ASSESSMENT OF LIQUIDITY RISK

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Introduction. In this methodology, the liquidity risk of commercial banks (bank) is considered exclusively in terms of quantitative analysis within the quanti-tative model of liquidity risk. Liquidity risk is calculated for all financial instruments that affect the bank's liquidity, and is conducted for all types and periods of interest rates used in the bank, including for fixed and floating interest rates, on the basis of the model of the value of the cash flows. The value of the cash flows of the financial instrument affecting the liquidity of the bank is determined by discounting the cash flows of the instrument, in accordance with the stress assessment of the bank's funding yield curve for the given type of financial instruments. The stress assessment of the bank's funding yield curve for each type of instrument is determined by summing the current market yield of a given type of instrument and the approved value of the shock of the yield shock. The shock of the yield is interpreted as an independent factor of the bank's liquidity. The in-terest rate is considered as a market factor. between the borrowing yield shock and the market interest rate. The borrowing yield shock determines bank's risk management unit.

Methodology. For each instrument (portfolio of instruments) affecting the liquidity of the bank, its duration is determined. The VAR of liquidity risk of the instrument or portfolio of instruments is determined by the following formula:

$$LIQ = N^{-1}(P)DC\sqrt{\sigma^2 + S^2} \quad (1)$$

where

LIQ is the VAR of liquidity risk,

$N^{-1}(P)$ -is the regression function of the standard normal distribution,

P is the confidence probability,

D is the duration of the instrument or portfolio of instruments,

C is the market value of the instrument or portfolio of instruments,

σ is the absolute volatility of the interest rate in question,

S is the bond yield shock for a given type of instrument.

The market value of instruments is determined based on market quotations, and the volatility and shocks of interest rates of each type are determined based on historical data on interest rates of that type or, in the absence of data - on the basis of historical data on interest rates of a similar type - taking into account expert judgments. methods of

estimating value, volatility and shocks;

- for the instruments quoted in the market, the evaluation is made on the basis of the general quotations of these instruments, which are averaged according to transacttions, or in the absence of such, on the basis of the quotations of dealers (brokers) for purchase or sale£

- for instruments that are not quoted in the market, but have quoted analogues, the assessment is made on the basis of the data of quotations of analogues, taking into account possible adjustment factors,

- for instruments that are not quoted on the market and do not have quoted analogues, the assessment is made on the basis of expert assessments.

Literature review. We have examined the works of prominent scholars related to the above mentioned topics. Particularly, we have taken into consideration the academic studies conducted by local and foreign experts [Astrelina et al., 2012, 176], [Lavrushina, 2011, 56], [Veshkin, Avagjan, 2007, 350], [Larionova, 2003, 272], [Blanchard and Pedro, 2017, 149–68]. Some experts concentrate on the experience of certain countries [Bolognesi, 2020, 39], [Campello et al., 2022, 57], whereas the others assess the liquiddity risk in close relation with measuring loan recovery rate, connecting methodology and empirical evidence [Calabrese and Michele, 2008, 193–214]. Finally, analysis of the impact of centralized management on recovery rates of credit loans. [Li, Muzi and Xiaoguang, 2022, 497–502], bank lending in transition economies [Perotti, 1993, 21–32], as well as works related to the nudging debtors with non-performing loans, and an evidence from three field experiments [Saulītis, 2023, 76] are also examined and considered in our study.

Scientific novelty. In this methodology the consumption risk of commerical banks is observed mainly through quantitative analysis in the fremes of consumption risk model. The consumption risk is counted for all the financial tools that impact on commercial banks consumption.

Analysis. Aggregation of liquidity risks for different types of interest rates and for different terms is done taking into account the correlation of different types of interest rates. It is allowed to use simplifying assumptions about the nature of the adjustment in accordance with the following method of aggregation:

• The risk for each foreign currency and interest rate is determined by the summation of the risks of the given interest rate and instruments in the given foreign currency. Here it is implicitly assumed that the aggregation of risks for different periods of the same type of interest rates in the same foreign currency is performed with supposedly 100% correlation, that is, the risk of the given foreign currency and interest rate is determined by summing up risks with different terms in terms of the given foreign currency and interest rate. This point of the algorithm corresponds to the assumption of

"parallel movement" of the yield curve. Calculations are made separately according to assets and liabilities in accordance with current interest rates and volatilities.

• For each foreign currency and interest rate, the risks of assets and liabilities are aggregated. At the same time, the risks of assets are taken with a plus, and the risks of liabilities are taken with a minus.

• Aggregation of risks of different types of foreign currencies and interest rates is done on the assumption of no correlation between different types of interest rates in different currencies. In that case, the risks R_1 and R_2 are aggregated into a single R risk according to the following formula.

$$R = \sqrt{R_1^2 + R_2^2} \qquad (2)$$

The following indicators can be the result of liquidity risk assessment:

– Absolute estimate of VAR as the amount of possible losses of the bank in comparison to the value of the bank's portfolio in the form of a decrease in the value of the nominated portfolio, which is used in calculating the liquidity risk (market/balance sheet/expert) as of the reporting date.

– Relative assessment of VAR as the ratio of absolute assessment to the value of the Bank's portfolio, which is used in calculating the liquidity risk (market/balance sheet / expert) as of the reporting date.

The above indicators are calculated for the bank's actual portfolios. The obtained values of the indicators characterize the current liquidity risk of the bank's portfolios. The indicators are calculated for all categories and types of instruments across all the bank's portfolios. The bank's portfolios and limits, which are in different foreign currencies, are recalculated in the currency of the given country at the exchange rate set for the working day corresponding to the reporting date. The calculation of derivatives indicators is done by their types (options, forwards, futures) according to all base assets that are subject to interest risk, as well as according to indices. Among the liquidity risk assessment parameters one should consider:

- confidence level,
- depth of background,
- the term of the portfolio,
- risk factors,
– shocks.

Liquidity risk assessment parameters should be defined by the bank's asset and liability management committee, with the presentation of the risk management department, revising (approving) as necessary, but at least once a year, as well as monitor the compliance of the defined parameters with the requirements of regulatory bodies and international organizations, and if necessary, submit recommendations for their change to the

bank's asset and liability management committee. The selection of the method for calculating VAR, adjustment coefficients and carrying out expert assessments are carried out by the bank's risk management by the department on its own, about which it must inform the bank's assets and liabilities management committee.

The duration of the instrument portfolio (sub-portfolios) is calculated as the average of the durations of the instruments (sub-portfolios) weighted by the value of the instruments (sub-portfolios) using the following formula:

$$D = \frac{1}{C}\sum_i D_i C_i \,, \qquad (3)$$

where

D - is the duration of the instrument portfolio,

C - is the fetched value of the portfolio, determined by the following formula

$$C = \sum_i C_i \,; \qquad (4)$$

D_i is the duration of the i instrument (sub-portfolio)

C_i is the yielded value of the i instrument (sub-portfolio)

$$D = -\frac{1}{C}\frac{\partial C}{\partial Y} \qquad (5)$$

where

D is the duration of the instrument,

C is the yielded value of the instrument,

$\frac{\partial C}{\partial Y}$ is the first derivative of the given value with respect to the interest rate.

– if the numerical method is used for the calculation of the given value or the application of the analytical formula leads to laborious calculations, then the duration of the tool is determined by the following formula:

$$D = -\frac{\Delta C}{C \Delta Y} \qquad (6)$$

where

D is the duration of the instrument

C is the yielded value of the instrument,

ΔC is the change in the value of the instrument that corresponds to

ΔY is interest rate changes,

ΔY is the change in interest rate

The value of the instrument is determined according to the following formula

$$C = \sum_{i, T_i \le T_{\exp}} C_i e^{-Y_i T_i} + I e^{-Y_{\exp} T_{\exp}} \qquad (7)$$

where

C is the yielded value of the instrument,

C_i the i cash flow of the given instrument,

T_i up to i cash flow time (year). presumably,

$T_i > T_{i-1}$ -Çó,

Y_i is the yield (with constant interest accrual) over

T_i time

I average value of the instrument at $T_{\exp}$ time (if the tool has no built-in options, then $I = 0$),

$T_{\exp}$ until the time of exercise of the first option (offer and/or early redemption) (or before the start of the exercise period)

$Y_{\exp}$ is the yield (with constant interest accrual) during

$T_{\exp}$ time.

The magnitude of each cash flow in formula (7) is determined in one of two ways

- according to the fixed interest rate. in this case, the amount of cash flow is constant,

- in accordance with the floating interest rate, and the amount of the cash flow is determined in accordance with the terms of the instrument with a floating interest rate, for example, the flow can be determined as LIBOR USD + 2%. In this case, the forward interest rate, which is defined by the following formula, is accepted as an estimate of the floating interest rate.

$$F_i = \frac{Y_i T_i - Y_{i-1} T_{i-1}}{T_i - T_{i-1}} \qquad (8)$$

It is allowed to use the simplifying assumption that the yield curve is constant

$$Y_i \equiv Y = Const \qquad (9)$$

At $T_{\exp}$ time the average value of the I instrument is generally determined by numerical methods, such as the Monte-Carlo method.

The duration of a non-coupon instrument (a bond, a promissory note, or a debt obligation in general, with repayment of principal and interest at the end of the latter's term) is equal to the period until maturity, and the duration of a floating-rate instrument (here it is assumed that the interest rate according to the coupons (payments) is determined by the previous coupon at the time of maturity) is equal to the period until

the first coupon (payment) £ The duration of the instrument with fixed interest rates, which does not contain options, is calculated according to the following formula:

$$D = \frac{1}{C}\sum_i T_i C_i e^{-Y_i T_i} \qquad (10)$$

where

D is the duration of the instrument

C is the delivered value of the tool, which is defined by the following formula

$$C = \sum_i C_i e^{-Y_i T_i}; \qquad (11)$$

C_i is the i cash flow on the given instrument,

T_i is the time of i cash flow (year), it is assumed that $T_i > T_{i-1}$,

Y_i is the yield (with interest compounded continuously) over time.

Conclusions. Analysis and assessment of liquidity risk should be performed on a regular basis (or often on the condition that adequate software and technical means are available to support the process of liquidity risk assessment). In addition to regular assessments, liquidity risk assessment can be performed in the following cases:

- with special instructions of the collegial body of the bank,

- at the initiative of the bank's risk management department – in case of significant changes in the market situation or stress factors.

The bank's risk management department monitors liquidity risk based on regular assessments and prepares the following types of reports:

- analysis of the forecasted liquidity of the bank based on the scenarios of the development of events,

- analysis of the bank's liquidity ratios and maintenance of internal regulations. Reports on liquidity risk should be included in bank's asset and liability management committee meeting agenda and relevant management decisions should be made.

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Liquidity management of a commercial bank is one of the most complex problems that arise in practice for all groups using financial analysis (bank lenders, internal control, bank-partner analysis departments, rating agencies, banking supervision), whether the bank is able to respond to its obligations, which are affected by the characteristics of the situation and change of the resource base, the return of assets, the financial result of the activity, the amount of own funds (capital), as well as the quality of the bank's management system. There is no single index for liquidity assessment, the fulfillment or non-fulfillment of which would allow us to draw a conclusion about the bank's situation, because liquidity is a multi-factor characteristic, for the assessment of which different groups of indicators are used: liquidity norms set by the RA Central Bank, coefficients characterizing the bank's liquidity situation system, system of analytical tables. The effectiveness and timeliness of the management decisions depends on the quality of the performed analysis and the relevance of the results of the bank's liquidity situation.