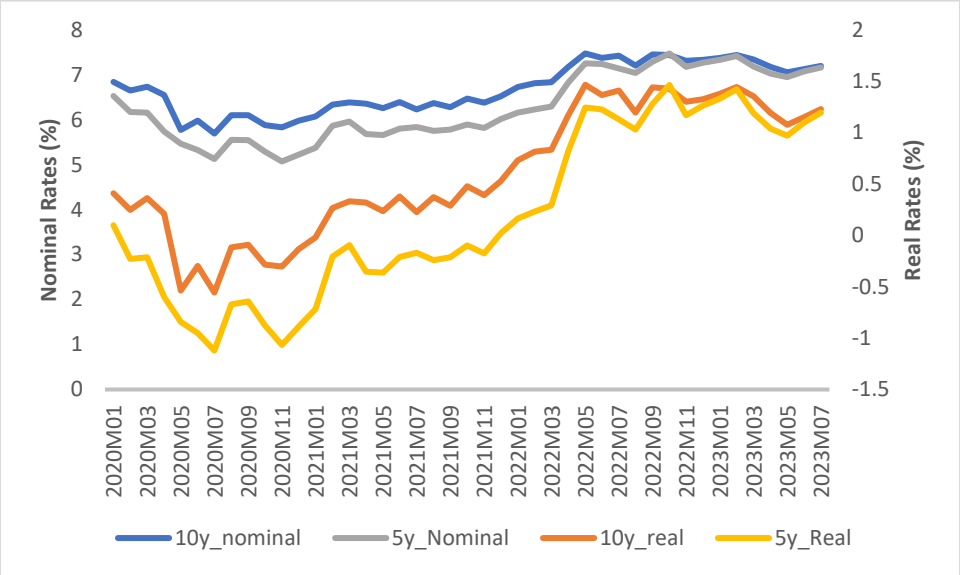
Standing Deposit Facility (SDF) Rate	6.25	6.25	6.25	6.25	6.25	6.25
Marginal Standing Facility (MSF) Rate	6.75	6.75	6.75	6.75	6.75	6.75
Bank Rate	6.75	6.75	6.75	6.75	6.75	6.75
Base Rate	8.85/10.10	9.10/10.40	9.10/10.40	9.10/10.40	9.10/10.40	9.10/10.40
MCLR (Overnight)	7.95/8.45	8.15/8.45	8.15/8.45	8.15/8.45	8.15/8.45	8.15/8.45
Term Deposit Rate >1 Year	6.00/7.25	6.00/7.25	6.00/7.25	6.00/7.25	6.00/7.25	6.00/7.25
Savings Deposit Rate	2.70/3.00	2.70/3.00	2.70/3.00	2.70/3.00	2.70/3.00	2.70/3.00
Call Money Rate (Weighted Average)	6.75	6.59	6.47	6.54	6.64	6.61
91-Day Treasury Bill (Primary) Yield	6.86	6.63	6.63	6.65	..	..
182-Day Treasury Bill (Primary) Yield	7.08	6.72	6.73	6.72	..	..
364-Day Treasury Bill (Primary) Yield	7.08	6.72	6.72	6.70	..	..
10-Year G-Sec Par Yield (FBIL)	7.22	6.90	6.91	6.84	6.80	6.78
Reference Rate and Forward Premia						
INR-US$ Spot Rate (₹ Per Foreign Currency)	83.06	83.87	83.93	83.92	83.49	83.67
INR-Euro Spot Rate (₹ Per Foreign Currency)	87.94	92.91	93.31	92.95	93.29	93.46
Forward Premia of US$ 1-month	1.88	1.12	1.28	1.41	1.66	1.65
3-month	1.69	1.34	1.45	1.58	1.78	1.74
6-month	1.75	1.64	1.73	1.84	2.03	2.11

Source: Reserve Bank of India, 2024 (data accessed on October 4th, 2024)

The variables included in the study consist of time series data with monthly frequency spanning from January 2020 to July 2023. All the data used in the study are sourced from the Reserve Bank of India database. As per the requisite of the theoretical model, the dependent variables selected for the study include the yield of 10-year and 5-year GSecs, which constitute the long-term interest rates, and the yield of 3-year GSecs and 91-day Treasury Bills, which constitute the short-term interest rates. The independent variables include inflation and expected inflation derived from the Consumer Price Index (CPI), the output gap derived from the Index of Industrial Production (IIP), the capital flows, fiscal deficit, and the

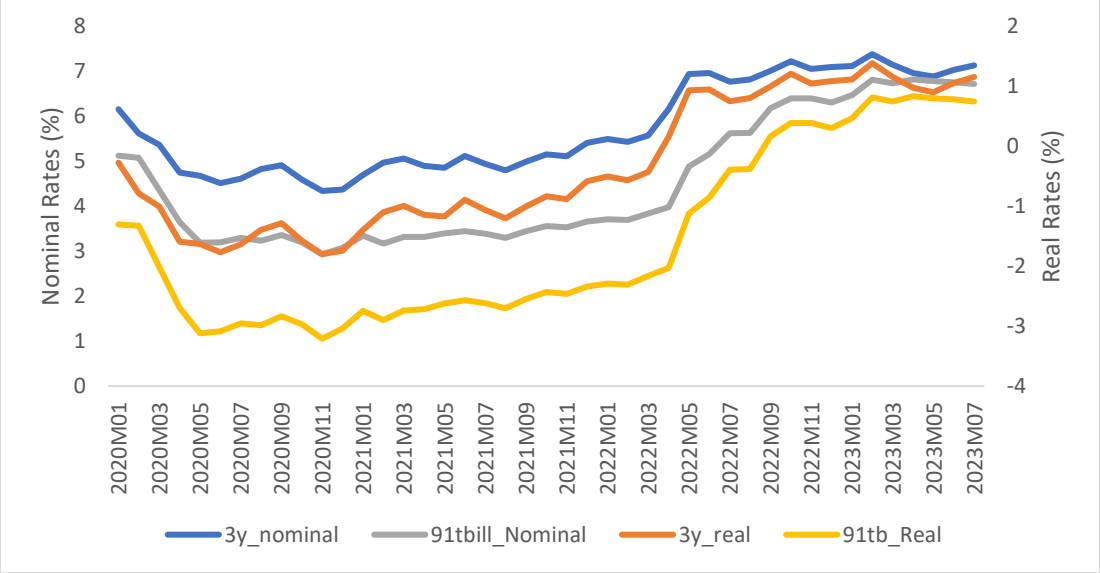
money supply captured through the broad money. The fall in interest rates of both the long-term and short-term government securities (Gsecs) was evident during this period (Figure 1 and Figure 2).

Figure 1: Long-term interest rates (Jan 2020 - July 2023)



Source: Basic data - Reserve Bank of India Handbook of Statistics (2024)

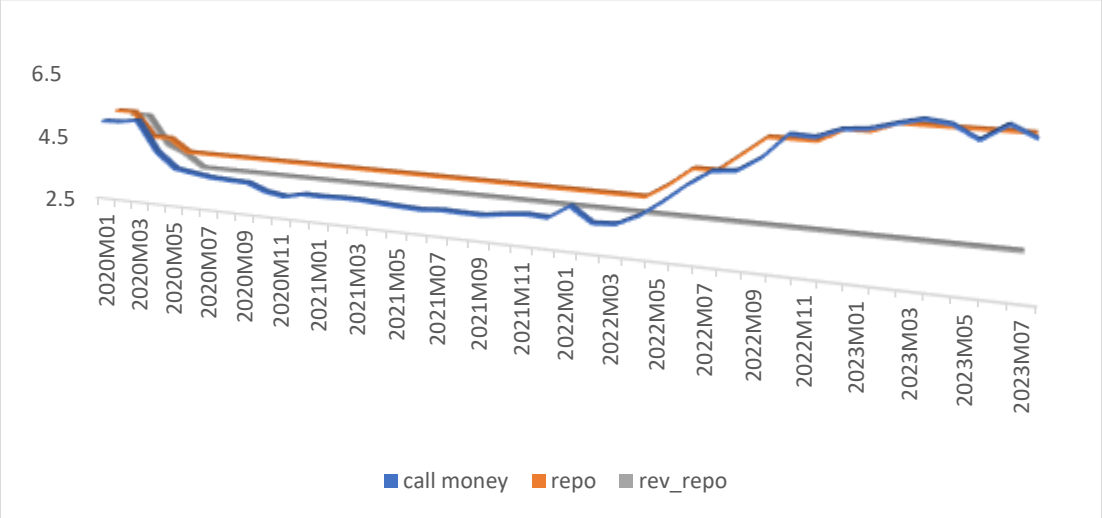
Figure 2: Short-term interest rates (Jan 2020 - July 2023)



Source: Basic data - Reserve Bank of India Handbook of Statistics (2024)

The Monetary Policy Committee (MPC) unanimously decided to keep the policy repo rates unchanged while it was deemed necessary to revive and sustain the economic growth at that time. All the policy rates were kept at moderate levels to facilitate the recovery of the economy (Figure 3). Unlike the advanced economies which reduced the policy rates closer to the zero-bound, the RBI did not lower the policy repo rates below the targeted inflation rate of 4 per cent. These measures of rate cuts were complemented by liquidity infusion measures adding to the array of both conventional and unconventional measures aimed at boosting investor confidence and ultimately, reviving the economy. Variable Rate Reverse Repo (VRRR) was followed to migrate the surplus liquidity from short-term periods to long-term periods. Further modulation of long-term GSec yields was carried out through Operation Twist involving the simultaneous sale of short-term and long-term Gsecs, lowering the interest rates of instruments benchmarked to GSecs (Das, 2023).

Figure 3: Monetary policy rates (January 2020 – July 2023)

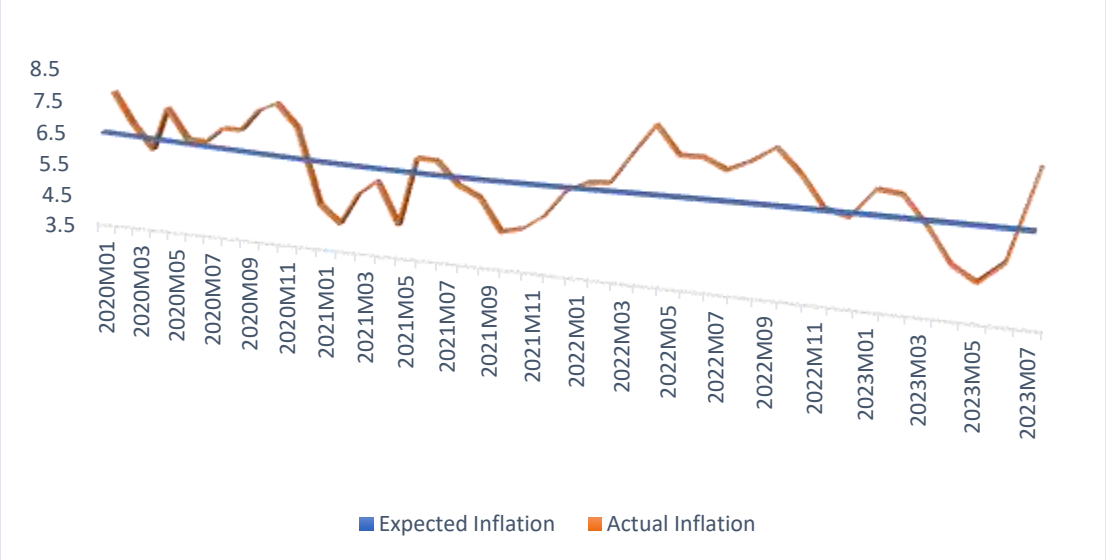


Source: Basic data - Reserve Bank of India Handbook of Statistics (2024)

The data on inflation are taken as the Consumer Price Index (CPI), which is transformed into the ex-ante real rate of interest following Fischer's equation (see Correia et al. 1995; Chakraborty, 2012; Chakraborty, 2024), where the expected inflation is computed using the Hodrick-Prescott filter. The inflation in the pre-pandemic period hovered around 7 per cent in January 2020 driven by rising food prices, before falling to below 6 per cent level in March 2020. The lockdowns and the disruptions in the supply chains resulted in a spike in inflation

to more than 7.5 per cent. The inflation levels from January 2020 to July 2023 reflect a period of economic turbulence and recovery as depicted in Figure 4.

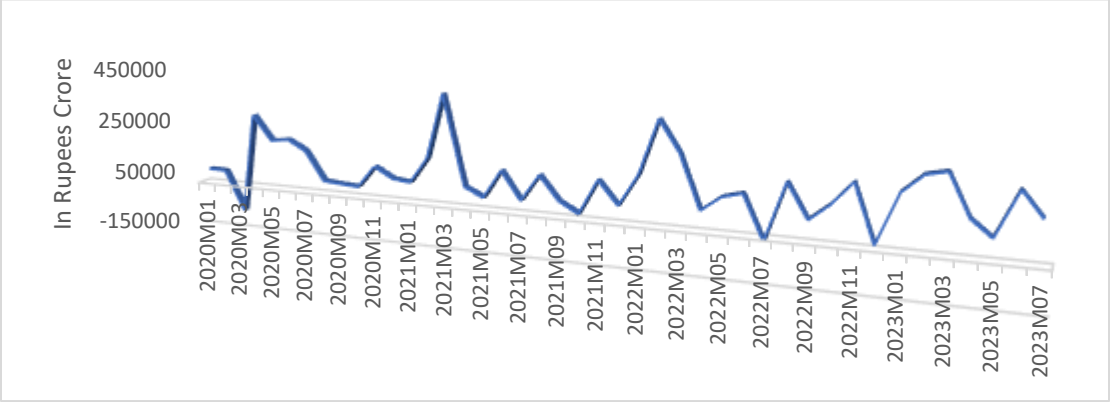
Figure 4: Actual Inflation and Expected Inflation Derived using HP Filter



Source: Basic data - Reserve Bank of India Handbook of Statistics (2024)

Fiscal deficit, central to the broader policy debate about its impact on interest rates, is considered an important variable determining the interest rate. Figure 5 captures the monthly progression of fiscal deficit during the pandemic period and through the recovery phase. The pandemic period witnessed a surge in the fiscal deficit due to the disruptive effects of the nationwide lockdown leading to a severe contraction in economic activity and the concurrent allocation of resources towards the mounting health expenditure and sustenance of livelihoods. The pandemic-induced challenges were addressed through well calibrated fiscal expansion during the recovery period.

Figure 5: Monthly Gross Fiscal Deficit



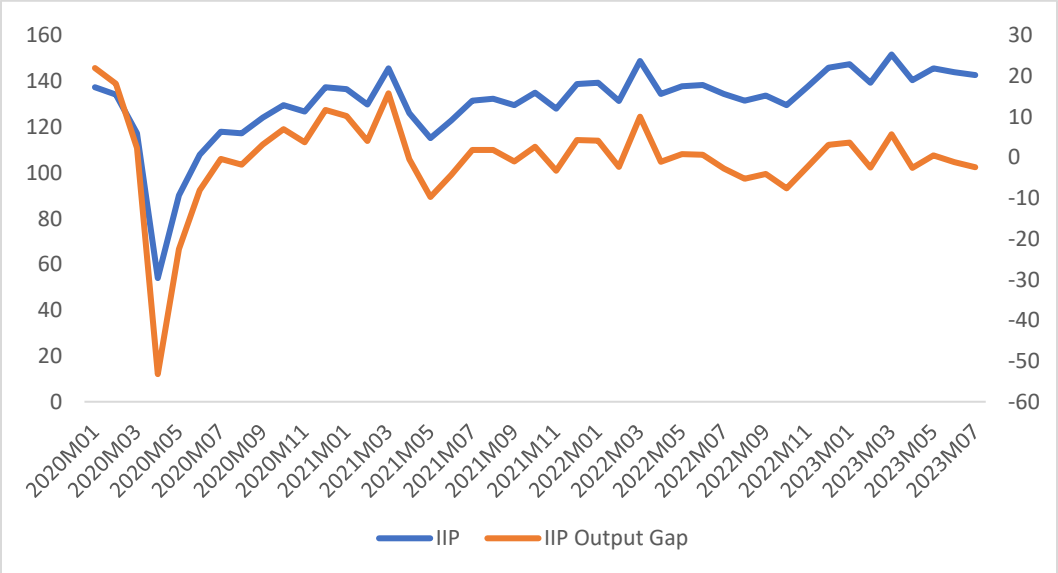
Source: By the authors from Basic Data - Reserve Bank of India Handbook of Statistics (2024)

The pace of economic activity is gauged by the output gap derived from the seasonally adjusted Index of Industrial Production (IIP). Here, the output gap which depicts the transitory deviations from the potential output is derived as:

$$[((Acutal\ IIP - Potential\ Output)/Potential\ Output) * 100)].$$

Here, the potential output is derived using the Hodrick-Prescott filter. The major advantage of the Hodrick-Prescott filter is that it allows the output gap to be stationary across a range of smoothing values while accommodating the changes in trend over time (de Brouwer, 1998). The plot of monthly IIP and the output gap is depicted in Figure 6.

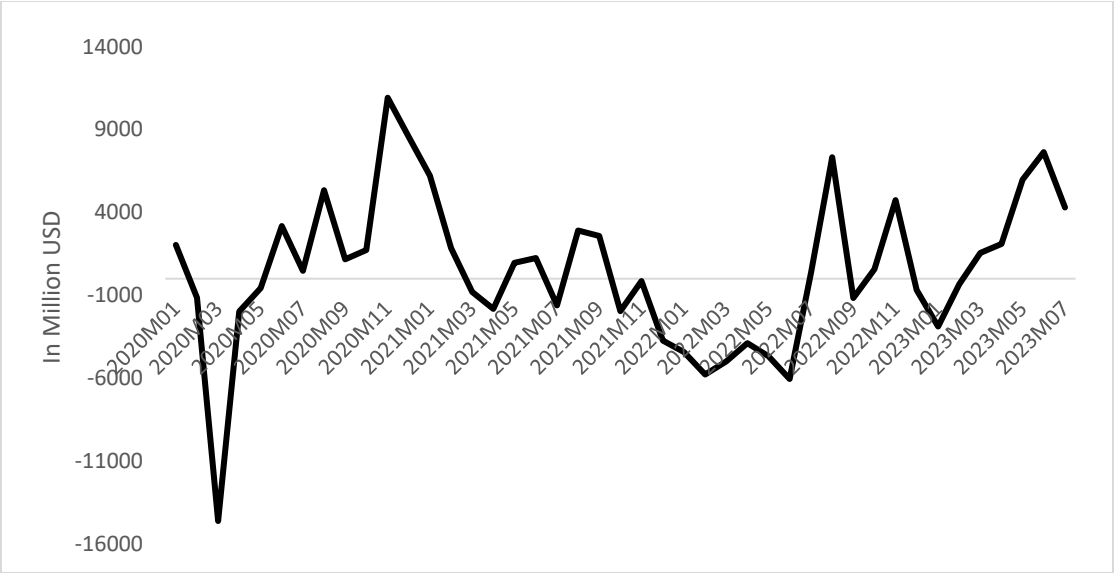
Figure 6: IIP and Output Gap derived using HP Filter



Source: By the authors from Basic Data - Reserve Bank of India Handbook of Statistics (2024)

The capital flows into the economy are captured by the net foreign portfolio investments. India experienced a substantial outflow of net portfolio investments in the wake of the pandemic (Figure 7), and also in 2022 driven by the tightening of financial conditions globally (Goel and Novikova, 2023). Amidst the volatile capital flows during the pandemic, the RBI pursued an accommodative policy of lower interest rates in order to bolster economic recovery.

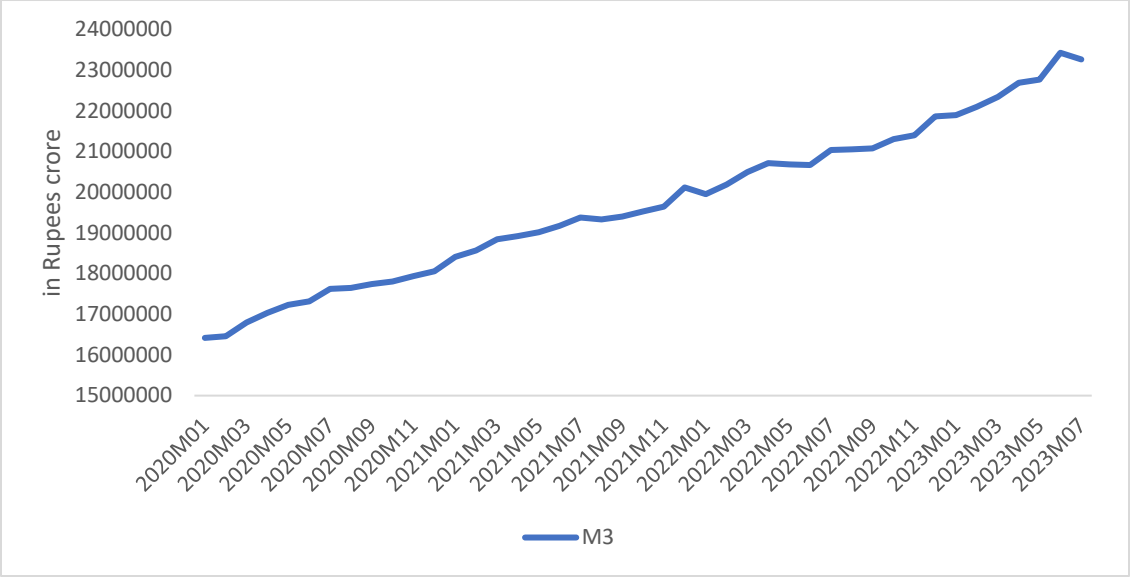
Figure 7: Monthly Net Portfolio Investments



Source: Source: Basic data - Reserve Bank of India Handbook of Statistics (2024)

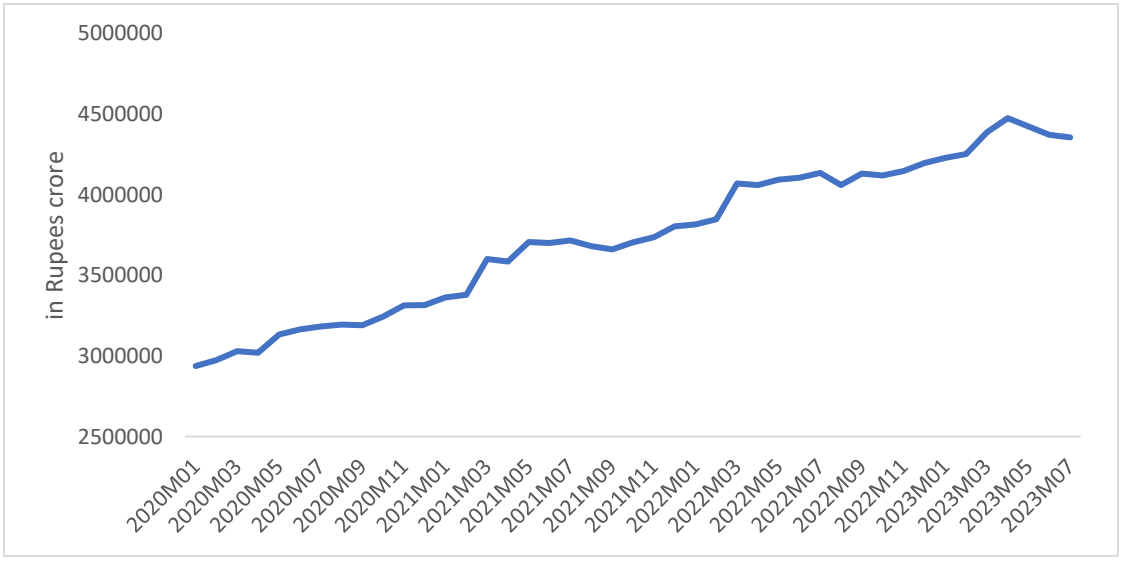
The trends of money supply in India are captured by the broad money (M3) and the high-powered money (M0). Empirical literature shows that broad money is negatively associated with long-term interest rates, while it exhibits a positive relationship with short-term interest rates (see Vinod, Chakraborty and Karun, 2016). Figures 8 and 9 present the trajectories of M3 and M0 during the reference period of the study. The present analysis considers M3 as one of the determinants of interest rates. Prior to estimating the ARDL models, Figures 10-21 encapsulates the bivariate scatterplots, which visually represents the stylized facts of the plausible direction of relationship between the variables.

Figure 8: Trends in Broad Money (M3)



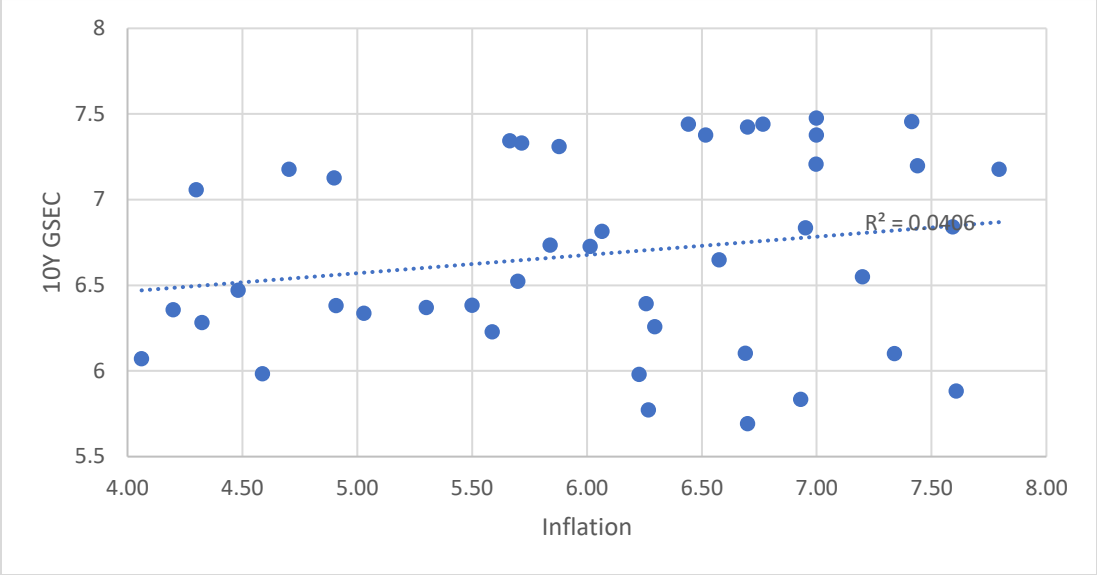
Source: Basic data - Reserve Bank of India Handbook of Statistics (2024)

Figure 9: Trends in High Powered Money (M0)



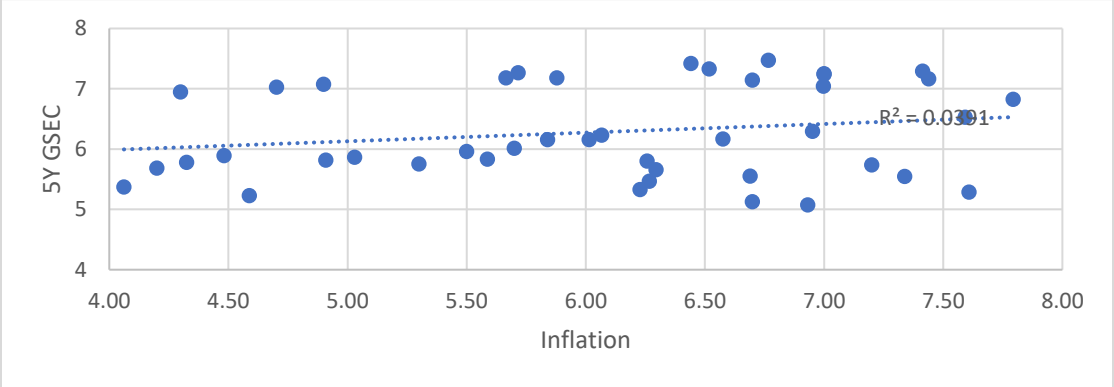
Source: Basic data - Reserve Bank of India Handbook of Statistics (2024)

Figure 10: Scatter Plot of 10YGSEC and Expected Inflation



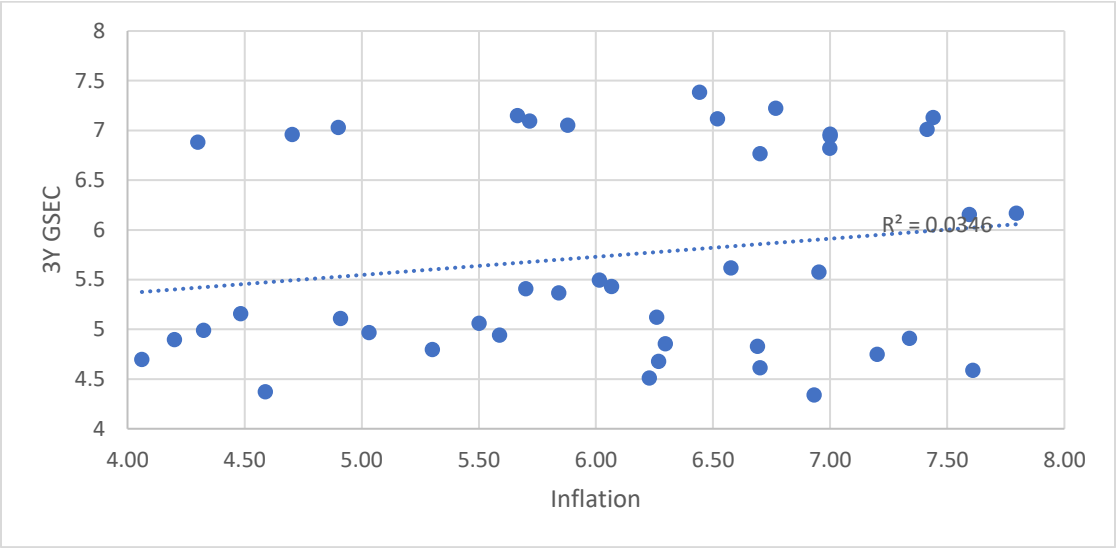
Source: Basic data - Reserve Bank of India Handbook of Statistics (2024)

Figure 11: Scatter Plot of 5YGSEC and Expected Inflation



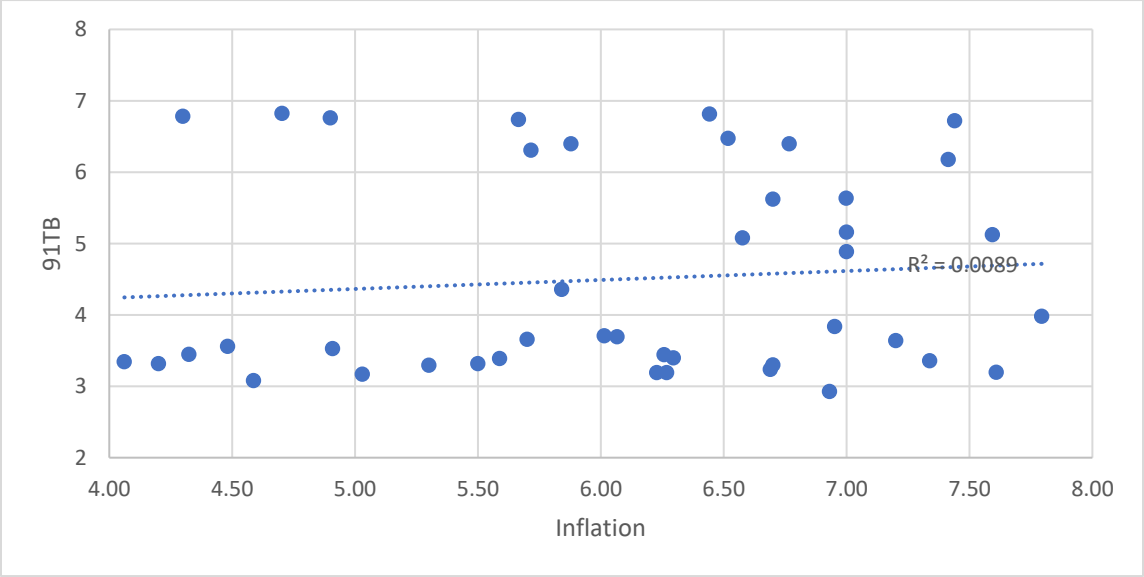
Source: Basic data - Reserve Bank of India Handbook of Statistics (2024)

Figure 12: Scatter Plot of 3YGSEC and Expected Inflation



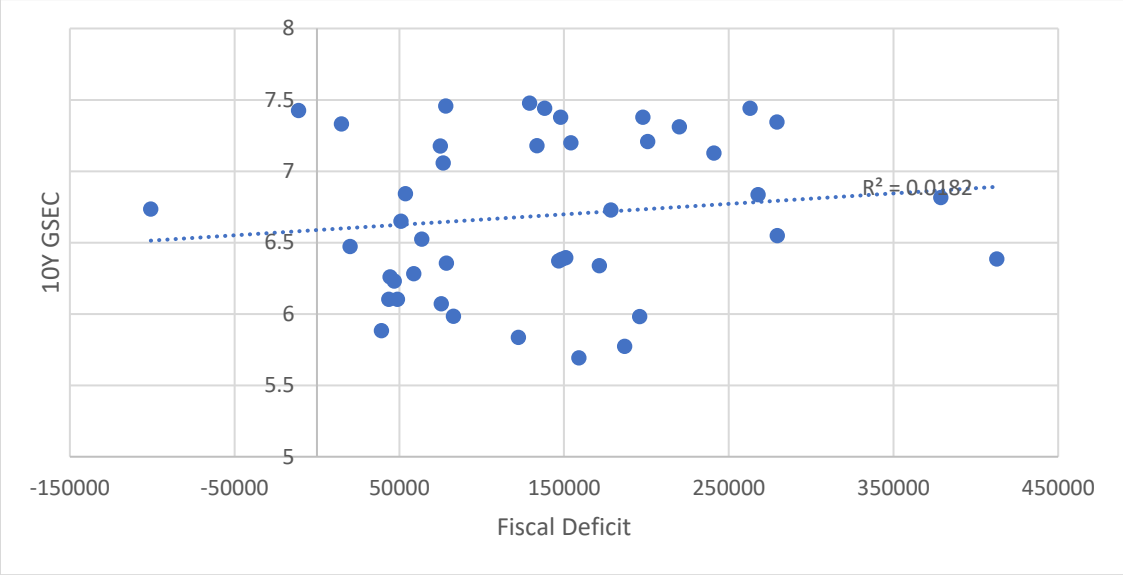
Source: Basic data - Reserve Bank of India Handbook of Statistics (2024)

Figure 13: Scatter Plot of 91 Treasury Bill rate and Expected Inflation



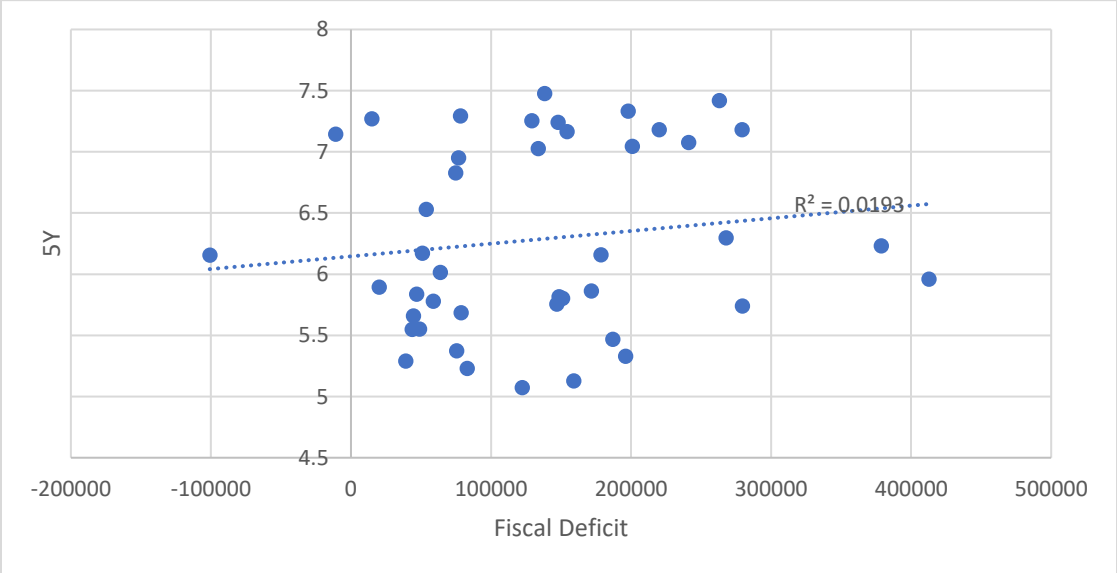
Source: Basic data - Reserve Bank of India Handbook of Statistics (2024)

Figure 14: Scatter Plot of 10YGSEC and Fiscal Deficit



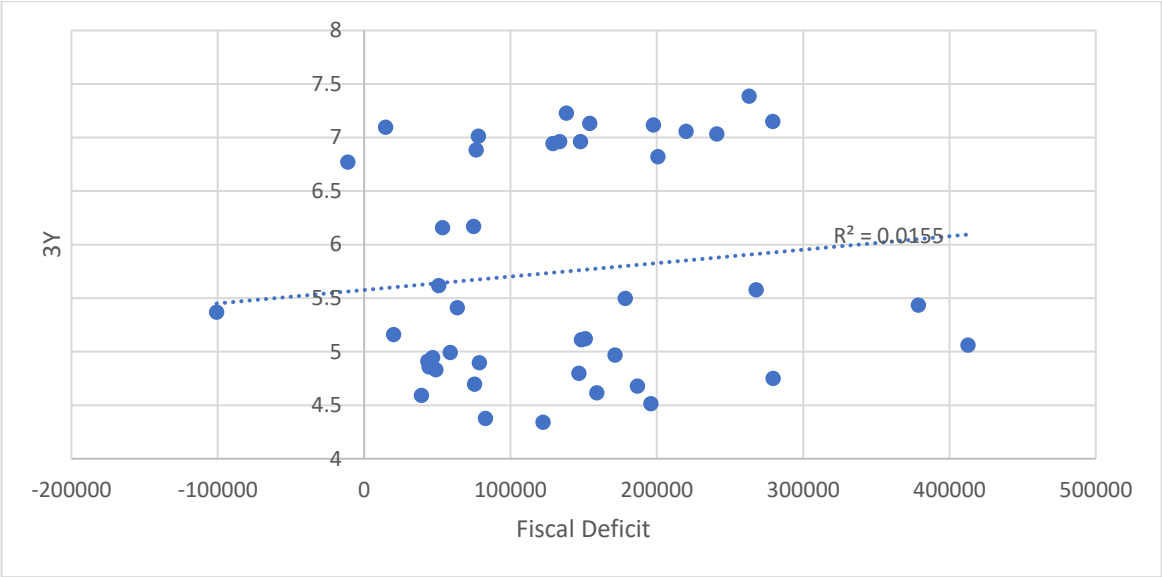
Source: Basic data - Reserve Bank of India Handbook of Statistics (2024)

Figure 15: Scatter Plot of 5YGSEC and Fiscal Deficit



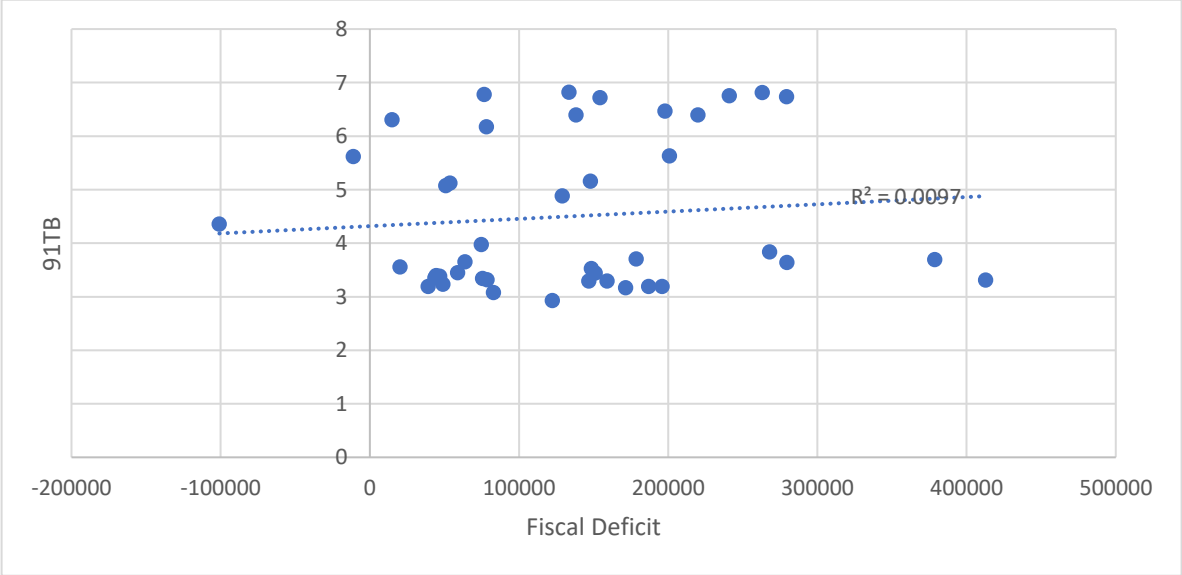
Source: Basic data - Reserve Bank of India Handbook of Statistics (2024)

Figure 16: Scatter Plot of 3YGSEC and Fiscal Deficit



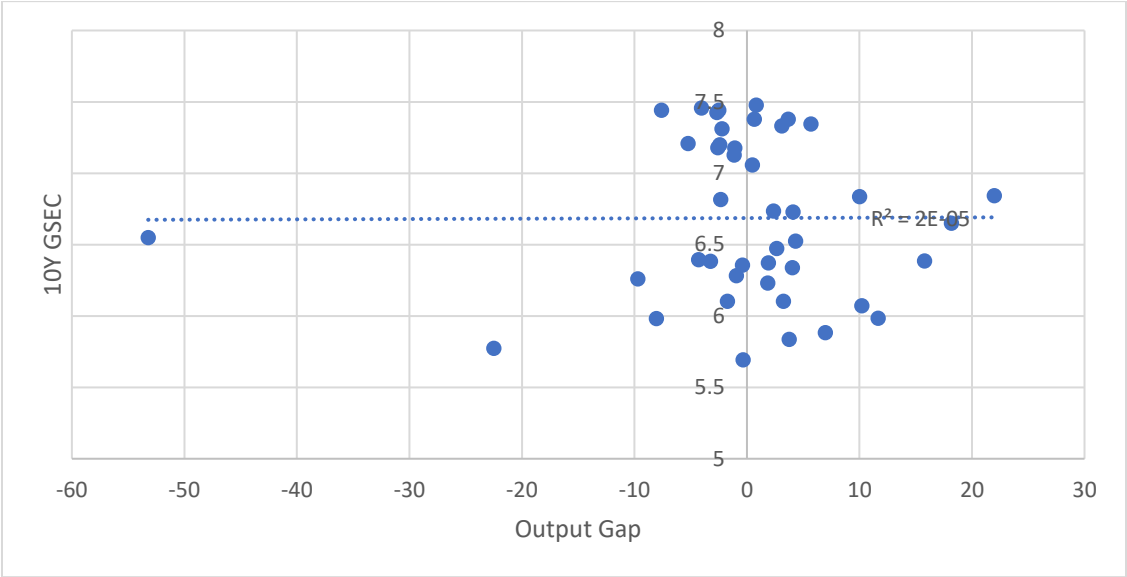
Source: Basic data - Reserve Bank of India Handbook of Statistics (2024)

Figure 17: Scatter Plot of 91 Treasury Bill rate and Fiscal Deficit



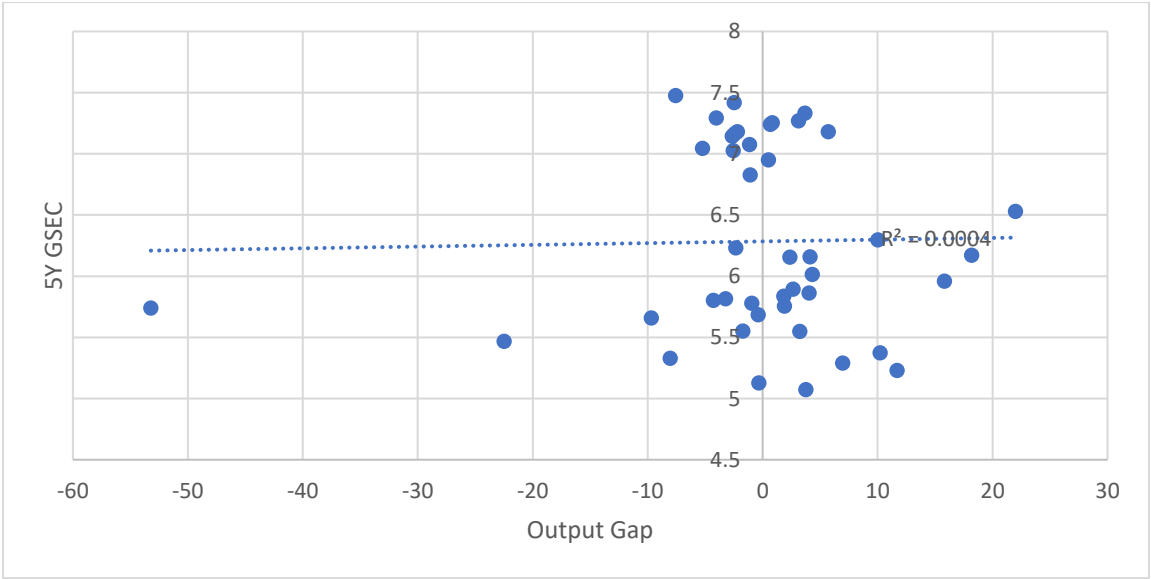
Source: Basic data - Reserve Bank of India Handbook of Statistics (2024)

Figure 18: Scatter Plot of 10YGSEC and Output Gap



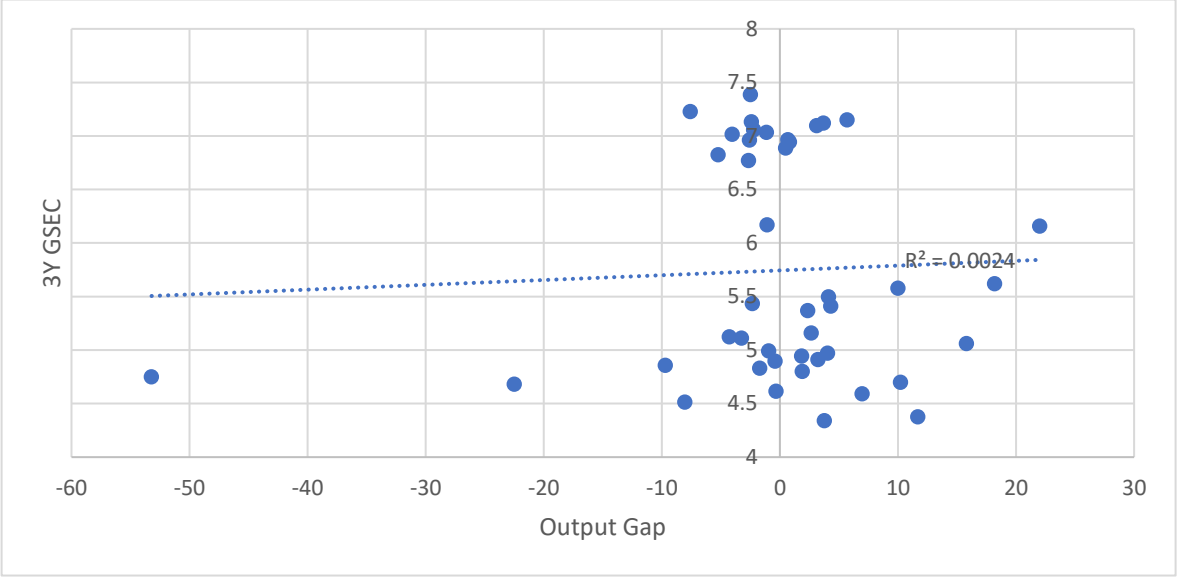
Source: Basic data - Reserve Bank of India Handbook of Statistics (2024)

Figure 19: Scatter Plot of 5YGSEC and Output Gap



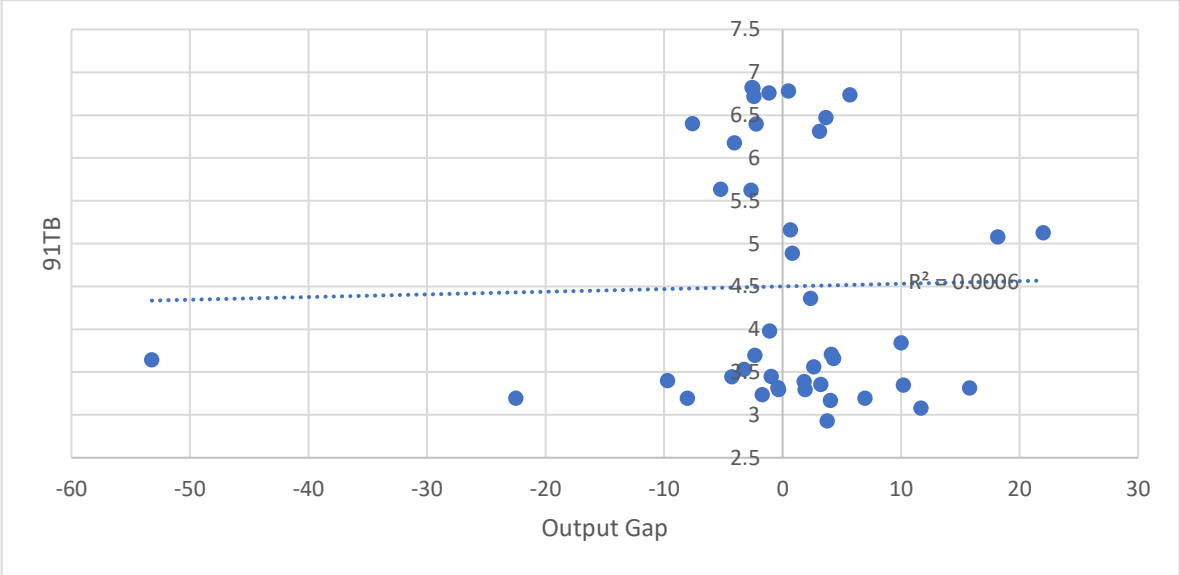
Source: Basic data - Reserve Bank of India Handbook of Statistics (2024)

Figure 20: Scatter Plot of 3YGSEC and Output Gap



Source: Basic data - Reserve Bank of India Handbook of Statistics (2024)

Figure 21: Scatter Plot of 91 Treasury bill Rate and Output Gap



Source: Basic data - Reserve Bank of India Handbook of Statistics (2024)

3 The Empirical Approach

We employ ARDL model for studying the term structure of interest rates in India .

$$Y_t = \mu + \sum_{i=1}^{p} \gamma Y_{t-i} + \sum_{j=1}^{q} \beta X_{t-j} + \varepsilon_t \quad (1)$$

where, Y and X are the dependent and independent variables respectively. Y depends on p lags of itself $(Y_{t-1}, \dots, Y_{t-p})$, the autoregressive components and q lags of the independent variable X $(X_{t-1}, \dots, X_{t-q})$.

Consider a simple ARDL (1,1) model with a single explanatory variable:

$$y_t = \mu + \gamma y_{t-1} + \beta_0 x_t + \beta_1 x_{t-1} + \varepsilon_t \quad (2)$$

The Error Correction Model (ECM) is obtained from the ARDL, which integrates the short-run dynamics with the long-run equilibrium. By defining first differences $\Delta y_t = y_t - y_{t-1}$ and $\Delta x_t = x_t - x_{t-1}$, from (2) we obtain,

$$\Delta y_t = \mu + \beta_0 \Delta x_t + (\gamma - 1)(y_{t-1} - \theta x_{t-1}) + \varepsilon_t \quad (3)$$

were, $\theta = -(\beta_0 + \beta_1)/(\gamma - 1)$. This derived form of the model is the error correction form of the model, where $\Delta y_t = \mu + \beta_0 \Delta x_t + \varepsilon_t$ is the equilibrium relationship, and $(\gamma - 1)(y_{t-1} - \theta x_{t-1})$ denotes the equilibrium error which shows the deviation of the variables from the equilibrium. In the long run, as the model moves towards equilibrium, the difference between the dependent variable and the independent variables (ECM) should not increase.

Equation (3) is estimated to conduct an F-bounds test to find the long-run relationship between the variables. For this purpose, the following hypothesis is tested:

$H_0: \theta_1 = \theta_2$ (Null hypothesis: Long-run relationship doesn't exist)

$H_1: \theta_1 \neq \theta_2$ (Alternate hypothesis: Long-run relationship exists)

Both the long-run effects and short-run effects can be analysed from (3). $\theta = (\beta_0 + \beta_1)/(\gamma - 1)$ is the long-run effect of a shock in x_t. The short-run effect of shock change in x_t is β_0.

Taking lag on both sides and re-arranging, (3) can be re-written in the ECM form as:

$$\Delta y_t = \beta_0 \Delta x_t - \omega ECT_{t-1} + \varepsilon_t \quad (4)$$

where, $(\gamma - 1) = \omega$ and the equilibrium error $(y_{t-1} - \theta x_{t-1}) = ECT_{t-1}$(Error Correction Term). β_0 is the impact multiplier (the short-run effect) which measures the immediate impact a change in x_t will have on a change in y_t. ω is the feedback effect, or the adjustment effect, which shows how much of the disequilibrium in the previous period is corrected in the current period. For the model to converge to equilibrium, the coefficient of ECT (ω) should be negative and statistically significant. A positive coefficient of error correction term indicates divergence, while a negative coefficient indicates convergence.

where, the first part of the equation θ_1, θ_2, …, θ_7 represent the long-run relationship, the second part $\beta_1, \beta_2, \ldots, \beta_7$ denote short-run dynamics of the model, Δ denotes the difference operator, and ε_t is the error term. In the long run rate of interest models, the results of the bounds test for all the estimated equations reveal that for all the estimated equations the null hypothesis of no cointegration is rejected at 1 per cent level of significance since the value of the F statistic lies above the bound I(1) implying the existence of a long-run relationship among the variables. Estimating the results of the long-term interest rates of GSecs 10Y and 5Y, Table 2 displays the long-run coefficients of the specified ARDL models with their lags. Both the long-term interest variables deny the existence of any significant long-run relationship between fiscal deficit and interest rates, in accordance with the reviewed empirical literature (Chakraborty, 2002; Das, 2004; Goyal, 2004; Chakraborty, 2012; Vinod, Chakraborty, and Karun, 2014; and Chakraborty, 2024). The results show that the coefficient of short-term interest rate is positive for both the long-term interest rates and significant at 1 per cent indicating the strong influence of short-term interest rates over long-term interest rates in adherence with the theoretical perception (Akram and Das, 2019). Further supporting the theoretical conjectures, the expected inflation rates have strong positive influence on the interest rate in the long run. While the capital flows exhibited a positive influence, the money supply given by broad money showed a significant negative relationship with the long-term interest rates. Interestingly, the output gap did not exhibit any significant influence on the long-term interest rates.

Table 2: ARDL Estimation of GSEC 10Y yield rate

Variable	Estimate	t-stat
$\Delta lnfd_t$	0.0041	0.9550
$\Delta ln91tb_t$	0.5564	3.7410***
$\Delta lnkflows_t$	0.0086	3.8729***
$\Delta lnkflows_{t-1}$	-0.0029	-1.4708
$\Delta lnkflows_{t-2}$	0.0015	0.6622
$\Delta lnopg_t$	0.0208	1.7732*
$\Delta lnopg_{t-1}$	0.0190	1.7962*
$\Delta lnopg_{t-2}$	0.0273	2.6647**
$\Delta lnopg_{t-3}$	0.0219	2.3102**
$\Delta lnm3_t$	4.9135	2.2725**
$\Delta lnm3_{t-1}$	13.8785	6.5699***
$\Delta lnm3_{t-2}$	9.6992	3.6721***
EC_{t-1}	-1.5197	-10.1868***

*, **, *** denote significance at 10%, 5% and 1% respectively.

Table 3: ARDL Estimation of GSEC 5Y yield rate

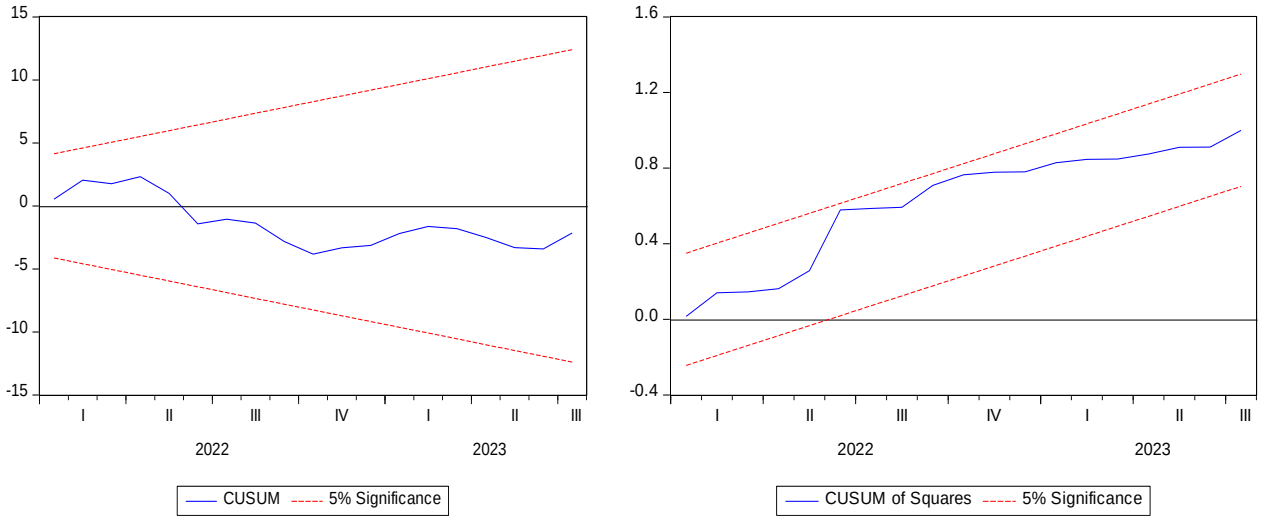
Variable	Estimate	t-stat
$\boldsymbol{\Delta lnfd_t}$	0.0013	0.4715
$\boldsymbol{\Delta ln91tb_t}$	0.4542	3.2275***
$\boldsymbol{\Delta ln91tb_{t-1}}$	0.2132	1.7269*
$\boldsymbol{\Delta lnkflows_t}$	0.0033	2.0514**
$\boldsymbol{\Delta lnm3_t}$	6.2237	3.6229***
$\boldsymbol{\Delta lnm3_{t-1}}$	13.1092	6.5620***
$\boldsymbol{\Delta lnm3_{t-2}}$	7.4861	3.3811***
$\boldsymbol{EC_{t-1}}$	-1.0010	-8.9139***

As revealed by the ECM representation in Table 2 and 3, Gsec10Y and Gsec5Y are determined by the short-term interest rate (91 day Treasury Bill rate), the inflation expectations, capital flows, and the broad money. Consistent with the long-run relationship, the results negate the influence of fiscal deficit on long-term interest rates. The error correction (EC) representation of the estimated ARDL equation shows that the coefficient of EC is negative as expected. However, the speed of adjustment more than 1 indicates an over adjustment, where 151 per cent of any disequilibrium in the previous period is corrected to equilibrium in the current period in the case of GSEC 10Y. In the case of long-term interest rate given by 5Y yield rate, the 100 per cent of the disequilibrium in the previous period is

corrected in the current period. Therefore, the dependent variable converges to the long-run equilibrium rapidly in both the long-term interest rate models.

The next step is to check for any potential bias or misspecification in the executed model. For checking the stability of the model, the plot of Cumulative Sum of Recursive Residuals (CUSUM) and CUSUM of squares (CUSUMSQ) is observed. CUSUM and CUSUMSQ test which are based on the cumulative sum of recursive residuals, plots the cumulative sum along with standard error bands indicating the level of significance limits. If the cumulative sum falls outside the level of significance limits, it indicates instability of parameters. In Figure 22, the plot of CUSUM and CUSUMQ statistic of the estimated model lies within the critical bounds at 5% level of significance showing that the estimated parameters of the model are stable over sample period.

Figure 22: CUSUM and CUSUM of Squares of the GSEC10Y yield rate model



The stability tests of the GSEC 5Y yield rate model show that the plots of CUSUM and CUSUM of squares lie within the critical bounds at 5% level of significance indicating stability of the estimated parameters of the model over the sample period as depicted in Figure 23.

Figure 23: CUSUM and CUSUM of Squares of the GSEC 5Y yield rate model

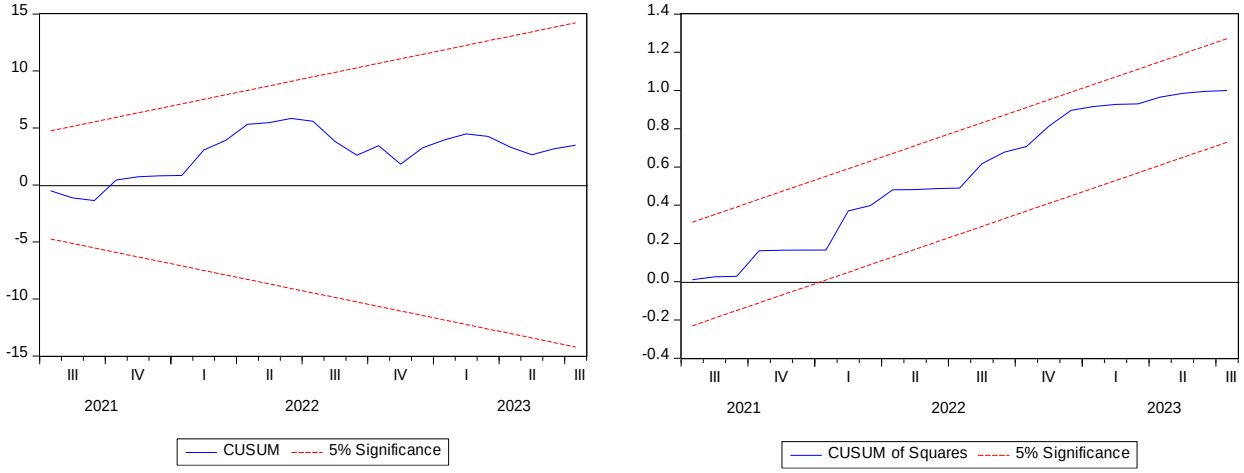
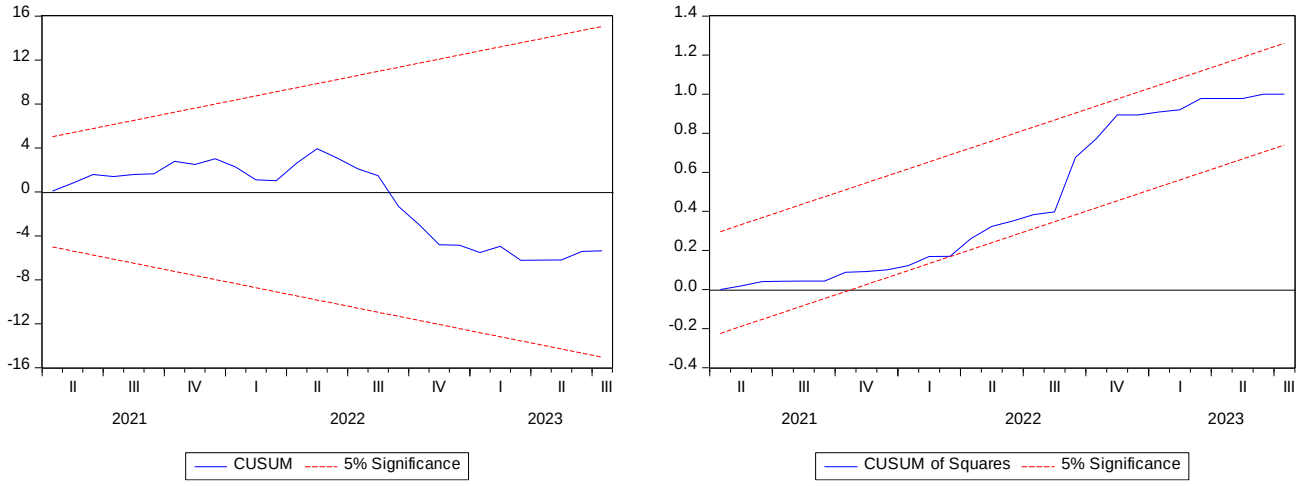


Figure 24: CUSUM and CUSUM of Squares of the GSEC 3Y yield rate model



The stability tests of the GSEC 3Y yield rate model show that the plots of CUSUM and CUSUM of squares lie within the critical bounds at 5% level of significance indicating stability of the estimated parameters of the model over the sample period (Figure 23).

4. Conclusion

Against the backdrop of the new Monetary Policy Committee (MPC) decisions to maintain the status quo policy rates, we analyse the post-pandemic monetary policy stance in India. Using high-frequency data, the term structure of interest rate is analysed incorporating fiscal deficit and other open economy macroeconomic variables. The results revealed that the fiscal deficit does not significantly determine interest rates in the post-pandemic monetary policy stance in India. The long-term interest rates were strongly influenced by the short-term interest rates, which reinforces that term structure is operating in India. The results further revealed that long-term interest rates were positively influenced by capital flows, and inflation expectations, while it was inversely impacted by the money supply. These inferences have policy implications on the fiscal and monetary policy coordination in India, where it is not the deficits that increase interest rates in India. On the contrary, it is crucial to analyse the efficacy of high interest rate regime on public debt management.

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