Mikael Juselius

mikael.juselius@bof.fi

Nikola Tarashev

nikola.tarashev@bis.org

Online appendix: forecasting model for expected and unexpected losses

This appendix outlines the econometric model that underpins the expected and unexpected loss forecasts in Graph 3 of the Bulletin. The loss rates that the model forecasts are quarterly net charge-off rates on commercial and industrial loans extended by banks in the United States. For further details and an assessment of the model's performance relative to alternatives, see Juselius and Tarashev (2020).

The model comprises input data and an econometric specification. The two input variables are lagged loss rate observations, LR, as well as the quarterly debt service ratio, DSR, and credit-to-GDP gap, $C2Y$, which are part of the BIS credit statistics. From the standpoint of quarter t, we model the loss rate in quarter $t+h$ (with $h = 1,...,12$) and the squared error in estimating this rate as follows:

$$LR_{t+h} = \alpha_h + \sum_{k=0}^{1}\left(\beta_{h,k}LR_{t-k} + \gamma_{h,k}DSR_{t-k}\right) + \vartheta_{t+h} \qquad (1)$$

$$\hat{\vartheta}^2_{t+h} = exp\left(\sigma_h + \sum_{k=0}^{1}\left(\delta_{h,k}LR_{t-k} + \theta_{h,k}C2Y_{t-k}\right)\right) + \varepsilon_{t+h}, \qquad (2)$$

where the dependent variable in equation (2) equals the square of the fitted residual in equation (1).

To derive forecasts for quarter $T+h$ from the standpoint of quarter T we proceed in two steps. First, we estimate *simultaneously* the parameters of the above two equations on the basis of all available data up to quarter T. Second, on the basis of the first equation's parameter estimates and observations of LR and DSR from quarters T and $T-1$, we construct the *expected losses* $E_T(LR_{T+h})$. Likewise, to derive $E_T(\hat{\vartheta}^2_{T+h})$, we use observations of LR and $C2Y$ from quarters T and $T-1$ in the second equation. Finally, we calculate unexpected losses as $2\sqrt{E_T(\hat{\vartheta}^2_{T+h})}$.

Equations (1) and (2) underpin out-of-sample forecasts. In practice, these forecasts are "quasi real-time", because the data are typically revised between the quarter to which they apply and the time of the analysis.