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| MCM Technical Assistance Handbook  Monetary Operations and Domestic Market Development  Liquidity Forecasting |
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**THIS CHAPTER: LIQUIDITY FORECASTING**

Liquidity forecasting is the process of forecasting and centralizing all relevant information that impact the future path of central bank reserves. Short-terms areused toensure that market conditions are aligned with the announced stance of monetary policy, whether expressed as a quantity, or as an interest rateLiquidity forecasts over longer periods can be used to manage the structural liquidity position to ensure that the volume of open market operations is within a range that allows the central bank to maintain sufficient control over the chosen operating target. This chapter provides the conceptual framework for liquidity forecasting based on an analysis of the components of the central bank balance. It also outlines the processes and statistical methods for forecasting the key components affecting the supply and demand of reserves.

**THIS HANDBOOK**

This handbook aims to distill, document, and make widely available, the lessons learnt from MCM TA over a long period while also incorporating lessons learnt globally. It covers a wide range of central banking topics pertaining to governance and risk management, monetary policy, monetary and foreign exchange operations, and financial market development and infrastructures, while highlighting, where relevant, specific issues for low-income resource-rich countries. It is intended to document and promote good practices and support the consistency of advice over time. It is, however, stressed that one size solutions cannot fit all, and all advice therefore needs to be tailored to country-specific circumstances. The handbook comprises self-contained, issue-specific chapters with cross-references on overlapping issues where needed. It is targeted at those who provide TA (both IMF and non-IMF personnel), and practitioners in central banks and other relevant institutions.

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# Glossary

|  |  |
| --- | --- |
| Automated Teller Machines | ATMs |
| Autonomous Liquidity Factors | AFs |
| Autoregressive Integrated Moving Average | ARIMA |
| Balance of payments | BoP |
| Bank Reserves | R |
| Cash Coordination Committee | CCC |
| Claims on Government | CG |
| Currency in Circulation | CIC |
| Czech National Bank | CNB |
| European Central Bank | ECB |
| Excess Reserves | ER |
| Forecasted Autonomous Factors | AFF |
| Foreign Exchange | FX |
| Government Deposits | GD |
| Liquidity Absorption operations | LA |
| Liquidity Coverage Ratio | LCR |
| Liquidity Injection operations | LI |
| Mean Square Errors | MSE |
| Memorandum of Understanding | MoU |
| Ministry of Finance | MoF |
| Money Market | MM |
| National Bank of Kazakhstan | NBK |
| Net Foreign Assets | NFA |
| Net-stable Funding Ratio | NSFR |
| Open Market Operations | OMOs |
| Other Items Net | OIN |
| Realized Autonomous Factors | ARF |
| Required Reserves | RR |
| Root Mean Square Error | RMSE |
| Senior Financial Officers Survey | SFOS |
| Survey on credit terms and conditions in euro-denominated securities financing and OTC derivatives market | SESFOD |
| Technical Assistance | TA |

# Executive Summary

**Liquidity forecasting entails a process of forecasting and centralizing all the relevant information that impact the** **near-term path of banking system liquidity,** **generally** **defined as commercial bank reserves held at the central bank.** Credible liquidity forecasts underpin the effective implementation of monetary policy facilitating the calibration of central bank open market operations that ensure that market conditions are aligned with the announced stance of monetary policy, whether expressed as a quantity, or as an interest rate.++++++

# Context

**A credible short-term liquidity forecasting framework is important for the effective implementation of monetary policy**. In frameworks where the operating target is either short-term interest rates or a monetary aggregate (i.e. reserve money), central bank open market operations need to be appropriately calibrated to ensure market conditions are aligned with the announced stance of monetary policy in support of its price stability objective. Such calibration is facilitated through the liquidity forecasting process.

**The importance of liquidity forecasting varies depending upon the monetary policy operational framework.** Past crises have seen many central bank balance sheets grow with operating frameworks moving to so-called *floor systems*, where liquidity is abundant, either because interest rates are at the zero-lower bound (i.e. quantitative easing) or assets have been purchased to support the functioning of key financial markets (a financial stability objective). In these circumstances active liquidity management, and therefore liquidity forecasting, maybe somewhat less important than in other operational set-ups such as in a pre-crisis *mid-corridor system*. In this system, liquidity forecasts are important, since the supply of reserves needs to be accurately calibrated to estimated demand, to ensure a chosen market rate is aligned with the announced policy target.

**The institutional set-up and financial sector context are key considerations when establishing a forecasting framework.** Government operations are often the key challenge in producing overall accurate liquidity forecasts and here, the location of the government’s operational account matters as does the quality if its own cash-flow forecasts (if produced). Further, the entities with which the central transacts, and the nature of those interactions are critical elements in ensuring the forecasting framework is fit for purpose. And finally, the depth, breadth and resilience of the financial sector is important in understanding the influences on liquidity conditions, including demand for reserves.

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**Monetary policy is implemented by controlling a component on the central bank balance sheet – usually the price or the quantity of reserves.[[1]](#footnote-2)** Central bank reserves are sometimes referred to as *banking system liquidity* (or simply *liquidity),* as they represent the most liquid asset in the economy owing to their on-demand nature and the creditworthiness of the central bank. In quantity-based monetary frameworks only changes in the supply of reserves need be forecasted since implementation requires the supply to be aligned with the targeted quantity. In most interest rate-based operational frameworks having a good understanding of the demand for reserves is however important to align interest rates with the policy target while minimizing interest rate volatility.[[2]](#footnote-3)

**Financial sector arrangements differ widely across countries and individual characteristics must be considered when establishing a liquidity forecasting framework.** The relationships between the central bank, government (and semi-government entities), and private non-bank entities need to be well-understood to ascertain the impact that transactions between entities have on liquidity conditions. In short, it matters which entities have operational accounts at the central bank, and how these accounts are used.

**Based on motives to hold reserves there are three overlapping concepts:** 1) regulatory demand arising through the imposition of reserve requirements, in which case reserves may lose at least some of their liquid asset characteristic,[[3]](#footnote-4) 2) voluntary reserves, arising since banks generally need to hold a buffer to ensure they meet their payment obligations throughout the day, and 3) excess reserves, which is defined as all reserves held in excess of the reserve requirement; this includes amounts held both voluntarily and involuntarily, the latter of which could arise as a result of the policy stance of the central bank (as in the case quantitative easing).

**The central bank balance sheet is the focal point for forecasting the supply of reserves (figure 1).** Changesin reserves arise through changes in items the central bank has little or no control over – so-called autonomous factors (AF) – and through central bank actions taken to offset changes in the autonomous factor; often termed *monetary operations*. Four autonomous factors are identified:

* *Net foreign assets:* Central bank sales or purchases of foreign currency involve the settlement of the domestic leg of the transaction with a private counterpart that may either be a commercial bank or the customer of the commercial bank. In both cases the settlement of the transaction impacts reserves of the commercial bank held at the central bank. In fixed exchange rate arrangements, the central bank has no control of this item, while in floating exchange rate regimes, central bank interventions are discretionary, and it does have control over it to the extent that it can choose when to intervene, consistent with its policy objectives.
* *Currency in circulation:* Commercial banks supply central bank notes and coins to their customers on-demand, which they acquire from the central bank, in exchange for reserves they hold in their account at the central bank.
* *Net Government Position*: Government’s revenue and expenditures have counterpart entries in the accounts of private sector participants, which is reflected by changes in the reserves held by the commercial bank with which they bank, this is the case where the government account is located at the central bank. There is no aggregate liquidity impact where the government account is held in the private sector, although there may be material distributional effects impacting reserve demand resulting from large government flows.
* *Other Entities*: This category captures non-government and non-bank entities that hold accounts at the central bank. An understanding on how these entities operate these accounts is vital to understand the extent to which these activities need to be incorporated into liquidity forecasts. Other entities will generally fall within the following three broad categories.
  + *Quasi-government entities:* examples include, state-owned development banks, commodity exporters or utility companies.
  + *Other official entities:* examples here include accounts held by foreign central bank and multilateral institutions (e.g. International Finance Corporation).
  + *Non-bank financial institutions:* Examples of non-bank entities that have accounts at the central bank include securities dealers, central counterparties (CCPs) and non-bank deposit taking and lending institutions (e.g. co-operative banks).
* *Other Items Net*: This item consists mainly of central bank capital and is sometimes treated as a residual item where the full balance sheet is forecasted.

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| **Figure 1. Central Bank Balance Sheet and Banking System Liquidity**   |  |  |  | | --- | --- | --- | |  | **Assets** | **Liabilities** | | **Autonomous Factors (AF)** | Net Foreign Assets (NFA) | Currency in Circulation (CIC)  Net Government Position (NGP)  Other Entities (OE)  Other Items Net (OIN) | | **Structural Operations (SO)**  **(> 30 days)** | **Liquidity Injection (SOLI)**   * Net Domestic assets * Long-term lending operations * Foreign Exchange Swaps | **Liquidity Absorption (SOLA)**   * Reserves: Reserve Requirement * Long-term borrowing operations * Foreign Exchange Swaps | | **Open Market Operations (OMO)**  **(< 30 days)** | **Liquidity Injection OMOs (OMOLI)**   * Securities Purchased * Repos (and other secured lending) | **Liquidity Absorption OMOs (OMOLA)**   * Securities Issued * Reverse Repos | | **Banking System Liquidity** |  | **Reserves: Excess Reserves (ER)** |   Assets = Liabilities  NFA + SOLI + OMOLI = CIC + NGP + OE + OIN SOLA + OMOLA + ER  **Structural Operations (SO)** are calibrated to achieve a Targeted Structural Liquidity Position which aims to *right-size* the OMOs to efficiently achieve the operating target  Targeted Structural Liquidity Position = AF – (SOLI – SOLA)  **Open Market Operations (OMO)** are calibrated to achieve a targeted quantity of excess reserves and consistent with the monetary policy operating target (either a price or a quantity)  ER = AF – (SOLI – SOLA) – (OMOLI – OMOLA) |

**Where the operating target is specified in terms of an interest rate, liquidity forecasts must focus on *changes in the supply and demand for excess reserves;*** because the price of excess reserves, which is revealed through deals between banks (so-called unsecured interbank transactions), is the key to the transmission of monetary policy through its impact on bank funding costs, other short-term money market rates, and on other longer-term instruments that incorporate expectations about the future path of policy rates, as well as risk premia. There are a variety of ways in which central banks specify their interest rate operating targets, for example, the unsecured interbank rate, a repo rate, or sometimes more generally as the level of short-term money market rates. The rationale some central banks use for focusing on the unsecured interbank rate is because it directly relates to a liability on its balance sheet (i.e. excess reserves).

**The *structural liquidity position* is an important concept to be incorporated into the liquidity forecasting process.** This position (see figure 1) is defined as the net of the autonomous factors (AF) after incorporating structural operations (SO). The sign and size of the structural liquidity position can be managed by the central bank with the objective of *rightsizing* the OMO – that is, ensuring the volume of the OMO is keep within a range that ensures adequate control over interest rates. This *rightsizing* is dependent in part on the size of the financial sector, the number of counterparties, and the efficiency of the interbank market. The central bank can adjust the structural position through several actions: changes in the level of reserve requirements, issuances of its own long-term liabilities, purchases or sales of domestic assets, and purchases or sales of foreign currency.

**Ideally liquidity forecasts are produced daily.** Even when the central bank conducts its main OMO less frequently, say weekly, daily forecasts allow for closer monitoring of banking system liquidity as the central bank may need to use fine-tuning operations if the daily monitoring indicates a significant forecasting error or warns of an extraordinary liquidity shock (Cabrero, Camba-Mendez, Hirsh and Nieto (2002)).

**Liquidity forecasts should comprise at least one reserve maintenance recognizing that forecast quality declines at longer horizons.** In the absence of reserve requirements, the horizon should extend to at least the horizon of main OMO (e.g., seven days if the central bank has a weekly 7-day OMO). Despite diminished accuracy, longer-term projections are however useful to identify trends in components of the balance sheet (e.g. currency in circulation and net foreign assets) that may need to be offset with operations of a structural nature to ensure that OMOs remain within .



# Analytical Presentation – the Template

**Short-term liquidity forecasts should be presented in a way that facilitates the calibration of the central bank’s operations.** A template is needed for this purpose and the design may vary dependent upon the institutional and financial sector context, and the specification of the operating target (a quantity or a price), and the design of the operational framework.

**The template should ideally be at a daily interval with a horizon of at least one maintenance period (see example in figure X):** The opening reserves position (closing from the previous day), forecasted changes in disaggregated AFs (NFA, CIC, NGP and NFA), known central bank operations (maturing and planned) and the demand for reserves (assuming an interest rate operating target). Spanning a full maintenance period with a daily average of reserve compliance against the requirement will highlight the degree to which pressure may emerge on interest rates towards the end of the period; indicated where the daily average compliance is substantially below the required level. Compliance through a given period can also be compared against the observed fulfillment pattern, again to highlight potential liquidity pressures that may need to be addressed through ad hoc liquidity measures.

**Disaggregated file data should feed into the main items on the template with a structure that captures *outcomes,* to facilitate the analysis of forecast errors.** There should be separate files (or tabs) for all AFs and other items that link to the main template – to avoid the need for manual reentry of items. These separate files should contain the data at a sufficiently disaggregated level to facilitate the forecasts. As an example, the file on NGP should contain a schedule of government securities maturing and expected issuances (an element that should be relatively certain), and the forecasts of the key revenue and expenditure lines. In addition, the structure of the template and associated files should allow for the collection of outcomes in each item – again sufficiently disaggregated – to facilitate rigorous assessment of the forecast errors.

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| **Figure X: Liquidity Forecasting and Monitoring Template (Sample)**     |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | |  |  | Liquidity Projections for One Maintenance Period | | | | | |  |  | Day t | Day t+1 | Day…. | Day t+14 | Total | |  | **A. Opening Reserves Balance (Closing Previous Day)** | **23** | **20** |  |  |  | |  | *1.Autonomous Factor Supply: Inflow (-), Outflow (+)*  *= a + b + c + d +e* | *-15* | *7* |  |  |  | |  | a. Change in Net Foreign Assets | -15 | 5 |  |  |  | |  | b. Change in Currency in Circulation | 2 | -3 |  |  |  | |  | c. Change in Net Government Position | -2 | 1 |  |  |  | |  | d. Change in Other Entities | 0 | -5 |  |  |  | |  | e. Change in Other Items Net | 0 | 9 |  |  |  | |  | 2.*Central Bank Operations – maturing and planned*  *= f + g + h + i + j* | *-21* | *-23* |  |  |  | |  | f. Maturing: Repos (-), reverse repo (+) | -18 | -23 |  |  |  | |  | g. Maturing: Standing Facilities: lending (-), deposit (+) | -1 | 0 |  |  |  | |  | h. Secondary market purchases (-), sales (+) | 0 | 0 |  |  |  | |  | i. Reserve requirement changes | -2 | 0 |  |  |  | |  | j. Other transactions | 0 | 0 |  |  |  | |  | **B. Forecasted Reserves Pre-Central Bank Operations**  = A + 1 + 2 | **-13** | **4** |  |  |  | |  |  |  |  |  |  |  | |  | **C. Forecasted Demand** | 20 | 21 |  |  |  | |  |  |  |  |  |  |  | |  | **D. Forecasted Excess Supply (+) / demand (-)**  **= B - C** | -33 | -17 |  |  |  | |  |  |  |  |  |  |  | |  | **E. Central Bank Operations – Calibration**  **= k + l + m** | **33** | **17** |  |  |  | |  | k. Repos (+), reverse repos (-) | 33 | 17 |  |  |  | |  | l. Secondary market purchases (+), sales (-) | 0 | 0 |  |  |  | |  | m. Other | 0 | 0 |  |  |  | |  |  |  |  |  |  |  | |  | **F. Forecasted Reserves Post-Central Bank Operations**  **= B + E** | **20** | **21** |  |  |  | |  |  |  |  |  |  |  | |  | Required Reserves | 18 | 18 |  |  |  | |  | Reserves Compliance Actual (daily average to date) | 20 | 20 |  |  |  | |  | Reserves Compliance (based on fulfillment pattern) | 19 | 19 |  |  |  |   Source: Authors |

# Forecasting the Autonomous Factors [Romain to add 3-4 pages]

There are two approaches to liquidity forecasting:

* *Forecasting all components of the central bank balance sheet:* This approach ensures for completeness of coverage while it likely requires more resources than the alternative below.
* *Forecasting only items that have an impact on excess reserves:* This approach focuses only on the items relevant for achieving the operational target therefore requiring less resources.

## Currency in Circulation







## Net Government position

**Three institutional elements can greatly support the central bank liquidity forecasting process:** 1) consolidation of all government transactions into a single treasury account at the central bank – this reduces the complexities involved with multiple accounts, some of which that may not impact liquidity (i.e. those involving accounts in commercial banks), while also minimizing credit risks to the government, 2) production of good quality cashflow forecasts by the MoF – it has the best available information to do this, and 3) a one-day ahead notification to the central bank of the aggregate movement across the government account – this results in certainty about the impact of government transactions on system liquidity.[[4]](#footnote-8)

**However, often the institutional arrangements are less than supportive requiring the central bank needs to establish its own process for forecasting government operations…..**

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| **Figure 3. Government Transaction Forecasting Process**    Source: Authors. |

## Net Foreign assets

**The degree of complexity involved in forecasting NFA is dependent upon the exchange rate regime.** There is no ongoing requirement to forecast NFA in fully floating exchange rate regimes while, the greater the degree central bank intervention – from managed floats to fixed exchange rate regimes – the greater the challenge in forecasting changes in NFA. Further, with a standard FX settlement convention of T+2, all same day flows are known (because the transactions were agreed two days prior), and only longer-dated transactions within the forecast horizon need to be forecasted.

## Other Entities

**The liquidity impact of Other Entities that operate accounts is potentially important. T**his category may be made up of a heterogenous range of entities and so it’s possible that different approaches are required for the different type of entities within this category. While not exhaustive, three broad types of entity can be identified as follows:

* *Quasi-government entities:* examples include, state-owned development banks, commodity exporters or utility companies.
* *Other official entities:* central banks sometimes allow foreign central banks to operate accounts to facilitate transactions in the local currency; for example, the US Federal Reserve allows many central banks to operate accounts to facilitate USD transactions. While in emerging and low-income countries, multilateral organizations (i.e. International Finance Corporation) may hold a central bank account to facilitate in-country lending, which when disbursed impacts domestic liquidity conditions.
* *Non-bank financial institutions:* Examples of non-bank entities that have accounts at the central bank include securities dealers, central counterparties (CCPs) and non-bank deposit taking and lending institutions (e.g. co-operative banks).

**The central bank should set clear terms and conditions for accounts operated by other entities.** The objective of these is to reduce the incidence of liquidity shocks that could undermine the effective implementation of monetary policy. The terms and conditions are best laid out formerly in a service level agreement (SLA) which imposes obligations on the account holder to operate in prescribed way. An SLA could contain the following requirements:

* Explanation of the purpose and intended broad parameters on use of the account,
* One day ahead reporting of transactions above a set threshold – that threshold to be set based on the liquidity impact relative to the size of the market,
* A limit on the minimum and maximum end-of-day account balance – it would not be expected that overdrafts would be permitted,
* Terms of participation in other central bank facilities – the expectation is the account holder would be a conservative be a passive manager of its liquidity and use market counterparties as needed. It would not be expected that such a holder has access to central bank credit facilities.[[5]](#footnote-10)
* A maximum daily transaction value, and
* Financial incentives for compliance with the terms and conditions to deal with situations where operational processes may not always provide a sufficient constraint on compliance. For example, balances more than a threshold could attract a negative interest rate.

**While well-specified SLAs will limit the likelihood of liquidity shocks, there may still be a need to forecast the flows some Other Entity account holders.** This is particularly the case where there is no SLA or where it is loosely specified. In this case forecasts should be based on an analysis of the account balances using techniques as previously noted in the CIC section [check/elaborate?].

## Other Items Net

**Other Items Net are AFs other than the NFA, CIC, OE and NGP which may not impact liquidity and therefore generally need only be considered if the full central bank balance sheet is being forecasted.** These items include the central bank’s capital, reserves, and the revaluation accounts, fluctuations in which, generally do not impact banking system liquidity. However there can be cases where such items do impact reserves, for example when central bank dividends are paid into a government account held with a commercial bank and so all transactions in this category need to be considered for impact and materiality on reserves.

**Other smaller items of the central bank balance sheet, that do not have a significant impact on bank reserves, can be summed up and modeled on an aggregated basis.** Only large items should be disaggregated and separately forecasted one of which may be the *reserve float*. A reserve float arises if the payor’s and payee’s accounts with the central bank are not credited and debited on the same day, a problem arising from inefficiencies in the payment system (Veale and Price, 1994). The best approach to forecast the reserve float is to extrapolate historical data and assess the float’s specific economic and noneconomic determinants, such as tax and payroll dates as well as specific factors contributing to transportation delays.

# Forecasting Reserves Demand [Romain to add 2-3 pages]

**Based on the motives to hold reserves, three overlapping concepts are relevant:** (1) Reserve requirement—the amount required to be held through regulation;[[6]](#footnote-12) (2) voluntary reserves—the amount held for precautionary reasons; and (3) excess reserves—the amount held in excess of the reserve requirement. Excess reserves can be held voluntarily if they have a precautionary motive or involuntarily if banks would dispose of them if the central bank would offer placement opportunities. In normal circumstances, voluntarily held reserves will closely equate with excess reserves, while quantitative easing is an example of banks being forced to hold reserves in excess of their voluntary demand.















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# Transparency and Forecast Quality



**Publication of *good quality* forecasts will improve market participants’ knowledge of short-term liquidity developments and likely improve the efficacy of monetary policy.** The central bank’s short-term liquidity forecasts represent the most complete assessment of the market’s current and forecasted liquidity position, information which assists banks to assess their position relative to the market. Publication of these forecasts may enhance institutions’ ability to better anticipate, and therefore manage, changes in their own liquidity positions – for example during periods when taxes are paid into the government’s account at the central bank. The size and frequency of liquidity shocks will be reduced with improved forecasting and transparency, leading to lower liquidity premia on term money market instruments, which supports market deepening and in turn, the transmission of monetary policy.

**Many central banks publish forecasts.** From a sample of 36 central banks Veyrune and Guo (2019) observe that 20 central banks publish some sort of forecast, which can either be a publication of AFs, a liquidity forecast, or an OMO allotment target.In most instances, the publication is weekly, particularly where the liquidity forecast, or the details of the expected AFs is used to determine the size of main monetary operation[[7]](#footnote-17). In relation to the details of the forecast, practices vary across central banks – with some central banks providing the individual forecast for AFs (ECB, Albania, Serbia) while others publish the aggregate liquidity target (Canada, Bank of England) so banks can gauge the availability of liquidity. Banks do not necessarily need the detailed composition of the AFs – the interest in the aggregate size of the market liquidity position should suffice to complement banks’ liquidity management strategy and provide an indication as to whether the market has enough reserves to meet short-term funding needs. Updates of the AFs at the time of the next monetary operation or within the maintenance period would provide regular communication and helps with transparency on the central bank’s monetary operations.

**The decision on whether to publish depends largely on the quality of forecasts.** While there is clear benefit in publishing *accurate* forecasts, publication of inaccurate forecasts may not be helpful to market participants while also undermining the credibility of the central bank.

**Testing for forecast errors should be rigorous to improve the quality of forecasts.** Improving forecasts is a constant process requiring an assessment of the AFs to better identify the source of the error. Various statistical tests can be applied to examine three important aspects (see Box 3):

1. ***Accuracy*,** which could be measured using the root mean square error (RMSE)to test the size and frequency of errors of the aggregate AFs,
2. ***Bias*,** which supplements the RMSEtest to determine whether the forecast consistently underestimates or overestimates the autonomous factor, and
3. ***Volatility*** in the forecast errors**,** to determine the reliability of AFs – i.e. whether the market can use the forecast in decision-making.

**Box 3. Testing Forecast Quality of Autonomous Liquidity Forecasts**

One important function for the liquidity forecasting team is to validate forecasts to ensure their accuracy and reliability for decision-making for both the central bank’s monetary operations and market participants (if the AFs are published). Testing forecast quality can be a periodic, with results used to improve subsequent forecasts – either through adding information for other factors from the central bank’s balance sheet that may be contributing to changes in autonomous liquidity factors or through adjustments in forecast methods. Where tests show good forecast quality, central banks could move forward with publishing AF forecasts.

The testing of forecast quality can use simple statistical tools to test for accuracy and bias. Tests should be applied to the overall forecast and to the individual components that make up the forecast.

1. **Testing for accuracy**: Root Mean Square Error (RMSE)

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| --- | --- |
|  | A smaller RMSE indicates a lower degree of forecast error, implying higher accuracy. |

1. **Testing for accuracy and bias**: OLS Estimation of the Relationship between the realized AFs (ARF) and the forecasted AFs (AFF)



Under the assumption that forecasts are unbiased and accurate, AFR should move proportionally to AFF without drift and limited forecast errors. The expected values for coefficients are =0; =1.

If ≠0, there is an unconditional bias in the forecast, suggesting that the change in autonomous factors over the period would be systematically over- or underestimated.

If ≠1, would suggest a bias conditional to the change in the forecast, indicating that the bias changes with the size of the autonomous factor change.

The test is based on the null hypothesis of both conditional and unconditional forecast bias together, conducted as the joint Wald test of =0 and =1.

Source: Authors

# Organization

**The liquidity forecasting function should be set-up as a standalone unit with a clear mandate and accountability.** The size of the unit will largely depend on the complexity of the financial system, and the reliability of the inputs received from different sources. The unit’s main tasks are to:

* Establish daily/weekly/monthly processes as necessary, to produce liquidity forecasts,
* Gather inputs from, internal sources—such as the research department, FX operations department, and payment systems department, and external to the central bank, such as the MoF and banks,
* Maintain the databases of core components used in the forecasts and the liquidity forecasting template,
* Assess *optimal* statistical approaches for forecasting the AFs,
* Assess forecast errors and refine the statistical approaches to minimize the incidence of error, and
* Publish the liquidity forecasts (when deemed appropriate).

**The skills required within the unit will range from advanced econometrics to good data management and administrative skills.** The task requires a high standard of integrity, given that the calibration and conduct of the monetary operations is dependent upon its output. Advanced econometric skills are essential to ensure that models are developed and frequently recalibrated to produce accurate forecasts of the AFs.

**The liquidity forecasting unit usually sits within the monetary operations unit or within the research area.** In some cases when the function is being established, it is housed within the research area given the need for good quantitative skills and that short-term liquidity forecasts can be linked with medium-term monetary targets, in countries with quantity-based frameworks. More frequently however, liquidity forecasting is conducted within the area responsible for conducting the monetary operations, given the close link between liquidity forecasting and liquidity management activities.

# Technical Assistance Approach

**TA will involve several steps to provide the authorities with recommendations needed to establish a credible liquidity forecasting framework.**  A sequenced approach is suggested as follows:

1. Assess the institutional and financial sector contexts to ensure an understanding of all the influences on banking system liquidity (i.e. location of the government account, role of SOEs or NBFIs).
2. Review the available data (of the AFs) – quality and frequency – identifying data gaps to be addressed and advise on the structure of the database needed to support the process.
3. Develop a template consistent with the institutional and financial set-up; the monetary policy framework (i.e. a quantity or interest rate operational target) and the operational framework (i.e. frequency of main operation, design of reserve requirement). Two key decisions here are the frequency and horizon of the forecasts.
4. Develop processes and models for forecasting the individual components:
   * + - Currency in Circulation: typically the largest liability of the central bank balance sheet.
       - Net Government Position: establish processes (i.e. Memorandum of Understanding) to receive cashflow forecasts from the government, otherwise identify models or alternative techniques to forecast this component. TA should help set up the basic structures to facilitate mutual information sharing between the relevant ministries and the central bank.
       - NFA: Foreign exchange transactions are usually settled on a T+2 basis and the same-day influence of this component should almost always be known with certainty. Weekly forecasts may be needed where the main operation is itself weekly.
       - Other AFs, with the emphasis on these other factors determined by their variability and relative contribution to forecast errors.
       - Demand for Reserves: using surveys, analysis of high-frequency data on reserve balances including throughout the reserve requirement maintenance period.
5. Establish an error testing process for each of the AFs with regular reporting on the trends in errors, with emphasis on the need for constant improvement and to address any deterioration in forecast quality.
6. Assess accuracy of the existing forecast framework (to the extent that there is one) and the degree to which the forecasts should be published. If the forecasts are not published, provide an assessment on the degree improvement needed before they can be published.
7. Assess and recommend changes as necessary on central bank capacity (types of skills), resourcing (number of staff) and the organizational structure (location of forecasting unit and reporting lines).















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1. In fixed exchange rate regimes, the central bank controls the price of a foreign currency measured in local currency terms. [↑](#footnote-ref-2)
2. In *floor systems* and *fixed-rate full-allotment systems* (see chapter on Operational Framework Choices), precise liquidity forecasts may be less important than in other systems. [↑](#footnote-ref-3)
3. See chapter on Reserve Requirements. [↑](#footnote-ref-4)
4. The Bank of Mexico requires such notification from the Ministry of Finance. [↑](#footnote-ref-8)
5. There may be rare exceptions. The US Federal Reserve established the Foreign and International Monetary Institutions Authorities (FIMA) Repo Facility which provides permanent repo access to designated counterparties to support the functioning of US treasury market. <https://www.federalreserve.gov/monetarypolicy/fima-repo-facility.htm> [↑](#footnote-ref-10)
6. See Chapter on Reserve Requirements. [↑](#footnote-ref-12)
7. In response to the crises most central banks (included in the survey) have adapted the operational strategy to provide significant excess reserves and adopt fixed rate full allotment auction procedures; yet central banks continue to publish liquidity forecasts to limit potential spikes in interest rate due to perceived liquidity shift. [↑](#footnote-ref-17)