

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.

Keywords: autonomous factors, time-series forecasting, central banking

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1 Introduction

Many central banks have to control the level of liquidity in the banking system, also called systemic liquidity. Systemic liquidity is defined as the aggregate balance of monetary counterparties (eligible commercial banks' mostly)¹ with the central bank.

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.

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

¹Although, in a few countries, some non-banks entities - such as CCP - are allowed to maintain an account with the central bank

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 .

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