

Forecasting Short-term Borrowing and Lending Rate in Inter-Bank Market

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Abstract

The call money rate or short-term inter-bank borrowing and lending rate is generally the rate that a large number of banks use to borrow and lend from one another in the overnight market for a short period of time. This study has been attempted to forecast short-term inter-bank borrowing and lending rate of Bangladesh up to 2021. The month-wise data for the years 1997-2013 has been used to forecast the rates for each month-wise of the next eight years. This data has been obtained from Bangladesh Bank. Box-Jenkins ARIMA model have been deployed to forecast the rates. During the period 1997 to 2013, data series shows that there were some differences in pattern of movement (trend) between borrowing rate and lending rate but after the end of 2006, the trend of rates are same. Results suggest that both the borrowing and lending rates indicate a cyclical pattern till 2013, it will be remained same till 2016 and after that fluctuation between the rates will be seen but at a slowly decreasing rate. In December 2014, short-term inter-bank borrowing rate will be at 7.78 and lending rate will be 7.82. In December 2021, short-term inter-bank borrowing rate will be lowest at 6.95 and lending rate will be 7.01. The study also recommends to provide appropriate environment through necessary incentives and facilities to the lenders and borrowers ensuring the removal of bottlenecks of money market.

Keywords : Call Money Rate, Overnight Money Rate, Call Money Market, ARIMA, Forecasting, Time series, ADF, Box-Jenkins

JEL Classification : C22, C32, C53, E52

1. Introduction

1.1 Background of the Study

With economic reforms and financial liberalization, Bangladesh started to put greater reliance on a market based financial system since the early 1990s. Overtime, among others, administered interest rate structures have been abolished and deregulation in the banking sector has taken place (Shahiduzzaman & Naser, 2007). Accordingly, Bangladesh Bank (BB), the central bank of Bangladesh, started reinforcing indirect monetary policy operations, namely repo (repurchase agreement), reverse repo, interbank repo and floating exchange rate system. Through the passage of time, an increasing focus has also been given to monitor the day-to-day activities in the short-term inter-bank borrowing and lending market or call money market in order to pursue a prudent monetary policy by the

central bank. Theoretically, call money market is the institutional arrangement where short-term funds flow from banks and other financial institutions holding excess liquidity to banks and financial institutions in need of immediate funds without any collateral security. There are various reasons why central banks around the world pay greater attention to the stability of the call money market. It is generally viewed that the uncertainty caused by volatility in the call money rate gives confusing signals to the market participants about the stance of the monetary policy. In addition, as other interest rates in the money market come with different lags, it is the call money rate, which the central bankers and market participants can monitor on a daily basis. In a market, where call money rates fluctuate from a very high to a very low end, market players, especially banks, are encouraged to keep higher excess reserve than under normal situation to meet the uncertainties and can even be reluctant to purchase near cash assets like bills and bonds from the primary market. The situation exacerbates if there is no active secondary market for bills and bonds where banks can easily convert those to cash reasonably quickly. In such a situation, Open Market Operations (OMOs) conducted by the central may not be such effective as to influence the excess liquidity in the market.

Call money rate for overnight transactions reflects the demand for and supply of liquidity in the market. Therefore, the use of monetary policy instruments to influence the liquidity position in the market places a substantial impact on the rate. A common objective of the central bank's monetary policy is thus to minimize the persistent deviations of the call money market rates. It is therefore expected day-to-day implementation of monetary policy would be linked to the stability of the call money market rate. On the other side, if market participants find that the central bank's operational measures can effectively control the movement of market rates then they incorporate the belief into their demand. Obviously, the success of this process depends on the effectiveness of the transmission channel of the interest rates. However, if such success holds, credibility of the central bank would be enhanced, which further helps policy measures to become more effective. It is also argued that central banks can use open mouth operations (signaling) rather than any actual interventions to keep market rates at a target level, if such credibility holds (Guthrie & Wright, 2000).

Given the above reasons, there is a common objective of a central bank's operational policy to minimize the persistent deviations of the overnight money market rate(s) from its policy rates. This study forecasted the future pattern of short-term inter-bank borrowing and lending rate till 2021, which will take us to the 50th anniversary of our independence¹. In order to do so, the time series pattern of both the rates between the periods 1997 to 2013 on a monthly basis with 204 observations have first been examined. Having investigated this pattern, empirical models for both the rates have been created for capturing the feature of the data. The empirical results presented in the paper have important implications for monetary policy.

1 Bangladesh Government has chalked out Vision-2021 program aiming to elevate the country as a middle-income country over the next decade.

1.2 Objectives of the Study

The paper is an attempt to identify the following two research questions, one, to show the trend pattern of short term inter-bank borrowing and lending rate based on month-wise data for the period 1997-2013 and two, to forecast short term inter-bank borrowing and lending rate over a period 2014-2021.

2. Literature Review

As money became a commodity, the money market became a component of the financial markets for assets involved in short-term borrowing, lending, buying and selling with original maturities of one year or less (Wikipedia). According to Akhtaruzzaman et al. (2005), the five distinct components under the organized segment of money market in Bangladesh are: Inter-bank Market, Call Money Market, Bill Market, Repo Market, and Reverse Repo Market. Among them, inter-bank call money market is very important for the financial institutions for their required fund management. Short-term inter-bank borrowing and lending rate are actually termed together as Call money Rate or Call Money Rate or Overnight Money Rate or Overnight Call Money Rate or Broker Loan Rate or day-to-day Money Rate or Islamic Inter-bank Fund Market (IIFM).

Bangladesh Bank (BB), the central bank of Bangladesh, has introduced a new call money market, Islamic Inter-bank Fund Market (IIFM), for shariah-based banks and financial institutions. BB laid out a set of rules, according to a statement released. The decision to introduce the IIFM has been taken to discipline the liquidity management of all shariah-based banks, financial institutions and Islamic banking branches of the traditional financial institutions and banks operating in Bangladesh. It is said that the transactions would be based on profit instead of interest. According to the rules, if a bank has excess funds, it will invest the amount in the IIFM for a day, allowing another cash-starved Islamic bank to borrow for the same period (The Daily Star, 2011).

According to Sarker (1999), it is generally observed that Bank Rate has a significant impact on the movement of transaction in call money market and the interest rate associated with it. In general, call money rate varies directly with the movement of Bank Rate but transaction varies in different direction. It is also noticed that though the Bank Rate remained fixed for a considerable period of time, the rates of interest in call money market fluctuated significantly. Therefore, it may be assumed that many factors other than Bank Rate contribute to the fluctuations of transaction and rate of interest in this market. The major factors that can be held responsible for the movement of the transactions in call money market and the rates of interest associated with it are as follows: Economic Activity, Delay in Getting Loan from the Central Bank, Attitude of the Central Bank, Availability of Loanable Fund, Maintenance of Banker-customer Relationship and Avoidance of Penalty from Central Bank Sarker (1999).

The primary money market of Bangladesh is comprised of banks, Financial Institutions (FIs) and primary dealers as intermediaries and saving and lending instruments, treasury bills as instruments. There are currently 15 primary dealers (12 banks and 3 FIs) in Bangladesh. The only active secondary market is overnight call money market which is participated by the scheduled banks and FIs. The money market of Bangladesh is regulated by BB, the central bank of Bangladesh (BB Website).

Overnight rate refers the interest rate at which a depository institution lends immediately available funds (balances within the central bank) to another depository institution overnight. Overnight means 24 hours. Theoretically in Bangladesh, loan is taken for 24 hours but practically its goes for more than one day and maximum 7 days. All listed banks and financial institutions are participated in this system. Bangladesh Bank does not fix its rate. Its rate depends on demand and supply of the money market. The demand of call money is high sometimes seasonally especially in Eid Festival.

In recent years, the inter-bank call money rate remained almost stable as there was injection of fresh funds by the central bank in the market ahead of the Eid-ul-Fitr. The central bank sometimes injects fresh funds through purchasing US Dollar from the commercial banks directly and some banks are selling their excess foreign currency to the central bank and receive local currency that is being used in the money market before the Eid festival. The short-term borrowings normally increase before the Eid festival for meeting the growing demand of bank clients. The central bank continues its intervention in the inter-bank foreign exchange market through buying of US currency directly from the commercial banks aiming to keep the market stable (The Financial Express, 2009).

According to Alam (2013), though the demand for cash increased in the banks and Non-Bank Financial Institutions (NBFIs) ahead of the Eid-ul-Fitr, the inter-bank call money rate remained steady. The call money rate is the interest rate that banks charge other banks or financial institutions on overnight loans. The banks borrow funds from other banks to finance the shortfall created during festival-time demand. Usually, the call money rate experiences an abnormal rise ahead of two major festivals, the Eid-ul-Fitr and the Eid-ul-Azha. "Of the total amount, some amount of money has been injected into the banking sector by the central bank. The remaining amount was meant to replace with the mutilated notes. However, BB statistics shows that the banks and NBFIs transact at a call money rate. Meanwhile, commercial bank branches in the city and elsewhere witness a rush of customers withdrawing cash before Eid. Bank managements take preparations in advance before Eid to meet the demand for cash to mark the Eid. Besides, managements of different banks stock adequate cash to be posted in the Automated Teller Machine (ATM) booths time to time to facilitate cash withdrawal. But sometimes the demand for taka soars ahead of the Eid, but fails to make much impact on the currency market, as call money rates does not significantly increase. Bankers are not attaching any significance to the meagre one to one-and-half percent rise in the call money rates because they think it is normal.

Considering that the last banking day ahead of Eid, the rush for the cash withdrawals from the bank are huge. But that does not push up the call rate very much. For various reasons there is adequate liquidity in the market. The Bangladesh Bank has been helping the commercial banks to maintain the cash flow by offering special repos. This has stabilized the currency market (Abdullah, 2013). According to a Bangladesh Bank statement, during the first five days of the current month, the Central Bank has boosted circulation of money by Tk. 35.34 billion. Updated statement of the Bangladesh Bank showed a banking sector surplus of Tk. 720 billion. Of this, Tk. 500 billion was invested in various government bills and bonds. Banks were free to invest the remaining around Tk. 220 billion, but it could not do so for weak demand. Due to the surplus cash in the banks, the demand for call money is less in 2013. That is why even the interest rate is stable. Three years ago, on December 19, 2010, banks and other financial institutions had to borrow money at a whopping 190 percent interest due to acute shortage of cash. From since last year the situation has turned for the better with call money rates stabilizing between 7 to 12 percent. However, it had increased to 18 to 20 percent ahead of Eid. In 2013, it is truly stable even in the festive season – another indication of Bangladesh's economic stability in the midst of uncertain, fractious politics (www.bdnews24.com).

Bangladesh Bank has recently issued a circular to submit Net Asset Particulars only through online to the Department of Financial Institutions and Markets within 25 January and 25 July DFIM Circular Letter No. 7, dated September 1, 2013. Financial institutions have to submit Net Asset Particulars due to account of the limit of borrowing credit from call money market (Highest limit of Net Asset is 15%).

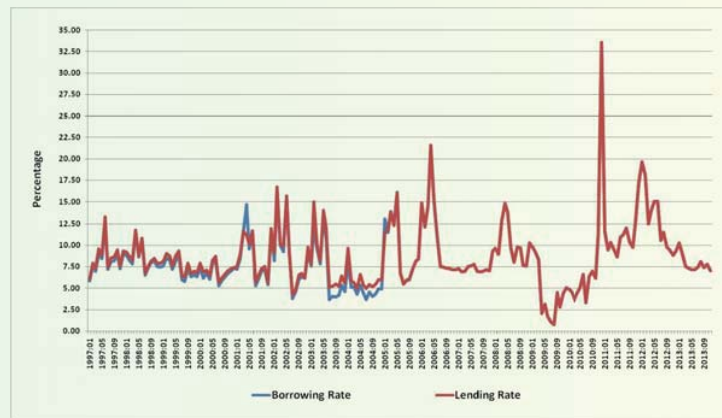
3. Data and Methodology

The data of this article is collected from Bangladesh Bank, Monthly Economic Trend, Various Issues. The information of the study is based on both qualitative and quantitative data. Qualitative data was compiled by computer program such as MS Word. Quantitative data is analyzed by Eviews-7.1 software and MS Excel. This study has been adopted the methodology of Box-Jenkins using ARIMA models and Augmented Dickey Fuller (ADF) for Unit Root Test. The article is divided into different sections. After introductory section, second chapter reveals the literature review. The third section shows the methodology of the study. The fourth, fifth and sixth sections are the analysis parts. Fourth section expresses the trend of short-term inter-bank borrowing and lending rate. The fifth section formulates the models. The sixth chapter forecasts the rates. The seventh section includes recommendations and concluding remarks.

4. Data Plotting and Analysis

Based on data, at first the author has tried to plot these data in a line curve (Figure-1) and tried to understand the types of trend pattern.

Figure-1: Monthly Short-term Borrowing and Lending Rate in Inter-Bank Market for the Period 1997-2003



Source: Authors' Calculation.

Figure-1 shows cyclical components of time series analysis with little seasonal factors. The series of Figure-1 displays no trend. It does, however, appear highly serially correlated. There is some seasonality in this series also. Basically, Eid festival is the season when most fluctuations are seen in our country. But the month of Eid is not fixed as it is decided based on moon. According to Naser & Shahiduzzaman (2009), month-by-month analysis for the period 1997 to 2007 suggests that call rates have an upward trend starting from March to June. Thereafter, a gradual downward movement sets in up to November. After a brief slowdown, the rates again move up for the month in December for the practice of 'window dressing' by the commercial banks. But after those periods, it has a reverse trend. Figure-1 reveals that the call rates have been highly volatile reflecting some noise and brisk activities in the money market, resulting from the pressure in the foreign exchange market and tight liquidity situation in the money market (Bangladesh Bank, Annual Reports, Various Issues, Chapter 6). According to Bangladesh Bank, Monetary Policy Statement (January- June 2014), Call money rates have leveled off and average retail interest rate spreads have fallen below 5%. Call money rates have declined since their peaks in early 2012 when they were around 20%, and also fell in H2FY13 from around 10% in January 2013 to around 7% in June 2013. They have since leveled off ranging from around 7-8% in H1FY14.

5. Model Identification and Analysis

To uncover the hidden structure as well as to forecast short-term inter-bank borrowing and lending rate, the following equations have been taken into consideration in this work:

$$B_t = \alpha + \beta_p B_{t-p} + \theta_q \varepsilon_{t-q} + \lambda D_t + \varepsilon_t \dots\dots\dots (i)$$

Where,

- B_{t-p} = Borrowing Rate at Period t-p
- ε_t = Random Error Term at Period t
- ε_{t-q} = Random Shock at Period t-q
- D_t = Dummy Variable, where $D_t=1$ if time is month of Eid and 0 otherwise
- p = AR Model
- q = MA Model
- t = Present Period
- $\alpha, \beta_p, \theta_q$ and λ are Parameters to be Estimated.

$$L_t = \alpha + \beta_p L_{t-p} + \theta_q \varepsilon_{t-q} + \lambda D_t + \varepsilon_t \dots\dots\dots (ii)$$

Where,

- L_{t-p} = Lending Rate at Period t-p
- ε_t = Random Error Term at Period t
- ε_{t-q} = Random Shock at Period t-q
- D_t = Dummy Variable, where $D_t=1$ if time is month of Eid and 0 otherwise
- p = AR Model
- q = MA Model
- t = Present Period
- $\alpha, \beta_p, \theta_q$ and λ are Parameters to be Estimated.

Both the above equations are nothing but ARIMA models, which are developed by Box & Jenkins (1976). Since then, this model has gained enormous popularity due to its versatility in many areas in business and in economics in particular. Here dummy variables are used in both the models. Generally, there is no significant seasonality is seen in these data series, but there are some significant fluctuations also in these series. As it is a rare case, that's why dummy variables are used here and Holiday Variation which is one type of calendar effect of measuring seasonality due to Eid festival. Because of this, an "Eid Dummy" is used here which is 1 if the month contains Eid and 0 otherwise.

From the line graph (Figure-1), we see a time series of short-term inter-bank borrowing rate that is non-stationary in both mean and variance. After plotting the data series through E-views 7.1, the Autocorrelation Function (ACF) and Partial Autocorrelation Function (PACF) also indicate that the time series is non-stationary as there is a significant spike at ACF at lag 1, and then slowly declined. The PACF also shows that it has also spike at lag 1. Therefore, it can again be conclude that the time series is non-stationary. Taking the first difference of the data gives the series of monthly changes. Now the series looks just like a white noise series, with almost no autocorrelations or partial autocorrelations outside the 95% level. Now it is clear that the ACF and PACF at first difference series have no significance spikes at any lags. Thus, ARIMA models with first difference are recommended for the time series. We see that after taking first order difference, the absolute value of ADF test statistics (-13.69) is greater (in absolute terms) than the critical “tau” (in absolute terms) -2.58, -1.94, -1.62 at 1%, 5% and 10%, respectively. Therefore, we can conclude that the values of series are stationary at first difference and the first differenced time series can be used for forecasting. The Durbin-Watson statistics is significant at 2.03. In order to find the values of the model coefficients which provide the best fit to the data and testing the assumptions of the model to identify any areas where the model is inadequate. Then, we can construct the ARIMA model as following steps.

Table-1: Value of the Model Coefficients for Short-term Inter-bank Borrowing Rate

ARIMA Model	BIC	Adjusted R ²	SEE
1;1;1	5.120800	0.184868	3.032917
1,7;1;1	5.160226	0.178107	3.057586
1,2;1;1	5.141696	0.189310	3.031905
1,2,7;1;1	5.177555	0.181698	3.050900

Source: Authors’ Calculation.

Schwarz Criterion (BIC) has achieved the smallest values for model (1;1;1) compared with other models, this would prove that (1,1,1) is the optimal model for forecasting. So, the model of short-term inter-bank borrowing rate can be written as:

$$B_t = \alpha + \beta_1 B_{t-12} - \theta_1 \varepsilon_{t-12} + \lambda D_t + \varepsilon_t \dots\dots\dots (i)$$

Where,

B_{t-12} = Borrowing Rate at Period t-12 for AR(1) Model

ε_{t-12} = Random Shock at Period t-12 for MA(1) Model

D_t = Dummy Variable

ε_t = Random Error Term at Period t

$\alpha, \beta_1, \theta_1$ and λ are Parameters to be Estimated.

Similar procedures are also followed for short-term inter-bank lending rate as its data series is also looked like borrowing rate. After taking first order difference of lending rate, the absolute value of ADF test statistics (-13.98) is greater (in absolute terms) than the critical “tau” (in absolute terms) -2.48, -1.94, -1.62 at 1%, 5% and 10%, respectively. The Durbin-Watson statistics is significant at 2.03. Now we can construct the ARIMA model as following steps.

Table-2: Value of the Model Coefficients for Short-term Inter-bank Lending Rate

ARIMA Model	BIC	Adjusted R ²	SEE
1;1;1	5.106277	0.191979	3.010973
1,2;1;1	5.097516	0.219878	2.965664
1,2,7;1;1	5.160322	0.186873	3.024725

Source: Authors’ Calculation.

Schwarz Criterion (BIC) has achieved the smallest values for model (1,2;1;1) compared with other models, this would prove that (1,2;1;1) or (1,1,1) [smallest AR] is the optimal model for forecasting. So, the model of short-term inter-bank borrowing rate can be written as:

$$L_t = \alpha + \beta_1 L_{t-12} + \theta_1 \varepsilon_{t-12} + \lambda D_t + \varepsilon_t \dots\dots\dots (ii)$$

Where,

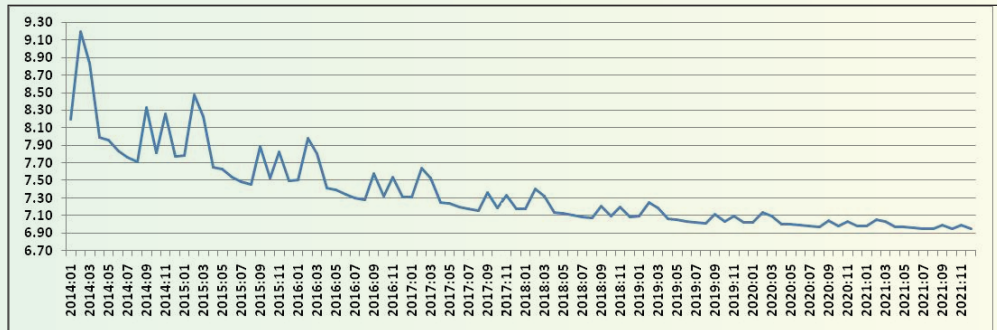
- L_{t-12} = Lending Rate at Period t-12 for AR(1) Model
- ε_{t-12} = Random Shock at Period t-12 for MA(1) Model
- D_t = Dummy Variable
- ε_t = Random Error Term at Period t
- $\alpha, \beta_1, \theta_1$ and λ are Parameters to be Estimated.

6. Forecasting

6.1 Forecasting Short-term Inter-bank Borrowing Rate

Bangladesh has been experiencing a relatively moderate but sustained short-term inter-bank borrowing rate in recent years. This study has found that this trend will not sustain in the every month of next 8 years as we see the trend has downward gradually with cyclical fluctuations at a certain rate (in between 9 to 6) as there are still seasonal factor of the month of Eid festival (Figure-2). All the forecasted values of every month of next eight years (up to 2021) are shown in Appendix-1 which is shown with following line curve.

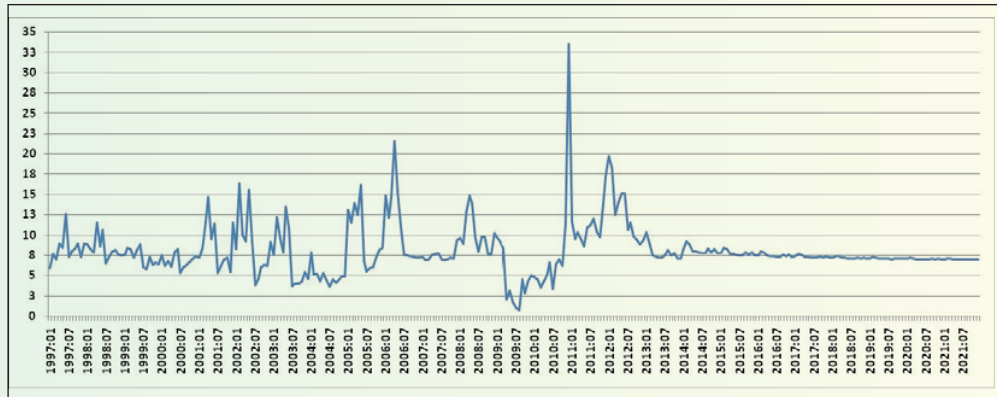
Figure-2: Forecasted Short-term Inter-Bank Borrowing Rate for the Period 2014:01 to 2021:12



Source: Author's Calculation

In Figure-3, we see the history of short-term inter-bank borrowing rate of Bangladesh starts through 1997, together with the out-of-sample point and 95% interval extrapolation forecasts for the next 96 months begins through 2014. The forecasts look reasonable; the model has evidently done a good job of capturing the cyclical patterns with some seasonal factors.

Figure-3: Short-term Inter-Bank Borrowing Rate: History (1997:01-2013:12) and Forecast (2014:01-2021:12)



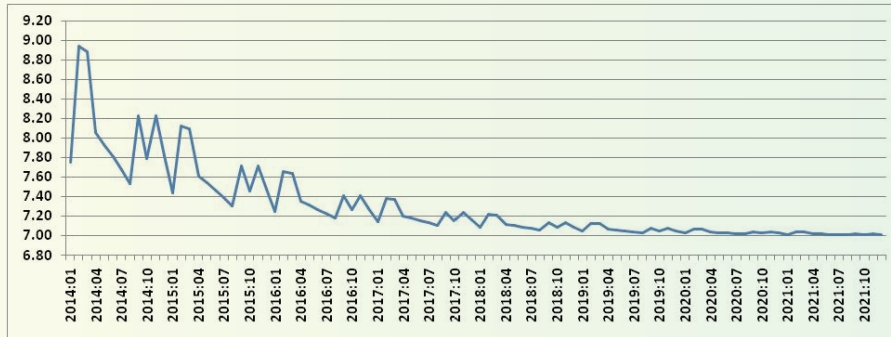
Source: Author's Calculation

6.2 Forecasting Short-term Inter-bank Lending Rate

Bangladesh has also been experiencing a relatively moderate but sustained short-term inter-bank lending rate like borrowing rate in recent years. This study has found that this trend will not sustain in the every month of next 8 years as we see the trend has downward gradually with cyclical fluctuations at a certain rate (in between 9 to 6) as there are still

seasonal factor of the month of Eid festival (Figure-4). All the forecasted values of every month of next eight years (up to 2021) are shown in Appendix-2 which is shown with following line curve.

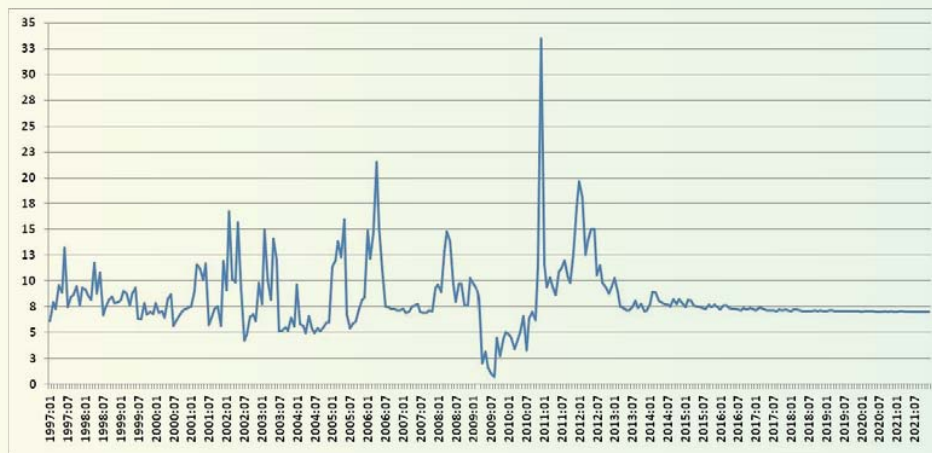
Figure-4: Forecasted Short-term Inter-Bank Lending Rate for the Period 2014:01 to 2021:12



Source: Author's Calculation

In Figure-5, we see the history of short-term inter-bank lending rate of Bangladesh starts through 1997, together with the out-of-sample point and 95% interval extrapolation forecasts for the next 96 months begins through 2014. The forecasts look reasonable; the model has evidently done a good job of capturing the cyclical patterns with some seasonal factors.

Figure-5: Short-term Inter-Bank Lending Rate: History (1997:01-2013:12) and Forecast (2014:01-2021:12)



Source: Author's Calculation

7. Recommendations

From the past and future behavior in the short-term inter-bank borrowing and lending market, it may be concluded that the need for additional inflow of cash may arise from different reasons. One bank cannot expect what is going to be happened in the other bank at a particular period of time due mainly to bilateral negotiations among the financial institutions. The situation is almost uncontrollable for any bank which feels the need of additional inflow of cash. Under the circumstances, banks need to come to central bank for soft lending like discount loan, repo facilities etc. But central bank has some limitations regarding outflow of money due mainly to keep the price level stable. Therefore, the banks/NBFIs have no other way but to borrow their necessary fund from the inter-bank money market at a high rate of interest which may help the market to be volatile. But to keep the these rates at a reasonable level, central bank has already advised the NBFIs to avoid their high dependency on call money market and also advised to seek their required fund through credit line, mortgage-based securitization, asset securitization, etc. as the substitute source of call money market for their long-term fund. Accordingly, it has been decided that all registered Financial Institutions (FIs) will be allowed to borrow money maximum 15% of their net asset from the call money market. Therefore, all FIs should keep the level of their borrowing from call money market at 15% (maximum) of their net asset. Besides these, we may recommend the following policy options:

1. Prudential guidelines may be issued for the participants so that the call money market should be perfectly competitive. For example all banks/NBFIs having excess cash reserve, should have willingness to participate in the inter-bank call money market for lending their fund.
2. Prudential guidelines may also be made for the utilization of money from inter-bank money market. Banks and NBFIs should mention the purpose of borrowing money from the call money market in their daily statements. In this regard, penalty may be charged for the banks those have taken the opportunities of borrowing money at a low interest rate and lend it to other banks/NBFIs at a high interest rate during the same period.
3. A strong data base on call money information (including daily database, the name of borrower and lender; bank-wise highest, lowest and weighted average interest rates on borrowing and lending; bank-wise amount of borrowing and lending etc.) along with a monitoring cell may be formed by the central bank for close monitoring of the movement of call money market etc.
4. To eliminate unofficial money broking business by the banks, a money broking house/company may be established.
5. The central bank can consider soft lending through its repo operations for those banks and NBFIs who are financially weak.

8. Concluding Remarks

The main objectives of this research paper were to forecast short-term inter-bank borrowing and lending rate till 2021. From this study, it is found that the short-term inter-bank borrowing and lending rate will be fluctuated at a slowly decreasing rate which highlighted the fact that during the entire forecasted period, there will be balance between supply and demand of credit in the call money rate and thus it will ensure smooth pace of investment and the country has a probability to maintain the current growth rate of these rates under money market operation.

Several important lessons emerge from the study for the market players, including the policy makers. The results suggest that Bangladesh Bank can influence the call money rate both through its conduct of the monetary policy and through the market structure that it creates through setting reserve requirements. Regarding the adoption of various indirect operational arrangements in recent years by BB namely, repo and reverse repo, both the repo and reverse repo operations can significantly influence the movement in the market clearing rates. Banks of Bangladesh will gain own solvency that inter-bank transactions will be less and only those will be happened during major crisis of liquid money. Bangladesh will succeed to be a middle-income country by 2021 which actually the target of the Vision 2021.

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