

Liquidity Risk – Measurement and Control[#]

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Introduction

In response to the financial crisis and its impacts on financial institutions, new regulatory requirements for the banks' liquidity management were introduced. In the context of an effort to identify the main sources of financial instability, it has been concluded that sufficient liquidity is equally important for banks as the capital adequacy requirements (see e.g. BCBS, 2008). During the period of the crisis, banks that satisfy the requirements of the capital adequacy also have gotten into serious liquidity – possibly even solvency – problems (see e.g. Schäfer, 2010).

Liquidity risk generally does not cause a reduction in the equity. The causality is rather the opposite: a decrease in the bank's equity (long-term loss) ultimately results in the bank's insolvency (i.e. loss of its liquidity). In the case of insolvent banks, the loss of their liquidity represents the primary, immediate reason for the termination of their activity. Only in the extreme cases of banks experiencing a crisis of liquidity, the crisis has an impact on their solvency – the bank has to sell off its assets at a loss or seek any available credit assistance, usually under less than unfavorable conditions; this reduces its solvency and subsequently also its liquidity.

Regulatory procedures applied before the outbreak of the financial crisis respected the specific status of the liquidity risk within the group of financial risks of banks, and applied mostly qualitative requirements¹ against this risk that gave banks a scope for implementation of individual

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¹ Provision of the Czech National Bank Nr. 2 from April 27, 2001 “On standards of bank liquidity management”.

risk profiles with regard to the nature and extent of the performed activities. Particularly within the domain of the liquidity management, regulators respected the unique structure of the residual maturity of assets and liabilities of the given bank and its potential access to the financial market. However, the crisis events pointed to the drastic signs of an inadequate exogenous liquidity (see e. g. Bangia – Diebold – Schuermann – Stroughair, 2008).

While for a bank² the management of its liquidity position on the microeconomic level is an essential part of its financial management, the macroeconomic dimension of this issue is significantly affected by the financial stability of the given country, and due to the cross-border activities of multinational financial groups by the stability of international financial markets too.

The presented paper aims to define the liquidity of a bank, outlines the main principles employed for its measurement and describes the regulatory requirements. It focuses on the original, minimum standards for the liquidity risk management, as well as on a discussion about the new quantitative approach, with an emphasis on the legitimacy of its application on the banking sector of the Czech Republic.

1 Liquidity of a bank and liquidity of the financial market

Liquidity of a bank has different *meanings*. It is most frequently specified (Bessis, 2003) as an ability to meet at any time its own obligations that become due, repay payable deposits to creditors in the requested form, or to make such a payment from the account following the client's authorized order. However, liquidity can be also seen as a part of bank's assets that can be easily, quickly and without undue costs converted into money³. The risk of a loss of liquidity is therefore the risk of a loss of an ability of the bank to meet its due obligations and to finance its assets.

Liquidity risk can be structured into the *risk of financing*⁴, or the insolvency risk, and the *market liquidity risk*, which can be understood as the risk of the low liquidity of the market with financial instruments, preventing rapid liquidation (settlement) of positions and limiting the

² In the text will be used the term “bank”, although implementation of the numerous requirements on the level of the European justice applies to credit institutions.

³ Following an exact specification, this group of assets may be labelled as so-called quickly liquid assets.

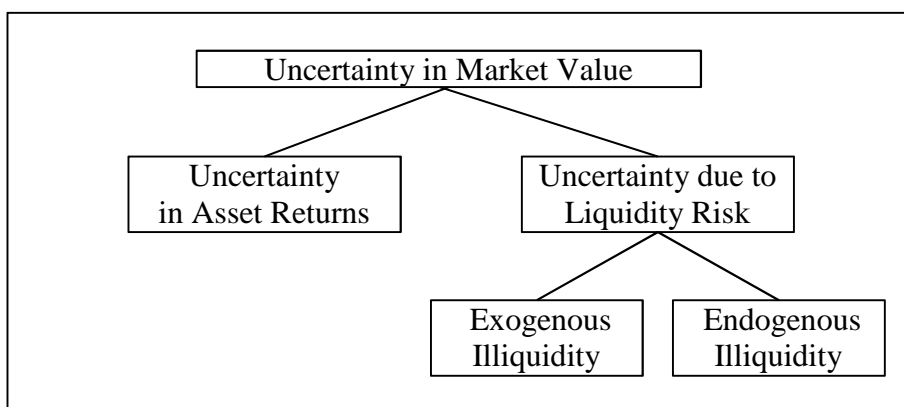
⁴ The so-called balance sheet liquidity related to the residual maturity of assets and liabilities.

bank's access to the cash. This market aspect of the liquidity risk can cause insolvency especially to the major banks that operate on both domestic and foreign financial markets and that expect thanks to their high rating an easy access to credit resources from the interbank market, and hold in their portfolios large volumes of well marketable securities.

Balance sheet liquidity is connected with the securing of liquidity within the given bank. However, there is always a link to the *liquidity of the financial market* at the same time. With the growth in banks' dependence on financial markets the need to monitor the market liquidity that can be ascertained increases (Kyle, 1985) using the following attributes. In the first place this is the size of the difference in bid–ask quotations⁵ for individual traded financial instruments and the volume of completed transactions that may be executed without significant impact on market prices of the given assets. These are so-called costs of implementation or costs of banks to close their positions within a short time.

The speed of execution of individual deals, possibly expressed e.g. as the time interval from the closure of a spot contract until its settlement, can be labeled as the costs of waiting or the cost of the forced postponement of the deal's execution. Unlike costs of implementation these costs grow over time. Finally, attributes of the market liquidity include also the flexibility with which prices of financial instruments return back to the “normal” level after the previous imbalance caused by a random shock.

Fig. 1: Taxonomy of the Market Risk



Source: Le Saout (2002).

⁵ The spread between the prices offered and demanded; spread.

Uncertainty of the financial market due to the liquidity risk has its endogenous and exogenous dimension. Endogenous risk of the market liquidity relates to the specific position traded on the market and results from the properties of this position. Exogenous risk of the market liquidity has a form of hardly predictable situations and affects all traded financial instruments and all institutions that are on the market as investors.

2 Risk of a loss of liquidity

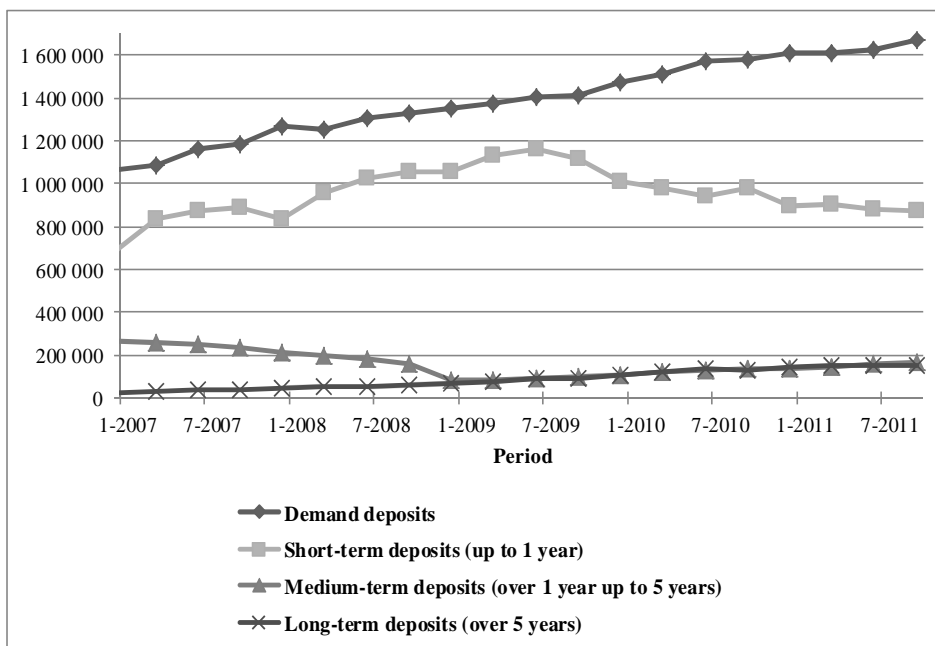
The bank, like any other business, has to keep continuously disposal cash funds immediately available for carrying out its common operations (payments to suppliers, commitments to employees, and other due obligations). For the bank, however, the importance and certain difficulties associated with the management of its liquidity position⁶ relate mainly to carrying out functions of the key intermediary on the financial market, particularly activities related to an application of the *time transformation of money and capital*. In a simplified way, universal bank typically consciously transforms predominantly unstable liabilities, such as current account balances, into assets with longer maturities, of which a significant portion represents secondarily difficult to trade credits to clients. This is one of the principles of the banking business. At the same time, the bank has to oversee the development of individual balance sheet and off-balance sheet items and predict its impact on the amount of expected cash flows it will have disposal.

This phenomenon may be demonstrated using the following figures, that show the development and structure of deposits and the development and structure of credits – prevailing items in the structure of bank's balance sheets on aggregate data for the banking sector in the Czech Republic from September 2005 to September 2011. Fig. 1 shows the structure of primary deposits, i.e. deposits from non-bank subjects. Primary deposits preponderance is typical for liabilities and owners' equity side of the balance sheet of the bank. If we focus on the structure of these deposits, we may observe their unequivocal distribution: current deposits or balances on current accounts are markedly dominating that causes a significant problem for banks in its liquidity management. Deposits with a given maturity have in terms of the liquidity risk management once again rather inappropriate structure. Short-term

⁶ The correct definition of the term “liquidity position” reflects the framework of determined time bands for an excess or deficiency of resources.

deposits with maturity of up to one year are significantly prevailing. Medium-term deposits – over one year and up to 5 years, and long-term deposits – over 5 years, are represented minimally.

Fig. 2: Client deposits by time (CZK+FC)



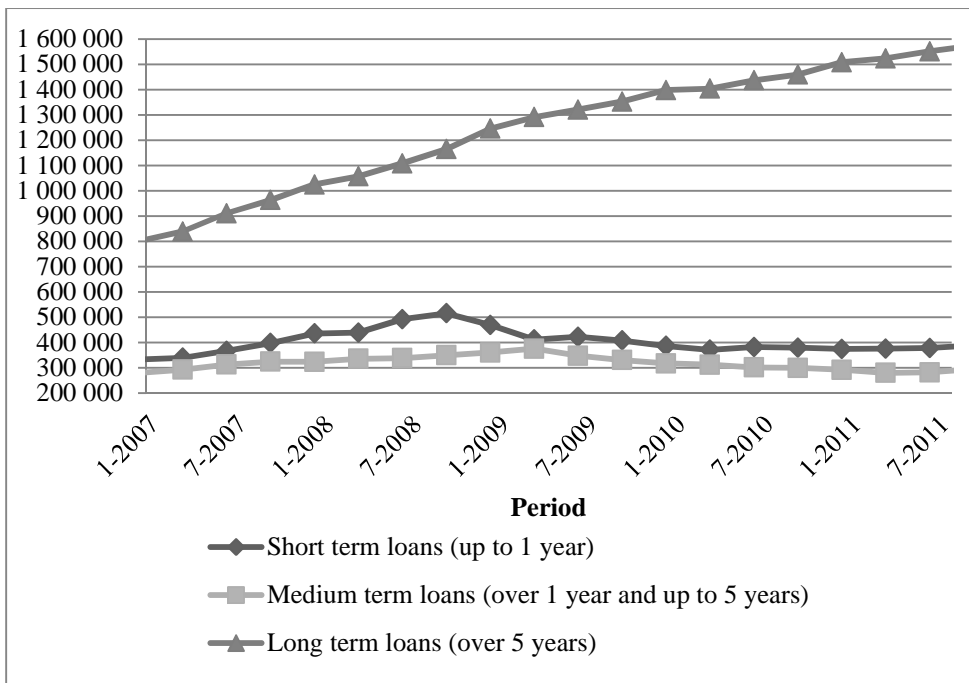
Source: processed based on the Czech National Bank's statistical data.

In contrast with liabilities, a crucial part of the asset side of banks' balance sheets is represented by loans provided to non-bank clients. These are financial instruments with a given maturity. According to the Fig. 2, long-term loans with a maturity over 5 years clearly dominate in terms of the time structure. This striking time discrepancy between maturity of the key assets and liabilities is enhanced even more by the view on the so-called residual maturity. Provided loans should generate banks' incomes – they should be repaid in accordance with relevant contractual arrangements.

However, if the bank that is providing loans is unsuccessful in the management of its credit risk, this appear in the reduced quality of the portfolio of financial receivables that with respect to the probability of default exhibit different properties than originally anticipated and are therefore included in lower categories of the classification. The bank must categorize receivables in order to value its assets more realistically. The time to maturity of financial receivables is a key parameter used in the

classification. As the typically provided loans “fall through” to lower, poorer quality categories, the situation of the bank in the domain of liquidity management deteriorates. Non-performing loans do not meet the planned liquidity. By contrast, interest payments from liabilities that are funding the provided loans drain the liquidity. This situation thus even worsens the cash flow of a bank (Blahová, 2003). It depends, therefore, on the quality of the loan portfolio that represents a significant share of the asset structure of commercial banks and affects the liquidity situation of a given bank. Likewise, for example, the interest rate risk may under certain circumstances adversely affect the market price of debt securities in the portfolio of a bank and thus reduce the cash flow generated from their sale. Often enormously large off-balance sheet activities of banks, especially loan commitment volumes represent another risk factor. Their potentially negative impact on the liquidity situation of banks is often pointed out (Gatev – Strahan, 2006).

Fig. 3: Client loans by time to maturity (CZK+FC)



Source: processed based on the Czech National Bank’s statistical data.

3 Liquidity management as a part of the financial management

Liquidity management is usually a part of the strategic management of the bank's balance sheet, a part of the ALM (assets and liabilities management) in other words. The aim of the strategic balance sheet management is to maximize the bank's profit and shareholders' assets (market value of the bank's shares) while respecting the required riskiness. The objective of liquidity management is not to maintain sufficient liquidity at all times. To successfully manage the liquidity means respecting the linkage with the profitability⁷ and riskiness. The trend in liquidity management is to work on the liability side rather with short-term maturity of financial instruments that represent for a bank low interest costs, while on the assets side to concentrate on longer maturities, linked from the bank's perspective with expectations of higher interest incomes. Balances on current accounts have significant effect both on the profitability in the positive sense as well as on the bank's liquidity in a negative sense. Banks associate with them on the one hand low interest payment costs accompanied by a fee income; on the other hand these are the so-called money at sight (current deposits) with no given maturity and as such represent therefore in terms of the liquidity management a certain inconvenience.

Banks use a combination of several approaches for the management of liquidity risk. Measurement of the liquidity risk is very complicated both in terms of its cash flow as well as in terms of its position on the financial market. Methods of the liquidity risk measurement are based on empiricism and often use a formulation of alternative scenarios.

There may be identified *three basic concepts of the liquidity measurement*:

- methods based on stock quantities,
- methods based on cash flow monitoring, and
- model approaches.

3.1 Methods based on stock quantities

The principle of this method is a breakdown of bank's all financial instruments into predetermined categories and their mutual benchmarking. The result is a set of indicators for the liquidity management that are, in

⁷ Between liquidity and profitability is an inversely proportional relationship. The bank tends to minimise the costs of excessive liquidity.

order to increase the explanatory power, appropriate to compare with the limits set for individual indicators by the bank. Limitations of this approach arise mainly from the omission of financial flows. It is a static view on the bank's liquidity.

3.1.1 Indicators based on the asset side of the balance sheet

Indicators which are based on the assets side of balance sheet represent mainly ratio:

- quick liquid assets / total assets (%).

and banks try to keep this value at minimum level 25 %.

Tab. 1: Aggregate data for the banking sector of the Czech Republic

Date	31. 12. 2008	31. 12. 2009	30. 6. 2010	31. 12. 2010	30. 6. 2011
<i>Quick liquid assets / total assets</i>	23.06	25.31	26.96	26.10	28.11

The indicator is used to measure the liquidity risk arising from the insufficient volume of quick liquid assets to cover liabilities in the short-term horizon. Specification of quick liquid assets can be given in a modified way.⁸

- liquid securities / total assets (%).

Presently, perception of liquid securities is – when the debt crisis in the Euro zone is discussed – rather complicated. Financial market participants perceive some corporate bonds as superior to the state (government) bonds. Securities that a bank designates as so-called liquid should be accepted by the counterparty as a collateral in REPO operations, or alternatively, there should be an option to sell them without any significant negative impact on the price. The degree of liquidity of securities depends on parameters of the partial financial market.

$$I = \sum_{i=1}^N \left(W_i \cdot \frac{DP_i}{P_i} \right), \quad (1)$$

where I = liquidity index,

⁸ Without minimum reserves requirements, or including minimum reserves requirements.

- DP_i = the price with a discount at an immediate sale of the i -th asset on the market,
 P_i = the market price of the i -th asset under normal conditions,
 W_i = the share of the i -th asset on the total bank's portfolio.

The indicator is based on the asset side of the balance sheet and has more to do with the market liquidity (Bragg, 2007). It characterizes liquidity of the bank's portfolio with respect to the possibilities of its conversion into money through sale on the financial market. It measures the bank's suffered potential loss at a rapid (immediate) sale of its assets on the financial market for a rather unfavorable price that would result from the urgency of the sale compared to the price that the bank would receive for its assets under "normal" conditions when it would have no reason to quickly obtain the necessary liquidity. The index takes values from 0 to 1. The greater the discount of sale prices in quick asset sale, the lower the value of the index and the less liquidity of the portfolio.

3.1.2 Mixed indicators

These indicators measure the asset against liability items of the balance sheet. They typically manage the volume mismatch between assets and liabilities in a defined time bin (different time data can be substituted). It is important to use an unequivocal methodology to allow the given bank monitoring of the indicators' development in time.

- Assets with maturity of up to one year / Liabilities with maturity of up to one year
- Client loans / Client deposits
- Liquid assets / Total deposits

3.1.3 Indicators based on the liability side of the balance sheet

This type of indicators is in practice used infrequently. The liability side of the balance sheet is analyzed primarily in terms of the calculation of so-called bank sediments⁹. With respect to the liability side of the balance sheet, it is appropriate to implement a thorough diversification of liabilities. The bank must monitor the concentration of funding sources – the share of the volume-significant deposits on total liabilities.

- Volatile liabilities / total liabilities
- Volatile liabilities / permanent liabilities

⁹ Its significance will be discussed within the description of the gap analysis method.

3.2 Methods based on the cash flow monitoring

The main deficiency in the previous approach that ignores cash flows from instruments is eliminated by the second group of methods, based on the gap analysis principle. These methods examine maturity mismatches within predefined time bins. If the given financial instrument is linked with a contract maturity, its inclusion in the time bin is unambiguous. However, when it comes to products such as current accounts, savings accounts or overdraft loans, the maturity is not uniquely specified and the bank is forced to choose a variant categorization of these instruments by using scenarios.

The principle of assessing the liquidity risk using the analysis of the differences in residual maturity of assets and liabilities may be demonstrated on the example of a hypothetical bank as contained in Tab. 2.

Liquidity GAP is calculated as the difference between assets and liabilities in a given time bin. Provided that assets exceed liabilities it relates to the so-called *long GAP position*, in case that liabilities exceed assets it is a *short GAP position*.

Monitoring the liquidity risk using the GAP method

The limit values for indicators of the time discrepancy in liquid GAPs that specify the maturity mismatch of assets and liabilities in defined time bins are also set based on an analysis of the time series of a liquid GAP and a prediction of a future development. *Determination of limits* results from the investment strategy of the given bank. The limit¹⁰ is defined as the maximum % of the cumulative GAP from the cumulative volume of liabilities up to the certain maturity. As liabilities are understood both interest-bearing and non-interest-bearing bank liabilities within the given time interval.

Algorithm of the drawing limit calculation

The drawing limit is determined by verifying the share of the GAP with the given maturity on liabilities with that maturity. In the case of longer maturities are also included liabilities with shorter maturities – with cumulative liabilities and with GAPs including GAPs from shorter

¹⁰ In practice, the bank monitors GAP separately for individual currencies. However, the limit value that corresponds with the total value in the given time bin is converted into the domestic currency (CZK).

Tab. 2: Residual maturity of assets and liabilities of a hypothetical bank in CZK million

Maturity	< 1 M	1-3M	3-12M	1-2Y	2-3Y	3-4Y	4-5Y	> 5Y	DEF	Σ
Assets 31. 12.										
Cash, deposits at the CNB	800	-	-	-	-	-	-	-	1600	2400
Financial investments for trading	600	2100	6400	2200	800	800	400	900	25	14225
Receivables from banks	27000	700	3200	700	-	-	-	500	-	32100
Receivables from clients	1900	12300	22500	21100	10700	16300	24300	43200	-	152300
Financial investments	7	3800	8000	5100	2900	790	11100	10400	12	42109
Tangible + intangible assets	-	-	-	-	-	-	-	-	1650	1650
Other assets	5	-	160	120	75	45	310	1120	720	2555
Total	30312	18900	40260	29220	14475	17935	36110	56120	4007	247339
Liabilities and equity 31. 12.										
Liabilities to banks	24800	1490	510	60	10	20	-	4010	-	30900
Liabilities to clients	148900	75400	7360	1200	410	380	280	4	1280	235214
Bonds issued	-	690	3250	4600	1640	190	7300	6850	-	24520
Financial liabilities towards trading	200	140	570	580	810	440	320	990	-	4050
Reserves	-	-	-	-	-	-	-	-	780	780
Other liabilities	28	54	290	170	280	230	190	750	1840	3832
Equity capital	-	-	-	-	-	-	-	-	29800	29800
Total	173928	77774	11980	6610	3150	1260	8090	12604	33700	329096
GAP	-143616	-58874	28280	22610	11325	16675	28020	43516	-29693	-81757
Cumulative GAP	-143616	-202490	-174210	-151600	-140275	-123600	-95580	-52064	-81757	

Source: own processing

maturities with cumulative GAPs. This way is achieved a compensation of short and long GAP positions

$$\frac{\text{cumulative GAP with maturity } n}{\text{cumulative liabilities with maturity } n} \text{ This value (expressed in \%)}$$

must not exceed the limit set (e.g.) at 50%. For purposes of these calculations, all assets and liabilities are classified into individual bands by their residual maturity, irrespective of the real tradability of liquid bank assets. Special treatment is usually applied to balances of current accounts. These are classified into longer maturities according to results of the calculation of the so-called *sediment*¹¹ on current accounts. The bank monitors drawing of the limit and possibly approaches towards an intervention – restructuring of the bank's balance sheet. Any change in the bank's strategy is also followed by a reassessment of the limit. Following the same strategy, the bank at least once a year evaluates the timeliness of the limit's setting.

3.3 Model approaches

The third approach is based on modeling of random situations that affect the bank's liquidity position. The bank should be able to predict and measure the sensitivity of its liquidity position related to random facts¹² with respect to the probability of their occurring. Models that implement these processes operate on the basis of the Value at Risk (see e.g. Cosandey, 2001). They examine the maximum liquidity outflow with 1% probability over the period of 10 days, based on the historical period of 1 year. It is necessary to respect that changes in the liquidity position cannot be approximated by the normal distribution at the same time. The implementation is also complicated by the fact that observed historical data do not reflect liquidity risks in extreme stress situations.

Despite the limitations above, banks still work with models that monitor the market liquidity on the principles of VaR – Liquidity – adjusted Value at Risk (L-VaR). The aim is to determine the value of the portfolio of assets at risk with regard to the market liquidity risk. Standard VaR models assume that positions can be closed on the market at a fixed

¹¹ A name generally applied to the volume of funds on current accounts as well as on revolving term deposits, which based on historic observations do not exhibit an outflow. It is calculated as a sum of minimum balances for given periods.

¹² E. g. drawing of assigned credit facilities, sudden outflow of primary deposits, increase in the volume of overdue receivables or those with payment delays, alternatively.

market price and within a fixed time period. This approach ignores the impact of changes on market prices of the investor's position caused by selling of a large volume of financial instruments. Distortive may also be the fact that are not reflected potential, additional implementation costs and it is abstracted from the impact of the bid-ask spread volatility.

4 Development of regulatory requirements

Due to the nature of the liquidity risk as introduced within previous parts of the paper, its regulation was predestined to an *application of qualitative requirements*. It should be noted that the formulated recommendations and requirements were based on assumed practice of the banks themselves. To rephrase, most banks had already the required procedures in place even before the regulatory requirements were introduced.

4.1 Minimum standards of a bank liquidity management

The first measure of this type was in the Czech Republic the Measure Nr. 2/2001 on banks' liquidity management standards. It was a response to the recommendations of the Basel Committee and to experiences of regulators and financial market participants from other countries. Qualitative formulation of requirements gave each individual bank a space to assess its individual risk profile with regard to the nature and the scope of activities it performed actually. This measure was based on the best practices in the given area and also the terminology used reflected the experience gained by the regulator within previous monitoring activities.

Over time, qualitative requirements for the liquidity risk management became a part of requirements for the *management and control system* of banks, or quality requirements for internal processes of banks. Formulated are *basic qualitative principles* that should be respected. Standards may be considered as minimum requirements. The regulator requires that banks create and maintain policies and procedures for continuous and predictive (forward looking) measurement and management of their net liquid position. In addition, the bank also has to have contingency plans for extraordinary circumstances which often take the shape of alternative scenarios simulating the liquidity crisis.

Scenarios for liquidity risk management should include a set of internal and external assumptions on which the bank assesses expected net cash flows. Among the internal assumptions the development of the structure of assets, liabilities and off-balance sheet items in terms of their residual

maturity may primarily be included. The development on the interbank market as well as e.g. the development of a national solvency of particular countries rank in turn among the external assumptions

Any scenario must include a description of steps the given bank will implement to cover the expected cash flow. First of all it must include an estimation of the volume of maturing assets that the bank is able and plans to renew. Furthermore, an estimate of anticipated increases in the most volume-important assets together with an asset categorization in terms of their liquidity must be included. Focus should also be targeted on the volume of commitments, including specification of the usual renewal level of due obligations and the usual growth in new deposits. Based on the historical experience, the bank must include into the scenario also an outlook of current account balances of its clients and an outlook of other instruments without contract maturity. The bank must also include in its scenarios the sphere of potential activities reflected outside its balance sheet. It must therefore examine the outflow of funds through loan commitments, guarantees and documentary letters of credit, fixed term contracts and options. In order to make an effective tool from scenarios, the bank must verify the accuracy and timeliness of assumptions with respect to the dynamically changing internal and external environment in which it operates and continuously adjust its scenarios.

For the case of exceptional circumstances and the design of a crisis contingency plan, the bank must arrange for an adequate information flows within the bank, clearly delimit authorities and responsibilities and formulate possible ways of adjusting the development of assets, liabilities and off-balance sheet items by specifying the backup financial resources¹³.

The bank must manage the liquidity risk in individual major currencies and set the corresponding limits. If the bank finances the assets held in one currency by liabilities held in another currency, it analyses conditions of its entry into the foreign exchange market and the possible exchange conditions. It sets the limits for liquidity risk management summarily for all currencies in which it holds accounts, as well as individually for each currency with which it works. When determining the adequate setting of the limits, the bank has an option to respect its financial situation, nature, scope and complexity of the performed activities.

¹³ E. g. an agreement with decisive shareholders on the provision of assistance in the form of a deposit that satisfies the necessary maturity and volume.

Within the context of risk management, the suitability of diversification with respect to the structure of the bank's balance sheet tends to accentuate rather the asset side of the balance sheet. However, the bank must with respect to the management of financial resources and its access to the financial markets sufficiently diversify and stabilize also its own commitments and resources. Above all, it must create and maintain contacts with major creditors, correspondent banks, major trade partners and clients, to check the degree of reliability of individual sources, to monitor various options of financing its assets and the development of these opportunities in variant solutions and to monitor and maintain the option to access the financial market in order to sell its assets.

4.2 Minimum liquidity standards – new approach

In an effort to identify the main sources of risks that stood behind the financial crisis, as one of the sensitive areas has been identified the level of financial market regulation (see EC, 2009). At the same time, there was also an attempt to find politically attractive grounds and to arrange for a quick remedy. Without for example considering and adequately differentiating regulatory and supervisory practices and their sometimes different levels of application in different territories, new elements of regulatory requirements were formulated.

In the author's opinion, the new demands on liquidity risk management are among the most significant ones. Specifically, they correspond with *two minimum liquidity standards*.

For the short time horizon, the indicator *LCR (Liquidity Coverage Ratio)* was formulated respecting of which should ensure maintaining the adequate level of highly liquid assets. For the time interval of 30 days, the bank must estimate the net outflow of cash and hold such a volume of high quality liquid assets that exceeds the amount of the predicted outflow.

$$LCR = \text{high quality liquid assets} / \text{net outflow within 30 days} > 1$$

The bank may perceive its assets as highly liquid provided they meet the following requirements. They should represent a low credit and market risk¹⁴ and they should be assessed in a simple and certain way. In case of using a valuation model strong assumptions should not be adopted for its use and inputs should be public domain. Structured and exotic products are not suitable for this purpose. Assets intended for this use

¹⁴ Low volatility, denomination in convertible currencies with a low currency risk.

should demonstrate a low correlation with risky assets and should be acceptable by the central bank within the facilities. However, at the time of their use these assets themselves may not serve as a collateral (they must not be loaded).

The denominator, constructed as net cash outflows, is an expected quantity supported in case of a cash outflow by a calculation. The total outstanding liabilities and off-balance sheet items are multiplied by values of the probability with which they could be drawn. In a similar manner the inflow of cash proceeds is treated where the maximum volume must be adjusted to 75% of the total expected cash outflows.

The implementation of this indicator is set for 2015, while starting from this year the indicator is monitored by the banks.

For the long-term time horizon in relation to the risk of funding banks will respect the indicator *NSFR (Net Stable Funding Ratio)*, known as the indicator of pure stable funding. It is a ratio between the *usable* stable resources and the *required* resources, which since 2018 has to meet the limit of 100%, while the monitoring period begins from the next year.

$$NSFR = \text{usable stable resources} / \text{required stable resources} \geq 1$$

The indicator is intended to strengthen the medium and long-term funding of banks' assets. It is an effort to reduce the significant maturity mismatch of assets and liabilities and the temporal transformation of money. Above all, this indicator will have a clearly negative impact on banks that used to prefer issuing bonds with a shorter maturity and had a considerable volume of deposits with no maturity term (See e.g. Härle – Poppensieker – Stegemann, 2010). In response to the new regulatory requirements a reduction in credit issuances may be expected and thus, apart from other consequences, worsening of a funding access for the real sector.

4.3 Discussion about a justifiability of the implementation on the Czech banking sector

Pitfalls of a global application of the new indicators may in certain contexts be seen as a step back towards the regulation based on accentuating the quantitative methods and insufficiently respecting individual risk profiles of banks. This claim may be documented on the situation of the banking sector in the Czech Republic. If we look at the ratio of deposits to provided loans in selected countries of the European Union (CNB, 2010), we observe that compared to the rest of the EU

member states, the banking sector of the Czech Republic achieves the most favorable values when it ranks at nearly 140%. Apart from Belgium and Slovakia, other countries are below 100%, i.e. the volume of received deposits does not exceed the volume of provided loans. Our banking sector, among others also due to its focus on the retail banking, did not notice any significant impacts on its liquidity during the financial crisis and there were no interventions by the state or by the central bank, alternatively, towards strengthening of the banking sector's capital or liquidity. From the macroeconomic perspective it is appropriate to analyze the daily liquidity of the banking sector, monitored and reported by the central bank. The liquidity outlook points towards the total volume of excess liquidity of the banking sector that the central bank attempts three times a week to withdraw from the market using monetary operations.

The question is whether to view the global application of the new regulatory requirements across the board within the European Union as necessary and appropriate also towards the banking sector that does not show any sign of increased liquidity risk neither in terms of the balance sheet liquidity nor at the level of the money market liquidity. The answer is not clear. It would be obviously possible to consider a larger involvement of the supervision element in the whole process of strengthening the prudential business and for example via an early warning system, itself used as one of surveillance methods, to apply the requirement of a compliance with liquidity indicators selectively only on the group of banks that indicate deficiencies in the area of an adequate liquidity.

However, the new requirements are obviously related to the current legislative proposals of the European Commission in the domain of crisis management (Allen – Babus – Carletti, 2010) and intra-group assistance. Foreign financial groups have substantial ownership of our banks and as such therefore represent their parts and subjects to the requirements applicable on the EU level. Given the tendency of strengthening the European supervisory structures, there does not remain much room for an implementation of even justified practices in the domain of requirements on the management of liquidity risk by the national regulator, in the case of the Czech Republic by the central bank, which withdraws the excess liquidity through open market operations.

Conclusion

The presented paper aims to specify the liquidity of the bank, outlines the main principles applied for its measurement and describes the regulatory requirements. It focuses both on the original, minimum standards for the liquidity risk management, as well as discusses the new, quantitative approach, with an emphasis on the legitimacy of its application on the banking sector of the Czech Republic.

The structure of the paper was chosen with the intention to point at the close interconnection of the two dimensions of liquidity – the balance sheet and the market one. This strong linkage supports legitimacy of the new regulatory requirements. Introduced principles of the liquidity measurement methods prove that the procedures used by banks are within objective restricting factors, such as e.g. amounts payable without agreed maturity, relatively thorough and that they attempt to incorporate all the influences that have a decisive share on the liquidity position a bank. Still, banks cannot get completely under their control the expected market liquidity. Towards the risk of a “bank liberalism”, that was among others given in the context of the underestimation of the management of liquidity position of banks, had been pointed already during the pre-crisis period (Kaminsky – Reinhart, 1999). Liquidity management is for a bank an integral part of its strategic balance sheet management, along with the riskiness and profitability. And it was precisely the linkage to profitability that motivated some banks towards underestimating the liquidity management. New regulatory requirements on an increased possession of highly liquid assets will have a negative impact on profitability. However, under the current situation the return to inappropriately high returns on capital of banks cannot be expected, generated using high leverages and underestimating the liquidity management by a number of, mainly systemically significant, banks. Finally, it is a positive fact that the application of the two indicators will allow the comparison of banks in relation to the liquidity risk. Due to in the European area non-standard liquidity situation of the Czech banking sector, however, may the adoption of the new minimum standards seem to be overly hard and limiting. But we should also consider the situations where the liquidity would on the level of an international financial group be secured at the expense of one of the group members, the monitoring of minimum standards appears to be desirable.

References

- [1] Allen, F. – Babus, A. – Carletti, E. (2010): *Financial Connections and Systemic Risk*. [on-line], Washington, D. C., National Bureau of Economic Research, [cited 12th February, 2012], <http://www.nber.org/papers/w16177.pdf?new_window=1>.
- [2] Bangia, A. – Diebold, F. X. – Schuermann, T. – Stroughair, J. (2008): *Modeling Liquidity Risk with implications for Traditional Market Risk Measurement and Management*. [on-line], Philadelphia, Wharton Financial Institutions Center, c2008, [cited 12th February, 2012], <<http://fic.wharton.upenn.edu/fic/papers/99/9906.pdf>>.
- [3] BCBS (2008): *Principles for Sound Liquidity Risk Management and Supervision*. Basel, Bank for International Settlements, c2008, [cited 12th February, 2012], <www.bis.org/publ/bcbs138.pdf>.
- [4] Bessis, J. (2003): *Risk Management in Banking*. New York, Wiley, 2003.
- [5] Blahová, N. (2003): *Nástroje k určení rizikového profilu banky. (in English: The Instruments to Specify Risk Profile of the Bank)*. In: Hamerníková, B. (ed.): *Rozvoj finanční a účetní teorie a její aplikace v praxi z interdisciplinárního hlediska. (in English: Development of Accounting and Financial Theory and its Application in Practice from Interdisciplinary Point of View.)* Praha, Oeconomica, 2003, s. 128-138.
- [6] Bragg, S. (2007): *Business Ratios and Formulas*. New York, Wiley, 2007.
- [7] CNB (2001): *On Standards of Bank Liquidity Management. Provision of the Czech National Bank Nr. 2 from April 27*. Praha, Czech National Bank, 2001.
- [8] CNB (2010): *Report on the Financial Stability 2009/2010*. [on-line], Praha, Czech National Bank, c2010, [cited 12th February, 2012], <http://www.cnb.cz/miranda2/export/sites/www.cnb.cz/en/financial_stability/fs_reports/fsr_2009-2010/FSR_2009-2010.pdf>.
- [9] Cosandey, D. (2001): *Adjusting Value-at-Risk for Market Liquidity*. Risk Magazine, 2001, vol. 4, no. 1, pp.115-118.
- [10] EC (2009): *De Larosière Report*. [on-line], Brussels, European Commission, c2009, [cited 12th February, 2012], <http://ec.europa.eu/internal_market/finances/docs/de_larosiere_report_en.pdf>.

- [11] Gatev, E. – Strahan, P. (2006): *Banks' Advantage in Hedging Liquidity Risk: Theory and Evidence from the Commercial Paper Market*. *Journal of Finance*, 2006, vol. 61, no. 2, pp. 867-892.
- [12] Härle, P. – Poppensieker, T. – Stegemann, U. et al. (2010): *Basel III and European Banking: Its Impact, How Banks Might Respond, and the Challenges of Implementation*. [on-line], Washington, D. C, McKinsey, c2010, [cited 12th February, 2012], <http://www.mckinsey.com/~media/mckinsey/dotcom/client_service/Risk/Working%20papers/26_Basel_III_and_European_banking.aspx>.
- [13] Kaminsky, G. L. – Reinhart, C. M. (1999): *The Twin Crises: The Causes of Banking and Balance-of-Payments Problems*. *American Economic Review*, 1999, vol. 89, no. 3, pp. 473-500.
- [14] Kyle, A. S. (1985): *Continuous Auctions and Insider Trading*. *Econometrica*, 1985, vol. 53, no. 6, pp. 1315-1335.
- [15] Le Saout, E. (2002): *Incorporating Liquidity Risk in VaR Models*. Rennes, Université de Rennes, c2002, [cited 12th February, 2012], <<http://www.scribd.com/doc/7174003/Incorporating-Liquidity-Risk-in-VaR-Models>>.
- [16] Schäfer, J. (2010): *QIS Neue Liquiditätsstandards*. [on-line], Frankfurt am Main, Deutsche Bundesbank, c2010, [cited 12th February, 2012], <http://www.bundesbank.de/Redaktion/DE/Downloads/Kerngeschaeftsfelder/Bankenaufsicht/QIS/qis_neue_liquiditaetsstandards.pdf?__blob=publicationFile>.

Liquidity Risk – Measurement and Control

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ABSTRACT

The article deals with the liquidity risk in the banks in the context of the financial crisis. At first, the balance sheet and market liquidity are defined and the main principles of the methods for measuring liquidity risk, which banks use, are identified. Then follow review of main challenges of managing the liquidity of banks. Finally, it discusses qualitative regulatory requirements and eligibility of newly formulated standards with regard to minimum liquidity in general and in relation to the Czech banking sector in particular.

Key words: Liquidity; Bank; Risk; Financial market; Regulation.

JEL classification: G21, G28.