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Identifying the Determinants of Banks' Liquidity and Analyzing Its Forecasting Technique in the Context of Bangladesh

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Abstract

The central bank's sound liquidity management is crucial for the stability of the financial system as well as the overall economy of any country, including Bangladesh. Identifying the core component of banks' liquidity and its determining factors from the central bank's point of view is important in this context. In addition, identifying the proper liquidity forecasting technique is essential for sound liquidity management. This study attempts to identify these factors with regard to Bangladesh. It is found that excess reserves (total reserves with the Bangladesh Bank minus required reserves) are the most liquid assets of banks. There are two types of determining factors for excess reserves. These are autonomous factors (net foreign assets, claims on government, currency in circulation, and net other items) and policy factors (net claims on banks and required reserves). Bangladesh Bank cannot directly control the autonomous factors, but the policy factors can be controlled through applying the monetary policy instruments like reserve ratio, repo facilities, and Bangladesh Bank bills. In this context, BB needs to know how much liquidity should be injected/mopped up from the market on a daily basis. Proper liquidity forecasting is the only way to find this idea. Therefore, the Monetary Policy Department (MPD) of BB Head Office forecasts the banks' liquidity every morning for the next five working days. MPD basically forecasts the autonomous factors to forecast the overall liquidity situation. To forecast the autonomous factors, MPD uses the moving average method, the judgmental approach, and adjustments of seasonal and festival impacts on the trend values of these autonomous factors. This study finds the positive impacts of liquidity forecasting on liquidity management. However, to enhance the effectiveness of liquidity forecasting, this study seems to extend the forecasting horizon up to the reserve maintenance day. Regarding the forecasting technique, this study suggests that MPD should apply the econometric technique, like the ARMA model, particularly for the currency in circulation. In addition, MPD should take help from the Forex Reserve and Treasury Department of the BB Head Office and the Ministry of Finance in forecasting the net foreign assets and net claims on the government, respectively.

Keywords: Liquidity Forecasting, Liquidity Management, Open Market Operations.
JEL Classification: E4

1 Introduction

The term 'liquidity' refers to the ease with which an asset can be converted into ready cash or any other asset without affecting its market price. This term is commonly used to describe how quickly an asset can be bought or sold. Therefore, currency in the form of both notes and coins is considered the most liquid asset of an economy. The total liquid assets of an economy are held in the hands of the public (i.e., individuals, institutions, including government, and organizations) as well as in the banking system.

Though the currency held outside the banking

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Table 1: Liquid Assets at the End of December 2024

Public Liquid Assets		**Banks' Liquid Assets**	
Components	**Taka (Billion)**	**Components**	**Taka (Billion)**
Currency outside Banks	2,764	Cash in tills	284
Demand deposits	1,980	Excess reserves with BB (LCA)	935
Time deposits	15,788	Reserves with BB (FCA)	1
		Reserves with BB (IRFA)	1
		Reserves with chests of SB	28
		Nostro A/C balances	0
		Investments in GS	3,779
Total Public Liquid Assets (M2)	**20,532**	**Total Banks' Liquid Assets**	**5,028**

Source: Bangladesh Bank.
Note: M2 = Broad Money; LCA = Local Currency Account; FCA = Foreign Currency Account; SB = Sonali Bank PLC; GS = Government Securities, including Islamic bonds such as Bangladesh Government Islamic Investment Bonds and Sukuk bonds.

system (central bank plus commercial banks) is treated as the total liquid assets of the public, the public deposits to commercial banks are also considered as liquid assets of the public, as they can be converted into cash or any other assets almost easily. Therefore, in a broader sense, the total liquid assets of the public are broad money, which consists of currency outside banks and the total public deposits in banks.

With regard to banks' liquidity, it is the sum of banks' local currency reserves with their own vault, called cash in tills, as well as their excess reserves with the Bangladesh Bank (BB). In addition, the banks' local currency reserves with the chest branches of Sonali Bank (where those chest branches work as representative of Bangladesh Bank), foreign currency reserves with the branches of Bangladesh Bank, investments in government securities, nostro A/C balances, and the Islamic Bank's local currency balance in the Islamic Refinance Fund Account (IRFA) maintained in BB are also considered the banks' liquid assets in a broader sense. Now, the major components of public liquid assets as well as banks' liquid assets are shown in Table 1.

Among the two types of liquid assets mentioned above, the banks' liquid assets, particularly the banks' reserves with BB (LCA), are very important to the Bangladesh Bank as it largely influences the stability of the banking system and the implementation of monetary policy. The banks' reserves with BB (LCA) or banks' excess reserves with BB (LCA) reflect the position of the banks' liquidity.

Bangladesh Bank is always eager to manage the position of banks' liquidity necessary for achieving its monetary policy goals—price stability, higher economic growth, and stability in the financial system. Both the excess and the shortfall of banks' liquid assets are undesirable for the financial system of any country. The excess liquid assets are created due to low investment opportunities, and they indicate an inefficiency of the banking industry. The excess liquidity weakens the banking industry by reducing its profitability. On the other hand, the shortfall of liquid assets reduces the public's reliability on the banking industry and causes harm to the overall economy. In this context, it is mentionable that the recent liquidity crises in some private commercial banks have threatened the overall Bangladeshi economy.

To manage this liquidity position, Bangladesh Bank uses several monetary policy instruments like open market operations, change in reserve ratio, etc. To use the policy instruments rightly, it is very important to forecast

the banks' liquidity position properly. Because the liquidity forecasting helps the central bank to decide how much liquid assets, particularly cash, it needs to inject into or withdraw from the banking system on a day-to-day basis with a view to smoothing its undesirable fluctuations that could distort the implementation of monetary policy and create volatility in the financial system. That means liquidity forecasting is necessary for a central bank's sound liquidity management, which is essential for the proper implementation of a country's monetary policy and ensuring financial sector stability.

With regard to monetary policy, the main objective of a central bank is to maintain the internal and external par value of domestic currency, i.e., the domestic price level and exchange rate of domestic currency, in order to foster the growth and development of the country. Usually, public liquid assets, which can broadly be defined as broad money (M2), influence the domestic price level and exchange rate of domestic currency. Because of this, the central bank is always very eager to control the money supply under any type of monetary policy strategy to achieve its prime objective, i.e., price stability. Generally, the central bank uses the monetary aggregate (broad money, M2), interest rate, or exchange rate as a nominal anchor (intermediate target) of monetary policy for achieving its prime objective. Bangladesh Bank (BB), the central bank of Bangladesh, used M2 as an intermediate target of monetary policy until June 30, 2023. Thereafter, BB uses the short-term interest rate (i.e., the weighted average interbank call money rate) as a nominal anchor of monetary policy to achieve its prime objectives.

Under the monetary targeting strategy (the broad money target), reserve money, which has a multiplier effect on broad money, was the operating target of BB's monetary policy. That is why the BB controlled the reserve money in order to control the broad money. The reserve money consists of two major components: currency in circulation and banks' reserves with BB. BB cannot directly control the currency in circulation as it depends on public choice, but BB can directly control the banks' reserves. As a result, BB forecasted the banks' reserves, or specifically the excess reserves, on a daily basis for sound liquidity management. This forecasting of bank reserves or excess reserves is called liquidity forecasting, as the terms bank reserves and liquidity are used interchangeably in the existing literature (Borio, 2000).

Although BB switched from a monetary-targeting to an interest rate-targeting monetary policy regime in July 2023, the significance of liquidity forecasting and liquidity management has increased over the years. Therefore, BB has been continuing its existing liquidity forecasting practice, which was formally started in 2002. BB has a specific liquidity forecasting framework under which it collects daily data on different factors that influence the banks' reserves regularly. The factors that influence the position of bank reserves are divided into autonomous factors and policy factors. Among these factors, BB forecasts mainly the movement of autonomous factors by using different forecasting techniques in order to forecast the position of banks' liquidity.

In this backdrop, it is very important to identify the factors that influence banks' liquidity and analyze the liquidity forecasting techniques applied in BB. It is also very important to analyze the liquidity forecasting techniques applied in other central banks in order to find out the best option for the Bangladesh Bank. Moreover, it is very important to analyze the significance of daily liquidity forecasting on liquidity management, which is necessary for the proper implementation of monetary policy. But the existing studies do not emphasize such a type of analysis, particularly with regard to Bangladesh. Actually, the existing studies emphasize more on the operational framework of liquidity management and implementation of monetary policy for a particular country.

Therefore, this study attempts to fill such a deficiency and explore the more appropriate liquidity forecasting techniques that might be helpful for sound liquidity management in Bangladesh.

1.1 Objectives of the Study

The main objective of this study is to identify the key determining factors of banks' liquidity and its forecasting techniques, necessary for sound liquidity management in the context of Bangladesh. Therefore, the specific objectives of this study are:

- To identify the factors that determine the movement of key items of banks' liquidity in the context of Bangladesh.
- To analyze the necessity of liquidity forecasting, and identify the appropriate forecasting techniques in the context of Bangladesh.
- To analyze the impact of liquidity forecasting and liquidity management on the real economy of Bangladesh.

1.2 Scope of the Study

This study basically follows a descriptive research technique that links up economic theory with the practice of Bangladesh Bank with respect to liquidity forecasting and liquidity management. It explores the liquidity forecasting techniques and tools can be used in the context of Bangladesh. It analyzes the impact of liquidity forecasting and liquidity management on the real economy of by using descriptive statistical tools like tables and charts. This study collects relevant data and information mostly from domestic secondary sources, including the Bangladesh Bank and the Bangladesh Bureau of Statistics.

1.3 Structure of the Study

Regarding the structure of this study, Section 1 clearly describes the background, objectives, and methodology of this study. Section 2 reviews the existing literature related to liquidity forecasting and liquidity management. Section 3 identifies the factors that influence the banks' liquidity. The liquidity forecasting technique appropriate for the Bangladesh context is discussed in Section 4. Section 5 analyses the impact of liquidity forecasting and liquidity management on the real economy of Bangladesh. Finally, the concluding remarks are expressed in Section 6.

2 Literature Review

Studies that elaborately identify the determining factors of banks' liquidity and their forecasting technique are very limited in the existing literature. However, there are some studies that are closely related to the current research topic, directly or indirectly. Among them, Partlan et al. (1986) forecast the banks' reserves for open market operations of the Federal Reserve Bank of New York. They try to forecast both the demand and supply of banks' reserves. On the demand side, they project deposits included in the narrow money to forecast the demand for required reserves and various seasonal impacts and regulatory changes to forecast the demand for excess reserves. On the supply side, they project the technical factors of the Federal Reserve's balance sheet, such as floats, currency in circulation, and U.S. Treasury deposits, to forecast banks' reserves.

Reddy (2002) estimates a short-term liquidity forecasting model for India, considering all liquidity operations that eventually influence banking system reserves. Their estimated model consists of six equations. Equation 1 estimates the net liquidity inflows or outflows through the ways and means advances by the central and state governments. Equation 2 estimates the daily excess reserve positions of banks over the fortnight. Equation 3 determines the weighted average call money rate. Equation 4 estimates the one-month forward

premium rate in the foreign exchange market. Equation 5 estimates the evolution of yield on government securities with a residual maturity of one year. Finally, equation 6 estimates the evolution of yield on medium-term five-year government security. Based on their estimated model, they try to find out the amount needed to inject/withdraw from the market on a daily basis.

Bindseil et al. (2004) identifies the level of excess reserves relevant to the implementation of monetary policy, specifically in the case of the Euro system. They find that the excess reserves may increase over the years due to changes in the operational framework of monetary policy. But the volatility and hence unpredictability of excess reserves are not desirable for liquidity management and the implementation of monetary policy.

Dheerasinghe (2006) forecasts the currency in circulation, one of the major autonomous factors of excess liquidity, in the context of Sri Lanka. He uses an econometric model following Diebold (2004), where time trend and seasonality are considered as major explanatory variables for the change in currency in circulation. He uses daily data from January 1, 2000, to August 31, 2005 (sample period) for the estimation process and data from September 1, 2005, to January 31, 2006, for the post-validity test. His estimated model fits the data well and provides very close forecasts during the post-sample period. The model clearly identifies both inter-month and intra-month variations of currency in circulation. The model also identifies that the Sinhala/Tamil New Year, elections, Christmas, and the day prior to public and bank holidays have a significant positive impact on demand for currency in Sri Lanka.

Gray (2006) addresses the ways that are used by central banks to tackle the issues that arise from excess liquidity in the banking system. In this regard, the experiences of Egypt, Hungary, India, Russia, and Turkey are incorporated in his handbook. He identifies net foreign exchange reserves, net lending to the government, and lender of last resort (LOLR) credit to commercial banks as the main sources of excess liquidity and suggests managing them for liquidity management. He argues that though the export revenues are a blessing for the economy, it is sometimes a curse for the central banks. Therefore, the export revenues, particularly from natural resources like oil, need to be managed for sound liquidity management. Similarly, the net claims on government and LOLR credit should be managed by changing the monetary policy framework for liquidity management.

In another study, Gray (2008) examines the issues involved in forecasting the central bank's balance sheet and refers to it as 'liquidity forecasting' since the item on the balance sheet that central banks typically try to manage is commercial banks balances, a subset of high-powered liquidity. He emphasizes the understanding of the motivations of different items in the central bank's balance sheet for liquidity forecasting. He opines that this understanding cannot be developed simply by looking at data; rather, it is necessary for central banks to communicate regularly with the main participants in the market—primarily commercial banks that have an important role in the payment system—and be proactive in this respect.

Talasli (2010) introduces the ARMA-based approach to model the pattern of excess reserves within the maintenance period. His estimated results indicate that there exists a systematic pattern of excess reserve balances within a maintenance period. The effect of uncertainty about liquidity shocks, the volume of payment flows, and inefficiencies in the interbank money market borrowing have effects on the pattern of reserve holdings. Further development of the interbank money markets (such as the reduction in trading costs and increased transaction volume), together with increased competitiveness between Turkish

Table 2: Bangladesh Bank Balance Sheet at the End of December 2024

Assets		Liabilities	
Items	**Taka (Billion)**	**Items**	**Taka (Billion)**
Net Foreign Assets (NFA)	2358	Currency in Circulation (CIC)	3049
Net Claim on Government (NCG)	969	Required Reserves (RR)	764
Net Claim on Banks (NCB)	1981	Excess Reserves (ER)	182
Net Other Items (NOI)	-1313		
Total	**3995**	**Total (Reserve Money)**	**3995**

Source: Bangladesh Bank.

banks, may induce banks to manage their daily reserves in a more cost-efficient way and create a smoother demand for reserves.

The existing literature reviewed here defines liquidity, which is actually excess reserves. They also identify the determining factors of excess reserves. Some of the studies explain the way of liquidity forecasting by forecasting the determining factors of excess reserves. But no study provides a complete framework of liquidity forecasting with practical data. Besides, no study has been conducted regarding liquidity forecasting in Bangladesh. Therefore, the current study will add a new chapter to the existing literature.

3 Determining Factors of Banks' Liquidity

To identify the factors that influence the position of banks' liquidity, it is necessary to analyze the components of the Bangladesh Bank balance sheet, which is shown in Table-2.

According to the Bangladesh Bank's balance sheet,

$$CIC + RR + ER = NFA + NCG + CCB + NOI \tag{1}$$

Now, rearranging the balance sheet items, we can write:

$$ER = NFA + NCG + CCB + NOI - CIC - RR \tag{2}$$

This means the banks' liquidity, represented by ER (excess reserves), is positively influenced by NFA, NCG, NOI, and NCG and negatively influenced by CIC and RR. Therefore, the daily change in banks' liquidity (ΔER) can be measured as:

$$\Delta ER = \Delta NFA + \Delta NCG + \Delta NOI + \Delta NCB - \Delta CIC - \Delta RR \tag{3}$$

Out of these six determining factors of banks' liquidity, four factors—NFA, NCG, CIC, and NOI—are autonomous factors as the central bank has no full control over them. On the other hand, two factors—NCB and RR—are policy factors as the central bank has full control over them.

3.1 Net Foreign Asset

Net foreign assets (NFA) of Bangladesh Bank are the difference between its foreign assets and foreign liabilities at a point in time. The foreign assets consist of nine foreign currencies held by BB, holdings of special drawing rights (SDR) and gold, and reserve positions in the IMF. Among them, the nine foreign currencies are the US dollar, British pound sterling, Australian dollar, Canadian dollar, Japanese yen, Chinese yuan, Singapore dollar, and Swedish krona. The foreign liabilities consist of the IMF's SDR allocation, banks' foreign currency balance at BB, BB's currency swap with banks, liability in the Asian Clearing Union (ACU), projected payment to the

IMF within one year, and Japan's debt relief grant. The change in net foreign assets (NFA) of Bangladesh Bank mainly depends on the movement of the balance of payment items, like exports and imports of goods and services, net interest income, net inflow of foreign remittances, net foreign investment, and net foreign aid. In this way, usually, the positive change in the overall balance of the country's foreign transactions increases the NFA of BB, and the negative change reduces it. However, the BB's intervention in the foreign exchange market is an important factor in this context. The BB's purchase of foreign exchange increases the NFA of BB, and the sale of foreign exchange reduces it.

3.2 Net Claims on Government

In addition to banks and finance companies, the Bangladesh Bank is the bank of the government. Currently, Bangladesh Bank maintains 116 current accounts for the government of Bangladesh, which facilitate numerous daily transactions of different ministries and government agencies. The names of some major accounts are the Ways and Means account, etc. If the total receipts are greater than the total payments, then the BB's net claims on the government increase, and vice versa. In this way, the transactions of government Treasury bills and bonds between the BB and government accounts largely influence the BB's net claims on the government. Usually, such transactions are held in the primary market of government securities. The primary market, i.e., the auction market of government securities held in BB on Sunday (for Treasury bills) and Tuesday (for Treasury bonds) on a regular basis.

3.3 Currency in Circulations

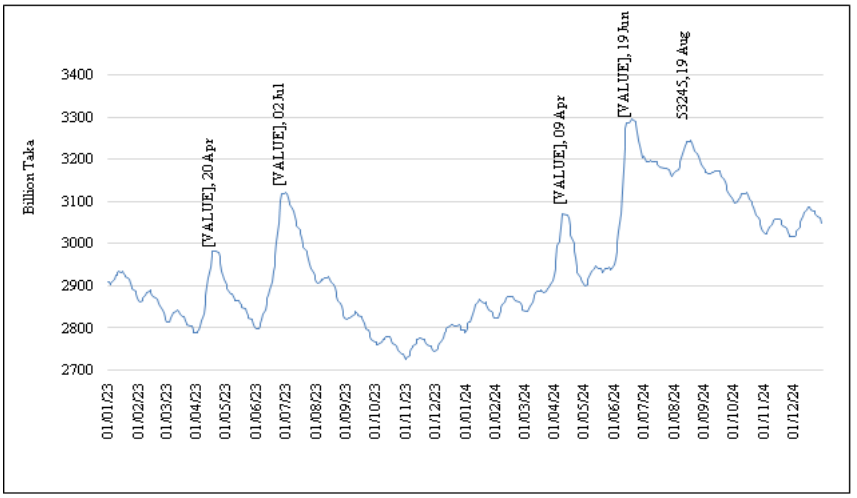
Currency refers to notes and coins (legal tenders) owned by the government, as well as the central bank, and currency in circulation refers to currencies held outside the central bank of a country. Currency in circulation is comprised of two major components: currency held outside the banking system, which means currency held in public, and cash in tills, which means currency held in the commercial banks' own vaults. The volume of currency in circulation in a specific period is determined by several socio-economic factors. These are:

Seasonal Impact: It is the combined impact of employee's payroll schedule and the reserve maintenance period of the commercial banks. Usually, the employees' salaries/wages are paid on a monthly basis at the end of every month or at the beginning of the next month. But it expenses over the next month. On the other hand, the commercial banks have to maintain a minimum amount of reserves in the central bank on a biweekly average basis as well as on a daily basis. Due to the combined impact of payroll schedule and reserve maintenance period, the currency in circulation increases at the first half of every month and decreases at the second half of every month. Thus, the currency in circulation makes an inverse U-shaped trend on a monthly basis in Bangladesh (Chart-1).

Social Festivals: Currency in circulation increases due to higher public demand for cash ahead of the social/national festivals like Eid-ul-Fitre, Eid-ul-Adha, Durga puja, Christmas, Pahela Baishakh, etc. in Bangladesh. In Chart-1 shows 5 big spikes in the daily movement of currency in circulation during 2023 and 2024. The 1st spike on 20 April 2023 and the 3rd spike on 09 April 2024 occurred for Eid-ul-Fitr, and the 2nd spike on 02 July 2023 and the 4th spike on 19 June 2024 occurred for Eid-ul-Adha.

Payment System: The development of a payment system may reduce the volume of currency in circulation. In the case of Bangladesh, the payment system has developed enough over the years, mainly due to Bangladesh Bank's initiatives like the introduction of Bangladesh Automated Cheque

Chart 1: Currency in Circulation (2023-2024)



Source: Bangladesh Bank.

Processing System (BACPS), Bangladesh Electronic Funds Transfer Network (BEFTN), Real Time Gross Settlement (RTGS), National Payment Switch Bangladesh (NPSB), e-payment gateways, and mobile financial services.

People's Trust in Banks: If individuals or firms (businesses) do not trust the banking system, they may prefer to hold cash outside the banking system. We observe some such cases in Bangladesh, particularly in the second half of 2024. Therefore, a spike in the movement of currency in circulation happened on 19 August 2024 (Chart-1).

Size and Costs of Transactions: Usually, the small transactions are conducted in cash. However, some large transactions are also often transacted in cash, especially in the informal sectors like the real estate business. Regarding costs, people may discourage to deposit money in banks if the transaction costs are high.

Interest Rate: Generally, the higher interest rates attract the people to deposit their currencies in banks. However, their trust in banks is very important in this context.

Inflation Rate: Usually, a high inflation rate forces people to hold more money to maintain day-to-day transactions. It also discourages people from depositing money in banks as it reduces the real interest rate (nominal interest rate minus inflation rate).

Economic Stability: People may prepare to hold more physical currency outside the banking system as precaution during the period of economic instability.

Financial Inclusion: People who are unbanked or under-bank particularly in rural area hold cash for daily transactions. So, the low level of financial inclusion increases the holding of currency outside the banking system.

3.4 Net Other Items

Net other items (NOI) refer to both asset and liability items of the central bank balance sheet, which are not incorporated with NFA, NCG, NCB, CIC, RR, and ER. The sum of other liability items is greater than the sum of other asset items. That is why the NOI is negative in Table-2. Among NOI, some major other asset items are: claims on other financial

institutions and overseas development institutions, suspense account, expenditure account, and dead stock and stationery account; and some major other liability items are: capital account, balances of GIIB fund, accumulated depreciation, and creditor adjusting account.

3.5 Net Claims on Banks

Net claim on banks (NCB) is the most important determinant for banks' liquidity and it is under the full control of the Bangladesh Bank. Bangladesh Bank uses its monetary/liquidity management tools like open market operations, demand loan and refinance facility, and the issuance of Bangladesh Bank bill and Bangladesh Government Islamic Investment Bond to make a necessary change in NCB. Making a change in reserve requirement is also an important factor in this context.

Open Market Operations: Open market operations (OMO) are a very effective tool for liquidity management by the central bank. It refers to the sale or purchase of securities, particularly government securities, by the central banks to or from commercial banks. The direct transactions (sale or purchase) of government securities between Bangladesh Bank and the commercial banks or finance companies are very limited. It happens sometimes in the name of secondary trading. However, Bangladesh Bank frequently exchanges foreign currencies with commercial banks that could also be treated as open market operations, though it is used for foreign exchange management. In addition, Bangladesh Bank uses several instruments, like repo operations, for liquidity management that could be treated as open market operations. Because the government or other securities are exchanged between the Bangladesh Bank and commercial banks or finance companies in those cases. Such instruments are:

- **Central bank repo:** It is the Bangladesh Bank's liquidity support for the conventional banks and finance companies that injects liquidity into their current accounts maintained in BB. At present, repo auctions are held once a week (on Monday), and their tenors are 7 days, 14 days, and 28 days. The repo auction is also held on the last day of the reserve maintenance period (usually the 14th day and the end of the month) for overnight. The current repo rate, called the policy rate, is 10 percent applied for all types of repos irrespective of their tenors. The collaterals used for repo operations are government treasury bills and bonds.
- **Assured liquidity support:** It is a Bangladesh Bank's liquidity facility for the primary dealer banks (at present 24 banks). Under this facility, Bangladesh Bank allows PDs to apply for assured liquidity support (ALS) as they have the underwriting obligation to devolve any unsubscribed bidding in the auctions of government securities. The auction is held on demand for overnight, and its interest rate is the policy rate of 10 percent. The collateral used for this facility are as like as normal repo, i.e., government treasury bills and bonds.
- **Standing lending facility:** It is a Bangladesh Bank's liquidity facility for all banks and finance companies that have eligible securities. Banks can apply for SLF on every working day during office hours. But this facility is offered for overnight, and its interest rate is 150 basis points higher than the normal repo rate. Therefore, the current SLF rate is 11.5 percent. Usually, the banks and finance companies that do not get a normal repo facility or need more money can apply for the standing lending facility.
- **Assured repo:** It is a Bangladesh Bank's liquidity facility for all conventional banks that want to use the special-purpose treasury bonds (issued for the electricity and fertilizer sectors) as collateral. This liquidity facility is provided for 7, 14, 28, 90, and

180 days. The auction is held on demand at the interest rate of 10 percent (policy rate).

- **Repo for investment in the capital market:** It is a Bangladesh Bank's liquidity facility for the conventional banks, on condition that they will invest it in the capital market. The auction is held on demand at the interest rate of 4.75 percent (right now). The tenor of this facility is 180 days, and the collateral used for these facilities is government treasury bills and bonds.
- **Liquidity support against claims on incentives for remittance:** It is a Bangladesh Bank's liquidity support for the conventional banks against the banks' claims on incentives for remittance. The auction is held on demand at the interest rate of 10 percent (policy rate), and its tenor is 28 days.
- **Islami bank liquidity facility:** It is a Bangladesh Bank's liquidity support for the Shariah-based Islamic banks. The auction is held on demand on the basis of the profit-sharing ratio (PSR). Its tenors are 7, 14, and 28 days. This facility is issued against the Bangladesh Government Investment Sukuk.
- **Modaraba liquidity support:** It is a Bangladesh Bank's liquidity support for the Shariah-based Islamic banks. The auction is held on demand on the basis of the profit-sharing ratio. Its tenor is 28days and issued against claims on incentive for remittance.
- **Special liquidity support:** It is a Bangladesh Bank's liquidity support for the sharia-based Islamic banks. The auction is held on demand on the basis of PSR. Its tenor is 180 days and is issued against the government's special-purpose treasury bonds.
- **Standing deposit facility:** It is a Bangladesh Bank's investment facility for the conventional banks and NBFIs. The auction is held on demand, and its interest rate is 150 basis point lower than the policy rate, i.e., 8.5 percent right now. This facility is provided for overnight.

Demand loan and Refinance Facility: Bangladesh Bank provides liquidity support on demand by two specialized banks, Bangladesh Krishi Bank and Rajshahi Krishi Unnayan Bank. The interest rate on a demand loan is equivalent to bank rate, which is 4 percent right now. No collateral is needed against the demand loan. Bangladesh Bank also provide refinance facility for the conventional banks to facilitate the priority sector, especially small and medium enterprise, and the agriculture. The interest rate on the refinance facility is usually the equivalent or less than bank rate (4 percent right now).

Issuance of Bangladesh Bank Bills: It is a Bangladesh Bank investment facility for the conventional banks. It is used for mopping up the excess liquidity from the market. The auction is held on Wednesday, and the interest rate (cutoff rate) is settled by the auction committee. The tenors of Bangladesh Bank bills are 7, 14, 28, 90, or 180 days.

Issuance of Bangladesh Government Islamic Investment Bonds (BGIIB): It is an investment facility for the shariah-based Islamic banks. The auction is held every Thursday, while the benefit depends on PSR. Its tenors are 3 or 6 months.

Investment from BGIIB Fund: It is a liquidity facility for the Sharia-based Islamic banks. The auction is held on demand, and the benefit depends on PSR. Its tenors are 3 months or six months.

3.6 Required Reserves

The required reserves are the minimum amount of reserves that the commercial banks have to maintain in the central bank on a daily as well as a biweekly average basis. The required reserves are measured by multiplying

the cash reserve ratio by the average liabilities (demand plus time deposits) of the commercial banks to the public. Here, the cash reserve ratio (CRR) is the percentage of a bank's deposits that it must keep in cash with the central bank. At present, the CRR is 4 percent on a biweekly average basis and 3.0 percent on a daily basis. As a direct instrument of liquidity management, Bangladesh Bank reduces CRR to address the liquidity situation and increases it to tighten the liquidity situation.

4 Liquidity Forecasting

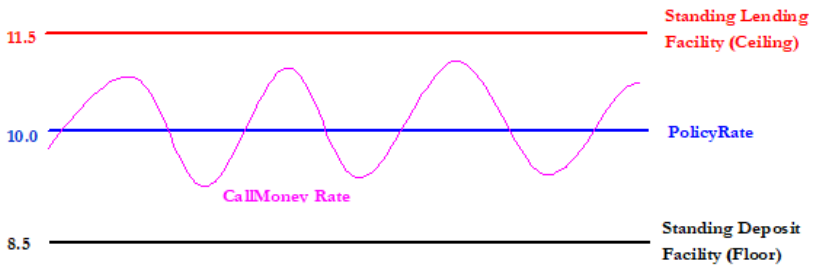
Liquidity forecasting is indeed the process of compiling and analyzing all relevant data to predict the future stance of banks' liquidity without central bank interventions or actions. It is a key part of liquidity management by the central bank. Because liquidity forecasts enable the central bank to decide on how much liquidity to provide to or withdraw from the market on a day-to-day basis, with the objective of smoothing undesirable fluctuations in liquidity demand and supply (Gray, 2006). The purpose of this smoothing of fluctuations is to create stable liquidity conditions and steer the operating target of the central bank's monetary policy.

Considering the significance, the central bank should dedicate one of its relevant units to liquidity forecasting such that it can produce accurate and timely projections of banks' liquidity. This liquidity forecast should be arranged as a rolling process under which every new piece of information is promptly incorporated. The liquidity forecasting horizons and forecasting intervals should be adjusted with institutional setups. In a system with reserve requirements, the forecasting horizon should comprise at least the current maintenance period, and the interval should be one working day. Appropriate forecasting techniques should be used in the liquidity forecasting process. Thus, the central bank should follow some crucial steps in the liquidity forecasting process. These are (i) communicating with the different information sources and ensuring the timely receipt of the data, (ii) supervising the consistency of the forecasted components, (iii) producing an overall liquidity projection on a daily basis, and (v) assessing forecasting errors (Gray, 2006).

As per the prevailing interest rate-based monetary policy framework, introduced by Bangladesh Bank in July 2023, the short-term interest rate, i.e., the weighted average interbank call money rate, is the operating target of monetary policy. There is an interest rate corridor set by Bangladesh Bank to achieve the operating target immediately and the final target, i.e., price stability, ultimately. In the corridor, the policy rate, i.e., repo rate, is set at the middle, the standing lending facility rate at the upper bound, and the standing deposit facility rate at the lower bound of the corridor (Chart-2). According to the norms of the interest rate corridor, the interbank call money rate always remains within the corridor. However, Bangladesh Bank constantly tries to keep the weighted average call money rate close to the policy rate to achieve its monetary policy goals. Therefore, the Bangladesh Bank applies its monetary policy instruments to inject or mop up liquidity to or from the market as and when necessary. In this regard, liquidity forecasts help the Bangladesh Bank to decide how much liquidity it should inject or mop up to or from the market on a daily basis.

Bangladesh Bank, the central bank of Bangladesh, has formally started to forecast the banks' liquidity on a daily basis since 2002. The Monetary Policy Department (MPD), one of the core departments of BB, is responsible for exercising this forecasting practice. At present, the BB's liquidity forecasting horizon is 5 working days, and the interval is one working day. Since the banks' reserve maintenance period is two weeks, BB should extend its forecasting horizon up to two weeks. Regarding forecasting techniques, BB mostly uses the

Chart-2: The Prevailing Interest Rate Corridor



(Source: Bangladesh Bank.)

moving average method, the judgmental approach, and the adjustment with the seasonal trend. BB should use an econometric forecasting technique, like the ARIMA model, particularly for currency in circulation, one of the significant autonomous factors of banks' liquidity. However, the steps that MPD follows in liquidity forecasting are discussed below.

Step 1: In the morning of every working day, which can be called the current day (t), MPD collects the immediate past working day's (t-1) reserves of all commercial banks with the branch offices of BB using the online platform and adds them together to measure the overall banks' reserves of that day (t-1). Thereafter, the banks' required reserve, which remains fixed for a month, is subtracted from the banks' reserves to measure the excess reserves of all commercial banks on the immediate past working day (t-1). The actual position of this excess reserve works as the base of liquidity forecasts for the next 5 working days, i.e., the day of t, t+1, t+2, t+3, and t+4.

Step 2: As mentioned earlier, the determining factors of banks' reserves are divided into autonomous factors and policy factors. MPD, basically, attempts to forecast the autonomous factors, such as NFA, NCG, CIC, and NOI, to forecast the overall liquidity position of the banks. MPD does not forecast the policy factors, such as NCB and RR, as they are decided by the auction committee. But the maturity information of policy factors is helpful in forecasting the overall liquidity position. Usually, the policy factors are used to keep the liquidity position on the right track. There is an inverse relation between the excess reserves and the interbank call money rate. Since the current monetary policy framework desires to keep the call money rate close to the policy rate, BB injects liquidity into the market during the tight situation indicated by upward movement of the call money rate and mops up liquidity during the loose situation indicated by downward movement of the call money rate.

Step 3: MPD preserves the historical data on both autonomous and policy factors, which is necessary for overall liquidity forecasting.

4.1 Forecasting the Autonomous Factors

Net Foreign Assets (NFA): The components that influence the NFA of BB have been discussed in detail in Section 3.1. Among these components, the BB's FX intervention, i.e., the sale or purchase of foreign exchange by Bangladesh Bank to or from the commercial banks, is treated as a policy factor, as the intervening decision comes solely from Bangladesh Bank. In addition, there are a lot of foreign exchange transactions between the Bangladesh Bank and other stakeholders like commercial banks, the government, and foreign governments, institutions, or or-

ganizations. These transactions, which are recorded at the Forex Reserve and Treasury Management Department (FRTMD) of BB Head Office, influence the movement of BB's NFA on a regular (daily) basis. MPD collects the actual information about these FX transactions from FRTMD on a regular basis and then forecasts the NFA for the next five working days using the moving average method and a judgmental approach. Since the detailed information is recorded at FRTMD, it would be better to forecast this component by FRTMD and provide it to MPD on a regular basis.

Net Claims on Government (NCG): The components that influence the BB's net claims on government (NCG) have been discussed in detail in Section 3.2. Among the components, MPD collects the information on government securities (government treasury bills and treasury bonds) in advance from the Debt Management Department (DMD) of BB Head Office. Because the Finance Division of the Ministry of Finance provides the transactions schedule of government securities to DMD one month ahead for taking necessary action, i.e., for issuing the securities through open auction. Usually, the government treasury bills are issued on every Sunday, and the treasury bonds are issued on every Tuesday. In addition to issuing information, MPD also collects information regarding the maturity of government securities in advance from DMD. This advanced information on government securities helps MPD to forecast NCG.

However, there are many other transactions that happened in different government accounts maintained in BB. MPD collects the actual information on the other government transactions from the Motijheel Office of BB. But MPD does not get any advance information on these other transactions from any sources, including the Motijheel Office or the Accounts and Budgeting Department of BB Head Office. Therefore, MPD uses the moving average method and a judgmental approach to forecast the movement of the other government transactions, necessary for forecasting the NCG. In this context, this study suggests MPD for collecting the government's future cash flow plan from the Finance Division on a daily basis, which will be helpful for forecasting NCG more accurately.

Currency in Circulation (CIC): The factors that influence the movement of currency in circulation are discussed in detail in Section 3.3. MPD collects the actual data on currency in circulation from the Issue Department of the BB Motijheel Office and forecasts it on a daily basis using the moving average method and the judgmental approach that considers the impacts of the influential factors, like seasonal impact, social festivals, interest rate, inflation rate, people's trust in banks, payment system, financial inclusion, etc. To forecast the CIC more accurately, this study emphasizes the use of econometric models, like the ARMA model.

In this context, MPD may follow Dheerasinghe (2006), who used an autoregressive moving average (ARMA) method to forecast the currency in circulation on a daily basis in the case of Sri Lanka. Following the movement of CIC data from 1 January 2000 to 31 October 2005, Dheerasinghe (2006) runs a regression model for CIC on time trend, seasonality, holiday variations, and festival seasons and gets significant positive results.

In the case of Bangladesh, Chart-1 shows that there is an upward time trend in CIC. In addition, the movement of CIC is largely influenced by seasonal impacts and social festivals. With regard to seasonality, CIC increases in the first half of every month and decreases in the second half. With regard to social impact, CIC largely increases ahead of Eid festivals, i.e.Eid-ul-Fitrre and Eid-ul-Adha, and reduces after the Eid festivals. Therefore, MPD may try to estimate the following regression model and then use the ARMA approach to forecast CIC on a daily basis. The required model can

be:

$$CIC_t = \alpha \text{Time}_t + \sum_{i=1}^{x} \beta_i D_{it} + \sum_{j=1}^{y} \gamma_j EF_{jt} + \sum_{k=1}^{z} \delta_k EA_{kt} + \epsilon_t \quad (4)$$

Where CIC_t is the currency in circulation (dependent variable); Time_t is the time trend $(1, 2, \ldots, n)$; D_{it} represents days of the month $(i = 1, \ldots, x)$; EF_{jt} and EA_{kt} are festival periods for Eid-ul-Fitr and Eid-ul-Adha respectively; $\alpha, \beta, \gamma, \delta$ are coefficients; and ϵ_t is the error term.

Net Other Items (NOI): NOI is the residual term of the central bank balance sheet, which includes both asset and liability items. MPD uses the moving average method and the judgmental approach to forecast the NOI.

4.2 Use of Policy Factor in Liquidity Forecasting

As mentioned earlier, MPD does not forecast the policy factors as they are decided by the auction committee. But the maturity information of policy factors, which is known in advance, is used in liquidity forecasting. For example, the maturity amount of a normal repo, which is issued for 7, 14, or 28 days, is known in advance, and this amount is deducted in forecasting the excess reserves on the day of its maturity.

4.3 Liquidity Forecasting Framework

Table 3 shows a stylized liquidity forecasting framework that is followed by MPD right now. According to this framework, the forecasting horizon is five working days (from Day t to Day t+4), and the forecasting interval is one working day. To explain this framework, it is assumed that the day on which the liquidity forecasting is being done is Wednesday (Day t), and it is the first day of a month, which includes 30 days. There are no Eid festivals in this forecasting period. In addition, we assume that all policy options are applied by the Bangladesh Bank during this forecasting period, following the set rules discussed in Section 3.5. In Table 3, '+ve' indicates the existence of positive figures, and '-ve' indicates the existence of negative figures against each policy. Now, some important features of Table 3 are explained below.

First, the autonomous factors (items 1-4) are forecasted for five working days using the techniques discussed in Section 4.1.

Second, the actual figures existed in the previous working day (Day t-1, Tuesday) against all policy factors except the Bangladesh Bank bills (item 17) and BGIIB funds (item 18). Because, as per the set rules, the Bangladesh Bank bills are issued and mature (based on tenure) on Wednesday, and the BGIIB funds are issued and mature (based on tenure) on Thursday. Therefore, only the maturity figures are shown against the BB bills and BGIIB funds.

Third, the issue and maturity figures against the central bank repo (item 6) are shown only on Tuesday, as its issuing day is Tuesday and the minimum maturity period is 7 days.

Fourth, the figures existed only on day t-1 and Day t against the policy factors (items 7-16), whose issuing day depends on demand, and the maturity period is overnight (items 7-16).

Fifth, in the case of demand loans and refinance facilities, the issuing and maturity dates depend on demand. Therefore, the issuing figure existed on Tuesday, and the maturity figures existed throughout the forecasting period.

Sixth, the issuing day for investment from BGIIB funds depends on demand, but the maturity period is 3 or 6 months. Therefore, the issuing figure existed on Tuesday, and the maturity figures existed throughout the forecasting period.

Seventh, as per the set rule, the required reserves change only on the first day of the month. Therefore, the figure existed only on Wednesday, the first day of the month.

Eight, the excess reserves (stock) are measured by adding A (sum of change in autonomous factors) and B (sum of policy factors) to the previous day's balance (stock) of excess reserves. For example, the excess reserves (stock) for Day t-1 are calculated by adding A and B for Day t-1 to the balance (stock) of excess reserves at Day t-2 (Monday). Similarly, the excess reserve (stock) for Dayt is calculated by adding A and B for Day t to the balance (stock) of excess reserves at Day t-1.

5 Impacts of Liquidity Forecasting

The whole process of liquidity forecasting, explained in Section 4, is being completed by 1 pm on every working day. Observing the forecasted level of excess reserves and some other necessary information like the exchange rate movement, the movement of the interbank call money rate, and the interbank repo rate, the auction committee, i.e., the liquidity management committee, takes decisions about the use of policy factors in order to inject/withdraw liquidity to/from the market. The auction committee makes the decisions regarding almost all policy factors, except the standing lending facility (SLF), until 3 pm on every working day. The decision regarding SLF is taken between 3 and 5 pm on every working day (Bangladesh Bank, 2024). Chart-3 shows the sum of policy actions (net action) taken by BB's auction committee on a daily basis.

In Chart-3, the net positive action indicates liquidity injection, and the net negative action indicates liquidity absorption by Bangladesh Bank to/from the commercial banks. The liquidity is injected by the Bangladesh Bank when there is a shortage and absorbed when there is a surplus. It is observed that the movement of net policy action is highly fluctuating over the period, but its trend line seems close to the horizontal axis, i.e., zero.

The impact of BB's policy actions seems to be effective for liquidity management in Bangladesh. Nonetheless, there were liquidity shortages (shortage of reserves) on most of the days during April-December 2024, due to some specific reasons, including the high rate of non-performing loans and huge foreign currency selling by Bangladesh Bank to the commercial banks (Figure-4). As a result, there was an increasing trend in the interbank call money rate. However, the interbank call money rate remained within the interest rate corridor, and it was close to the repo rate, indicating the achievement of the monetary policy goal.

In addition to maintaining stability in the banking system, the ultimate goal of liquidity management is price stability, which is not perfectly fulfilled in Bangladesh during the last two years. Thus, the CPI inflation was very high during the years 2023 and 2024 (Chart-5).

6 Conclusion

The effective forecasting and management of banks' liquidity by the central bank is crucial for the stability of the financial system. It is also crucial for achieving the monetary policy goals, particularly the price stability, under the interest rate-based monetary policy regime that exists in Bangladesh right now. To do this task effectively, it is essential to define the banks' liquidity clearly and identify its determining factors properly. In a broader sense, the banks' liquid assets consist of cash in tills, excess reserves (local currency) with Bangladesh Bank, foreign currency reserves with Bangladesh Bank, reserves with the chest branches of Sonali Bank, reserves with Islamic Refinance Fund Accounts (IRFA), nostro account balances, and investments in govern-

Table 3: Liquidity Forecasting Framework

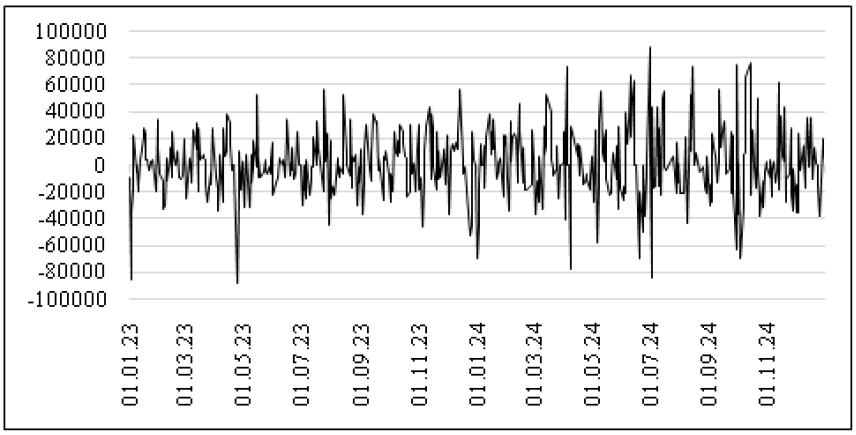
Particulars		Actual			Forecast		
		$\mathbf{Day}_{t-1}$ (Tue)	$\mathbf{Day}_t$ (Wed)	$\mathbf{Day}_{t+1}$ (Thu)	$\mathbf{Day}_{t+2}$ (Sun)	$\mathbf{Day}_{t+3}$ (Mon)	$\mathbf{Day}_{t+4}$ (Tue)
	1	2	3	4	5	6	7
A. Autonomous Factors		±	±	±	±	±	±
1. Net foreign assets		±	±	±	±	±	±
2. Net claims on govt.		±	±	±	±	±	±
3. Currency in circulation		±	±	±	±	±	±
4. Net other items		±	±	±	±	±	±
B. Policy factors		±	±	±	±	±	±
5. FX Intervention	(Purch+/Sale–)	±					
6. Central bank repo	(Issue+/Maturity–)	±					−
7. Standing lending facility	(Issue+/Maturity–)	±	−				
8. Assured liquidity support	(Issue+/Maturity–)	±	−				
9. Assured repo	(Issue+/Maturity–)	±	−				
10. Capital market repo	(Issue+/Maturity–)	±	−				
11. Liquidity against incentives	(Issue+/Maturity–)	±	−				
12. Standing deposit facility	(Issue+/Maturity–)	±	+				
13. Islami bank facility (IBLF)	(Issue+/Maturity–)	±	−				
14. Modaraba liquidity	(Issue+/Maturity–)	±	−				
15. Special liquidity support	(Issue+/Maturity–)	±	−				
16. Demand loan & refinance	(Issue+/Maturity–)	±	−	−	−	−	−
17. BB Bills	(Issue+/Maturity–)		+				
18. BGIIB funds	(Issue+/Maturity–)						
19. Investment from BGIIB	(Issue+/Maturity–)	±	−	−	−	−	−
20. Δ Required reserves	(−)		−				
C. Excess reserves (stock)	±	±	±	±	±	±	±

ment securities. Among the components, excess reserves are the most liquid assets for the commercial banks, and they are under the full control of the Bangladesh Bank. Therefore, the terms excess reserves and banks' liquidity are used interchangeably. That means the liquidity forecasting and liquidity management refer to the forecasting and management of the excess reserves. This excess reserve is one of the significant liability items of the Bangladesh Bank balance sheet.

This study analyzes the central bank balance sheet to identify the determining factors of banks' liquidity and finds two types of factors: autonomous factors and policy factors. The autonomous factors include four items—net foreign assets, net claims on government, currency in circulation, and net other items. The policy factors include two items: net claims on banks and the required reserves. The net claims on banks are influenced by several monetary policy instruments like the normal repo facility, standing lending facility, standing deposit facility, assured liquidity support, Islami Bank liquidity facility, Bangladesh Bank bills, etc. These monetary policy instruments are used to keep the excess reserves on the right track. But to apply these instruments, it is essential to guess how much liquidity should be injected or mopped up from the market on a day-to-day basis. Liquidity forecasting gives such a message to the Bangladesh Bank authority, i.e., the liquidity management committee or auction committee.

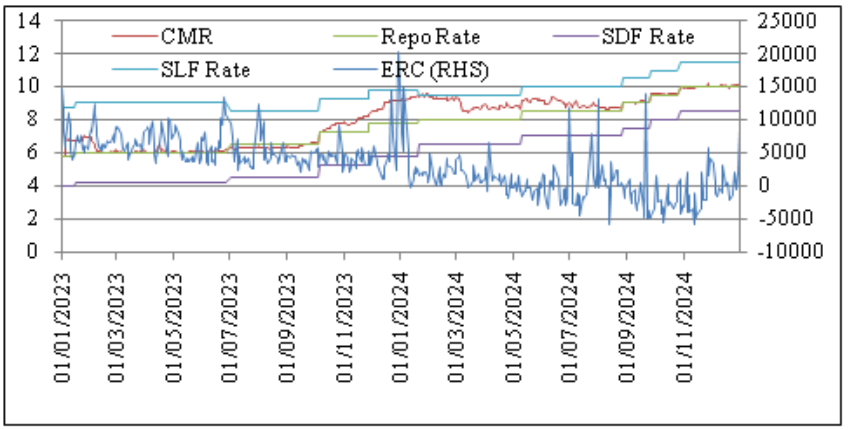
The Bangladesh Bank authority has assigned the responsibility of liquidity forecasting to the Monetary Policy Department (MPD). MPD, basically, forecasts the above-

Chart-3: BB's Policy Actions for Liquidity Management (Million Taka)
(1 Jan 2023 – 31 Dec 2024)



(Source: Bangladesh Bank.)

Chart-4: Movement of Excess Reserves (in Crore taka), Call Money Rate, and Policy Rates
(1 Jan 2023 – 31 Dec 2024)



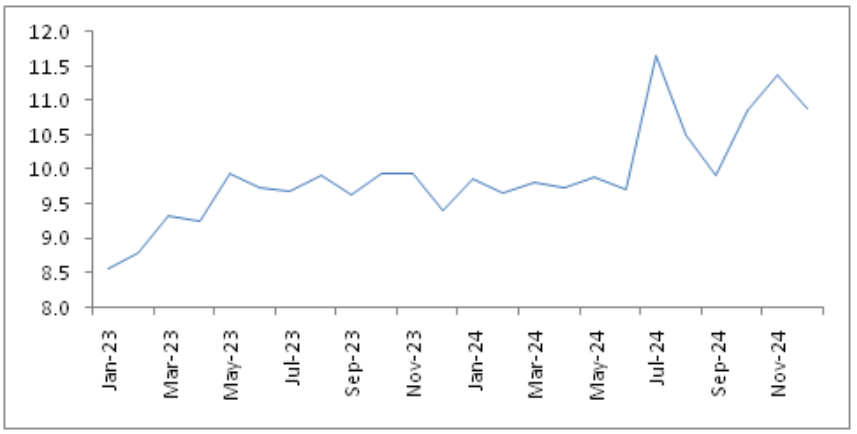
(Source: Bangladesh Bank.)

Note: CRM = Call Money Rate, SDF = Standing Deposit, Facility, SLF = Standing Lending Facility and ERC = Excess Reserves of the Conventional Banks

mentioned four autonomous factors in order to forecast the overall liquidity. MPD mainly uses the moving average method, the judgment approach, and the adjustment of seasonal and festival impacts with the trend value of autonomous factors. This study has explored a clear liquidity forecasting framework that is practiced by MPD. The impact of liquidity forecasting on liquidity management is very fruitful in Bangladesh. Therefore, the movement of excess reserves and the interbank call money rate are almost stable with reasonable deviations. Nonetheless, BB should emphasize the improvement of the current practices of liquidity forecasting for better results.

In order to improve the current practice of

Chart-5: Movement of CPI-based Headline Inflation (P-t-P)
(Jan 2023-Dec 2024)



(Source: Bangladesh Bank)

BB's liquidity forecasting, BB may request the Forex Reserve and Treasury Management Department of BB to forecast the net foreign assets daily and provide it to MPD on a regular basis. MPD may request the Ministry of Finance to provide its near-future cash flow plan to MPD on a daily basis, which will be helpful to forecast the net claims on the government properly. This study also suggests MPD for applying an econometric technique, like the ARMA model, in forecasting the autonomous factor, particularly the currency in circulation.

Disclosure Statement

Views expressed in this paper are the authors' own and do not necessarily reflect the views of institutions they are affiliated with.

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