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Interest Rate Instability and Macroeconomic Environment in Bangladesh: Some Links and Policies

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Abstract

Significant economic shocks are dispersed and financial policies are greatly impacted by interest rate volatility. This study uses monthly data from January 2011 to March 2017 to examine the behavior of several interest rates in Bangladesh's economy, including loan, deposit, call money, and T-bill. The results of our step-by-step regression analysis show that: (a) the instability of T-bill rates, deposit rates, and money supply has a significant impact on the instability of lending rates; (b) the instability of T-bill rates is significantly impacted by the instability of deposit rates, call money rates, lending rates, and monthly exports; and (c) the instability of T-bill rates and money supply has a significant impact on the instability of call money rates. We also apply a vector auto-regressive (VAR) framework to investigate the time-based causal linkages among these variables. Policymakers can manage the oscillations of the T-bill rate in order to regulate the variations of the call money rate, as the former has a major beneficial impact on the latter. The call money rate's volatility is significantly impacted negatively by the money supply.

Keywords: Bangladesh, Interest Rate Instability, Macroeconomic Environment

1. Introduction

Over the past few decades, Bangladesh's interest rates have experienced substantial fluctuations due to a variety of internal and foreign causes. Hossain (2019) claims that the necessity to strike a balance between encouraging investment and economic growth and controlling inflation has largely shaped interest rate policies in Bangladesh. Interest rates have been influenced by the Bangladesh Bank (central bank) through a variety of

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monetary instruments, such as repo rates, open market operations, and statutory liquidity ratio changes. Nevertheless, the nation has seen periods of interest rate volatility in spite of these measures, which has made it difficult to maintain macroeconomic stability.

Interest rate instability spreads shocks across the economy. For instance, Edwards (1998) highlights how interest rate instability complicates the effects of globalization on financial markets. This complex relationship has been a major concern for financial institutions, investors, regulators, and researchers, especially after the near collapse of small and large industries, as well as major financial institutions in the U.S. during the 1970s and 1980s.

High interest rate instability often calls for changes in how macroeconomic factors interact within the financial sector. However, there is limited research on how interest rate instability relates to macroeconomic factors in emerging economies. To better understand this relationship in Bangladesh, we first need to outline the connections between these intertwined factors.

T-bill (Treasury Bill) rate[4] is the quotation of daily price in secondary market on the currently auctioned T-bills. The demand and supply of T-bill in secondary markets drives the discount rate of T-bill. The call money rate reflects the liquidity position of financial institutions like a bank. The monetary policy of an economy governs call money rate. When call money rate is lower, the banks can borrow more money from central bank or brokers. This availability of money can make competitive auction of T-bills as well as can drive the T-bill rate. In other way, lower call money rate increases the demand of risk free investment like T-bill, raising the T-bill rate. When the deposit rate is higher than T-bill discount rate, the lower demand on T-bill reduces the instability of T-bill rate.

Increase in lending rate generates more interest rate risk for the individuals, institutional investors, and financial institutions like banks. The more interest rate risk shifts funds to the safe sector like T-bill. Moreover, increase in lending rate creates idle money in banks due to lower level of investment. This idle money increases the demand of T-bill, raising the instability of T-bill rate. In addition, good economic condition creates the opportunity of business expansion that drives the export of an economy,

[4] T-bill discount rate= $\frac{\text{Par Value}-\text{Purchase Price}}{\text{Par Value}} \times \frac{360 \text{ Days}}{\text{Numbers of day to maturity}}$

increasing the demand of T-bill (Rose, 1994). As a result, the instability in T-bill rate increases.

In Bangladesh, deficit budget is a common phenomenon. Hence, the financial crowding out happens due to upward pressure on interest rate impelled by the debt financing of the government (Chakraborty, 2007). The larger extent of borrowing of government from the domestic sector sharply declines the CRR, creates liquidity crisis in banks, and increase instability in call money rate. Consequently, lending interest rate increases, private investment falls, and banks rely on call money that increases call money rate. The government's dependence on T-bill also increases T-bill rate. The increase in T-bill rate raises the call money rate due to spur on money demand.

1.1 Research Objective

The absence of literature in Bangladesh critically explaining the links and policies regarding interest rate instability and macroeconomic environment of Bangladesh motivates us to uncover the behavior of the instability of interest rate in line with macroeconomic environment.

1.2 Research Questions

a) What is the relationship between interest rate instability and various macroeconomic factors in Bangladesh? How do T-bill rates, deposit rates, and money supply instability affect lending rate instability?

b) How does the instability of T-bill rates influence the instability of other interest rates (e.g., call money rates, lending rates) in Bangladesh?

c) What are the causal linkages between the instability of interest rates and macroeconomic variables such as money supply and exports?

d) How does interest rate instability affect the overall macroeconomic environment, including financial institutions and investment behaviors, in Bangladesh?

e) What policy recommendations can be derived to manage interest rate instability and its impact on the macroeconomic environment in Bangladesh?

2. Literature Review

A bulk of literature are found on the interconnection between instability in interest rate and macroeconomic environment. Here, Stone (1974), Chance and Lane (1980), Booth and Officer (1985), Scott and Peterson (1986), and Bae (1990) are prominent. Besides, Choudhry (1999) and Payne (1992) inspected the factors of instability in T-bill rate. Celikoz et al. (2011) inspected the factors of instability in deposit rate.

Sander and Kleimeier (2006) found that T-bill rate has significant positive impact on the banks' lending rate in South Africa. They also found that demand for risk free securities increases T-bill discount rate. The rise in demand for risk free assets eventually increases lending rate. However, Kovanen (2011) found insignificant positive impact of T-bill rate on banks' lending rate.

Drechsler et al. (2017) argued that market power of banks is responsible of high instability in deposit rate that decreases the instability in lending rate. They also argued that banks can increase the deposit rate to strengthen the capacity to grab more lending opportunities in money market. Flannery (1983) argued that monetary policy based on income gap of banks is responsible for instability in lending rate. Therefore, banks retain their income gap in the tightening monetary policy by increasing lending rate that eventually raises instability in lending rate Gomez et al. (2016). Moreover, the income gap can be raised during lending interest rate instability for increased credit risk of borrowers (White, 1991).

Kuttner and Mosser (2002) found that money supply affects the economy through multiple diffusion channels such as level of lending, interest rate and so on. Taylor (1995) demonstrated the significance of only interest rate channel in this perspective. Furthermore, Hsing (2005) found that money supply has positive impact on real GDP on the ground that an expansion in real quantity of money decreases the nominal interest rate. However, Weber et al. (2001) found that increased money supply in U.S. raised inflation in 1970s whereas 5 percent decrease in money supply reduced inflation by 3.5 percent in 1990s, driving the nominal interest rate. Therefore, money supply has both positive and negative impact on the interest rate depending on the nature of the monetary policy.

Sarkar (1999) stated that banks taking part in T-bill auction face high demand of call money in during liquidity mismatch. Banks' crisis to pay the value of T-bill raises the call money rate. So, the instability in call money rate increases the spread of T-bill, driving the instability in T-bill

rate. Furthermore, call money rate rises during the fund crisis of banks, raising the interest rate of money market instruments (Akhtaruzzaman et al. 2005).

Olweny (2011) argued that the unregulated deposit rate largely depends on banks' financial stability. So, the banks can raise the deposit rate to strengthen financial stability. Saglam (2005) found that instability in time deposit rate has negative impact on money demand and money demand has positive impact on the instability of T-bill rate (see also, Baba, Hendry, and Starr, 1993; Garner, 1986). Ismail and Ghazali (2005) found that monetary policy has significant impact on the T-bill rate in Malaysian economy. Cook (1998) stated that changes in T-bill spread occurs largely by the instability of lending rate in the short run. For example, Federal Reserve declared major alteration in operating strategies which resulted larger instability in lending rate. Consequently, the spread of T-bills increased from 2 basis index to 8-10 basis index, increasing the instability in T-bill rate.

Inflation rate of an economy is an important component of interest rate. Comparatively low (high) inflation rate has linkage with comparatively low (high) rate of T-bills (Dominique and Sack, 1999). Souza-Sobrinho (2017) found that instability in T-bill rate has positive relationship with export in Brazil. Madhumathi and Ranganatham (2012) stated that exports have significant impact over the instability in T-bill rate by increasing the lending rate. Dwyer and Hafe (1989) argued that trade balance affects the supply and demand of foreign funds in an economy. The change in the supply and demand of foreign funds can both increase or decrease the lending rate, raising the instability in lending rate.

Shahiduzzaman and Naser (2007) calculated the instability in call money rate of Bangladesh from 1st January 2003 to 26th December 2006. They stated that banks with increased demand of funds raise lending rate. However, there is no significant impact on the instability in call money rate. Antal et al, (2001) found that treasury account balances affect the interbank call money rate. Maskay and Pandit (2010) demonstrated that money market instruments like treasury bill has profound impact on the liquidity mismatch in which demand of more call money raises instability in call money rate. Central bank increases the money supply as a part of monetary policy to keep fluctuations of interest rate in control, decreasing call money rate or bank rate (CBN, 2016). Nath and Ghose (2017) found that significant decrease in call money rate due to alteration in monetary policy.

CBS (2012) stated that the early segment of the year 2012 reflects the high growth in broad money supply but its normal development amides the year remained at 20.2 percent. Consequently, normal weighted call money rate (WCMR) was expanded by around 120 points with the policy rate increments in February and in April 2012. The normal WCMR came to its most noteworthy points of 10.71 percent in mid-July and settled from that point to around 10.54 percent until the point that decreased the policy rate on 12 December 2012.

Rahman and Barua (2017) claim that swings in investment levels have been linked to interest rate volatility in Bangladesh, which in turn has an impact on economic growth. Low interest rates can cause inflationary pressures and overheating, while high interest rates typically deter borrowing and investment, especially in the private sector.

Changes in interest rates may have an effect on the currency rate. Higher interest rates in Bangladesh frequently cause the local currency to appreciate, which can reduce export competitiveness, according to Mollah and Uddin's (2018) research. Lower interest rates, on the other side, may cause capital flight and currency depreciation, which raises the possibility of inflationary pressures as a result of increased import costs.

Improving oversight and regulation of the financial industry can help reduce the dangers brought on by changes in interest rates Hasan and Chowdhury (2021). Additionally, they stress how crucial it is to create a more diverse financial sector in order to lessen reliance on conventional banking channels.

2.1 Research Gap

From the above literature, we can conclude that the interconnection between the instability in interest rate and macroeconomic environment are not fully explored in Bangladesh. This interconnection varies based on the nature of the economy. Moreover, the linkage may also alter due to different regulatory pressures and monetary policy. We, therefore, explore the link between the instability of interest rate and macroeconomic environment and subsequently recommend some policies.

3. Data and Methodology

Lending rate (LIR), deposit rate (DR), call money rate (CMR), T-bill (91 days) rate (TDR), money supply (M2) and export (ME) have been collected from the “Major Economic Indicators: Monthly Update (MEI)” of

Bangladesh Bank. MEI is monthly publication of the central bank of Bangladesh. The data have been collected from January, 2011 to March, 2017.

3.1 Unit Root Test

To check the unit root problem, we use ADF test without trend and constant, only constant term, and with trend and constant forms. The forms are given below.

$$(1)\quad \Delta Z_t = \delta Z_{t-1} + \sum_{j=1}^{m} \alpha_j \Delta Z_{t-j} + \vartheta_t$$

$$(2)\quad \Delta Z_t = \mathrm{X}_0 + \delta Z_{t-1} + \sum_{j=1}^{m} \alpha_j \Delta Z_{t-j} + \vartheta_t$$

$$(3)\quad \Delta Z_t = \mathrm{X}_0 + \mathrm{X}_1 t + \delta Z_{t-1} + \sum_{j=1}^{m} \alpha_j \Delta Z_{t-j} + \vartheta_t$$

If $\delta = 0$, then the variable is $I(1)$. The appropriate lag length equation-1, equation-2, and equation-3 are selected by AIC and SBIC. We also use PP test to verify consistency of the ADF test. We provide the test results in Table 2.

3.2 ARMA (p,q) and ARIMA (p,d,q) Models

If the variable is stationary, we employ $ARMA(p,q)$ model to calculate the conditional variance (instability). We employ $ARMA(p,q)$ model to calculate the conditional variance (instability) of LIR, DR, TDR, and CMR otherwise we employ $ARIMA(p,d,q)$ (Edward, 1998).

$$(4)\quad \mathrm{M}_t = \theta_0 + \sum_{i=1}^{p} \theta_i \mathrm{M}_{t-i} + \sum_{j=1}^{q} \varphi_j \vartheta_{t-j} + \vartheta_t$$

If the variable is non-stationary, we employ $ARIMA(p,d,q)$ model to calculate the conditional variance (instability).

$$(5)\quad \Delta^d \mathrm{M}_t = \theta_0 + \sum_{i=1}^{p} \theta_i \Delta^d \mathrm{M}_{t-i} + \sum_{j=1}^{q} \varphi_j \vartheta_{t-j} + \vartheta_t$$

d=1 represents the first difference of the variable M. σ_t^2 is the calculated conditional variance either from Equation-4 or from Equation-5. $\sigma_t^2 = Var(\vartheta_t / \vartheta_{t-k}) = E(\vartheta_t^2 / \vartheta_{t-k}); k = 1, 2.....\mathrm{k}$ is the lag length which has been selected by AIC and SBIC. Let us define the conditional variance

(instability) of the variables- LIR, DR, TDR, and CMR as $VLIR$, VDR, $VTDR$, and $VCMR$ respectively

3.3 Regression and Causalities

We employ cointergation test if all variables along with conditional variance of lending rate ($VLIR$), deposit rate (VDR), T-bill rate ($VTDR$), and call money rate ($VCMR$) is I(1). We employ vector error correction model (VECM) to inspect causalities given the existence of cointegration. Else, we employ step-wise regression to inspect short run dynamics and TYDL approach (Toda and Yamamoto, 1995; Dolado and Luktkepohl, 1996) to inspect temporal causalities.

In absence of cointegration among the variables. Hence, we have to apply step wise regression to estimate short run dynamics in the following forms.

$$(6)\ \Delta \ln V LIR_t = \psi_0 + \sum_{i=1}^{p} \psi_{1i} \Delta \ln V LIR_{t-i} + \sum_{i=0}^{k} \psi_{2i} \Delta \ln V TDR_{t-i} \sum_{i=0}^{k} \psi_{3i} \Delta \ln V DR_{t-i} + \sum_{i=0}^{k} \psi_{4i} \Delta \ln M2_{t-i} + \mu_t$$

$$(7)\ \Delta \ln V TDR_t = \phi_0 + \sum_{i=1}^{p} \phi_{1i} \Delta \ln V TDR_{t-i} + \sum_{i=0}^{k} \phi_{2i} \Delta \ln V CMR_{t-i} + \sum_{i=0}^{k} \phi_{3i} \Delta \ln V DR_{t-i} + \sum_{i=0}^{k} \phi_{4i} \Delta \ln LIR_{t-i} + \sum_{i=0}^{k} \phi_{5i} \Delta \ln M2_{t-i} + \xi_t$$

$$(8)\ \Delta \ln V CMR_t = \delta_0 + \sum_{i=1}^{p} \delta_{1i} \Delta \ln CMR_{t-i} + \sum_{i=0}^{k} \delta_{2i} \Delta \ln V LIR_{t-i} + \sum_{i=0}^{k} \delta_{3i} \Delta \ln V TDR_{t-i} + \sum_{i=0}^{k} \delta_{4i} \Delta \ln M2_{t-i} + \eta_t$$

$$(9)\ \Delta \ln V TDR_t = \rho_0 + \sum_{i=1}^{p} \rho_{1i} \Delta \ln V LIR_{t-i} + \sum_{i=0}^{k} \rho_{2i} \Delta \ln V TDR_{t-i} \sum_{i=0}^{k} \rho_{3i} \Delta \ln V DR_{t-i} + \sum_{i=0}^{k} \rho_{4i} \Delta \ln M2_{t-i} + \theta_t$$

We present the results of short run dynamics in Table 5. The lag length for equation-6, equation-7, equation-8 and equation-9 has been selected by AIC and SBIC.

We also estimate the temporal causalities using Toda and Yamamoto (1995) and Dolado and Luktkepohl (1996) approach in the following form.

$$(9)\quad \begin{bmatrix} X_{1t} \\ X_{2t} \\ . \\ X_{nt} \end{bmatrix} = \begin{bmatrix} C_1 \\ C_2 \\ . \\ C_n \end{bmatrix} + \sum_{i=1}^{k} \rho \begin{bmatrix} X_{1t-i} \\ X_{2t-i} \\ . \\ X_{nt-i} \end{bmatrix} + \sum_{j=1}^{d_{\max}} \lambda \begin{bmatrix} X_{1t-k-j} \\ X_{2t-k-j} \\ . \\ X_{nt-k-j} \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ . \\ \varepsilon_4 \end{bmatrix}$$

$$(10)\quad \rho = \begin{bmatrix} \theta_{11i} & \theta_{12i} & . & \theta_{1mi} \\ \theta_{21i} & \theta_{22i} & . & \theta_{2mi} \\ . & . & . & . \\ \theta_{n1i} & \theta_{n2i} & . & \theta_{nmi} \end{bmatrix} \quad \text{and} \quad (11)\quad \lambda = \begin{bmatrix} \delta_{11k+j} & \delta_{12k+j} & . & \delta_{1mk+j} \\ \delta_{21k+j} & \delta_{22k+j} & . & \delta_{2mk+j} \\ . & . & . & . \\ \delta_{n1k+j} & \delta_{n2k+j} & . & \delta_{nmk+j} \end{bmatrix}$$

The $C's$, and $\theta's$ are the parameters to be estimated. $\varepsilon's$ are serially independent with mean zero and finite covariance matrix. The appropriate lag length for Equation-7 has been selected by the AIC and SBIC. Here, the appropriate lag length in traditional VAR is *k* in the level form of variables. The appropriate lag length has been selected by the SBIC and AIC. $d_{\max}$ is the maximum order of integration. Since all the variables are I(1), hence $d_{\max} = 1$. $C's$, $\theta's$, and $\delta's$ are the parameters to be estimated. $\varepsilon's$ are the random error terms which is identically and independently distributed with zero mean and finite covariance matrix. The causality analysis in this approach is more sophisticated than the traditional approach. This approach can be used regardless of the order of integration

4.0 Result and Discussion

4.1 Descriptive Statistics

The descriptive statistics of the data have been represented in Table 1.

Table 1: Descriptive statistics

Variables	Minimum	Mean	Maximum	CV (%)	Skewness	Kurtosis
LIR (%)	9.70	12.35	13.95	9.31	-0.55	2.05
DR (%)	5.01	7.28	8.68	12.79	-0.53	2.13
CMR (%)	3.50	7.94	19.66	18.41	1.00	4.09
TDR (%)	2.69	6.92	11.37	22.78	-0.06	2.09
M 2 (mn BDT)	4018405	6702214	9648231	17.41	0.14	1.84
ME (mn USD)	1449.98	2474.58	3592.97	12.12	0.143	2.629

We got platy-kurtic distribution of *LIR*, *DR*, M2, *TDR*, and ME unlike *CMR* with leptokurtic distribution. Furthermore, we got positively skewed distribution of *CMR*, M2, and ME unlike *LIR*, *DR*, and *TDR* with negatively skewed distribution. Besides, each variable has moderate variation.

4.2 Unit Root Test Results

We check the stationarity of each variable through ADF test and PP test. If LIR, DR, TDR, and CMR are not I(0). We also check the stationarity of the conditional variance of LIR, DR, TDR, and CMR. The stationarity of conditional variance (instability) and present the results in Table 4.

Table 2. Unit root test results

Model with Constant and Trend Term				
	Level Form		Difference Form	
Variables	ADF test	PP test	ADF test	PP test
LIR	-4.97***	-4.97***	-6.56***	-6.76***
DR	-4.41***	-3.82**	-1.71	-6.62***
TDR	-3.12	-2.87	-6.38***	-6.38***
CMR	-2.89	-2.90	-7.07***	-13.20***
$\ln M2$	-2.89	-2.85	-10.81***	-10.81***
$\ln ME$	-0.92	-7.94	-9.20***	-58.08***
Model with Constant Term				
	Level Form		Difference Form	
Variables	ADF test	PP test	ADF test	PP test
LIR	0.42	0.32	-4.36***	-4.28***
DR	-1.71	0.32	-1.64	-4.07***
TDR	-0.29	-0.70	-6.08***	-6.06***
CMR	-1.52	-1.36	-7.08***	-12.21***
$\ln M2$	0.75	0.56	-10.78***	-10.78***
$\ln ME$	-0.87	-4.43***	-9.25***	-57.24***
Model without Constant and Trend term				
	Level Form		Difference Form	
Variables	ADF test	PP test	ADF test	PP test
LIR	-0.81	-0.71	-3.86***	-4.23***
DR	-1.48	-0.68	-1.23	-3.98***

TDR	-0.54	-0.57	-6.10***	-6.09***
CMR	-1.26	-1.48	-7.05***	-8.84***
$\ln M2$	9.00	10.17	0.61	-5.88***
$\ln ME$	5.26	2.01	2.69***	-25.88***

***P<0.01; **P<0.05; *P<0.10: Significant at 1%, 5%, and 10% levels, respectively

Table 3. Summary of ARMA (p, q) / ARIMA (p, d, q) Model Selection

Variables	$ARMA(p,q) / ARIMA(p,q,d)$	Lowest value	
		AIC	SBIC
LIR	$ARIMA(1,1,1)$	-130.43	-121.21
CMR	$ARIMA(2,1,1)$	252.66	264.18
TDR	$ARIMA(1,1,0)$	102.51	109.42
DR	$ARIMA(3,1,2)$	-173.97	-160.15

Table 4: Unit Root Test Results of Volatility

Model with Constant and Trend Term				
	Level Form		Difference Form	
Variables	ADF test	PP test	ADF test	PP test
$\ln VLIR$	3.97	3.73	-2.56	-7.76***
$\ln VCMR$	-1.84	-2.05	-8.02***	-8.01***
$\ln VTDR$	-0.93	-2.18	-7.18***	-7.08***
$\ln VDR$	-2.23	-2.01	-10.65***	-10.69***
Model with Constant Term				
	Level Form		Difference Form	
Variables	ADF test	PP test	ADF test	PP test
$\ln VLIR$	4.32	4.18	-2.11	-7.45***
$\ln VCMR$	-1.30	-1.31	-8.03***	-8.03***
$\ln VTDR$	-2.53	-1.89	-7.20***	-7.16***
$\ln VDR$	0.20	0.20	-10.50***	-10.53***
Model without Constant and Trend Term				

	Level Form		Difference Form	
Variables	ADF test	PP test	ADF test	PP test
$\ln VLIR$	1.29	1.85	-1.89*	-7.19***
$\ln VCMR$	0.05	-0.01	-7.91***	-7.92***
$\ln VTDR$	1.43	-0.52	-7.25***	-7.21***
$\ln VDR$	2.05	2.05	-9.87***	-9.85***

***P<0.01; **P<0.05; *P<0.10: Significant at 1%, 5%, and 10% levels respectively.

From Table 2, we get all variables in I(1). We also get the conditional variances- $\ln VLIR$, $\ln VCMR$, $\ln VTDR$, and $\ln VDR$ in I(1). We also sketch the instability of lending rate, instability of T-bill rate, instability of deposit rate, and instability of call money rate in Figure 1(a), Figure 1(b), Figure 1(c), and Figure 1(d) respectively.

Figure 1(a): Volatility of lending interest rate

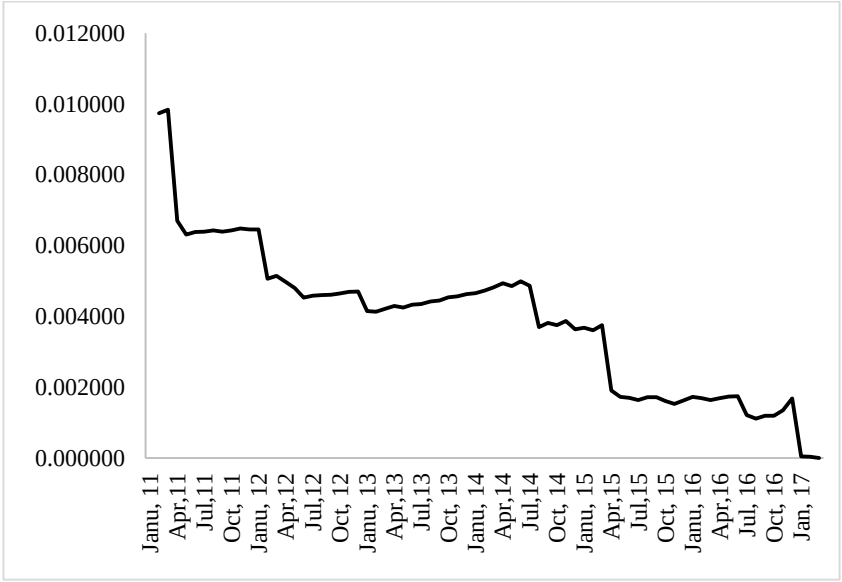


Figure 1(b): Volatility of T-bill discount rate

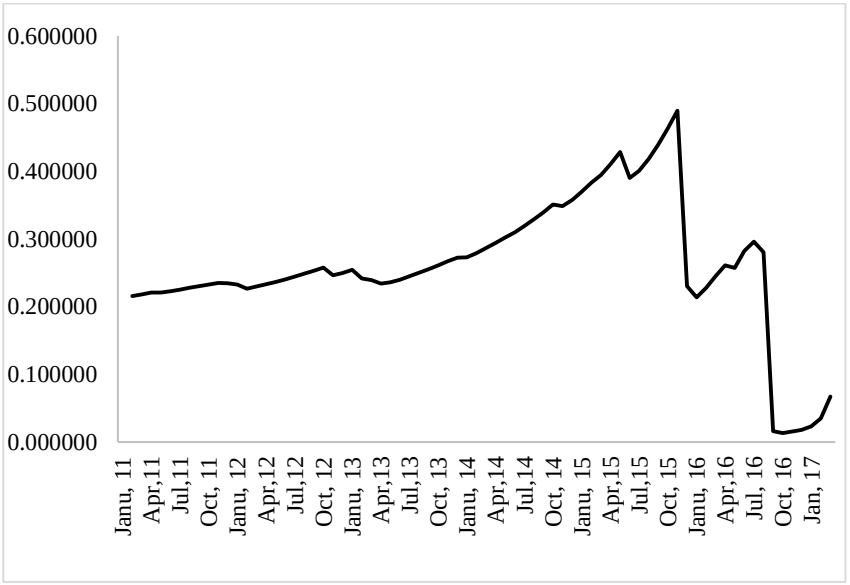


Figure 1(c): Volatility of deposit rate

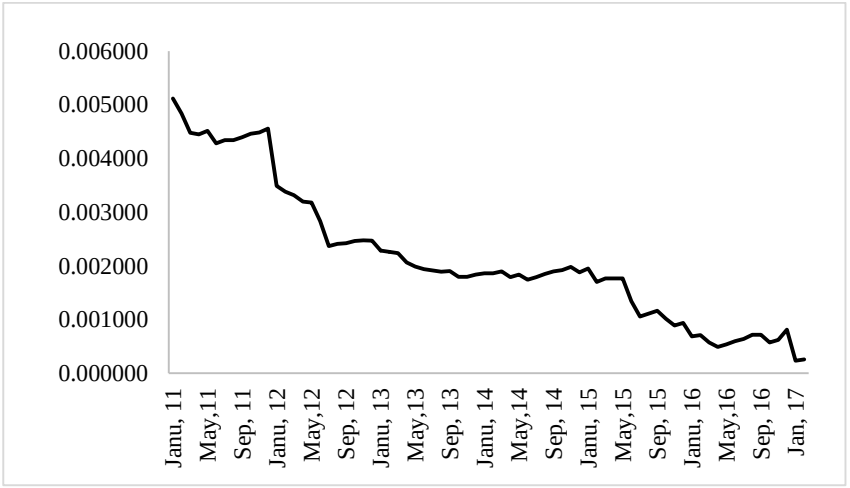
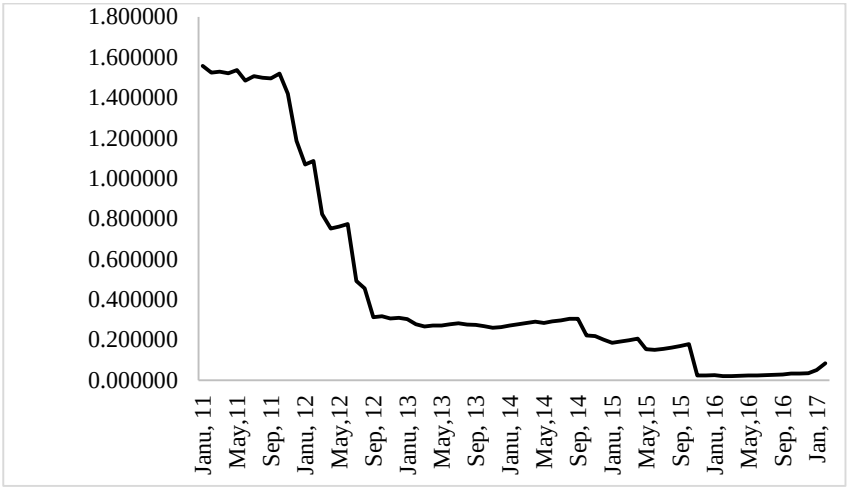


Figure 1(d): Volatility of call money rate



From Figure-1(a), Figure-1(c), and Figure-1(d), we can say that instability was higher in January 2011 and after that instability decreased. Instability of lending interest rate was close to zero (stable) from January 2017 to March 2017. In Figure-1(b), Instability of T-bill discount rate demonstrated an increasing trend from January 2011 to October 2015 and it stayed in peak in December 2015. After that there was a sharp decline up to January 2016 and a further increase of instability up to July 2016. Finally, instability declined and jumped to zero (stable) in August 2016 with an increasing trend thereafter. Instability in call money rate jumped to nearly zero (stable) from December 2015 to December 2016 with an increasing trend thereafter.

4.3 Short-run Dynamics

Table 5: Short run dynamics

Variable	Equation-6	Equation-7	Equation-8
Constant	-0.26*** (0.00)	-0.04 (0.31)	-
$\Delta lnVTDR$	0.37** (0.02)	-	0.19** (0.02)
$\Delta lnVDR$	-1.76*** (0.00)	-0.46* (0.06)	-
$\Delta lnM2$	10.05* (0.07)	-	-3.28* (0.09)

$\Delta lnVCMR$	-	0.31** (0.04)	-
$\Delta lnVLIR$	-	0.16* (0.06)	-0.06 (0.30)
$\Delta lnME$	-	0.57** (0.02)	-
F_{ARCH}	0.001 (0.97)	0.001 (0.97)	0.036 (0.85)
$F_{Autocorrelation}$	0.72 (0.40)	1.22 (0.27)	0.002 (0.96)

***P<0.01; **P<0.05; *P<0.10: Significant at 1%, 5%, and 10% levels, respectively.

From Equation-6, we can conclude that instability in T-bill rate has significant positive impact on the instability in lending rate. It can be deduced that the demand of risk free securities raises the money demand and the instability in T- bill rate. The raising money demand eventually increases the instability in lending rate. Instability in deposit rate has significant negative impact on the instability in lending rate. It can be deduced that decline in deposit rate instability in regulated environment increases the instability in lending rate due to the existence of income gap. Money supply has significant positive impact on the instability in lending rate. It can be said that expansionary monetary policy increases the instability in lending rate.

From Equation-7, we can say that the instability in call money rate has positive significant impact on the instability in T-bill rate. Call money rate reflects the liquidity position of banks. So, the fluctuations of call money rate alter the demand of T-bill which raises the fluctuations of T-bill rate. Instability in deposit rate has significant negative impact on the instability in T-bill rate. It occurs in the money market due to the existence of competitive environment. When deposit rate becomes more than T-bill rate, the demand of T-bill comes down among individuals, banks, and other institutional investors, resulting stability in T-bill rate. Therefore, the deposit rate fluctuations reduce the fluctuations in T-bill rate. Further, instability in lending rate has significant positive impact on the instability in T-bill rate. The demand of T-bill, risk free securities, may increase as long as the T-bill rate is higher than lending rate. Moreover, the increased interest rate motivates risk averse investors to go for risk free investment like T-bill. If there is no alternative to the T-bill in an economy like Bangladesh, the demand of the T-bill increases, driving the fluctuations of

T-bill rate. Lastly, increase in export in a growing economy creates the availability of funds for the export-oriented firms. More income would be generated from those firms. The excess income creates the channel to flow into T-bill, resulting the higher demand of the T-bill and lifting the fluctuations of T-bill rate.

From Equation-8, it can be concluded that instability in lending rate has not significant impact on the instability in call money rate. The stable lending interest rate in the competitive environment shows the strengthening liquidity position that reduces the demand for call money. The lower demand of call money lowers the call money rate fluctuations. So, the fluctuations of lending rate reduce the fluctuations of call money rate in the short run. Instability in T-bill rate has significant positive impact on the instability in call money rate. The increased demand of the T-bill lifts the fluctuations of T-bill rate and an increase in demand of T-bill also raises the fluctuations of call money rate. Lastly, money supply has significant negative impact on the instability in call money rate. The increase in broad money supply meets the liquidity mismatch in the economy. When the demand of money meets the supply of money, the fluctuations of call money rate reduce, the reduction that decreases the call money rate instability.

4.4 Temporal Causalities

Table 6. Temporal causalities

Equation 6

	$\ln VLIR$	$\ln VTDR$	$\ln VDR$	$\ln M2$
$\ln VLIR$	-	335.90*** (0.00)	27.88*** (0.00)	2.769 (0.83)
$\ln VTDR$	12.736** (0.04)	-	22.21*** (0.00)	10.86* (0.09)
$\ln VDR$	6.91 (0.32)	15.30** (0.01)	-	8.43 (0.20)
$\ln M2$	2.30 (0.89)	2.73 (0.84)	14.99** (0.02)	-

Equation 7

	$\ln VTDR$	$\ln VCMR$	$\ln VDR$	$\ln VLIR$	$\ln ME$
$\ln VTDR$	-	13.86** (0.03)	21.27*** (0.00)	26.78*** (0.00)	4.54 (0.60)

$\ln VCMR$	8.45 (0.20)	-	15.87** (0.01)	3.64 (0.72)	2.96 (0.81)
$\ln VDR$	27.27*** (0.00)	31.77*** (0.00)	-	13.14** (0.04)	12.32* (0.05)
$\ln VLIR$	234.18*** (0.00)	14.25** (0.02)	3.56 (0.73)	-	3.17 (0.78)
$\ln ME$	4.40 (0.62)	2.27 (0.89)	3.62 (0.72)	11.08* (0.08)	-

Equation 8

	$\ln VCMR$	$\ln VLIR$	$\ln VTDR$	$\ln M2$
$\ln VCMR$	-	1.895 (0.92)	4.09 (0.66)	3.65 (0.72)
$\ln VLIR$	39.96*** (0.00)	-	299.85*** (0.00)	4.48 (0.61)
$\ln VTDR$	13.47** (0.03)	14.17** (0.02)	-	11.79* (0.06)
$\ln M2$	10.74* (0.09)	2.22 (0.89)	6.41 (0.37)	-

***P<0.01; **P<0.05; *P<0.10: Significant at 1%, 5%, and 10% levels, respectively.

From Table-6, short-run bidirectional causality exists from instability in lending rate to instability in T-bill rate, from instability in deposit rate to the instability in T-bill rate, from the instability in deposit rate to the instability in lending rate, and from the instability in deposit rate to the instability in call money rate. Short-run unidirectional causality exists from money supply to the instability in T-bill rate, from the instability in deposit rate to money supply, from the instability in call money rate to the instability in T-bill rate, from export to the instability in deposit rate, from instability in call money rate to the instability in lending rate, from the instability in lending rate to export, and from the instability in call money rate to money supply.

5. Conclusion and Policy Implications

The money supply, deposit rate volatility, and T-bill rate volatility all significantly affect lending rate volatility. To control lending rate variations, policymakers should take the T-bill discount rate into account. In addition, banks and investors are able to comprehend the lending rate pattern. The variations in the lending rate are lessened by the variations in the deposit rate. Thus, deposit rate regulation can help policymakers reduce lending rate swings. The money supply significantly influences lending rate variations in a positive way. As a result, monetary policy can be established by policy makers to

regulate lending rates. Additionally, banks and investors can learn how changes in monetary policy affect lending rate swings. Therefore, it can be concluded that policy makers can take adequate precautions to control the large fluctuations of lending interest rate by considering the above impelling factors.

Instability in deposit rate, instability in call money rate, instability in lending rate, and export have significant impact on the instability in T-bill rate. Instability in deposit rate has significant negative impact on the instability in T-bill rate. Therefore, policy makers can regulate the fluctuations of deposit rate to control the T-bill rate. Besides, banks and investors can also take the opportunity of deposit rate fluctuations to buy, hold, and sell the T-bills. Instability in call money rate has significant positive impact on the instability in T-bill rate. Therefore, policy makers can increase or decrease the call money rate to meet liquidity mismatch of the banks and to control the flow of investment into T-bill. Occasionally, the government issues more debt securities to meet budget deficit. Central bank can decrease the call money rate to strengthen liquidity position of the banks and decrease the lending rate so that individuals, institutional investors, and banks can make more investment in T-bill. Furthermore, instability in lending rate has significant positive impact on the instability in T-bill rate. So, the policy makers can regulate the lending rate to control the large fluctuations of T-bill rate. Export has significant positive impact on the instability in T-bill rate. Therefore, the higher demand on the T-bill will rise due to availability of fund from the excess income of the export oriented firms, raising the instability in T-bill rate. In fine, policy makers can take adequate precautions to control the large fluctuations of T-bill rate by considering the aforementioned impelling factors.

At some point fluctuations in the money supply and T-bill rate have a big influence on the volatility of the call money rate. Policymakers can manage the oscillations of the T-bill rate in order to regulate the variations of the call money rate, as the former has a major beneficial impact on the latter. The call money rate's volatility is significantly impacted negatively by the money supply. Therefore, as part of monetary policy, policymakers can raise the broad money supply to stabilise or reduce the volatility of the call money rate.

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