A Forecasting Framework for Central Bank Liquidity

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Abstract

We develop a framework to forecast central banks' autonomous factors and estimate the liquidity position.

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1 Introduction

The September 2019 money market crash in the US reminded on the importance of liquidity management by the central bank. The conjunction of quarterly corporate tax payments and a large Treasury auctions on September 16 2019 have drained around USD 120 billion of banks' reserves at the central bank over only two business days, drying the interbank money markets liquidity. Consequently, the interbank rates hiked abruptly by more than 250 bps in a single day - against a daily average of 20 bps - pressuring the Fed Funds market.[1]

To implement monetary policy, most central banks have to control the liquidity conditions in the banking system. An important driver of the liquidity conditions in the banking system is the aggregate balance of all the monetary counterparties (commercial banks mostly)[2] that have an account with the central bank. These balances are also called "reserves" or "banks' reserves with the central bank." The sum of banks' reserves is sometimes called the "systemic liquidity".[3]

The aggregate level of reserves is crucial for implementing monetary policy and preserving financial stability. If the aggregate level of banks' reserves is too low, banks can face difficulties to settle their payments on the interbank market. Under low liquidity conditions, the demand for reserves increases, pushing the interbank rate up. Under extreme conditions, some banks might not be able to borrow reserves on the market and, in the absence of a refinancing alternative with the central bank, could default on their payments. On the contrary, under an excessive level of systemic liquidity, most banks have too much reserves, the demand for reserves plunges and the interbank rate converges towards the central bank deposit facility. In this situation, the transmission of monetary policy can be impeded, especially for central banks operating a corridor system.

Importantly, while the distribution of reserves among banks is decided on the intrabank market, with borrowing and lending banks, the aggregate level of reserves is under the control of the central bank. The central bank supplies banks' reserves ()

Central banks forecast liquidity to implement monetary policy. "Liquidity" is defined as on-call account of monetary counterparties (banks) at the central bank, also call "reserves." Liquidity forecasts are an important input to calibrate monetary operations, the objective of which is to align monetary conditions with the announced monetary policy stance. This applies to most monetary policy frameworks and is particularly important when the operational target is short-term interest rates.

[1] For more details, please refer to Anbil et al. (2020)

[2] Although, in a few countries, some non-banks entities - such as central counterparty clearing house - are allowed to maintain an account with the central bank

[3] Gray (2008) defines liquidity as "*the domestic-currency denominated, non-interest-bearing liabilities of the central bank held by the non-state sector*"

Statistical liquidity forecast consists in modelling the behaviors of the central bank non-monetary counterparties. Those counterparties are not supervised by the central bank and do not have access to the monetary policy operations of the central bank. Central banks can collect information directly from these counterparties. This is the non-statistical component of the liquidity forecast also called "institutional arrangements." However, central banks also use time-series models to forecast the behaviors of those counterparties.

We focus on modeling the behaviors of three nonmonetary counterparties that can have an influence on liquidity conditions. First, the Government could have an impact on liquidity via the transfers between its account at the central bank and those of the banks due to public expenditures and collection of revenues. Second, the public influences liquidity by demanding banknotes and coins which are issued against banks' reserves. Third, if the exchange rate is fixed and capital transactions allowed, a broad set of resident and non-resident counterparties could possibly influence liquidity via FX purchases and sales from and to the central bank. The items in the central bank balance sheet under the control of its nonmonetary counterparties are called "autonomous liquidity factors."

Currency in Circulation follows distinct seasonal patterns due to calendar effects related to the work week as well as public and religious holidays. These effects make it possible to develop point forecasting models for the level of these factors. For this reason, we propose forecasting currency in circulation using models [...]. Forecasting currency in circulation involved specific challenges such as treating mobile holiday (e.g., Ramadan or Chinese New Year) and structural break due to external shocks such as the COVID-19 pandemic.

On the other hand, net foreign assets do not display seasonal patterns, but do exhibit conditional volatility characteristic of financial returns data. For this reason, we propose forecasting net foreign assets, using models for conditional heteroskedasticity. Finally, the state treasury account follows seasonal patterns for some of its determinants but also exhibit conditional volatility characteristics for others. Some items that determined the Treasury account have clear seasonal pattern such as the payment of salaries and pensions as well as the collection of taxes. On the other hand, capital expenditures and tax revenues usually do not follow regular patterns.

In addition to developing forecasting models for three individual autonomous factors, we also consider forecast combination through taking an equally weighted combination either of all forecasts or of a trimmed set of models. The forecast quality is tested based on predictive performance metrics reflecting accuracy, bias, and reliability, which will be explained in this paper. Models are, then, ranked based on their predictive performance to combine them.

Finally, we also apply the method of forecast reconciliation to the liquidity forecasting problem. This involves, first, generating forecasts for the aggregate (or net) liquidity due to net foreign assets, currency in circulation and state account balance, leading to four forecasts

(one for each autonomous factor and one of the aggregates). In general, these four forecasts will not be coherent, i.e., the aggregate forecast will not be equal to the aggregate of the three individual factors. Reconciliation adjusts the four forecasts to ensure coherence. This method has been shown to improve forecasts in several contexts and is applied to liquidity forecasting for the first time here.

The remainder of the paper is summarized as follows. Section 2 introduces the data on the autonomous factors, highlighting the main features of each factor. Section 3 introduces the models and methods used both for forecasting and forecast reconciliation. Section 4 presents the results of extensive forecast evaluation and Section 7 concludes .

2 Introduction

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