

LIQUIDITY RISK MANAGEMENT IN BANKING

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Abstract: The objective of this paper is to provide a global perspective of the liquidity risk from a banking societies' viewpoint. Our paper belongs to the technical studies that analyze the concrete way in measuring the liquidity risk at the level of the banking societies from Romania. The study is structured on chapters that present the theoretical background in liquidity risk management and new trends in measuring, monitoring and controlling liquidity risk. Also, the paper contains a study cases part, which presents the actual stage and the challenges of the measuring the liquidity risk. We try to underline the importance of a flexible banking system, which should be able to measure and forecast its prospective cash flows for assets, liabilities, off-balance sheet commitments and derivatives over a variety of time horizons, under normal conditions and a range of stress scenarios, including scenarios of severe stress.

JEL classification: G18, G21, G32, G33

Key words: liquidity risk, simple net liabilities, cumulated net liabilities, liquidity rate, average maturities transformation, immediate liquidity

In banking, there are two fundamental financial risks associated to the management of bank resources, namely: the interest rate risk and the liquidity risk. This is due to the fact that both types of risk are caused by the uncertainty that characterize the way depositors may withdraw their investments in case of interest rate variation, on one hand, and by the uncertainty that involves the interest rate paid by the commercial bank to its customers in order to attract and keep funds in form of deposits, on the other hand. The liquidity risk arises in the general funding of the bank's activities and in the management of the asset positions. The market turmoil that began in mid-2007 has highlighted the crucial importance of market liquidity to the banking sector.

Literature review. In the last decades, financial institutions are expected to do their business within an environment which is more and more characterized by financial instability due to a number of factors that occurred simultaneously, such as fluctuations in both interest rates and exchange rates, lack of liquidity and growing competition in offering financial services. These factors had a substantial impact on the development of national economies and caused a great deal of problems especially in the banking system leading to bank failures.

As a result, the business environment became more risky having a negative impact on the ability of commercial banks and other financial institutions to properly function within the economic system. Therefore, the issue of an efficient and effective risk management in banking became an up-to-date necessity more than ever before. In

fact, this is a topical interest in Romania too where over the years banks had to deal with the financial instability within a general uncertainty that affected the entire Romanian economy.

As a result of the operating procedures and management decision making banks face a number of risks. From this point of view, we can define three broad categories of risk in banking [13]: financial risks faced by a commercial bank in the process of managing its assets and liabilities, consist of the following types of risks: credit risk, liquidity risk, interest rate risk, insolvency risk; operating risks which characterize the sphere of banking services and refer to: operational risk, technological risk, new product risk, strategic risk; environmental risks that are generated by the competitive business environment within any bank is expected to properly function; they involve fraud risk, business risk, competing risk, political and legal risk.

Regarding the exposure to risk, studies conducted in this area identify two types of risk [10], namely: *pure risks* (risks generated by banking activities and processes with a potential to produce events that would result in losses) such as physical risks (destructions, accidents, breakdown), financial risks (generated by traditional banking operations), criminal and fraudulent risks (frauds, thefts, embezzlement), responsibility risks (not complying with banking standards) and *speculative risks* (risks generated by trying to obtain maximum profit) such as market risks (variation of market conditions), business risks or liquidity risks.

Authors like Greuning, H. and Bratanovic, S. [7] provide a comprehensive overview of topics dealing with the assessment, analysis, and management of financial risks in banking. They focus on risk-management principles and stresses that key players in the corporate governance process are accountable for managing the different dimensions of financial risk. The approach of the authors provides a framework for identifying the key players in the risk-management process and discussing their accountability for the various dimensions of the financial and other risk management processes.

Important research methods and banking techniques underline the importance of systemic risk [16], focusing on the combination of banking risks such as: solvency and liquidity risks, credit risk, interest rate risk, price risks, operating risks, legal and representation risk, environmental risk. This treatment gives an insight into modern risk management and hedging techniques, offering practical guidance on the role of a bank's board and executive management, organization and co-ordination of risk management.

Considering these risks are very important for each bank in any circumstances but especially when it comes to re-funding processes, which requires a number of additional safeguards that have national relevance, the risk of insolvency and lack of liquidity is considered major risks in the lending process [2].

Description of banking risks provided by Oprețescu M. [11] can be considered a benchmark of recent research in the field. The author makes a clear distinction between the general risks and specific risks of a bank, conducting a multidimensional description of the banking risks types: the nature of the banking institution, bank characteristics, nature of exposure, transfer rate on bank results, bank-customer relationship, elements involving market risk, banking operations reflected in the balance sheet.

Prunea P. [12] presents the issue of banking risk starting with the type of risk considered by specialists to be the most important risk faced by a bank during its activity, namely the financial risks. This category represents the risk faced by a bank in the process of managing its assets and liabilities and involves credit risk, liquidity risk,

interest rate risk, currency risk and insolvency risk, and the author studies the prospect of liquidity risk as the source of customers' behavior.

Other works are oriented only to study a particular type of banking risk, for example, liquidity risk [3]. The authors develop liquidity analysis from NBR regulations on dealing with liquidity risk. Liquidity indicators are analyzed on the example of a commercial bank, the bank monitoring its assets and liabilities in terms of residual maturity and influence of certain factors on liquidity indicators.

As a rule, the issue of risk management in banking is tackled separately for each type of risk. However, we have to take into account the fact that these risks are in a constant interaction, having a significant impact on the entire activity performed by the commercial bank. Therefore, the global risk management in banking is not just an indispensable necessity but it also represents the best way of bank protection against the negative effects the commercial bank could register in case the issue of financial risks becomes a reality.

Having this in mind, every bank should be interested in establishing a global risk management, which must comprise four significant steps: risk identification and assessment, risk control, risk avoidance or reduction and shifting risks, which involves either covering the risks from the general reserves of the bank or transferring them to an insurance company or trading in options and commodities.

Aspects regarding liquidity risk. Financial crisis erupted in 2007 in United States from the high number of risk is part of corporate life being the essence of banking activities. Liquidity risk has been one of the main drivers of the credit crisis. A recognized risk is less "risky" than the unidentified risk. While not avoidable, risks are manageable.

Liquidity - the ability to fund increases in assets and meet obligations as they become due - is crucial to the ongoing viability of any banking organization. But the importance of liquidity transcends the individual bank since a liquidity shortfall at a single organization can have systemic repercussions. The management of liquidity is therefore among the most important activities conducted at banks. Over time, there has been a declining ability to rely on core deposits and an increased reliance on wholesale funding. Recent technological and financial innovations have provided banks with new ways of funding their activities and managing their liquidity, but recent turmoil in global financial markets has posed new challenges for liquidity management.

The lack of funds occurred as a result of non-performing credits may affect the bank's capacity of fulfilling its obligations towards depositors. Consequently, a major financial risk may appear, namely the illiquidity risk (also called the financing risk). This type of risk is associated with deposits and it is caused by the uncertainty that exists concerning the way depositors may withdraw the invested funds.

Liquidity risk is the risk that a financial institution cannot meet its financial liabilities when they come due, at reasonable cost and in a timely manner. Liquidity risk can materialize both through trading and non-trading positions. The liquidity risk represents a cost issue for banks and it involves the extant correlation between the assets of the bank with a quick stripping possibility and the feasible dimension of depositors' requests. Once occurred, the financing risk can be operatively solved but this fact implies a certain cost effort for the commercial bank. The liquidity issue doesn't refer to the fact that this liquidity cannot be obtained but it is related to the price paid for getting it in due time.

A certain lack of liquidity for a bank can arise from a variety of structural correlations between the resources of the bank and its investments. In order to avoid such a risk, commercial banks usually establish an optimal proportion between the nature, the feature and the maturity of their resources and the destination of granted loans. Thus, short-term resources proceeded from sight deposits should be partly utilized for granting short-term credits, the other part being retained as a reserve of liquidities kept by commercial banks in accounts at the National Bank of Romania. Although such a solution diminishes the possibility of commercial banks to maximize their profits, it is absolutely necessary for hedging the liquidity risk that can negatively affect the entire activity of a bank when it occurs.

The liquidity risk arises in the general funding of the bank's activities and in the management of the asset positions. It includes both the risk of being unable to fund assets at appropriate maturities and rates and the risk of being unable to liquidate an asset at a price close to its fair value and in an appropriate time frame. A bank has access to a diverse funding base. Funds are raised using a broad range of instruments including deposits, borrowings and share capital. This enhances funding flexibility and limits dependence on any one source of funds and generally lowers the cost of funds. The bank strives to maintain a balance between continuity of funding and flexibility through the use of liabilities with a range of maturities.

Liquidity is crucial to the ongoing viability of any banking organization. Banks' capital positions can have an effect on their ability to obtain liquidity, especially in a crisis. Each bank must have adequate systems for *measuring, monitoring and controlling liquidity risk*. Banks should evaluate the adequacy of capital given their own liquidity profile and the liquidity of the markets in which they operate.

Implementing liquidity risk management implies at least three stages (figure 1).

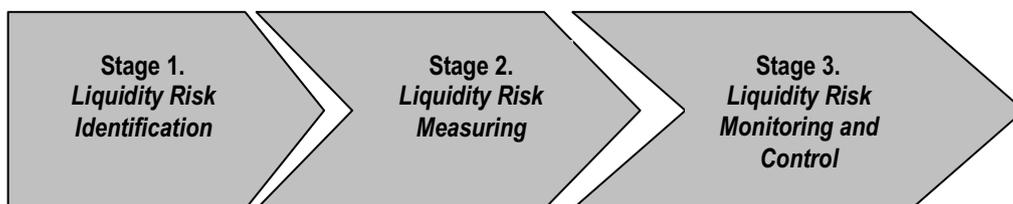


Figure no. 1. Liquidity risk management

Liquidity risk arises from the potential inability to meet all payments obligations when they come due. The bank manages the liquidity risk with the purpose of maintaining an adequate liquidity, so as to cover at all times its commitments on all time bands, as well as to maximize the net interest income.

The bank pays careful attention to liquidity risk management by setting fundamental objectives such as ensuring the necessary funds to cover, at any time, all financial obligations assumed by the bank and setting an appropriate balance sheet structure for minimizing any potentially negative effects. In this respect, the bank concentrates its efforts on identifying the liquidity risk sources, evaluating its risk exposure and setting appropriate limits to mitigate the possible consequences of liquidity risk.

Measuring liquidity risk. In order to *measure liquidity risk*, we take the example of a bank, namely Bank A. Using a system of indicators we can provide an overall picture on the degree of liquidity and quality of bank liquidity management for the bank involved:

- *simple net liabilities (successive)*. The maturity analysis of simple net liabilities for Bank A is presented in the following tables.

Table 1. Determination of simple net liabilities at 31.12.N

Thousand lei

No.	Maturity	Assets	Liabilities	Simple net liabilities
1.	< 3 months	9981100.3	12351245.0	2370144.7
2.	3-12 months	2694863.2	1948710.4	-746152.8
3.	1-5 years	2950822.5	665125.8	-2285696.7
4.	> 5 years	2845696.0	3507400.8	661704.8
5.	Total	18.472.482.0	18472482.0	0

Table 2. Determination of simple net liabilities at 31.12.N+1

Thousand lei

No.	Maturity	Assets	Liabilities	Simple net liabilities
1.	< 3 months	12628842.6	15880401.4	3251558.8
2.	3-12 months	3780438.1	2372060.0	-1408378.1
3.	1-5 years	4122855.2	2374018.9	-1748836.3
4.	> 5 years	3957156.4	3862812.0	-94344.4
5.	Total	24489292.3	24489292.3	0

- *cumulated net liabilities*. The maturity analysis of cumulated net liabilities for Bank A is presented in the following tables.

Table 3. Determination of cumulated net liabilities at 31.12.N

Thousand lei

No.	Maturity	Cumulated assets	Cumulated liabilities	Cumulated net liabilities
1.	< 3 months	9981100.3	12351245.0	2370144.7
2.	3-12 months	12675963.5	14299955.4	1623991.9
3.	1-5 years	15626786.0	14965081.2	-661704.8
4.	> 5 years	18472482.0	18472482.0	0

Table 4. Determination of cumulated net liabilities at 31.12.N+1

Thousand lei

No.	Maturity	Cumulated assets	Cumulated liabilities	Cumulated net liabilities
1.	< 3 months	12628842.6	15880401.4	3251558.8
2.	3-12 months	16409280.7	18252461.4	1843180.7
3.	1-5 years	20532135.9	20626480.3	94344.4
4.	> 5 years	24489292.3	24489292.3	0

- *liquidity rate*. The maturity analysis of liquidity rate Bank A is presented in the following tables.

$$LR_N = \frac{\sum_{i=1}^n L_i \cdot w_i}{\sum_{i=1}^n A_i \cdot w_i} = \frac{3149502660}{3347645300} = 0.94$$

$$LR_{N+1} = \frac{\sum_{i=1}^n L_i \cdot w_i}{\sum_{i=1}^n A_i \cdot w_i} = \frac{4011654840}{4643062720} = 0.86$$

where: A_i - assets with "i" maturity;
 L_i - liabilities with "i" maturity;
 w_i - weight for "i" maturity.

Table 5. Determination of liquidity rate at 31.12.N

Thousand lei

No.	Maturity	Assets	Liabilities	Weight (year)	Maturity weighted assets	Maturity weighted liabilities
1.	< 3 months	9981100.3	12351245.0	0.16	1596976.0	1976199.2
2.	3-12 months	2694863.2	1948710.4	0.625	1684289.5	1217944.0
3.	1-5 years	2950822.5	665125.8	3	8852467.5	1995377.4
4.	> 5 years	2845696.0	3507400.8	7.5	21342720.0	26305506.0
5.	Total	18472482.0	18472482.0	-	33476453.0	31495026.6

Table 6. Determination of liquidity rate at 31.12.N+1

Thousand lei

No.	Maturity	Assets	Liabilities	Weight (year)	Maturity weighted assets	Maturity weighted liabilities
1.	< 3 months	12628842.6	15880401.4	0.16	2020614.8	2540864.2
2.	3-12 months	3780438.1	2372060.0	0.625	2362773.8	1482537.5
3.	1-5 years	4122855.2	2374018.9	3	12368565.6	7122056.7
4.	> 5 years	3957156.4	3862812.0	7.5	29678673.0	28971090.0
5.	Total	24489292.3	24489292.3	-	46430627.2	40116548.4

- the average maturity of assets

$$t_{A N} = \frac{\sum_{i=1}^n A_i \cdot w_i}{TA} = \frac{3347645300}{1847248200} = 1.81 \text{ years} = 21.75 \text{ months} = 652.4 \text{ days}$$

$$t_{A N+1} = \frac{\sum_{i=1}^n A_i \cdot w_i}{TA} = \frac{4643062720}{2448929230} = 1.90 \text{ years} = 22.75 \text{ months} = 682.5 \text{ days}$$

where: A_i - assets with "i" maturity;
 w_i - weight for "i" maturity;
 TA - total assets.

- the average maturity of liabilities

$$t_{L N} = \frac{\sum_{i=1}^n L_i \cdot w_i}{TL} = \frac{3149502660}{1847248200} = 1.70 \text{ years} = 20.46 \text{ months} = 613.8 \text{ days}$$

$$t_{L N+1} = \frac{\sum_{i=1}^n L_i \cdot w_i}{TL} = \frac{4011654840}{2448929230} = 1.64 \text{ years} = 19.66 \text{ months} = 589.7 \text{ days}$$

where: L_i - liabilities with "i" maturity;
 w_i - weight for "i" maturity;
 TL - total liabilities.

- average maturities transformation

$$T_{m N} = t_A - t_L = 652.4 - 613.8 = 38.6 \text{ days}$$

$$T_{m N+1} = t_A - t_L = 682.5 - 589.7 = 92.8 \text{ days}$$

where: t_A - average maturity of assets;
 t_L - average maturity of liabilities.

- loans granted to customers / customer deposits formed

$$Lo_c / D_{c N} = \frac{L_c}{D_c} = \frac{7882238300}{1395388790} = 0.565$$

$$Lo_c / D_{c N+1} = \frac{L_c}{D_c} = \frac{1028877800}{1759708770} = 0.585$$

where: Lo_c - loans granted to customers;
 D_c - deposits formed by customers

- immediate liquidity

$$IL_N = \frac{P_b + S}{S_{rb}} \cdot 100 = \frac{7805882300}{1518249370} \cdot 100 = 51.41\%$$

$$IL_{N+1} = \frac{P_b + S}{S_{rb}} \cdot 100 = \frac{1129200170}{2074538160} \cdot 100 = 54.43\%$$

where: P_{bc} - placements with banks; S - investment securities;
 S_{rb} - raised and borrowed sources;

Based on these data, we can analyze the exposure of the bank to liquidity risk, comparing the results for both periods taken into account. The liquidity risk is almost absent due to the fact that all indicators recorded values close to the optimum level. Thus, the liquidity rate recorded values lower than 1, but very close to the optimum level 1, both in year N and N+1, which shows that the exposure to liquidity risk is very low. In terms of investments' profitability, these values show that ensuring a low liquidity risk does not affect profitability.

Table 7. Indicators for measuring liquidity risk

N o.	Indicators	U.M.	Year		N+1/N
			N	N+1	
1.	Liquidity rate	-	0.94	0.86	0.91
2.	Average maturity of assets	days	652.4	682.5	1.05
3.	Average maturity of liabilities	days	613.8	589.7	0.96
4.	Average maturities transformation	days	38.6	92.8	2.40
5.	Loans granted to customers / customer deposits formed	-	0.565	0.585	1.04
6.	Immediate liquidity	%	51.41	54.43	1.06

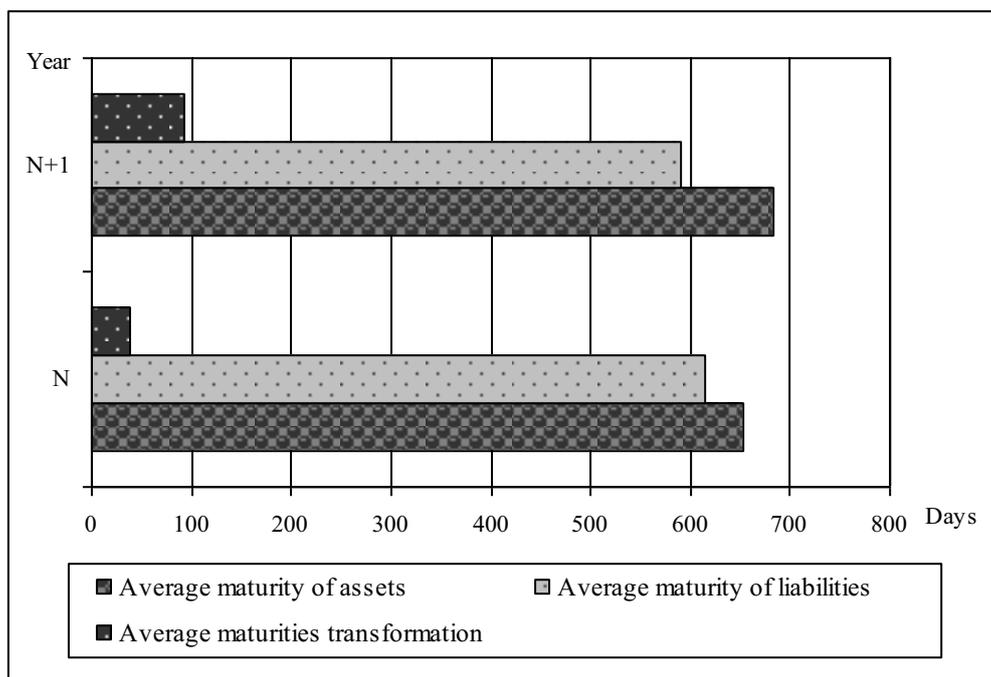


Figure 2. Indicators for measuring liquidity risk

Analyzing the average maturities of assets and liabilities, we can see that in the second period the average maturity for assets is higher than for liabilities, which leads to the conclusion that the bank is funded on short-term compared with the maturity of its resources. Thus, liabilities reach maturity faster than investments. The difference between these values is not very high, which shows an efficient management of liquidity risk.

The most conclusive indicator for liquidity risk is the average maturities transformation because it shows the concrete expression of the applied transformation. This indicator, which recorded a value of 38.6 days in year N and 92.8 days in the next year, shows an average interval of time in which resources reach maturity faster than investments, requiring funding if resources are not extending. The relation between credits and deposits is less relevant, expressing the degree of coverage for investments through raised resources. A lower value than 1, recorded in both years, shows a proper management of liquidity risk.

Monitoring and controlling liquidity risk. To monitor liquidity and funding, financial institutions need to have the capability and knowledge for regular liquidity risk management and reporting that measure the potential impact of moderate risk and crisis situations, and project sources and uses of funds. Sound short-term and long-term liquidity risk management is an integral component of a bank's contingency funding plan, to prepares a bank for any significant funding crisis that could arise.

In February 2008 the Basel Committee on Banking Supervision published *Liquidity Risk Management and Supervisory Challenges* establishing seventeen principles for managing and supervising liquidity risk in a number of key areas, such as:

- the importance of establishing a liquidity risk tolerance;
- the maintenance of an adequate level of liquidity, including through a cushion of liquid assets;
- the necessity of allocating liquidity costs, benefits and risks to all significant business activities;
- the identification and measurement of the full range of liquidity risks, including contingent liquidity risks;
- the design and use of severe stress test scenarios;
- the need for a robust and operational contingency funding plan;
- the management of intraday liquidity risk and collateral; and
- public disclosure in promoting market discipline.

In conclusion, liquidity measurement involves assessing a bank's cash inflows against its outflows and the liquidity value of its assets to identify the potential for future net funding shortfalls. A bank should be able to measure and forecast its prospective cash flows for assets, liabilities, off-balance sheet commitments and derivatives over a variety of time horizons, under normal conditions and a range of stress scenarios, including scenarios of severe stress.

A bank should define and identify the liquidity risk to which it is exposed for all legal entities, branches and subsidiaries in the jurisdictions in which it is active. A bank's liquidity needs and the sources of liquidity available to meet those needs depend significantly on the bank's business and product mix, balance sheet structure and cash flow profiles of its on- and off-balance sheet obligations. As a result, a bank should evaluate each major on and off-balance sheet position, including the effect of embedded options and other contingent exposures that may affect the bank's sources and uses of funds, and determine how it can affect liquidity risk.

A bank should recognize and consider the strong interactions between liquidity risk and the other types of risk to which it is exposed. Various types of financial and operating risks, including interest rate, credit, operational, legal and reputation risks, may influence a bank's liquidity profile. Liquidity risk often can arise from perceived or actual weaknesses, failures or problems in the management of other risk types. A bank should identify events that could have an impact on market and public perceptions about its soundness, particularly in wholesale markets.

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