

BANK LIQUIDITY RISK: ANALYSIS AND ESTIMATES

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Abstract. In today's banking business, liquidity risk and its management are some of the most critical elements that underlie the stability and security of the bank's operations, profit-making and clients confidence as well as many of the decisions that the bank makes. Managing liquidity risk in a commercial bank is not something new, yet scientific literature has not focused enough on different approaches to liquidity risk management and assessment. Furthermore, models, methodologies or policies of managing liquidity risk in a commercial bank have never been examined in detail either.

The goal of this article is to analyse the liquidity risk of commercial banks as well as the possibilities of managing it and to build a liquidity risk management model for a commercial bank.

The development, assessment and application of the commercial bank liquidity risk management was based on an analysis of scientific resources, a comparative analysis and mathematical calculations.

Keywords: liquidity risk, bank risks, commercial banks, liquidity ratios, obligatory reserves, liquidity risk management.

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1. Introduction

Liquidity risk is a critical component of all risks that affect the activities of a bank. Banks must assess their liquidity risk at all times and during periods of economical recession in particular. The article appraises the importance of risk to economy, its influence on the banking sector and identifies the risks that commercial banks face. Moreover, it assesses the significance of liquidity risk, analyses ways to manage it as well as the development of the liquidity ratio and the obligatory reserves requirement in Lithuania. A model to manage the liquidity risk in a commercial bank has been designed and used to assess the liquidity in one commercial bank controlled by a foreign bank.

Different authors demonstrate varying understanding of risk in a commercial bank. Some sources state that risk is the probability of losses resulting from the unforeseen impact of both external and internal factors affecting the bank.

By rendering financial services to the public, a commercial bank creates added value for its shareholders. To attain this goal, the resources available and the risks arising have to be managed in the most effective way possible. Banks handle financial resources entrusted to them by deposit-holders and invest the moneys striving to earn the maximum profit obtainable at an acceptable level of risk. When it comes to managing its risks, a commercial bank has to consolidate risk management, creating a uniform process since all risks and methods to manage it are interrelated.

One of the main objectives of a bank is to choose the best ratio of risk level and profitability. In banking, risk usually implies a threat that the bank might lose some of its resources, income, run higher costs whilst performing some of its financial operations. However, taking risks in the business of a bank does not always entail losses. Efficient risk management in a bank could provide the backbone for a successful business of the bank. Every bank faces a whole of different risks in the process of its operations, (Cooper 2007). Liquidity risk is one of the most important risks that banks face, since problems with liquidity may eventually lead to insolvency issues.

The commercial bank liquidity risk management model that the authors introduce in this article permits assessing how successful a commercial bank manages its liquidity risk. An assessment of a commercial bank's liquidity risk creates a possibility to see the gaps in managing such a risk and to improve the way the liquidity risk that the bank faces is managed.

2. Conception and meaning of liquidity risk

Why is liquidity risk management so important? During the recent financial crisis, although many banks had posted adequate levels of capital, they still experienced difficulties because they failed to manage their liquidity properly. Post-crisis, the higher cost of liquidity, larger funding spreads, higher volatility and reduced market confidence are driving financial institutions to allocate more resources to improving their liquidity risk management capabilities (BoL 2011).

One should begin analysing risks with the conception of risk in its broadest sense. Even though a lot of authors provide slightly varying definitions of risk, generally risk can be assumed to be an expression of a probable event as a value. Risk is the perceived loss that is often measured by the possibility of unfavourable choice, which is expressed as probability. An economist may see this probability as a ratio that indicates a possible loss of profit and the occurrence of losses (BIS 2009).

G. Kancerevyčius (2009) notes that risk occurs when the probabilities of potential results are known, uncertainty arises when the probabilities of different possible results are not known. This is what distinguishes risk from uncertainty.

So, based on a literary analysis, one can infer that risk is a probability, which shows that actual profitability will differ from the one that has been planned. The higher this probability is, the higher risk is faced. However, we cannot see risk only as an indicator of substantial losses. Accepting additional risks may lead to extra profit, and the higher the risk, the higher profit can be expected. In conclusion, the meaning of risk in economy can be perceived both as a probability of losses and an opportunity to operate under uncertain conditions and make higher income by accepting a higher degree of risk.

By rendering its services to the public, a commercial bank generates added value for its shareholders. This requires managing the resources available and any risks that may arise in the most effective way possible. Banks handle financial resources entrusted to them by deposit-holders and invest the moneys striving to earn the maximum profit obtainable at an acceptable level of risk Valvonis (2009) Many different methods exist to manage every type of risk. When it comes to managing its risks, a commercial bank has to consolidate risk management, creating a uniform process since all risks and methods to manage it are interrelated.

There are three main types of risks that can be identified: *market risk*, *credit risk* and *operational risk* (Crouhy, Galai, Mark 2007). This classification of bank risks sum up the risks that banks incur, yet it does not embrace one of the key types of risks that a bank faces, which is *liquidity risk*. A. Gaulia and I. Mačerinskienė (2006) further expand the classification of risk as established in the Basel rules of capital adequacy by adding liquidity risk.

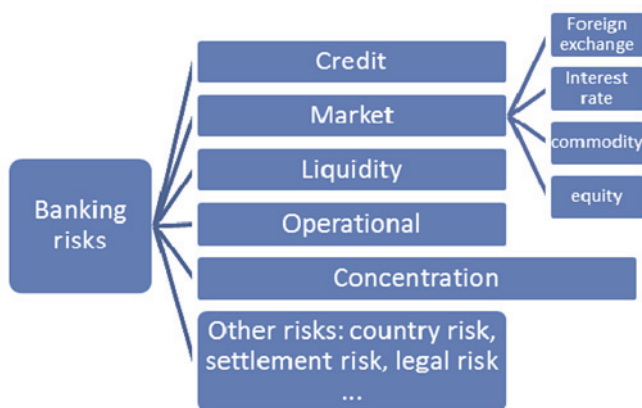


Fig. 1. Banking risk (Source: created by authors)

J. Bessis (2008) identified six principal types of risk such as *credit risk*, *interest rate risk*, *market risk*, *liquidity risk*, *operational risk* and *foreign exchange risk*. Authors of the current banks risk is reflected in Fig. 1. The scientist has added other types of risks to the ones mentioned above. Other risks may concern country risk, regulation risk and so on.

According to the classification of banking risks introduced by foreign economists Timothy W. Koch and S. Scott MacDonald (2006), *market risk* can be generally said to consist of three lesser risks: *stock price risk*, *interest rate risk* and *foreign exchange risk*. Timothy W. Koch and S. Scott MacDonald (2010) identified six types of risks. These are *credit risk*, *liquidity risk*, *market risk*, *operational risk*, *reputation risk* and *legality risk*. These risks go hand in hand with *capital risk*, which is perceived as a risk that the investor will lose all or part of their funds.

So, a commercial bank is affected by a plenitude of different risks. Many authors identify various risks that commercial banks face, yet the differences among them are not essential.

Liquidity risk is one of the most critical risks that banks run. Adequate management of liquidity may minimise the probability that serious problems will arise in future. In fact, the issue of liquidity is not limited to just one bank. A low liquidity ratio in one financial institution could affect the entire system. It is liquidity risk that may play the definitive role in the case of a bankruptcy of a bank. At a time of economic recession, the liquidity of a bank is a guarantee for the bank's financial stability (Brunnermeier, Lasse 2009).

Liquidity is the ability of a bank to fund increases in assets and meet obligations as they come due, without incurring unacceptable losses (BIS 2008). The fundamental role of banks in the maturity transformation of short-term deposits into long-term loans makes banks inherently vulnerable to liquidity risk, both of an institution-specific nature and that which affects markets as a whole. Virtually every financial transaction or commitment has implications for a bank's liquidity. Effective liquidity risk management helps ensure a bank's ability to meet cash flow obligations, which are uncertain as they are affected by external events and other agents' behaviour (CEBS 2009).

The European Central Bank (ECB 2009) defines liquidity risk as the ability of a bank to finance increases in assets and meet payment obligations when due. However, this definition does not reflect the extent of liquidity quite correctly. This extent is important when it comes to unforeseen utilisation of credit facilities, withdrawal of deposits, premature repayments of loans and/or payments of interest.

The rules for estimating the liquidity ratio as approved by the Bank of Lithuania describe the liquidity of a bank as the bank's ability to honour its obligations on time, fully and without interruptions.

T. P. Fitch (2006) defined liquidity in his dictionary of banking terms as the ability of an institution to meet its obligations. In banking, this term stands to include the ability of a bank to meet the demands of deposit holders who wish to withdraw their funds and to satisfy the needs of willing borrowers.

Banks are a vital part of the global economy, and the essence of banking is asset-liability management, liquidity, gap and funding risk management as well (Choudry 2007, 2009, 2010, 2012). Liquidity risk is the risk that a banking business will have

insufficient funds to meet its financial commitments in a timely manner. The two key elements of liquidity risk are short-term cash flow risk and long-term funding risk. The long-term funding risk includes the risk that loans may not be available when the business requires them or at acceptable cost. All banking businesses need to manage liquidity risk to ensure that they remain solvent.

Market and funding liquidity risks compound each other as it is difficult to sell when other investors face funding problems and it is difficult to get funding when the collateral is hard to sell. Liquidity risk also tends to compound other risks. If a trading organization has a position in an illiquid asset, its limited ability to liquidate that position at short notice will compound its market risk. Suppose a firm has offsetting cash flows with two different counterparties on a given day. If the counterparty that owes it a payment defaults, the firm will have to raise cash from other sources to make its payment. Should it be unable to do so, it too will default. Here, liquidity risk is compounding credit risk.

Accordingly, liquidity risk has to be managed in addition to market, credit and other risks. Because of its tendency to compound other risks, it is difficult or impossible to isolate liquidity risk. In all but the most simple of circumstances, comprehensive metrics of liquidity risk do not exist. Certain techniques of asset-liability management can be applied to assessing liquidity risk. A simple test for liquidity risk is to look at future net cash flows on a day-by-day basis. Any day that has a sizeable negative net cash flow is of concern. Such an analysis can be supplemented with stress testing. Look at net cash flows on a day-to-day basis assuming that an important counterparty defaults.

3. Management of liquidity risk in Lithuanian banks

To achieve better management of liquidity risk, the Bank of Lithuania has set a liquidity ratio for Lithuanian commercial banks to comply with.

The liquidity ratio: the relationship between the liquid assets and current liabilities of a bank may not be lower than 30 per cent.

$$L = \text{LA} : \text{CL} \times 100\%, L \geq 30\%,$$

where:

L is the liquidity ratio,

LA is the liquid assets,

CL is the current liabilities.

The Bank of Lithuania has also established the following concepts:

Liquidity buffer is liquid assets sufficient to meet an additional need for liquid assets that may arise during the designated survival period of a bank under unfavourable conditions according to the most probable scenario. The liquidity buffer is a short-term component of the liquidity counterbalance capacity.

Survival period is a short-term period established by a bank, when the bank can ensure continuity of its business and meet all of its obligations when they are due according to the established worst-case scenarios, without attracting additional cash flows and avoiding the necessity to sell its assets at a loss.

Net funding gap is the negative difference, which results from subtracting the expected monetary disbursements amount from the anticipated monetary revenues amount.

Banks must manage their liquidity buffers by making sure that it will be available to them should unfavourable circumstances arise, with no legal, regulatory or operating restrictions imposed on the application of such assets. Banks should steer clear of high concentrations of securities and other liquid assets.

Obligatory reserves are another important requirement that facilitates managing and safeguarding the liquidity of commercial banks. Requirements for obligatory reserves are the requirements of the central bank for commercial banks to have a particular amount of their identified liabilities covered with liquid assets. Said portion is known as the obligatory reserve ratio. The obligatory reserve requirement applies to maintain the liquidity of the banking system as well as a higher degree of stability in the interest rates on the monetary market.

Currently, obligatory reserves of the Bank of Lithuania must total 4 per cent of the bank's existing liabilities (BoL 2008). Considered the most liquid form of assets, obligatory reserves clearly assure a higher degree of liquidity and shock-resistance of the banking system, however they do nothing to protect deposits held with commercial banks due to the simple fact that the amount of such deposits normally exceeds the extent of the reserves by a dozen or so times.

The recent international financial crisis has underlined the importance of managing liquidity risk. The requirements for liquidity risk management have never been standardised on an international scale before (Jasevičienė 2012). That in mind, both the requirements of the CRD IV directive and Basel III set forth new standards for liquidity risk management as well. The standards shall consist of two indicators. The liquidity coverage ratio (LCR) is estimated as the ratio between the liquidity buffer and the net funding gap. The minimum required LCR is expected to be that of 100 per cent. The Lithuanian banking system is currently aligned with this ratio. The net stable funding ratio (NSFR) is the ratio between the existing long-term liabilities and the required long-term liabilities, the latter amount established on the basis of the available long-term assets. The NSFR's function is to harmonise the structure of long-term assets and liabilities. So far, banks do not completely comply with this requirement but are planning to achieve full compliance by the time the CRD IV directive is in place. During the second quarter of 2012 the amount of banks' liquid assets – balances of accounts, debt securities, cash – dropped, yet the liquidity ratio of the banking system remained unchanged and still stood at 39.8 per cent (Fig. 2).

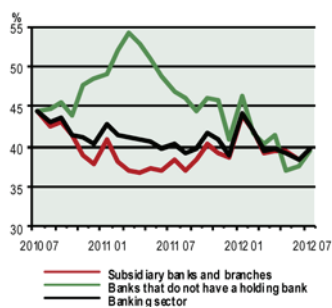


Fig. 2. Dynamic liquidity ratio percentage
(Source: Bank of Lithuania 2012 (created by authors))

This ratio remained intact because the maturities of financial resources held with banks were growing shorter and, according to the rules for calculating the liquidity ratio, these resources were recorded as liquid assets. Bearing in mind that the possibilities for the banks operating in Lithuania to attract funds during the crisis varied, and so did their strategies to manage liquidity as well as the structures of their liquid assets, for the purposes of analysis of banks' liquidity we can identify two groups of banks: subsidiary banks and branches of foreign banks, and banks that do not have a parent bank.

During the second quarter, the liquidity ratio of the group of banks that do not have a parent bank and are more vulnerable to liquidity shocks continued to decline and was lower than that of the subsidiary banks' group. Banks that do not have a parent bank manage their liquidity and comply with the requirements by making their own liquidity buffers and harmonising the maturities of assets and liabilities, and their liquidity is largely affected by fluctuations of the deposit volume. Most (54.3 per cent) of the liquid assets of these banks are investments into debt securities, whereas liquid balances of bank accounts make up slightly over 11 per cent of the liquid assets. The liquidity of subsidiary banks is becoming increasingly centralised, and as a result the formation of their liquidity buffers is formed and compliance to ratios is enforced by coordinating decisions and actions with the parent bank, considering the entire parent bank group. Liquidity risk management holds a certain amount of relevance for banks due to an absence of balance between the maturities of assets and liabilities within the banking system (Fig. 3).

Since the main type of business of banks operating in Lithuania is lending operations, the majority (59.5 per cent) of their assets is invested for periods extending beyond one year. Stable long-term sources of financing account for nearly half of the (32.4 per cent) amidst banks' liabilities, and therefore banks finance their long-term investments with short-term liabilities, which are being constantly renewed. As mentioned above, considering the risk of liquidity that stems out of the misbalance between assets and liabilities, the EU is planning to introduce a net stable funding ratio (NSFR),

which shall be used to determine the minimum amount of long-term liabilities required to cover the amount of long-term assets of a bank. Even though this ratio is scheduled to appear in the EU in 2018, banks should start looking for financial resources with extended maturities and strive for a better balance between their assets and liabilities in terms of their maturities already. Still, banks that do not have a parent bank will be facing challenges in prolonging the maturities of their liabilities, as such banks have difficulties in attracting long-term funds on the local market even at higher interest rates, however this prolongation of liability maturities may have a negative impact on the profitability figures of subsidiary banks as well.

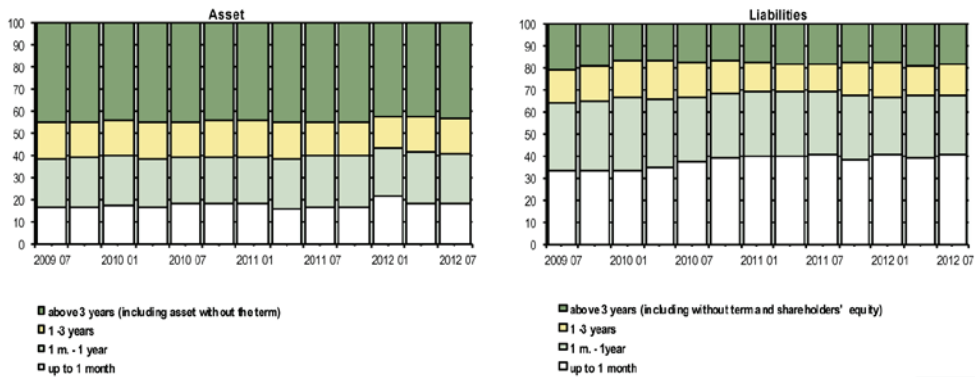


Fig. 3. Assets and liabilities by maturity dynamics
(Source: Bank of Lithuania 2012 (created by authors))

According to the data available for July 1, 2012, most banks have an adequate liquidity buffer to compensate for the net funding gap. As estimated by the banks, the liquidity buffer totalled LTL 16.9 billion compared to the net funding gap of LTL 7.1 billion, which means that the banks' liquidity buffer was 2.4 times bigger than the required floor value. The sufficient coverage of the net funding gap in the banking system is driven by parent banks, which include unused loans from foreign holding institutions into their liquidity buffer. The liquidity buffer of banks that do not have a parent bank on July 1, 2012 was just slightly bigger than their net funding gap.

The liquidity buffer required to secure short-term liquidity of banks under unfavourable conditions can be estimated, and the ratio can be compared for different banks with a higher degree of precision by using the liquidity coverage ratio (LCR), which by definition approximates liquidity buffer, yet is uniform for all financial institutions. Although the EU is planning to introduce this ratio in 2015, voluntary pilot calculation of the LCR across all eight banks doing business in Lithuania began in early 2012.

According to the information available for July 1, 2012, judging by the new requirements to be implemented (some of them are more rigid than those applied to estimating the liquidity buffer, for instance, defining financial instruments that can comprise the buffer in a very conservative fashion), the LCR of banks is a little lower and compliance

to it would entail a lower liquidity buffer than the ratio estimated on the basis of banks' reports. During the second quarter, the pilot LCR of banks improved slightly and, as of July 1, 2012, stood at 143 per cent (BoL).

The European Banking Authority (EBA 2012) is also actively involved in analysing and appraising the liquidity status of EU banks. According to the EBA (which has divided banks into two groups), at end of December 2011, the average LCR of Group 1 was 72.1%, with country results ranging from 25.6% to 122.9%. The shortfall is estimated at €1066.8 bn, of which 77.1% is represented by 3 countries. Only 9 banks, accounting for 20.5% of the Group 1, have an LCR ratio above 100%.

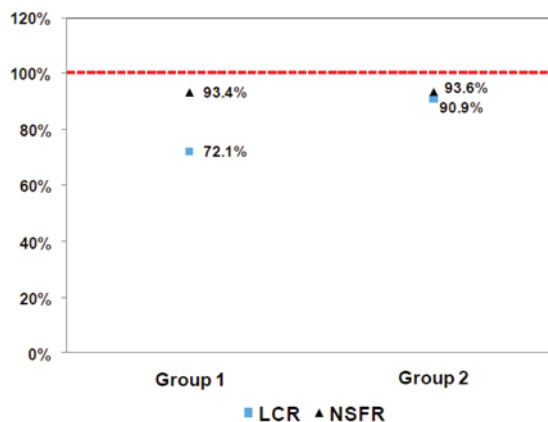


Fig. 4. LCR and NSFR ratio (Source: EBA 2012)

More than 80% of the holdings of LCR eligible liquid assets are Level 1 assets, which implies that on average the 40% cap on level 2 assets has a limited impact, while some countries are significantly affected. In total, 24 banks face a reduction in Level 2 assets of about €53 bn due to the cap on liquid assets. Group 2 LCR has significantly improved, now at 90.9%, on average. About 44% of the Group 2 banks (i.e. 49 of 111 banks) already meet the regulatory minimum requirement, with little difference between large and small banks. The shortfall of liquid assets is also reduced, to €101.7 bn. Concerning the NSFR, Group 1 banks report an average ratio of 93.4%, resulting in a shortfall of available stable funding of €1.1 trillion. Group 2 banks show very similar results, with an average NSFR of 93.6%. (Fig. 4).

4. Liquidity risk management model of a commercial bank

Following the analysis of scientific literature and the legislation of the Republic of Lithuania and the Bank of Lithuania that was presented in the theory part, we designed a model for managing liquidity risk in commercial banks (Fig. 5). This liquidity management model is based on theoretical ways to manage liquidity risk and the contemporary banking practice.

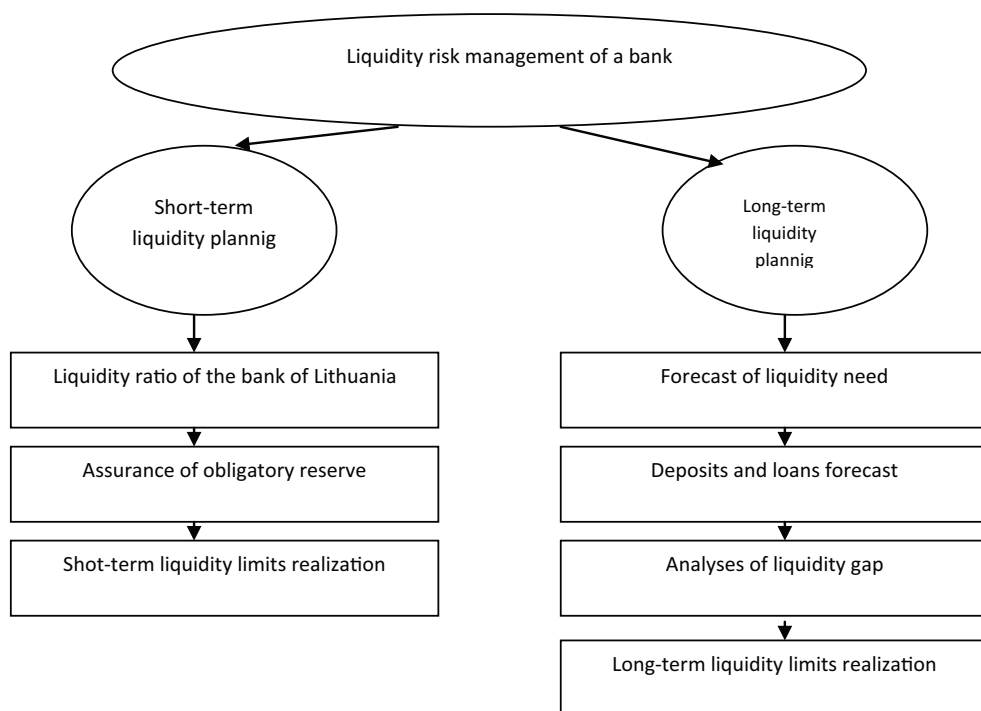


Fig. 5. Liquidity risk management model of a commercial bank
(Source: compiled by the authors based on Bessis 2008; Kancerevyčius 2009)

Assessment of liquidity risk in a commercial bank can be split into management of short- and long-term liquidity. The management of short-term liquidity of a bank covers a period of one month. Short-term liquidity of a bank can be managed in line with the liquidity ratio prescribed by the Bank of Lithuania as well as the internal short-term liquidity indicators of the bank.

Long-term liquidity management consists of managing a bank's liquidity over a period of one year (Kancerevyčius 2009). Management of long-term liquidity can be based on forecasting and satisfying the need for liquidity. Analysing the liquidity gap and assessing long-term liquidity ratios is equally important. Gap analysis allows you to see the differences between assets and debt liabilities both at present and at any given moment in future (Bessis 2008). A positive difference indicates that assets will exceed liabilities and shareholders' equity over the period of analysis. That means that the amount of assets during a respective period will be higher than that of liabilities. Whereas a negative difference will mean that, over the period of analysis, liabilities will exceed assets. This means that there will be a deficit of assets during a particular period. A zero difference indicates that the amount of assets precisely covers the amount of liabilities.

So, this model of managing a commercial bank's liquidity risk allows judging the success with which the commercial bank handles its liquidity risk. Assessment of the

liquidity risk of a commercial bank creates a possibility to pinpoint weaknesses in liquidity risk management and to manage the liquidity risk of the commercial bank with more efficiency.

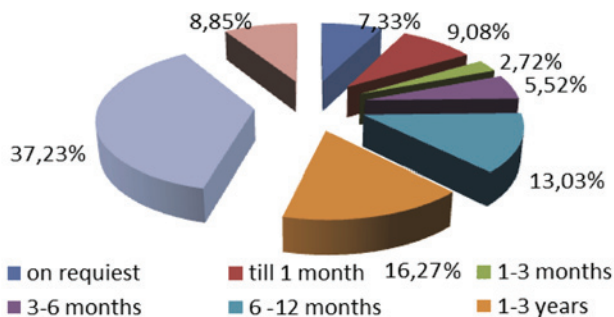


Fig. 6. Assets of a bank controlled by a foreign bank by maturity as of the 31st of December, 2011 (%) (Source: compiled by the authors based on a bank's controlled by a foreign bank financial year 2011 report)

5. The valuation of the liquidity risk of a bank controlled by a foreign bank

For the purposes of this analysis, we have chosen a universal commercial bank controlled by a foreign bank, which offers the entire range of banking services to private and business clients.

Before applying the liquidity risk management model to analyse the management of short- and long-term liquidity risk of the bank, we should carry out an analysis of the bank's assets and liabilities by maturity.

Notably, as of December 31, 2011 the majority of the subject bank's assets were long-term assets with maturity of 1 to 3 years (16.27 per cent) and over 3 years (37.23 per cent). The bank's short-term assets with maturity of under 1 month accounted for 16.41 per cent of all assets, and assets with maturity of up to 3 month made 19.13 per cent of the bank's assets (Fig. 6).

The largest portion (36.52 per cent) of the liabilities of the bank controlled by a foreign bank consists of liabilities with maturity of 1 to 3 years. The subject bank's short-term liabilities with maturity of under 1 month amounted to 33.39 per cent of its total liabilities, and liabilities with maturity of under 3 months accounted for 39.62 per cent of the liabilities (Fig. 7). The liabilities of the bank controlled by a foreign bank with maturity of up to 1 year amounted to one-half (50.26 per cent) of the bank's liabilities.

Therefore, considering the structure of the assets and liabilities of the bank controlled by a foreign bank by maturity, we can conclude that the short-term assets of the bank account for 37.65 per cent of its total assets, and short-term liabilities with maturity of under 1 year make up one-half (50.26 per cent) of its total liabilities.

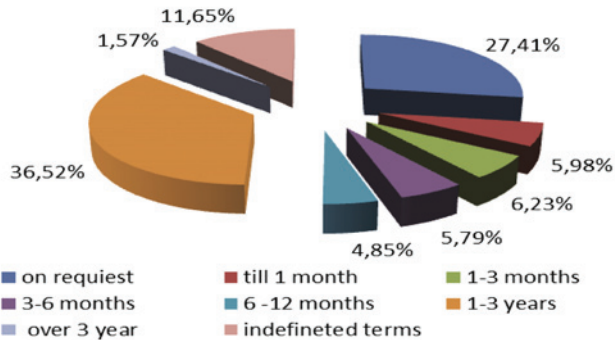


Fig. 7. Liabilities of a bank controlled by a foreign bank by maturity as of the 31st of December, 2011 (%) (Source: compiled by the authors based on a bank's controlled by a foreign bank financial year 2011 report)

5.1. Valuation of short-term liquidity risk

As we have already mentioned, liquidity risk management can be classified as short-term liquidity management and long-term liquidity management.

The liquidity risk management model presented in the methodology if this work will be applied and appraised on the basis of an example of one currently operating bank controlled by a foreign bank. The application of the liquidity risk management model should begin with an analysis of short-term liquidity management. According to the methodology of the research, short-term liquidity management should be based on compliance to the liquidity ratio established by the Bank of Lithuania and the internal liquidity limits of the bank.

To make sure it maintains its liquidity, every bank must first of all comply with the liquidity ratio prescribed by the Bank of Lithuania. According to the information provided in the financial statements of the bank controlled by a foreign bank, the bank fully complied with the liquidity ratio established by the Bank of Lithuania (Fig. 8). The bank has to compute this ratio following the rules for calculating the liquidity ratio as approved by the Bank of Lithuania. The liquidity ratio of a bank, i.e. the ratio between the bank's liquid assets and current liabilities may not be below 30 per cent (BoL 2008).

During the period covered by our analysis (2003–2011), the liquidity ratio of the bank controlled by a foreign bank was above the 30 per cent requirement. The higher-than-required liquidity ratio of the bank controlled by a foreign bank is evidence to the fact that the bank had sufficient reserves of liquid assets and was financially stable as far as liquidity risk is concerned. The liquidity increase in 2011 was the product of the increase in the amount of the bank's current liabilities driven by the bankruptcy of another bank. As a result, the subject bank reported surplus liquidity at the end of 2011.

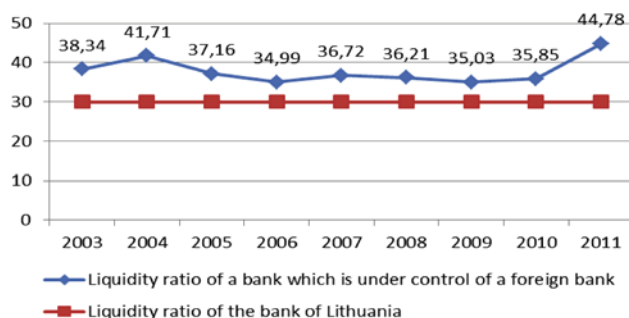


Fig. 8. Change of liquidity values 2003–2011 of a bank which is under control of the foreign bank (%) (Source: compiled by the authors based on a bank’s controlled by a foreign bank financial year 2003–2011 reports)

Another important facet of managing and assessing short-term liquidity is the liquidity limits set by the bank. The short-term liquidity of the bank controlled by a foreign bank was appraised on the basis of the short-term liquidity indicators suggested within the framework of our liquidity management model.

The immediate liquidity limit, which shows the amount of demand deposits held in cash in this case is 10.53 per cent. The amount of cash within the total of deposits held with the bank controlled by a foreign bank is 6.26 per cent. The ratio between the aggregate amount of liquid financial resources and the deposits held with the bank indicates that the bank holds 41.11 per cent of the deposits in liquid form. This ratio has probably increased as a result of the growth of the deposits portfolio. In theory, the recommended value under economic recession should be between 30 and 40 per cent (Table 1).

It should be noted that the difference between the liquid assets and short-term liabilities of the bank controlled by a foreign bank is negative. That means that the short-term liabilities of the bank are completely covered with long-term assets. The overall liquidity ratio shows that 18.82 per cent of the assets of the bank controlled by a foreign bank are liquid assets. In our particular case, the ratio is below the recommended threshold. It is difficult to interpret the value of this ratio explicitly, because it is estimated only with reference to the bank’s assets and does not reflect the demand for liquidity in the bank controlled by a foreign bank.

The deposit sensitivity ratio indicates that demand deposits account for 59.44 per cent of all deposits held with the bank controlled by a foreign bank (Table 1). In this case, this ratio is relatively high, making the bank sensitive to deposit withdrawals.

Table 1. The valuation of the short-term liquidity indicators of a bank controlled by a foreign bank (Source: compiled by the authors based on a bank's controlled by a foreign bank financial year 2011 report; Koch, MacDonald 2006)

	Short-term liquidity indicators	Calculated ratios and values	Recommended limits in the period of economic recession
1	Immediate liquidity limit	$322\,421 / 3\,060\,599 = 0.1053 \times 100\% = 10.53\%$	11–15%
2	Share of cash in bank's deposits	$322\,421 / 5\,149\,173 = 0.0626 \times 100\% = 6.26\%$	till 5%
3	Share of all liquid funds in bank's deposits	$2\,117\,000 / 5\,149\,173 = 0.4111 \times 100\% = 41.11\%$	30–40%
4	Overall liquidity ratio	$2\,117\,000 / 11\,242\,806 = 0.1882 \times 100\% = 18.82\%$	30–40%
5	Deposit sensitivity ratio	$3\,060\,599 / 5\,149\,173 = 0.5944 \times 100\% = 59.44\%$	30–40%
6	Bank's liquidity	$2\,117\,000 - 4\,727\,680 = -2\,610\,680$	Positive, negative
7	Share of all liquid funds in demand deposits	$2\,117\,000 / 3\,060\,599 = 0.6917 \times 100\% = 69.17\%$	30–50%

In our case, the share of all liquid funds in demand deposits is 69.17 per cent. This ratio indicates the extent to which the amount of liquid assets of the bank controlled by a foreign bank secures demand liabilities. In this case, the indicator exceeds the established floor of the ratio by quite a margin.

So, considering the short-term liquidity indicators depicted in the 2011 financial statements of the bank controlled by a foreign bank, we can conclude that not every ratio is within the recommended limits. Notably, the bank in question has a parent company and therefore commands an excellent opportunity to attract financing resources at a minimum price. This means that in the event of a liquidity crisis the bank could look forward to support from the parent institution. This opportunity minimises the bank's sensitivity to liquidity risk. As a result, we can say that liquidity risk management in the bank controlled by a foreign bank is less conservative.

Considering the short-term liquidity ratios of the bank controlled by a foreign bank, we would suggest that, at the time of economic recession, the bank should increase the share of liquid assets within its total assets base.

5.2. Valuation of long-term liquidity risk

After we have finished our analysis of the short-term liquidity of the bank controlled by a foreign bank, we should move on to examining its long-term liquidity. The type of analysis that is relevant for the purposes of managing and assessing the liquidity risk of a commercial bank is gap analysis.

The aggregate liquidity gap of the bank controlled by a foreign bank as of December 31, 2011 can be compared with the aggregate gap of the bank's liquidity as of December 31, 2010.

As you can see from the table, the overall liquidity gap over a 1–3 period was negative and stood at LTL 3,695,669 thousand (Table 3). As of December 31, 2010, the aggregate liquidity gap of the bank was also negative and amounted to LTL 4,014,408 thousand (Table 2). For periods of over 3 years, just like the net liquidity gap, this gap became positive and on December 31, 2011 amounted to LTL 313,470 thousand (Table 3). As of December 31, 2010, the aggregate liquidity gap of the bank controlled by a foreign gap over a period longer than 3 years was negative and stood at LTL 371,751 thousand (Table 2). The positive liquidity gap shows that, during the period under investigation, the bank controlled by a foreign bank had more assets than liabilities and shareholders' equity. When it comes to analysing the total liquidity gap of the bank controlled by a foreign bank, we can state that for all periods covered in our study the liquidity gap in the bank controlled by a foreign bank was negative (Table 2). This means that the bank had more liabilities than assets during all of the periods covered in our analysis.

Table 2. The liquidity gap analyses of a bank controlled by a foreign bank by the 31st of December, 2010 (thousand litas) (Source: compiled by the authors based on a bank's controlled by a foreign bank financial year 2010 report)

	On demand	Under 1 month	1-3 months	3-6 months	6-12 months	1-3 years	Over 3 years	Undefined term	Total
Total assets	610 768	676 922	496 800	629 849	981 691	2 480 740	4 188 539	1 234 275	11 299 584
Total liabilities and equity	2 583 548	1 992 329	1 367 711	514 311	1 061 224	2 372 055	545 882	862 524	11 299 584
Liquidity gap	(1 972 780)	(1 315 407)	(870 911)	115 538	(79 533)	108 685	3 642 657	371 751	-
Cumulative liquidity gap	(1 972 780)	(3 288 187)	(4 159 098)	(4 043 560)	(4 123 093)	(4 014 408)	(371 751)	0	-

Table 3. The liquidity gap analyses of a bank controlled by a foreign bank by the 31st of December, 2011 (thousand litas) (Source: compiled by the authors based on a bank's controlled by a foreign bank financial year 2011 report)

	On demand	Under 1 month	1-3 months	3-6 months	6-12 months	1-3 years	Over 3 year	Undefined terms	Total
Total assets	825 033	1 021 899	306 742	620 712	1 465 009	1 821 986	4 185 502	995 923	11 242 806
Total liabilities and equity	3 082 107	672 059	700 863	650 885	544 912	4 106 191	173 363	1 309 393	33 242 806
Liquidity gap	(2 257 107)	349 840	(394 121)	(30 173)	920 097	(2 284 205)	4 009 139	(313 470)	-
Cumulative liquidity gap	(2 257 107)	(1 907 267)	(2 301 388)	(2 331 561)	(1 411 464)	(3 695 669)	313 470	0	-

Additional liquidity indicators are relevant for the purposes of managing long-term liquidity risk in a commercial bank as well. The additional long-term liquidity ratios that we suggest in our liquidity risk management model are used to assess the long-term liquidity of the bank controlled by a foreign bank (Table 4).

Table 4. The valuation of the long-term liquidity indicators of a bank controlled by a foreign bank (Source: compiled by the authors based on a banks` which is under control of the foreign bank 2011 year financial report; Koch, MacDonald 2006)

	Long-term liquidity indicators	Calculated ratios and values	Recommended limits
1	Loans to deposits	$8\ 882\ 706 / 5\ 149\ 173 = 1.72$	about 1
2	Ratio for the stable portion of liabilities	$4\ 659\ 592 / 11\ 242\ 806 = 0.4144 \times 100\% = 41.44\%$	The higher the value
3	Ratio of liabilities equity coverage	$1\ 308\ 552 / 9\ 94\ 2543 = 0.13170 \times 100\% = 13.17\%$	1/10–1/25
4	Long-term liquidity ratio	$6\ 007\ 488 / 4\ 282\ 554 = 1.40$	Not less than 1

The ratio between loans and deposits in the subject bank shows that the bank has issued loans 1.72 times more than it has attracted deposits. We can say that deposits are not the only and principal source of finance for the bank controlled by a foreign bank. The bank procures its funding from the parent bank, through issues of debt securities or from loans on the banking market.

In our particular case, the ratio for the stable portion is 41.11 per cent. This indicator reflects the stable part of the liabilities. Since for the bank controlled by a foreign bank this ratio is quite high, we are safe to say that the liquidity of the bank is good. The ratio of liabilities equity coverage displays the bank’s ability to cover its liabilities with equity. In this case, the ratio is 13.17 per cent, meaning that only a small portion of the liabilities of the bank controlled by a foreign bank is covered with the bank’s equity. The long-term liquidity ratio shows that the amount of the bank’s long-term assets is 1.4 times the amount of its equity and long-term liabilities.

So, considering the long-term liquidity ratios that we found in the financial statements of the bank controlled by a foreign bank, we can conclude that the bank manages its long-term liquidity.

The liquidity risk management model that we developed was successfully applied in the case of the bank controlled by a foreign bank. The commercial bank liquidity risk management model allows appraising the short- and long-term liquidity of a bank, identify weaknesses in liquidity risk management and develop recommendations. On the basis of the hands-on application of this model, we can say that the bank in question manages its liquidity risk however at the end of 2011 it was faced with surplus liquidity.

After we conducted our analysis of the development of the requirements of the liquidity ratio and obligatory reserves for commercial banks, we are now able to see that at the time of economic recession banks, and especially those that do not have any parent bank, should increase the share of liquid assets across their asset base by

acquiring T-bills or other liquid assets. Should a bank feel the need for liquid resources, the author of this article should suggest raising funds through selling liquid assets or by attracting liabilities. The bank should uphold competitive interest rates on time deposits and organise ad campaigns to attract deposits.

6. Conclusions

After we have discussed and analysed the importance and management of liquidity risk that commercial banks incur, developed a commercial bank liquidity management model, and analysed how this model can be applied in practice by drawing on the case of one commercial bank controlled by a foreign bank, we can conclude that risk is defined by the notion of duality. Risk is a probability that reflects the chance to lose profit and run losses against earning additional profits. The concept of risk is integral to uncertainty. Scientists diverge on this relationship. There are two identifiable stances on the relationship between *risk* and *uncertainty*. One of them defines those two concepts as being identical, whilst the other one draws a distinct line between them. Commercial banks face different risks. The main types of risk that banks run, such as liquidity risk, credit risk and market risk are distinguished by all authors. It should also be said that all risks are mutually interrelated, regardless of the number of identifiable risks. Liquidity risk is a principal type of risks that banks face. Having analysed the notions of risk that different authors present, we can sum up that the liquidity risk of a bank is risk that the bank will be unable to meet its obligations when due as a result of shortage of liquid funds and will therefore suffer losses after a sharp decline in the amount of financial resources and an increase in the price of new funding to cover up previous debts. The main goal of managing liquidity risk is to ensure as profitable operation of the bank as possible, by maintaining a sufficient level of liquidity buffer to safeguard stable business of the bank. Effective management of liquidity provides a backbone for earning maximum profit at a certain liquidity risk level. Having discussed the methods to manage liquidity, we can conclude that the diversity of ways to manage liquidity is immense. The underlying liquidity management methods are based on managing the bank's assets and liabilities at a certain moment in time. Liquidity demands can be identified using methods of deposit structure and cash flow reporting. The method of deposit structure and the method of cash flow reporting augment one another. The first method embraces a thorough analysis of the structure of deposits accepted by the bank. The second method supplements the first one and covers the possibilities to withdraw deposits as well as the demand for credit. Assessment of liquidity risks in the bank is based on managing short-term (up to one month) and long-term (one-year) liquidity. Short-term liquidity of the bank is managed in line with the liquidity ratio requirement prescribed by the Bank of Lithuania by securing a required amount of obligatory reserves and complying with short-term liquidity ratios as well as the limits that apply to them. Long-term liquidity management relies on forecasting the need for liquidity, deposit and loan flows, meeting the need for liquidity, liquidity gap analysis and assessment of long-term liquidity

indicators. Liquidity gap analysis has revealed a mismatch between the bank's assets and liabilities by maturity. The Bank of Lithuania has placed an exclusive focus on managing liquidity risk as well. The stress testing analysis has shown that banks are rather successful in managing their liquidity. Having conducted analysis of the liquidity gap in one bank we can state that the net liquidity gap for each demand at the close of 2011 was LTL 2,257,107 thousand in the negative. The total liquidity gap for a period of one to three years was minus LTL 3,695,669 thousand. For periods longer than 3 years, the net liquidity gap of the bank was LTL 4,009,139 thousand, whilst the aggregate liquidity gap was LTL 313,470 thousand. During the economic recession, the bank that we analysed ensures coverage of loans outstanding with long-term liabilities and capital and complies with the recommended limits of additional long-term liquidity indicators.

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