UNIVERSITY OF LJUBLJANA
SCHOOL OF ECONOMICS AND BUSINESS

MASTER'S THESIS

LIQUIDITY RISK MANAGEMENT IN BANKS IN THE REPUBLIC OF NORTH MACEDONIA

Ljubljana, November 2022 KRISTINA PULOVSKA

AUTHORSHIP STATEMENT

The undersigned Kristina Pulovska, a student at the University of Ljubljana, School of Economics and Business, (hereafter: SEB LU), author of this written final work of studies with the title Liquidity risk management in banks in the Republic of North Macedonia, prepared under supervision of Marko Košak PhD and co-supervision of _____

D E C L A R E

1. this written final work of studies to be based on the results of my own research;

2. the printed form of this written final work of studies to be identical to its electronic form;

3. the text of this written final work of studies to be language-edited and technically in adherence with the SEB LU's Technical Guidelines for Written Works, which means that I cited and / or quoted works and opinions of other authors in this written final work of studies in accordance with the SEB LU's Technical Guidelines for Written Works;

4. to be aware of the fact that plagiarism (in written or graphical form) is a criminal offence and can be prosecuted in accordance with the Criminal Code of the Republic of Slovenia;

5. to be aware of the consequences a proven plagiarism charge based on the this written final work could have for my status at the SEB LU in accordance with the relevant SEB LU Rules;

6. to have obtained all the necessary permits to use the data and works of other authors which are (in written or graphical form) referred to in this written final work of studies and to have clearly marked them;

7. to have acted in accordance with ethical principles during the preparation of this written final work of studies and to have, where necessary, obtained permission of the Ethics Committee;

8. my consent to use the electronic form of this written final work of studies for the detection of content similarity with other written works, using similarity detection software that is connected with the SEB LU Study Information System;

9. to transfer to the University of Ljubljana free of charge, non-exclusively, geographically and time-wise unlimited the right of saving this written final work of studies in the electronic form, the right of its reproduction, as well as the right of making this written final work of studies available to the public on the World Wide Web via the Repository of the University of Ljubljana;

10. my consent to publication of my personal data that are included in this written final work of studies and in this declaration, when this written final work of studies is published.

Ljubljana, November 18th, 2022 Author's signature: _____

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ABBREVIATIONS

ASF – Available Stable Funding
BCBS – Basel Committee on Banking Supervision
BIS – Bank of International Settlements
CFP – Contingency Funding Plan
ECB – European Central Bank
HQLA – High-Quality Liquid Assets

LATAR – Liquid Asset to Total Asset Ratio
LCR – Liquidity Coverage Ration
LTD – Loan to Deposit Ratio
NBRNM – National bank of Republic of North Macedonia
NCO – Net Cash Outflows
NLO – Net Liquidity Outflows
NSFR – Net Stable Funding Ratio
RSF – Required Stable Funding

INTRODUCTION

Liquidity risk as a notion is of great importance for financial institutions and their regulators around the world. To quote Ruth Porat, CFO of Alphabet Inc., "Liquidity is oxygen for a financial system." Liquidity can be explained as a concept that is difficult to catch, and yet it has paramount significance when it comes to achieving a flawless operation of the financial system. This was not the case in mid-2007 when the major shock to the banking system happened. Since the 1930s, the financial crisis was a significant disturbance and a unique challenge in perceiving and implementing global liquidity risk management for financial institutions (Cornett, McNutt, Strahan, & Tehranian, 2010, p. 4).

Before the market turmoil, the regulation did not acknowledge the liquidity risk and its severeness at a high level. Although liquidity is of great importance, especially for security valuation and optimal portfolio choice (Bangia, Diebold, Schuermann, & Stroughair, 1998), liquidity has been missing from the financial regulation and became apparent after the financial crisis (Strahan, 2012, p. 1). As a result, the methodology of liquidity risk management is developed differently worldwide.

The main focus of this master's thesis will be on the comparison of the liquidity risk management regulation between the regulative principles of the National Bank of the Republic of North Macedonia (hereinafter: NBRNM) and the regulative aspects of the Basel Committee on Banking Supervision (hereinafter: BCBS) and the European Central Bank (hereinafter: ECB). Therefore, every bank should consider maintaining a more robust liquidity risk management by early identification of the liquidity risk, monitoring and controlling the liquidity regularly, establishing stress tests.

In North Macedonia, the consequences of the turmoil were detected during 2008 and 2009, and to increase the stability of the banking system, NBRNM has instantly undertaken many measures and actions, leading to the fact that, unlike the developed countries, the effects of the financial crisis in developing countries, such as North Macedonia (which experienced the effects more seriously in the timeframe between 2008-2009), were not that much severe. However, the banking system manifested indications of deceleration in the activities and weaknesses of the financial measures (Popovska, 2014).

The financial crisis opened many questions, especially about liquidity risk management, and emphasised adequate liquidity in financial institutions to resist shock events (Gomez & Khan, 2011). Therefore, the regulators needed to take into account the liquidity risk seriously. Thus, they decided to consider this type of risk in the Basel III regulations. In response to the financial crisis, the Bank of International Settlements (hereinafter: BIS) established the Basel III international regulation framework, intending to improve the stability of the system in the international banking sector and reinforce the regulation, supervision, and risk management of the banks (BIS, 2017).

The BCBS proposed and presented a new set of requirements to enhance its revised capital requirements framework in order to increase liquidity buffers and lower the risk of alterations in maturity and the mutual correlation within the financial system, including the lack of equality in information about the exposure of bank's liquidity risk and the level of the liquidity risk capacity (ECB, 2012). Because of this, in 2008, the Principles for Sound Liquidity Risk Management and Supervision (hereinafter: Sound Principles) were published, which highlight the importance of establishing and applying a robust liquidity risk management framework that is well integrated and implemented in the risk management process on bank-level (BCBS, 2010a).

Namely, the research problem of this thesis is to differentiate the liquidity risk management mandated by NBRNM from the one presented in the Sound Principles and unveil if there is anything in the Sound Principles that is not applied in the regulation of NBRNM, yet, it is essential for eligible liquidity risk management. Therefore, my methodological approach for this research is to use a comparative analysis of two legislatures for liquidity risk management, including the methodology of liquidity stress testing. In this thesis, I am also comparing the measurement methodology of a sample of 15 banks from North Macedonia and 15 banks from countries that are part of the European Union.

The data that I am using for this research is mainly collected from Basel III regulations and liquidity risk management regulations from North Macedonia, from research papers that ECB conducted, and other working papers based on liquidity risk management. Regarding the types of data, I am using both qualitative and quantitative information. Additionally, for the empirical part of my thesis, I am using a t-test hypothesis testing, where I am testing the statistically significant difference between both groups of banks in the time from 2008 to 2020, and to conduct this test significance, I am using data from Annual reports of the banks and Fitch Connect Database. For the initiation of the hypothesis testing, I am using Stata Software for Statistics and Data Science.

Furthermore, in order to achieve the fundamental purpose, the methodology of the analytical approach is presented by examining three research questions.

The first question is how much is the regulation of the NBRNM for the liquidity risk management aligned with the Sound Principles?

It is a known fact that because banks are of high importance in the financial stability of every country, most authorities tend to exercise a higher degree of regulation over banks. One of the most crucial segments banks are responsible for is sound liquidity risk management. Hence, for this part, I am thoroughly analysing the BCBS's liquidity standards introduced after the financial crisis to furnish detailed guidance on risk management and supervision of liquidity risk. In addition, I am portraying the legal requirements and obligations of liquidity risk management in North Macedonia. In 2020, NBRNM published a new Decision on the methodology for liquidity risk management to comply with the activities and the

international requirements related to the liquidity standards, which have been included in this research.

The second question is, is the methodology of liquidity stress testing used by the banks in North Macedonia synchronised with the framework of the ECB?

For the banks to establish robust liquidity risk management, they need to include one of many concepts in the process, which is stress testing. In this thesis, I am investigating both NBRNM's and ECB's methodologies and presenting a comparative analysis of these methodologies by studying their similarities and differences, interpreting the efficiency of the methodology that NBRNM uses, and presenting the synchronisation of the NBRNM's liquidity stress-testing methodology with the one that the ECB implements. Additionally, to make this analysis richer in details and information, I include a comparison of a survey conducted by the ECB about the usage of liquidity stress testing techniques on various European banks in 2008 and a survey (which includes similar questions as the survey from ECB) conducted by myself on five banks from North Macedonia.

The third question is, what are the dynamics of the liquidity positions in the sample of banks that I will determine in North Macedonia compared to the European Union banks between 2008 and 2020?

Regarding the third question, I am conducting a quantitative comparative analysis, which included calculations of the Loan to Deposit Ratio (hereinafter: LTD) and the Liquid Asset to Total Asset ratio (hereinafter: LATAR). In this case, the results portrayed the level of the before mentioned liquidity ratios on a sample of 15 banks from North Macedonia and 15 banks from different countries in the European Union, in a time frame between 2008 and 2020, on an annual basis on bank level. The criteria I am applying in this research for selecting the banks from the European Union banking sector are the banks' size, brand, and data availability. The results from this quantitative part perceived the impression that the banks in North Macedonia were implementing an acceptable strategy in the mentioned time frame to manage their liquidity risk properly.

In this master's thesis, first, I am determining the compatibility of the NBRNM's regulation for liquidity risk management with the Sound Principles. In the second part, I intend to establish the synchronisation of the methodology of liquidity stress testing that the banks from North Macedonia implement with the ECB's framework. Third, I am differentiating and comparing the methods of measuring and monitoring the liquidity risk between the NBRNM's requirements, the Sound principles, and the ECB's structure. Finally, I finish this thesis by conducting an analysis of the dynamics of the liquidity positions in the banking sector in North Macedonia that were compared to the banks from the countries that are part of the European Union between 2008 and 2020.

1 THE SYSTEM OF LIQUIDITY RISK MANAGEMENT ESTABLISHED BY THE NBRNM COMPARED TO BASEL III REGULATION

The first research question is briefly elaborated in this part of the thesis. It is challenging to measure liquidity risk without defining it first (Nikolaou & Drehmann, 2009, p. 8). John C. Hull defines liquidity as an aspect that an establishment can accomplish cash payments as they come due (Hull, 2015, p. 499). In the banking sector, liquidity risk represents the bank's probability of encountering a financial loss because of outstanding obligations that are not achieved on their due date (Arsovski, 1998, p. 206). Suppose a particular bank cannot resolve its obligations in the determined time. In that case, it will become illiquid, in which case the bank will default, leaving shareholders, creditors, or depositors with losses, which leads to the notable importance of the funding liquidity risk since it contains the ability to settle the obligations immediately (Nikolaou & Drehmann, 2009, p. 8).

When the global financial crisis occurred in 2007, it raised the importance of emphasising more attention to the financial system stability, especially in the banking sector (Nikolaou, 2009). One of the reasons some financial institutions, such as Lehman Brothers or Northern Rock, collapsed during the financial crisis was the decline of wholesale funding, which happened because of the investors' unwillingness to supply funds to certain financial institutions (Gauthier, 2011, p. 5). The difficulties that took shape as liquidity in financial markets started declining crucially, such as, for instance, banks rejected lending to each other due to the funding liquidity issues, and this was related to doubt over the exposure of their structured products, which was important since the liquidity of the structured products had fallen significantly, which strengthened the difficulties in the valuation of the structured assets (Nikolaou, 2009).

Namely, the liquidity risk should be classified into two parts, the inconsistency of the execution cost and opportunity cost (the execution cost gets lower with the necessary time for completing a planned transaction, and on the other hand, the opportunity cost grows with the time of execution) (Muranaga & Ohsawa, 1997, pp. 195-196).

When implementing strategies for liquidity risk management, banks should consider having daily strategies, which should be discussed throughout the whole organisation (Matz & Neu, 2007, p. 67). Liquidity management should be conducted carefully, including evaluating a severe liquidity scenario, to ensure the survival of the scenario by converting assets to cash or earning cash and increasing cash flow in another way using other methods (ECB, 2012). Moreover, besides establishing a more severe liquidity regulation that can reduce risk, banks should consider other methods of dealing with the risk since sometimes liquidity regulation may negatively influence the bank lending to the non-financial economy and bank profitability (Banerjee & Mio, 2014, p. 2).

During the financial crisis that began in 2007, two aspects significantly affected the liquidity: the augmented dependence on capital funding markets and the increased dependence on

short-term maturity funding tools (ECB, 2010, p. 129). Due to the financial crisis that began in the middle of 2007, the importance of liquidity risk was highlighted again in the financial market and the banking sector. Some banks encountered complications due to failure to follow basic principles of liquidity risk management. For many banks, the quantity of liquidity they might need to satisfy contingent responsibilities was not considered, whether contractual or non-contractual, as they believed that funding these obligations is highly beyond the bounds of possibility (BCBS, 2010a, p. 3). The financial crisis opened many questions, especially about liquidity risk management. The regulators needed to take into account the liquidity risk seriously. Thus, they decided to consider this type of risk in the Basel III regulations.

Since the beginning of the market turmoil in mid-2007, BCBS started to update the bank's practice guidelines and core principles to strengthen liquidity management and develop and improve the bank's supervisory practice (BCBS, 2008a, p. 13). Since strong capital requirements and robust supervisory standards are necessary for the banking sector's stability, the BCBS presented global liquidity standards that are internationally coordinated. These standards established minimum requirements and were introduced internationally (BCBS, 2010b).

Because of this, in 2008, the Principles for Sound Liquidity Risk Management and Supervision (hereinafter: Sound Principles) were published to secure detailed guidance on liquidity risk management and to promote a robust liquidity risk management framework (BCBS, 2010b).

The main focus of NBRNM is to establish a proper methodology for liquidity risk management, which shall include a liquidity risk management system and maintenance of an adequate liquidity level, and which should be compatible with the complexity, the nature, and the scope of the financial activities (Decision on managing banks' liquidity risk (NBRNM, 2011), NBRNM, No. 126/11, p. 1), which is according to the third principle of the Sound Principles.

According to the Banking Law issued by NBRNM, in order to maintain liquidity, liquidity risk management should be applied by the banks by establishing and maintaining an adequate maturity structure, organising and managing the inflows and outflows of funds, and providing a sufficient amount of liquid assets, observing the sources of funding and their concentration, and conducting a liquidity stress testing (Banking Law of Republic of North Macedonia (NBRNM, 2007), NBRNM, No. 67/07, p. 35). However, the banking law has poor exposure to the liquidity risk issue. Because of that, NBRNM implemented a decision on managing liquidity risk in 2011 to present a more detailed regulation to the banks in North Macedonia.

In the Decision on managing banks' liquidity risk (also issued by NBRNM), the liquidity risk is defined as the risk that the bank will become incapable of providing enough funds for reconciliation of its short-term liabilities at the moment of their maturity (when they come due) or to supply such funds at much higher costs (NBRNM, 2011, p. 1).

In 2020, NBRNM introduced a new Decision on the methodology for liquidity risk management to improve the liquidity risk management and get much closer to the Basel III regulations (Decision on the methodology for liquidity risk management (NBRNM, 2020), NBRNM, No. 146/20). This decision is more detail-oriented, especially regarding monitoring and measuring the liquidity risk.

Banks should develop and apply policies, procedures, and other internal acts for defining the implementation of the system of liquidity risk management (NBRNM, 2011, p. 2), identifying, detecting, measuring, controlling, and monitoring the liquidity risk, such as procedures for establishing and implementing manners of monitoring the Liquidity coverage ratio (hereinafter: LCR), for establishing internal liquidity ratios, for a conventional establishment and maintenance of an adequate maturity structure, for monitoring funding sources and their concentration, and for determining and controlling the availability of the unencumbered assets (NBRNM, 2020, pp. 4-5).

What can be included in the internal acts is a definition of expected maturity, a definition of the internal liquidity adequacy assessment process, and establishment of the methods and assumptions that are implemented in the stress testing process, and a determination of the methods for conducting regular revision and control of the contingency funding plan (hereinafter: CFP) (NBRNM, 2020).

1.1 Governance of liquidity risk management

Liquidity risk can be estimated when depositors exchange their financial claims immediately, or it can be determined as a potential to fund the exercise of off-balance sheet loan commitments, including the fact that if and when a withdrawal of deposits (by demanding cash) is made by liability holders, banks and other financial institutions have to sell some assets or borrow some additional funds in order to meet and complete the withdrawal (Saunders & Cornett, 2008, pp. 493-494).

Since cash is the most liquid asset, it is the best asset to pay and compensate the claim holders' withdrawal of funds, even though the entities prefer to lower their cash reserve holdings as assets because there is no interest payment in those reserves (Saunders & Cornett, 2008, pp. 493-494). When banks contain insufficient liquidity, there will be a problem of acquiring sufficient funds by increasing liabilities or converting assets quickly, which will affect the profitability (Shen, Chen, Kao, & Yeh, 2009, p. 3).

An appropriate governance is the first step to implementation of sound liquidity risk management. Major organisations direct their focus on five zones, such as concentration of oversight including board oversight, distinguishing the tactical from structural liquidity risk, the acceptance of the aggregate level of liquidity risk and the process of incorporating the liquidity risk into the strategic management (Venkat, Mikulka, & Magstadt, 2010, p. 3). Banks should be able to maintain an appropriate level of liquidity and an adequate cushion that is consisted of readily marketable and high-quality liquid assets that can sustain liquidity

stress situations, and the management team should constantly evaluate the information of the development of the bank's liquidity and regularly present to the board of directors (BCBS, 2008a, pp. 6-7).

What effective risk management really makes an estimate of are the future cash flow requirements under normal and stressed conditions (BCBS, 2008a, pp. 6-7). For a bank to articulate a proper governance of liquidity risk management, it should incorporate a suitable liquidity risk tolerance for its business strategy (Kumar & Yadav, 2013). The implementation of a sound liquidity risk management commences with suitable governance. Both regulatory frameworks (the Sound Principles, the Decision of managing banks' liquidity risk and the Decision on the methodology of liquidity risk management) agree with this statement and align banks to abide by.

In order to accomplish sound liquidity risk management, banks should identify, measure, estimate and control the liquidity risk that can jeopardise the bank's liquidity (Petreska, 2018). What NBRNM is demanding from banks from North Macedonia to stand by, in order to achieve the sound liquidity risk management, is to have an appropriate organisational structure of liquidity risk management, an adequate internal control procedure, to establish a suitable information system when managing the liquidity risk, to conduct various liquidity stress scenarios at least once a year and to develop a Liquidity Contingency Plan (NBRNM, 2011 and NBRNM, 2020).

1.1.1 Organisational structure for liquidity risk management in the banking sector

Regarding the third principle of the Sound Principles, the senior management should implement a strategy to manage the liquidity risk according to the defined risk tolerance by the bank, which should be conducted under normal and stress conditions, and the strategy should incorporate particular policies on liquidity management, such as (BCBS, 2008a, p. 7):

- the setup and maturity of both assets and liabilities;
- the variety and steadiness of funding sources;
- the method of managing liquidity abroad, across different business lines and legal entity in various currencies;
- the approach of intraday liquidity management;
- the presumptions on the liquidity and marketability of assets.

The meaning of adequate organisational structure of liquidity risk management for NBRNM is to define the responsibilities, obligations and tasks of the bank's management groups (Supervisory Board, the Risk Management Board and a special body that is responsible for the liquidity risk management) and of the bank's respective organisational parts that are authorised to monitor the liquidity and manage the liquidity risk of the bank (NBRNM, 2011, p. 2).

In the decision on managing liquidity risk, developed in 2011, NBRNM clearly defined the obligations of the three management bodies, that every bank must initiate, when it comes to management of liquidity risk. The responsibilities of every group are presented in Appendix 2. Moreover, NBRNM demands from the banks' board of directors, to approve and ratify critical policies and practices, (which should be reviewed at least once a year), to make sure that the senior management and the determined adequate personnel (that is needed to conduct the strategy), contain necessary experience, and to ensure that the bank has a proper system for measuring and monitoring all sources of liquidity risk (NBRNM, 2011). In the newly developed decision on the methodology of liquidity risk management, developed in 2020, NBRNM only demands from the banks to clearly define the competences in their organisational structure, but those competences are not presented in detail.

When comparing the two strategies and types of obligations between the NBRNM regulations and the Sound principles, when it comes to the organisational structure for managing the liquidity risk, there are mostly similarities in the responsibilities that banks must accomplish. Nevertheless, banks from North Macedonia should include methods of managing liquidity risk abroad and methods of incorporating intraday liquidity risk management, since these methods could present more information about the liquidity level, which can improve the management of liquidity risk.

1.1.2 Internal control and audit

Banks across the world should prepare liquidity policies which contain precise requirements (that vary significantly across national regimes), in order to initiate the internal strategy for liquidity risk management and to determine internal processes for monitoring, measuring and controlling the liquidity risk (BCBS, 2008b, pp. 6-7). The Decisions, developed by NBRNM oblige banks to contain appropriate internal control procedures in order to enable integration of the liquidity risk management process in the overall risk management process (NBRNM, 2011, p. 3). It is of great importance for both legislatives that in order to ensure integrity of the liquidity risk management, banks should have appropriate internal control.

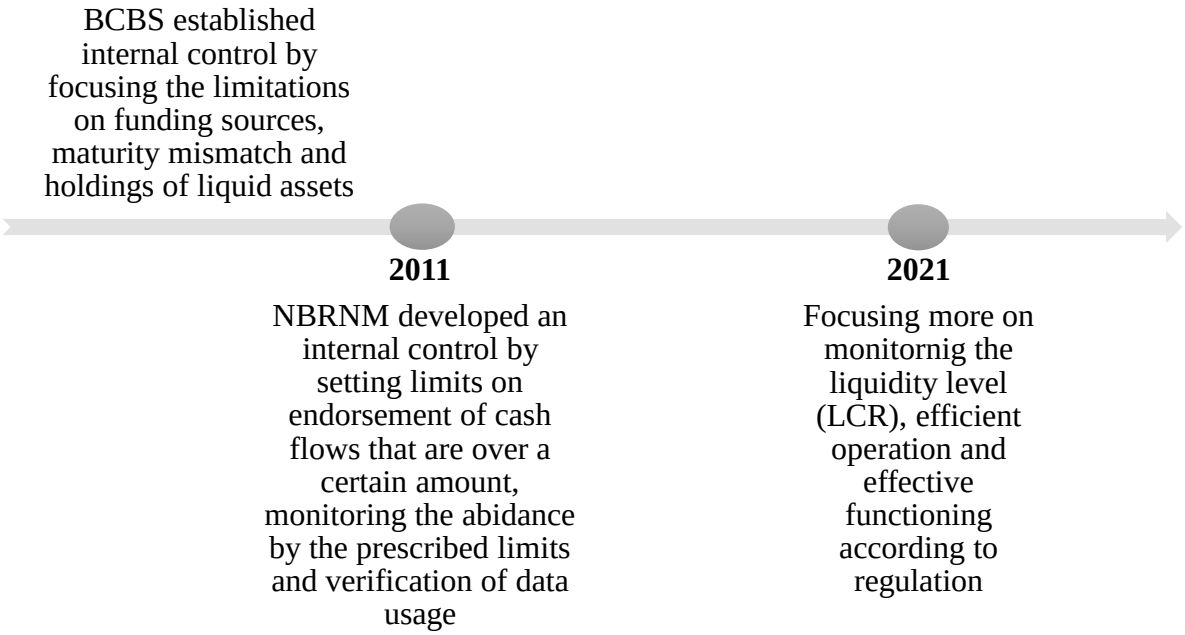
Moreover, the Sound Principles in the third principle (BCBS, 2008a, p. 8) put emphasis on the personnel who is responsible for the implementation of internal controls, and these personnel should be competent, trained with appropriate methods and independent in operational manner. The execution of the necessary changes in a timely manner is crucial for senior management, when the effectiveness of internal control is affected, adding the concept that the personnel that is conducting the internal control should apply revision of the effectiveness and implementation of the agreed structure for managing and controlling the liquidity risk (BCBS, 2008a, p. 8).

According to NBRNM, in the policy of liquidity risk management, that banks from North Macedonia are supposed to prepare, they should include the fact that senior management should develop a system of internal control that will provide at least efficient operation of

the bank, effective bank functioning according to the regulation, appropriate identification, measurement and control or decrease of the liquidity risk and so on (NBRNM, 2020).

Both local and global jurisdictions agree on the aspect that banks should develop policies for proper internal control. What should be included in these policies is the adequate information system, the assessment of future cash flows and net funding requirements, internal limitation on the cash flows that are over certain amount, the abidance by the determined limits, and other features.

Figure 1: Timeline for development of the system of internal control



Source: BCBS (2008a); NBRNM (2011); NBRNM (2020).

1.1.3 Information system

It is important for supervisors to demand from banks to report data on their liquidity positions and include a set of reporting criteria, since the reported information from the banks allows executive management to foresee if banks have liquidity pressure that is increasing and if the banks are operating according to the demands from regulators (BCBS, 2008b, p. 8). Moreover, according to the fifth principle of the Sound Principles, the reporting criteria should indicate the scope, manner and frequency of reporting for the board of directors, executive management, committee for managing assets and liabilities and the personnel that is preparing the reports, meaning that the reporting should be done on a more frequent basis, the current liquidity exposures and established limits should be compared and any infringement should be reported (BCBS, 2008a, p. 17).

According to the NBRNM's Decision on managing liquidity risk, when managing liquidity risk banks should develop an information system, which is needed to estimate, measure and monitor the liquidity and the liquidity risk of the bank on a daily basis and in precisely defined time periods, conduct stress testing, supervise the abidance by the determined liquidity risk exposure limits and tolerance, examine the deposit base developments and establish and supervise the deposits' stability, establish measurement and monitoring of the bank's liquidity, by currency that importantly influence the overall liquidity of the bank, on bank and aggregate basis and issue data in order to determine liquidity indicators, and for the necessities of the bank bodies and the rest of the persons that are included in the liquidity risk management, assemble reporting forms (NBRNM, 2011, p. 3).

In addition, the information system enables data generating in order to determine liquidity indicators and creating other types of reports for the needs of the senior management and other personnel included in the process of liquidity risk management, and from the established database of the information system, different plans, forecasts and prognosis of liquidity are prepared, in which the bank should take into account abiding by the defined limits, maintaining the currency and the maturity compliance of assets and the sources of funds, deposits' maturity and deposits' concentration (NBRNM, 2020, pp. 6-7).

According to the new decision of NBRNM, every bank should prepare and submit to the NBRNM certain important reports to present their liquidity risk management (NBRNM, 2011, pp. 6-7), as well as liquidity reports that are prepared on monthly basis (NBRNM, 2020, p. 35). These reports are presented in Appendix 3. NBRNM mandates from the banks to submit reports annually as well, such as reports on the number and the basis of the additional cash outflow according to the regulations that are set, every decrease of the credit quality of the bank that is meaningful from aspect of each contract that is concluded, according to the regulations and reports on goods and services on which the bank determined the probability and the amount of the cash outflow that are significant for the bank's operation (NBRNM, 2020, p. 36).

We can conclude from both legislations that senior management should incorporate an efficient management information system so that the bank can determine and monitor the positions of the liquidity and the liquidity risk, on a day-to-day basis, or in some cases in more distant time periods, and also in stressed events. The North Macedonian regulation for the implementation of the information system is following the fifth principle of the Sound Principles, by including a mandatory reliable information system, in their regulation, for every bank to prepare, that can present reports about the liquidity risk management to the supervisors and other adequate personnel. We can detect a lot of similarities between both regulations in this part.

By implementing a new decision of managing the liquidity risk, NBRNM is focusing more on monitoring the LCR and High quality liquid assets (Hereinafter: HQLA), and requires from banks to prepare and present more detailed reports for the need of liquidity risk management, in order to have more adequate and proper information system meaning that if

the LCR is below the required minimal level or if the bank predicts and expects that the LCR is below the requirement, according to the regulation, simultaneously with the LCR report (on aggregate basis and by significant currency) the bank should formally inform the NBRNM about the reasons that brought or will bring overcoming and will submit a plan in which the bank will define the measures, the actions and the deadlines for reaching or maintaining the required minimal level (NBRNM, 2020).

The NBRNM shall observe the fulfilment of the plan and can interfere with corresponding measures of fulfilment within a certain time period and if the bank is not maintaining and reaching the required level, by the end of every work day should present to the NBRNM the report of the LCR until the required level is achieved. With the implementation of the new decision, NBRNM assigned more austere obligations for the banks to abide by, which is better for a proper and suitable liquidity risk management. NBRNM is focusing on getting much closer to the Basel III regulations, and with the new legislation they are succeeding in their goal. This is a great sign for the NBRNM's legislation, because it is implementing a significant supervision over the management information system.

1.1.4 Contingency Funding Plan

For the purpose to develop strategies in order to tackle with stress scenarios, banks create contingency funding plans (hereinafter: CFP). According to the World Bank (Negret, 2009), the purpose of the CFP is to project cash flows, foresee funding sources and needs, and to coordinate the funding difficulties and how are they handled by the banks in various market circumstances, including the importance of determining the correspondence of the CFP's and the bank's risk exposure, organisational structure and activities. The Sound Principles demand in the eleventh principle from the banks to have a CFP that has clear strategies and action plans for defending against liquidity shortfalls in stressed events (BCBS, 2008a, pp. 27-29).

Once the CFP is created, banks should develop management responsibilities, procedures and policies which will allow the management of the bank to initiate well-informed, up to date, on time decisions and conduct an effective communication to execute the plan effectively, including the fact that they should have the contingency arrangements established in advance and potential liquidity sources should be identified in order to cover deficiencies that may befall in stressed situations (BCBS, 2008b, p. 7).

When the bank is designing the CFP, it should consider the stressed market conditions and its influence on the capability to sell or securitise assets, the reputational effects that are associated with implementation of the contingency funding measures, the connection between asset market and funding liquidity, and the capability to pass on liquidity across group entities, lines of business and abroad, considering the regulatory, legal, time zone and operational limitations and constraints (BCBS, 2008a, pp. 27-29).

In the NBRNM's previous Decision, it is written that banks should initiate a before mentioned CFP as well (NBRNM, 2011, pp. 4-5). Since NBRNM brought a new Decision

on the methodology for liquidity risk management, there is no change in the methodology of the development of the CFP between the two decisions. The new Decision of the methodology for liquidity risk management establishes manners in the CFP for defining the emergency conditions, early warning indicators as a sign of emergency, nominating the bank's personnel that has a responsibility for monitoring and reporting those indicators and developing ways of monitoring and applying the plan (NBRNM, 2020, p. 35).

Table 1: Comparison of the features that should be included in the CFP that are explained in the Sound Principles versus the features that are mentioned in the decisions from NBRNM

CFP features	Sound Principles	Decisions from NBRNM
1) Definition of the tasks and activities	Determining what kind of activities should be taken on what time period and what problems need to be escalated to higher senior levels in the bank in order to simplify the timely response that is needed to control and manage disturbances.	A definition of the tasks and activities that are supposed to be undertaken, and a well-known and clear division of responsibilities, activities, tasks, competences and decision-making connected with the implementation of the plan.
2) Determination of indicators and scenarios under stressed situations	Clearly defined, diversified set of feasible, manageable and available contingency funding measures (that can be flexibly deployed in order to conserve and preserve liquidity), and defined severe but credible stress scenarios and liquidity needs under stressed scenarios.	Indicators for early warning that can be used as signs of emergency and urgent situations.
3) Definition of the time duration	Investigation of the time duration for which the contingency measures can be conducted under different presumptions and stressed scenarios.	Defining the duration for undertaking the defined tasks and activities (such as using sources of funds under different conditions).
4) Nomination of a responsible personnel	Determining who can take and control the actions.	Nomination of employees who will be responsible for control, monitoring and reporting that is connected on such indicators, and defining the emergency subject and urgent situation on which the plan will be used.

(Table continues)

Table 1: Comparison of the features that should be included in the CFP that are explained in the Sound Principles versus the features that are mentioned in the decisions from NBRNM

(Continued)

6) Defining the method of communication	Defined distribution of communications in a clear, consistent, frequent manner on time to internal and external parties (supervisors, system operators or central banks), in stressed situations.	The method of communication that will be used with the central bank, significant depositors, important business partners, other clients and the public, in case of emergency, and the contact information of the employees or persons that are assigned to implement the CFP.
5) Testing and updating the CFP	**Testing, update and maintenance of CFPs, which should be implemented on a regular basis in order to ensure and preserve the efficiency, effectiveness and the operational feasibility.**	**There is no information for this matter in the NBRNM's decisions.**

Source: BCBS (2008a); NBRNM (2011); NBRNM (2020).

In Table 1, a comparison of the features that a CFP should contain between the Sound Principles and the decisions from NBRNM is presented.

From the conducted comparison of the features that should be included in the CFP, presented in Sound Principles and in the decisions from NBRNM, we can notice the following similarities:

- In both regulations the determination of the type of tasks and activities that should be taken is presented;
- Both regulations implement indicators for early warning and defining scenarios that can be used under stressed and urgent situations;
- Definition and investigation of the time duration for which the contingency measures can be conducted under different conditions and stressed scenarios is used by both regulations;
- Both regulations determine employees who will be responsible for control of the actions;
- Both regulations define the method of communication to internal and external parties, such as central banks, supervisors, system operators and business partners, in stressed situations.

The following differences can be noticed from the conducted comparison that is presented in Table 1:

- The decisions from NBRNM use clear division responsibilities and activities that are connected with the implementation of the plan, while they are missing the definition of the time period and what problems need to be elaborated to the higher management in the bank, which is explained in the Sound Principles;
- When it comes to testing, update and maintenance of CFPs, NBRNM does not present any particular information in the decisions about usage of these activities;
- In the decisions from NBRNM, there is no clear definition of diversified, manageable contingency funding measures included.

In establishing, determining and examining the CFPs, it is crucially important for the bank's staff to be aware of the operational procedures that are necessary to move liquidity collateral across various structures and systems, and the constraints that manage such movements (BCBS, 2008a, pp. 27-29).

The potential to recognise critical payments and to prioritise payments in circumstances where intraday liquidity resources become rare is crucial for a bank to contain, together with the ability to obtain additional sources of intraday liquidity in situations of critical disturbances, including by recognising, identifying and mobilising extra collateral, to examine the capability to regularly sell or repo certain assets and occasionally reduce credit lines, and the senior management should be able to audit every aspect of the CFP and to verify if the actions are delivered, and it should conduct a control and an update of the CFP at least every year or as business or market circumstances alter, for the board's acceptance (BCBS, 2008a, p. 29).

In both decisions only the design (what the bank should include in the CFP), the method of communication and the contact information of the staff that is responsible for the implementation of the CFP is briefly presented, and it is explained that the CFPs should be audited periodically in order to consider and adapt to the changes in the bank's internal and external environment. This part of the decisions contains most of the requirements that are included in the Sound Principles, such as a clear segregation of the responsibilities, actions, tasks and the decision-making regarding the implementation of the CFP, definition of stressed situations, indicators that will alert early in emergency events, determination of the personnel responsible for monitoring these indicators, identification of the fund sources and their size and the importance in their application under different circumstances. However, the presentation of the design of the CFP is not given in details.

In Table 1, we can see what the decisions lack of explaining, which is what the bank should consider when designing the CFP (as was explained previously), the importance of testing, the importance that the bank should have the ability to acquire additional sources of intraday liquidity in critical situations, updating and maintaining the CFP regularly, and so on. The decisions of NBRNM are mostly covering the requirements and demands of the Sound Principles, but they need to focus on detailed explanation on the statement of the plan, the contingency procedures, roles and responsibilities.

2 COMPARATIVE ANALYSIS OF LIQUIDITY STRESS TESTING

In the second part, I am elaborating the second research question. The Vice-President of ECB, Luis de Guindos at an annual US-EU Symposium in 2019 made a keynote speech where he stated that throughout the financial crisis, stress testing was applied mainly to identify capital shortfalls on bank level and to improve the market discipline, and this was accomplished with publishing consistent information on bank basis, though, after the financial crisis, stress tests and their method of usage advanced around the world and since then they have been appointed as a major part of the financial and supervisory stability for evaluating risk management and performance under various macroeconomic conditions (De Guindos, 2019).

Stress tests can be also described as quantitative "what if" analysis that can estimate the flexibility of the whole banking system in case of severe shocks (Baudino, 2018, pp. 1-4). The banking system should evaluate the degree of exposure of the liquidity risk for maintaining banking stability (Wong & Hui, 2009, p. 3). When conducting a stress test, it is significant for banks to discover the origin of the risks (BCBS, 2008a, pp. 24-27).

In the early 1990s individual banks started using stress test for internal risk management purposes, which were used on a small-range basis to furnish some statistical tools for bank management to assess the bank's trading activities and actions, and the functioning and the design of the stress test evolved over time, and therefore, during the 2004, in Pillar 1 and Pillar 2 of the Basel II regulatory framework, banks were supposed to abide by more demanding internal stress testing, but since the Basel II was not implemented and developed in every country around the world, most of the internal stress test models were still at a developing and progressive stage (Baudino, 2018, pp. 1-4).

BCBS through principle 10 of the Sound principles obliges the banks to orchestrate stress tests on a regular basis for different bank-specific and market wide stress scenarios, on short-term and long-term time period, under normal and stressed conditions in order to make sure that the bank contains the current exposure according to the determined liquidity risk tolerance and to identify possible liquidity strain sources (BCBS, 2008a, pp. 24-27). When accurately implementing a liquidity stress test, banks should consider an adequate design that can initiate significant information on banks' liquidity position or profile that is not probable to be generated from restricted series of standardised liquidity measures and metrics (for example added value can be found in the LCR's 30-day horizon) (BCBS, 2013a, pp. 1-2). What should be mentioned in this part as well is the possible reaction of the market members in market stress scenarios, and the possible impact of the bank's comportment on other market participants (BCBS, 2008a, pp. 24-27).

The reason why stress tests should be conducted regularly is so that banks can recognise, measure and present the probability of the following liquidity stress scenarios, developing examination of the probable impacts on the banks' liquidity position, cash flows, solvency, adding the fact that the higher management should analyse and discuss the outcomes of the

stress test so that they can determine certain actions to set boundaries of the bank's exposures, develop a liquidity cushion and modify the liquidity outline to meet the risk tolerance (BCBS, 2008a, pp. 24-27).

When developing stress scenarios, in order for the scenarios to include the funding and market liquidity risk, banks should take into account the nature of its actions and weaknesses, and these developed scenarios should enable the bank to conduct evaluation of the possible unfavourable influence these circumstances can have on the bank's liquidity position and the scenario design, and the diversity of shocks that are used should be carefully chosen (BCBS, 2008a, pp. 24-27).

The review of the stress test scenarios should be conducted by the senior management of the bank and the chosen scenarios with the stress test results should be well evaluated and documented, which means that any shown vulnerabilities and weaknesses should be properly presented, reported and discussed with the board of directors, and the results of the stress testing should be merged and incorporated in the strategic planning process and the bank's daily risk management procedures (BCBS, 2008a, pp. 24-27).

2.1 Liquidity stress testing methodology presented by ECB

In 2008, ECB established an analysis of liquidity stress testing in the European banks, which presents a central bank perspective on liquidity risk management of European banks. This research will be discussed in this part of the thesis, and part of their method of collecting information from banks will be used in the banks in North Macedonia as well by using some of the questions from the survey ECB used in European banks, to present their outcomes as well and to compare the results of both frameworks. While initiating and directing the stress testing, banks should consider the degree and the frequency, should correspond with the size of the bank and its exposures of liquidity risk, and should take into account the bank's significance in the financial system in which the bank operates, and banks should be capable to increase the stress test frequency in special stress scenarios (BCBS, 2008a, pp. 24-27).

As claimed by ECB in their research EU Banks' Liquidity stress testing and Contingency funding plans, the procedures and policies for scenario assessment or examination and their adjustment differ between banks. When determining the assumptions on the availability of funding sources under stress in their stress test scenarios, banks varied broadly and not every bank was controversial enough, as most banks did not anticipate a severe decrease and abbreviating of the funding sources and long-term funding (like the ones that happened in the financial crisis of 2008) (ECB, 2008).

In events like the financial crisis that occurred in 2008, liquidity might not be available for all maturities, defining a shortening of funding maturities, which is a significant feature in future stress tests, and therefore, it is important for banks to maintain enough funding sources on long-term that will lower the influence of short liquidity shocks and price increases for external funding (ECB, 2008).

2.1.1 Liquidity risk tolerance

It is important for banks to establish the liquidity risk tolerance, meaning they have to determine the maximum level of liquidity risk that banks are willing to accept and handle not only in normal times, but in possible stress events as well (ECB, 2008, pp. 13-14). The Sound principles, through the second principle, claim that banks should establish an appropriate level of liquidity risk tolerance, which will help in developing an adequate business strategy (BCBS, 2008a, p. 7). In addition, most banks are determining the liquidity risk tolerance by establishing limit systems that are developed on the basis of stress testing and a perception or a judgement of a specialist (ECB, 2008, pp. 13-14).

For the purpose to resist a stress event, banks should determine a liquidity risk tolerance that will be able to ensure a strong liquidity management in normal period (BCBS, 2008a, p. 7). When quantifying the risk tolerance, the probability space needs to be clarified, which contains the material awareness of a stochastic variable and the approximation of a probability distribution over the probability space, and afterwards, banks can choose their risk tolerance capacity of the aggregate probability distribution of shocks they could withstand (ECB, 2008, pp. 13-14).

The before mentioned ECB study of the liquidity risk tolerance points out that liquidity stress tests are estimated because it is not manageable or feasible to designate probabilities to all material liquidity shocks and there would be a high level of the uncertainty of the number of noticeable liquidity shocks and their bank specific nature to the estimation of the probability space and the probability distribution (ECB, 2008, pp. 13-14).

Scenario assumptions and liquidity stress tests' measurements are unforeseeable and in the measurement of liquidity risk tolerance, banks do not provide probabilities regularly, on a historical distribution basis of net cash flows and analysed liquidity stressed situations (ECB, 2008, pp. 13-14). It is important that when expressing the liquidity risk tolerance, the compromise between the profit and risk to be understood throughout the entire management (BCBS, 2008a, p. 7). Most of the banks tend to estimate the liquidity risk tolerance by survival horizon or limit system, and some of them focus on limit systems, which are connected with the liquidity risk tolerance, including the fact that the liquidity risk tolerance measurements are based on expert judgements, which are very subjective, not comparable between banks and they should be well documented (ECB, 2008, pp. 13-14).

2.1.2 Typology of scenarios

When banks administer a liquidity stress testing, according to the 10th principle of the Sound principles, they should consider using bank-specific and market-wide stress scenarios, both separately and in combination, to ensure a proper exposure management that will be in accordance with the liquidity risk management (BCBS, 2008a, p. 24). According to the research established by ECB, the majority of banks are using idiosyncratic and market-wide stress scenarios when conducting liquidity stress tests, although barely half of them are using combinations of the scenarios, and since it is very difficult for banks to define severe but

credible stress scenarios because of the considerable variations of the characteristics of events like the 2008 liquidity crisis, banks are impelled to use both types of scenarios and combinations of them (ECB, 2008, pp. 14-18).

Idiosyncratic or bank-specific liquidity stress scenarios that should be defined within the bank can be built around possible loss of confidence by fund sources in the bank because of stock price performance, unanticipated credit loss or effect on reputation from rumours, assumptions of rating downgrades with big credit losses, operational risk, corporate and retail deposits withdrawal, decreasing in counterparty limits, lack of liquidity in the market, reduction in asset prices, decreased access to wholesale funding, currency conversion, lack of capability to draw down on pre-committed lines, enlarge in demand for financial funding by the group entities, decrease in available credit lines and counterparty limits and utilisation of credit commitments (ECB, 2008, pp. 14-18).

Most of the liquidity stress test presumptions are based on expert judgement, statistical analysis or a combination of both (ECB, 2008, pp. 14-18). There is a significant diversity in the application of the idiosyncratic stress tests, by the majority of banks, in the severity of rating downgrades and the scope of funding sources, loan losses, operational risk situations, deposit withdrawals and wholesale funding liquidity run-offs (BCBS, 2013a, p. 31).

A survey that was presented in an ECB's research from 2008, contained many banks that described their systemic specific scenarios as a cause of the stress (sub-prime market liquidity crises, government crisis or monetary policy changes), a collection of negative economic indicators (such as bond yields increase or fall in stock prices), the termination of key funding markets (like covered bond markets or securitisation markets), a specific geographical circumstance (emerging markets, global markets or significant financial centres) and the cognised severity of the stress (such as mild or severe market crisis). Sometimes banks do not define specific market-wide situations (ECB, 2008, pp. 14-18).

Banks rather present assumptions that have consequences established with varying severity or intensity for their funding ability or their asset value, and these assumptions have uniqueness to each respondent and ECB through a conducted survey presented the most used ones, such as (ECB, 2008, pp. 14-18):

- Closure of repo markets and unsecured interbank markets;
- A non-immediate sale of market securities and sale at lower price rather than a fair price;
- A decrease of retail deposit stability;
- No capital market funding;
- Impossible securitisation and a disruption in commercial paper and certificate of deposit markets;
- Incapability of securing support within the group or institution;
- Granted credit lines are withdrawn by corporate clients;
- A disruption of the foreign exchange market;
- A withdrawal of professional demand deposits.

Market-wide or systemic liquidity stress scenarios are mostly placed by banks as specific scenarios and the duration of the stress can be specified as well (ECB, 2008, pp. 14-18). Before the financial crisis, most banks considered market-wide scenarios with specific and strong emphasis on interbank and bond markets (BCBS, 2013a, p. 31). In the ECB's analysis from 2008, situations that were mentioned which contain a key importance in most of the systemic risk scenarios of the banks are unsecured interbank market and the bond market, disruptions in repo markets, commercial paper and certificate of deposit markets and the withdrawal of retail deposits (ECB, 2008, pp. 14-18).

In addition, a few banks added also additional funding markets, such as central banks, wholesale euro deposits, corporate banks, parent bank funding and loans, adding the fact that most banks consider stress in national markets, some of them in international markets and a few of them find stress scenarios in regional markets, and some banks do not conduct idiosyncratic or market-wide stress scenarios (ECB, 2008, pp. 14-18).

2.1.3 Time-horizon of stress scenarios

One thing that is also important when conducting stress tests is the time-horizon of the stress scenarios. Time-horizons can be classified as intraday, medium-term and long-term time-horizon (ECB, 2008, pp. 18-19). Before the market turmoil, banks preferred short-term and medium-term time horizons, but after the crisis, they considered including much longer-time horizons, which means that they used stress scenarios that have different time-horizons between four weeks and twelve months (BCBS, 2013a, p. 32).

Stress scenarios that are based on short-term time-horizons do not include important features of persistent liquidity stress events, but long-term time-horizons have some damages too, such as a necessity of modelling behavioural reactions of other market participants, and considering this, it is best for the banks to use both types of time-horizons, which would allow them to include short, severe shocks and long, persistent and less severe disturbances (ECB, 2008, pp. 18-19).

2.1.4 Scenario reviews

Furthermore, the scenario reviews are considerably crucial when establishing liquidity stress testing. These reviews should actually concentrate more on the altering nature of the liquidity risk exposure of the bank than on impersonating liquidity shocks from the past, which means that when assembling scenario reviews, it is more efficient if the higher weight is placed on structural issues than focusing on mechanically repeating historical crises, and in order for the scenarios to be relevant, it is important for the banks to ask themselves if new products, new markets, new funding sources or changes in the behaviour of the counterparty are suitably seized by the scenarios (ECB, 2008, pp. 19-20).

Additionally, scenarios have to consider formerly unnoticed correlations, durations, severities of liquidity drains and funding issues (ECB, 2008, pp. 19-20). The results of the liquidity stress-testing should be included by the senior management in the strategic planning

process and in the risk management on daily basis, and the scenario design should be reviewed regularly for the purpose of remaining the adequacy of the nature and severity of the tested scenarios (BCBS, 2008a). There is a claim among banks that they should keep a simple and straightforward stress testing, it should not be altered suddenly because of consistency maintenance and assisting the monitoring of the stress test results, there should not be extreme stress test scenarios as senior management will probably define them as improbable, and in order for banks to have accurate results from regular scenario reviews, they should not regularly test a similar scenario over time (ECB, 2008, pp. 19-20).

Banks' procedures, practices and policies that are related to scenario reviews vary considerably in the frequency of the scenarios' adjustment, the triggers for those scenario reviews and the participation of the board management, and as long as banks' scenario reviews are directed to concentrate on appropriate scenarios in internal or external alterations in the liquidity risk exposure of banks, those scenario reviews will be of exceptional benefit (ECB, 2008, pp. 19-20).

2.1.5 Perimeter for stress testing

Next, what should be determined while establishing the liquidity stress test is the perimeter for stress testing, which can be entity specific, group-wide or a combination of both (ECB, 2008). Past experience highlights the higher significance of the group-wide level of stress testing, but since banks find it hard to detect support from other group members, it is probably best for additional entity specific stress tests to be conducted (if the entity sustains material liquidity risk), when local entities may face difficulties in times when they are prevented from obtaining liquidity from their parent bank (ECB, 2008, pp. 20-22).

According to the 6th principle of the Sound principles, banks should control the exposure of liquidity risk in the individual bank, the foreign branches and the group-wide banks as a whole (BCBS, 2008a). Most banks tend to execute stress test at a group level, or some of them use both group-wide and entity level, and when it comes to cross-border or intraday groups, if there is concern and distress for the banking group, the execution of the stress test at both levels will increase the robustness of the results of liquidity stress tests (ECB, 2008, pp. 20-22).

2.1.6 Barriers to cross-border transfers of liquidity

ECB orchestrated an analysis of the barriers to cross-border transfers of liquidity as well. In ECB's analysis, banks presented different types of barriers to the cross-border liquidity motion, which hinder their liquidity management, and those barriers are large exposure limits on intragroup exposure, local liquidity specifications and requirements, operational obstacles, barriers of cross-border collateral transfers, time zone mismatches and dissimilarities in central bank outlines (ECB, 2008, pp. 22-23).

The incorporation of potential barriers to the cross-border motion of liquidity is different among banks. It is wise for banks to consider barriers to the liquidity cross-border motion

into liquidity stress testing, which restrict the capacity of banks to cause liquidity in times and in places when and where is required, although, some of the barriers may have negative influence on effective liquidity risk management for cross-border groups, such as local liquidity requirements or central bank operational obstacles (ECB, 2008, pp. 22-23).

2.1.7 Measurement approaches for quantification of liquidity positions

Additionally, banks use many measurement approaches for quantification of banks' liquidity positions in order to get a full perspective of their risk. When ECB established their research (ECB, 2008), they determined a few measurements that banks used, such as cash flow maturity mismatch (which is used most frequently by the banks), then the liquidity shock approach and finally the balance-sheet maturity mismatch. Some banks consider using a combination of cash flow gap analysis and the liquidity stock approach (ECB, 2008, pp. 23-24).

These before mentioned approaches have some advantages and disadvantages. The advantage for the cash flow maturity is that it is flexible, simple, transparent and presents a general outline of the risk, and the disadvantage is that the approach is contemplated as short-term tool in which the long-term liquidity issues are not presented (cash flow mismatches can be also found in time buckets) (ECB, 2008, pp. 23-24).

Liquidity stock approach's advantage is the simplicity to produce and the disadvantages are that the approach is not dynamic, there is no measurement of probability of inflows or outflows and no projection of future cash flows, as for the balance sheet-based approaches, there is a probability that they are the most fundamental and easiest to operate, but they fail to reach the liquidity time dimension (ECB, 2008, pp. 23-24). Some banks tend to use a combination of approaches to quantify liquidity, such as a combination of liquidity shock approach and cash flow gap analysis (BCBS, 2013a, p. 32).

2.1.8 Disclosure of stress test results

Every bank should disclose their information of liquidity risk management, including analysis of future cash flows and the disclosure of the stress test results. According to the principle 13 of the Sound principles, there should be a public disclosure of the liquidity risk management framework and liquidity position by banks regularly in order for the market participants to have clear perception so that they can make a well-informed judgement about the reliability of the liquidity risk management (BCBS, 2008a, pp. 31-32). It is of great significance that banks determine the disclosure substance, the framework and the particular target audience very carefully and prudently in order to increase the sensible effect of the market discipline (ECB, 2008, pp. 24-25).

Central banks and senior managers have the right to request the results of the liquidity stress test, and this is very significant for the banks, since it would enhance the monitoring of the liquidity management and position (ECB, 2008, pp. 24-25). Liquidity risk is a sensitive problem within banks, thus any negative information about the liquidity position of the bank

might create severe consequences on the bank's liquidity (BCBS, 2008a, pp. 31-32). Most of the banks consider disclosure of the results to improve market discipline, although some banks believe that the scenarios of the stress tests cannot be easily interpreted without detailed understanding and presentation, and some believe that there is a low comparability of the results between banks (ECB, 2008, pp. 24-25).

Furthermore, the reason why banks are not publicly displaying the results is that the results cannot be explained without a detailed comprehension of the stress scenarios, and because of that, the results cannot be compared between banks and if the results are publicly revealed, this could have negative consequences on the liquidity condition of some banks in certain situations (ECB, 2008, pp. 24-25). Since liquidity risk tends to be more entity-specific, the results of the conducted liquidity stress testing should be disclosed with scenario information, underlying and business models, the bank's funding framework and the bank's liquidity risk management. (BCBS, 2008a, pp. 31-32). Although disclosure of liquidity risk management data is majorly incited, when it comes to liquidity stress testing results, public reveal will have more weaknesses than benefits, according to the Banking Supervision Committee (ECB, 2008, pp. 24-25).

2.1.9 Standardisation of liquidity stress testing

Finally, when disclosing results, banks should consider the standardisation of liquidity stress testing in order to minimise negative backlashes of disclosure. There is one way to enhance the comparability of the stress test results, which is jointly arranged circles that conduct common liquidity stress tests for the purpose of supervisors, in which case this will not affect the internal liquidity stress tests on a regular basis, and by using a common issue specification, banks that participate in those joined rounds of common liquidity stress test depend on bank-specific methods, data and tools to direct the common liquidity stress tests (ECB, 2008, pp. 25-28).

The coordinated rounds of the before-mentioned common liquidity stress tests could improve the information that is presented to central banks and senior management, and would allow them to determine the approximation of the systemic influence of a specific stress scenario, and nonetheless, banks should bear in mind the costs, which might allure banks to lower the usage of internal stress testing (which according to ECB, might lead to "crowding out" of scenarios), and the fact that there might be potential moral hazard effects, meaning that banks might suppose that the most severe scenarios that they should test are the common scenarios (ECB, 2008, pp. 25-28).

2.2 Methodology of liquidity stress testing in the Republic of North Macedonia

Through the Decision on the methodology of the risk management, NBRNM defines stress testing as an evaluation method of the internal and external risk factors and circumstances and their potential influence on the value of the bank's assets and liabilities, including the fact that the conducted method of stress testing should be suitable for the nature, type and capacity of the financial activities that will be performed by the bank (Decision on the

methodology of risk management (NBRNM, 2019), NBRNM No. 113/19, pp. 7-8). Prior to the establishment of the new Decision on the methodology for liquidity risk management, liquidity stress testing was presented by NBRNM as a method of testing the liquidity, at least once a year, under different conditions so that the bank can establish the impact of the scenarios on the liquidity of the bank, in order to get the bank ready for operations in emergency situations, to evaluate the possible ways of the growth of the bank and to discover what is the greatest source to finance the new products, services or activities (NBRNM, 2011, p. 4).

Stress tests, including liquidity stress tests, should be organised and directed based on extreme and theoretically feasible scenarios that can be specific for the bank and those that can emerge from the external conditions in which the bank operates (which can be coordinated and conducted with a combination of more simulations) (NBRNM, 2019, pp. 7-8). When orchestrating a stress test, the bank should include bank specific or internal scenarios and market-wide or external scenarios (presented in Figure 2), which reflect on changes and variations in the macroeconomic environment and disturbances of market functioning where the bank functions (NBRNM, 2011 p. 4).

Figure 2: Bank specific and market-wide scenarios that banks from North Macedonia should include in their liquidity stress test

Bank specific (internal) scenarios	**Market-wide (external) scenarios**
• considerable drop of the deposit base • damaged quality of credit portfolio • decline of the bank's creditworthiness • significant realisation of the bank's latent liabilities • the impact of the positions that permit premature withdrawal or repayment	• interest rate variations or market price fluctuations • inflation rate changes • restriction that is connected to the access to specific kinds of markets or funding sources, including the complete unavailability of important funding sources that are significant for the liquidity of the bank

Source: NBRNM (2011, p. 4).

The stress tests and the assumptions should be conducted in the following manner: there should be stress testing in normal business environment and stress testing in emergency conditions; the bank should define the implementation and the analysis of different stress scenarios and the frequency of their application; the Special Body and the Risk Management Board should take activities that depend on the stress-testing results; the Supervisory Board and the Risk Management Board need to determine an appropriate manner of reporting the results from the testing (NBRNM, 2011, p. 4).

By bringing a new decision on the methodology for liquidity risk management in 2020 into existence, NBRNM did not change much about the method of stress testing since the year of 2008. In the new decision, the following assumptions that can be indicators of scenarios of the bank in which it might be under stress are considered (NBRNM, 2020):

- A part or a total secured short-term funding loss;
- An outflow of a substantial proportion of the retail deposits;
- Liquidity outflows which can be a result of crucial deterioration of the credit quality and rating downgrade;
- Possible requirement for redemption of debt or payment of other liabilities;
- A partial or total loss of unsecured capacity of wholesale funding (together with wholesale deposits and other funding sources, such as credit and liquidity support from other financial institutions);
- Market volatilities in market returns, real estate price, currency instability that are influencing the collateral value or quality, or developing supplementary collateral needs;
- Unplanned activation of unconditional off-balance sheet liabilities for credit and liquidity support.

NBRNM developed a stress-test model in 2008 that banks are still applying, and this model is based on qualitative evaluation in combination with a quantitative analysis, and in order for the qualitative evaluation to be coordinated, banks should present detailed data on a questionnaire developed by NBRNM (NBRNM, 2008), and the questions are presented in Appendix 4.

Moreover, according to the model, developed by NBRNM, banks should perform a quantitative analysis of the stress testing, and the analysis should be conducted at the end of every year, and in this quantitative analysis, every scenario that will be included should have current impact on the structure of the balance sheet of the bank, and through the implementation of these scenarios, their impact on the liquidity position and the individual funds is being tested (NBRNM, 2008).

While executing the simulations, the bank should consider the defined assumptions, such as dependence only on individual liquid assets, containing an obligation to refinance every credit or loan that will mature (meaning that the level of approved loans are contained on the simulation date), lack of ability to provide liquidity from domestic interbank market or from NBRNM, the cash flows and accounts at NBRNM, as well as the assumption that the deposits in other banks are being used in full capacity and the necessity for liquidity funds is fulfilled through liquid assets' sale with a discount of 20% (that is, 80% of the value of the liquid assets should be paid), which means that the loss of the 20% less paid liquid assets will be reflected negatively on the internal funds of the bank (NBRNM, 2008). The scenarios that are being used for the quantitative analysis are presented in Appendix 5.

By using some of the questions that were applied in the survey of ECB’s research that was conducted on other European banks about the liquidity risk tolerance, type of stress test

scenarios, time horizon, perimeter covered, disclosure of the results and standardisation, I administered a survey that is presented in the Appendix 6. The survey contained 10 multiple-choice questions, and the target sample for this survey was 5 banks from North Macedonia to present their answers on the methodology of liquidity stress testing. Out of 7 asked banks, 5 banks presented their response and were included in the research.

Table 2: Comparison of the answers presented by European banks in 2008 and banks from North Macedonia

Questions	**European banks**	**Banks from North Macedonia**
1) Does your bank quantify its liquidity risk tolerance?	Most of the banks (60 out of 84 banks).	All banks (5 out of 5 banks).
2) What types of stress test scenarios does your bank consider?	All the types, but mostly combination of both bank-specific and market-wide (35 out of 84 banks).	Bank-specific (2 out of 5 banks) and combination of both bank- specific and market-wide (3 out of 5 banks).
3) Which of the following assumptions does your bank make within your idiosyncratic liquidity stress test scenarios, if these types of scenarios are used in your bank?	Rating downgrades including operational risk, withdrawal of corporate and retail deposits and so on (30 out of 84 banks).	Mostly withdrawal of corporate and retail deposits (5 out of 5 banks).
4) Which of the following assumptions does your bank make within the market-wide stress scenarios, if these types of scenarios are used in your bank?	Global market crisis, sub-prime market liquidity crisis, government crisis or change in monetary policy and so on (approximately half of 84 banks).	Severe global market crisis (2 out of 5 banks), no capital market funding (2 out of 5 banks), appreciation / depreciation of domestic currency (2 out of 5 banks), retail deposit stability decreases (2 out of 5 banks) and so on.
5) What is the maximum time horizon of your three most important market scenarios?	Some of the answers are below year (34 out of 84 banks), some of them one year and above (21 out of 84 banks) and a great number of banks did not respond to this question (29 out of 84 banks).	Most of the answers were 1 year and above (1 bank uses 1 year and 1 uses 3 years out of 5 banks), and other time horizon (2 out of 5 banks).

(Table continues)

Table 2: Comparison of the answers presented by European banks in 2008 and banks from North Macedonia

(Continued)

6) At which level do you perform your liquidity stress test?	Mostly both group and entity level (32 out of 84 banks).	Most of the banks answered entity level (3 out of 5 banks).
7) What type of measurement approach do you adopt for your liquidity position?	Cash flow maturity mismatch (57 out of 84 banks) and liquidity stock approach (43 out of 84 banks).	Liquidity coverage ratio (3 out of 5 banks).
8) Does your bank publicly disclose the results of its liquidity stress tests?	Mostly not foreseen (between 50 and 60 banks out of 84 banks).	Mostly not foreseen (3 out of 5 banks).
9) How would you rank the benefits for your bank of standardisation of liquidity stress tests? (From 5 = most important to 1 = least important)	Mixed answers, but most of them answered most important and important (more than 30 out of 84 banks).	The majority answered most important (3 out of 5 banks).
10) Given standardisation of liquidity stress tests, would disclosure requirements foster market discipline in liquidity risk management?	A great number of banks answered yes (59 out of 84 banks).	The most frequent answer is yes (3 out of 5 banks).

Adapted from ECB (2008).

NBRNM presents a template for presenting the methodology of stress-testing and the results application of the scenarios for evaluation of the sensitivity of the liquidity risk. However, NBRNM claims that this template should give banks an idea or a framework of what stress-testing means, but banks should accommodate to the conditions that are specific to each bank and to the movements of the economy. The reason why I am using the same survey that was used for other European banks is to investigate what type of feedback banks from North Macedonia will present for the same questions the other European banks answered and compare if the methodology that banks from North Macedonia are using is similar with the ones that the other European banks disclosed in the ECB's research.

In Table 2, I am presenting a comparison of the answers that both groups of banks presented on the same survey. The survey that I conducted about the stress-testing methodology on banks from North Macedonia found the following key facts:

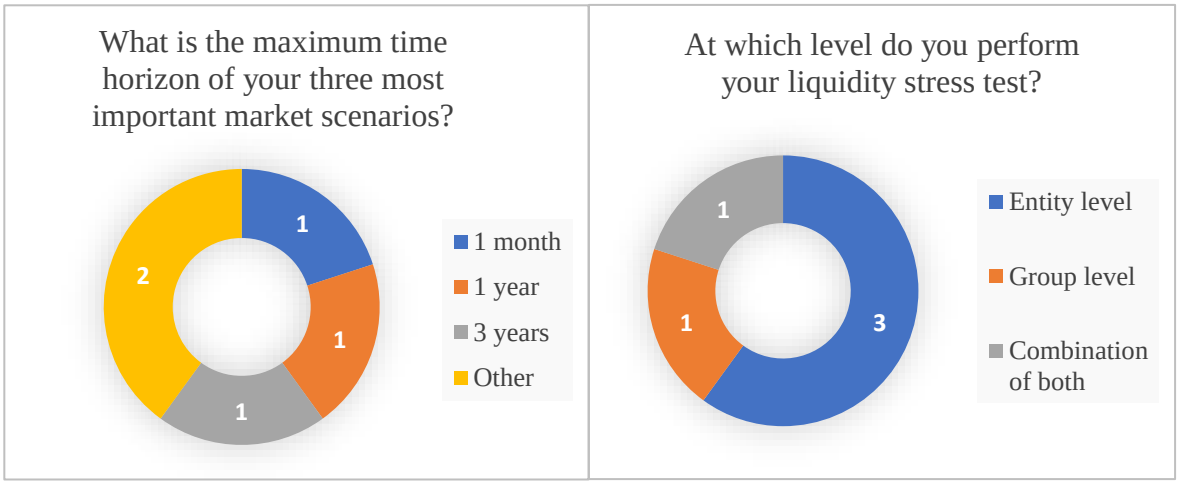
– All of the surveyed banks quantify their liquidity risk tolerance (5 out of 5 banks);

– 3 out of 5 banks consider combination of both idiosyncratic shocks and adverse market conditions, and 2 out of 5 banks prefer only bank specific liquidity stress scenarios;
– Only one bank performs its three most important market scenarios within a time horizon of less than 1 year, while two banks did not present their results for this question;
– Entity level is most used among the questioned banks for performing the liquidity stress test (3 out of 5 banks);
– Most implemented type of measurement approach that was adopted for the liquidity position is the LCR; (3 out of 5 banks).

Most of the banks do not prefer to present information if they publicly disclose their results, most of them rate the benefits of standardisation of liquidity stress tests as most important, and most of the banks believe that disclosure requirements would foster market discipline in liquidity risk management.

In Figure 3, a graphical presentation is established, where we can clearly see the outcomes for the fifth and sixth questions of the survey that banks form North Macedonia answered.

Figure 3: Results for questions 5 and 6 of the survey carried out on 5 banks from North Macedonia



Source: Own work.

From the results that I collected from a sample of 5 banks from North Macedonia, I can conclude that most banks are using more diversified model of stress testing than the one NBRNM established in 2008, regarding the types of scenarios, assumptions, time horizon and type of measurement. When it comes to comparing the results that other European banks presented in 2008 with the answers from banks from North Macedonia, there are notable similarities in the outcomes, from which we can conclude that both groups have similar methodology of liquidity stress testing, other than the fact that other European banks are using more diversified scenarios and assumptions within the scenarios, and other European banks apply more diverse time horizon, including short-term, medium-term and long term time horizons, and this is a rare case in banks from North Macedonia.

2.3 Interpretation on the efficiency of the liquidity stress testing methodology of the banking sector in the Republic of North Macedonia

By investigating the methodology of liquidity stress testing the banks in North Macedonia should use, and by comparing it with the methodology that BCBS and ECB are presenting, that international banks are supposed to use, the NBRNM methodology is rather underdeveloped. The methodology that ECB explains, and some of the European banks that are using is highly diverse, especially in the scenario design, the quantification of their impact on cash flows, their time horizon and the perimeter covered. What NBRNM developed back in 2008, as an example of stress testing the banks may use if they need help in the stress testing process, is a concept of qualitative evaluation in combination with a quantitative analysis (which is mostly conducted based on the results of the qualitative evaluation).

The 10th principle of the BCBS's Sound principles clearly states that banks should coordinate stress tests regularly with various scenarios, on bank or market level, with different time horizons. ECB performed research about the implementation of the stress testing method, and they came to a conclusion that the diversification of the scenarios and the other elements of the method is extremely important in order for the banks to develop quality liquidity stress testing for an astonishing methodology of liquidity risk management.

Table 3: Similarities and differences of liquidity stress testing techniques between European banks and banks from North Macedonia

Liquidity stress testing techniques	**Similarities between European banks and Banks form North Macedonia**	**Differences between both groups of banks**	
		European banks	**Banks from North Macedonia**
1) Liquidity risk tolerance	Most of the both groups of banks quantify their liquidity risk tolerance	Banks determine the highest level of liquidity risk banks are ready to accept or are willing to handle in normal and stress events and should use expert judgement	Banks present information if the banks implement internal restrictions and limits for their liquidity risk management and how is the abidance of the management of the liquidity risk
2) Typology of scenarios	Usage of idiosyncratic or bank-specific scenarios and combination of both types of scenarios	Use only market-wide scenarios as well	Do not use only market-wide scenarios

(Table continues)

Table 3: Similarities and differences of liquidity stress testing techniques between European banks and banks from North Macedonia

(Continued)

3) Time-horizon of stress scenarios	Usage of medium-term and long-term time-horizons	Usage of intraday and short-term time horizon	Do not use intraday and short-term time horizon
4) Scenario reviews	They keep a simple and straightforward stress testing	Concentrate more on the altering nature of past	NBRNM is more interested in the general results of the implementation of the entity's individual scenario about the bank's internal limits
5) Perimeter of stress testing	Entity-specific, group-wide and combined	No difference	NBRNM are only interested in the information of the influence of the widespread shocks on the liquidity position on the composition of the financial sources.
6) Barriers to cross-border transfers of liquidity	No similarities	Banks present different types of barriers	Interested in the concept whether the bank's stress test contains occurrences of the worldwide markets
7) Measurement approaches for quantification of liquidity positions	Cash flow maturity mismatch and balance-sheet maturity mismatch	Liquidity shock approach	Liquidity coverage ratio
8) Disclosure of stress test results	Most of the banks do not wish to speak of disclosure of their results	Some banks do not disclose the results to protect themselves from negative information	Banks generally disclose their results, but they do not present the results in detailed form
9) Standardisation of liquidity stress testing	Both groups consider standardisation as relevant	The common liquidity stress test is encouraged by ECB	NBRNM do not condition common liquidity stress test

Source: ECB (2008); NBRNM (2008); NBRNM (2011); NBRNM (2020).

The overall explanation of the research is the diversification of the scenarios, the establishment of the stress test limit system and the specialist perception, the usage of different time horizons, the fact that the main focus should be on changing the nature of the

exposure of the banks' liquidity risk, the influence on cash flows and the perimeter covered. What NBRNM cannot praise for is the diversification of the scenarios in their methodology of stress testing. They are using only 3 scenarios, which the third one is a combination of the first two scenarios. In Table 3, we can see the summarised concepts of the similarities and differences of the techniques of liquidity stress testing between both groups of banks.

First of all, ECB mentions the establishment of the liquidity risk tolerance as an important aspect of the stress test implementation. NBRNM seeks for certain requirements of liquidity measurements that present data for determining the liquidity risk tolerance in the liquidity risk management process, such as LCR and HQLA. Most of the other European banks that were included in the ECB research answered that they quantify their liquidity risk tolerance, which is similar with the answers the banks form North Macedonia presented in the conducted survey (ECB, 2008, p. 13), where all 5 banks claim that they quantify their liquidity risk tolerance.

When it comes to the typology of the scenarios, according to ECB's analysis, due to the difficulty of defining severe but reliable stress scenarios in turbulent events, it is more likely that banks should use a combination of both bank-specific and market-wide scenarios, even though their preferable choice is to use solely idiosyncratic or market-based scenarios. There is a possibility that some banks implement neither of the scenario types (meaning banks use neither bank-specific nor market-wide scenarios). Mainly, in the method of stress testing that NBRNM defined in their decisions, scenarios should be determined as specific for the bank and the ones that can emerge from the external conditions in the operating area of the bank.

It is preferable for the banks in North Macedonia, when conducting stress testing, to combine more simulations and use different methods for evaluating the impact on the extreme shocks upon the liquidity, solvency and profitability of the bank. This means that when performing a liquidity stress test, banks should implement internal scenarios or market-wide scenarios, which is in accordance to the 10th principal of the Sound principles, and is similar to the typology the foreign banks from the ECB analysis use.

European banks presented different outcomes when it comes to the type of scenarios, which means that some of them are using idiosyncratic shocks, some of them adverse market conditions and some of them are using combination of both. 3 out of 5 banks from North Macedonia that are used in the survey are abiding by this principal and are using combination of both types of stress test scenarios and 2 of them prefer to adhere with the idiosyncratic shocks. Some of the questioned banks are using more diversified assumptions when conducting the idiosyncratic or market-wide stress test scenarios, but some of them favour using only a few assumptions.

When conducting a stress test, what should not be forgotten is the time-horizon, which is one of the most significant aspects of a stress test implementation. It is crucial for the banks to use diverse time-horizons, because by using various time-horizons, banks can consider using short but severe shocks and mild but persistent shocks. One concept that NBRNM is

not taking account when conducting a stress test is the diverse time-horizon that the Sound principles mandate and the foreign banks tend to use.

NBRNM demands from banks from North Macedonia to present results of stress test at the end of every year. This can cost banks to miss out on advantages and disadvantages of short-term and long-term time-horizons, when designing stress-tests, and on the perks of using diversification when determining the time-horizon and stress scenarios. Other surveyed European banks are using different time horizons, such as short-term, medium-term and long-term time horizons. Unlike the used European banks, some of the questioned banks form North Macedonia use medium-term time horizons and are establishing more frequent stress tests, but none of them use intraday or short-term time horizons, which is something that banks should implement in their methodology to determine the aspects of short-term stress tests as well.

Scenario reviews are of great importance in liquidity stress testing, especially when banks should consider concentrating more on the changes of the nature of the liquidity risk exposure than using historical liquidity shocks. NBRNM is more interested in the general results of the implementation of the entity's individual scenario about the bank's internal limits that are connected to the assets and liabilities, revenues and expenses and the size of the individual funds. They do not focus on lowering the usage of the liquidity shocks from the past, but rather focus on the method of the stress-testing which should be appropriate for the nature, type and capacity of the financial activities of the bank.

European banks use the perimeter differently, which means that some banks use entity-specific, some use group-wide and some use combined perimeter (it depends on the conditions the banks operate). In North Macedonia, NBRNM does not ask for banks to choose a perimeter of stress testing. By asking some of the banks from North Macedonia about the perimeter of stress testing, most of them use entity specific, a few of them use group-wide and a few of them use combination of both. This outcome presents information that banks in North Macedonia tend to use the perimeter differently as well as European banks.

When it comes to the barriers to cross-border transfers of liquidity, the incorporation can have different impact among banks, and it is considered a clever move to include barriers in the stress testing. In NBRNM's case, they are interested in the feature if the bank's stress test analysis contains occurrences of the worldwide markets, but they do not specify the incorporation of the barriers to cross-border transfers.

As it was mentioned before, BCBS in their Sound principles, the 13th principle to be specific, claim that banks should publicly disclose their quantitative and qualitative information of liquidity risk management and disclose the stress test results. This part is very important for improving the market discipline. Nonetheless, some banks do not disclose the results of the liquidity stress testing method to protect themselves from negative information about the liquidity information. NBRNM does not request and encourage public disclosure of the results from the stress testing from banks from North Macedonia.

Most of the banks in North Macedonia generally disclose their information and results from stress testing in public, but not a detailed presentation of the results. They only present the detailed results to NBRNM and their senior managers, since they have the right to request the results in order to improve the monitoring of the liquidity position. This statement reflected in the conducted survey as well, meaning that when the banks were asked if they publicly disclose the results of liquidity stress testing, most of them answered not foreseen (they do not prefer to reveal information about disclosure of the results of the liquidity stress testing).

Additionally, the standardisation should be taken into account when disclosing the results of the liquidity stress tests, so that the negative repercussions on the disclosure would be minimised and avoided. This means that the implementation of the common liquidity stress tests for the purpose of supervisors is a method to improve the comparability of the stress test results, considering this will not influence the regular internal liquidity stress tests. The process of using common liquidity stress tests is encouraged by ECB, which is explained as a method of improving the data that is reported to the central banks and senior management, which can help them determine the estimation of the systemic impact of a certain stress scenario.

NBRNM presented an example of a liquidity stress test model that banks can use, but did not condition standardisation and common liquidity stress test methods on the banks. Most of the banks asked in the survey about the importance of the standardisation ranked the benefits of standardisation of liquidity stress tests as most important. 3 of the banks believe that disclosure requirements will foster market discipline and 2 of them did not wish to present their opinion on this matter.

In conclusion, the liquidity stress test methodology of NBRNM generally meets the requirements of the Sound principles and the ones that other European banks in the ECB's research follow. However, NBRNM uses an outdated methodology, which needs more improvement on the diversification of the time-horizons, the enhancing of the scenario design, the scenario reviews process, setting a defined perimeter and help the banks to cooperate and use the group-wide level of stress testing, broaden the horizons when defining world-wide stress scenarios and conduct analysis of barriers to cross-border motions, encourage the banks to disclose more detailed stress test results and improve market discipline and consider using standardisation in the stress test methodology. However, despite the usage of NBRNM's basic example of the methodology of liquidity stress testing, some banks are adding their own methods in the methodology of stress testing, including a diverse type of scenarios and assumptions, different time horizons, level, type of measurement and so on.

NBRNM should improve their basic methodology that banks are supposed to use and widen the horizons and the creativity of scenario design, like for example including assumptions such as operational risk, reduction in counterparty limits, reduction in asset prices, currency conversion, drop in stock prices, rise in credit spreads or interest rates, foreign exchange

market dislocation and much more assumptions, in order to increase the robustness of the results of the liquidity stress testing.

3 METHODS OF MONITORING AND MEASURING THE LIQUIDITY RISK

The liquidity risk framework and position will not be well presented and determined without measurement and monitoring. As Erik Banks explains in his research (Liquidity risk managing asset and funding risk), liquidity risk measurement might be challenging and considered a difficult task, mainly because of the dynamic and unforeseeable fundamental variables that initiate exposures, and in spite of that, banks should endeavour to establish qualified risk dimensions, which can lead to successfully established risk control (Banks, 2005, p. 129).

Since the financial crisis happened because of liquidity deficiency, some regulators mandated banks to increase and maintain an adequate buffer of liquid assets and reduce the risk of banks becoming illiquid (Pohl, 2017, p. 2). Thus, BCBS implemented two measurement standards for a more buoyant banking sector for supervisors to use in their liquidity risk supervision. The first one is the LCR, which promotes the short-term flexibility of the liquidity risk outline and ensures that banks have sufficient high-quality liquid assets to survive a stress scenario in 30 days, and the second one is the Net stable funding ratio (hereinafter: NSFR), which promotes resilience in a longer period (a time horizon of one year), which creates additional banks' inducements to fund their activities and operations with more stable funding sources (BCBS, 2010a). Eight principles are presented in the Sound Principles about management, measurement, and monitoring of the liquidity risk (from principle 5 to principle 12) (BCBS, 2008a).

Beforehand, when NBRNM established the Decision on managing banks' liquidity risk, the main focus for determining and maintaining an adequate level of liquidity by the banks was to plan and monitor the funding inflows and outflows, to determine and to maintain an appropriate maturity structure of its assets and liabilities, to monitor and control the funding sources and their concentration and capacity, to maintain prescribed liquidity ratios and to establish, monitor and control the internal liquidity indicators (Andreeva, 2010). The newly developed Decision on the methodology for liquidity risk management concentrates more on determining, calculating, monitoring, and maintaining the LCR as an indicator between HQLA and the net cash outflow.

For the banks to maintain and monitor the adequate level of liquidity position, banks should establish and maintain a fine maturity structure, monitor the funding sources, control the available unencumbered sources and establish, monitor, and maintain acceptable liquidity ratios, adding the fact that for a better initiation of the measurement, monitoring and maintenance of the liquidity risk, NBRNM requests from banks to develop procedures for determining internal liquidity ratios, for monitoring funding sources and their concentration,

for maintaining an adequate maturity structure, and for determining the available unencumbered assets (NBRNM, 2020).

3.1 Planning and monitoring the inflows and outflows

The planning process of inflows and outflows should comprise future, anticipated inflows, and outflows, which include deposits, securities, loans, borrowings, off-balance sheet items, and inflows and outflows with a high level of certainty (NBRNM, 2011, p. 5). As stated in the fifth principle of the Sound principles, banks should consider a strong method for forecasting future cash flows (that surface from assets and liabilities, as well as off-balance sheet items), which is used in an adequate time horizon (BCBS, 2008a). According to the previous Decision on liquidity risk management developed by NBRNM, planning and monitoring the inflows and outflows are important for banks in North Macedonia to maintain adequate liquidity (NBRNM, 2011, p. 5).

Banks should contain the capability of measuring and forecasting their potential cash flows for assets, liabilities, and off-balance sheet features, obligations, and derivatives at a different time, under normal or stressed scenarios (BCBS, 2008a, pp. 10-11). In the newly developed Decision on the methodology for liquidity risk management, NBRNM emphasised the calculation of the LCR liquidity ratio, which is a product of HQLA and Net liquidity outflows (hereinafter: NLO), and NLO's calculation contains items of liquidity outflows and liquidity inflows, which should be properly planned and incorporated (NBRM, 2020, pp. 21-33) When BCBS included the liquidity measurement into the fifth principle, they meant to include the evaluation of the cash inflows opposed to the outflows of the bank, and the liquidity value of its assets for identifying the capability of the future net funding shortfalls (BCBS, 2008a).

In their liquidity risk management, banks should identify, measure, and monitor the liquidity risk positions such as future cash flows, currencies that a certain bank uses, sources of contingent liquidity demand and associated causes that are connected with off-balance sheet positions, and correspondents, agreements or settlements and custody actions (BCBS, 2008a).

Through the previous decision, NBRNM determines the planning process, in which all kinds of current and future funding inflows and outflows should be included, together with off-balance-sheet position-based inflows and outflows, including the expected funding inflows that should come from deposits, securities sales, interbank borrowings, credit collection, off-balance sheet positions, financial derivatives, and other inflows, while future funding outflows should come from purchased securities, deposit payments, approved credits, interbank lending, financial derivatives, off-balance-sheet positions, and other outflows (NBRNM, 2011, p. 5). Since there is a possibility that valuations may worsen under market stress, assets should be carefully valued following the results of relevant financial reports (BCBS, 2008a).

According to the new decision from NBRNM, the liquidity outflows should contain items such as outflows from stable retail and other retail deposits, as well as retail deposits collected from other countries, outflows from operational deposits, outflows from other liabilities of the bank, outflows from taken off-balance sheet liabilities and additional outflows, and the inflows that are accomplished in other countries, where there are transfer limitations of assets or inflows that are expressed in non-convertible currencies, can be included in the calculation of the liquidity inflows only to the amount that corresponds with the outflow that is received in that country or in that non-convertible currency (NBRNM, 2020, pp. 21-33).

The ninth principle of the Sound Principles presents the necessity of active management of the collateral positions, segregating the difference between encumbered and unencumbered assets, monitoring the legal unit and the location where they held the collateral, and in which way it might be prepared in a specific period, which means that every bank should contain the capability to measure all the collateral positions, and should monitor their level of available collateral by jurisdiction, by currency exposure and by a legal entity, including the systems that should be able to monitor changes among intraday and overnight term or collateral usage term (BCBS, 2008a, pp. 23-24). Meanwhile, what the NBRNM did with the newly developed decision this year is they tried to incorporate a part where they abided by the ninth Sound principle (NBRNM, 2020).

This means that they are implementing a part where they mandate from the banks to calculate and monitor the available unencumbered assets, which can be used as collateral to obtain additional funding on the secondary market or using collateral for acquiring liquidity support from the central bank, taking into account the currency structure, the geographical region and the completion of the obligations to be used as collateral, adding the concept that the funds that are received as collateral should be identified and controlled, as well as those that have no restrictions for their application as collateral for obtaining additional funding (NBRNM, 2020, p. 34).

What banks should also do is widen their horizons and diversify their collateral sources, considering the capacity constraints, sensitivity prices, bank-specific concentrations, haircuts and collateral requirements under bank-specific and market-wide stressed conditions, and the availability degree of funds from counterparties (from the private sector) in different market-wide stress circumstances, including the fact that banks need to have enough collateral for meeting expected and unexpected borrowing necessities and for determining potential growths in margin requirements in various timelines, that depend upon the funding profile of the bank (BCBS, 2008a, pp. 23-24).

The process of planning and monitoring the inflows and outflows is very significant in the previous and current decisions, both developed by NBRNM. Since it is important to monitor, control and evaluate the cash inflows and outflows, including the off-balance sheet features, BCBS is demanding that banks implement a robust framework in this process so that future net funding shortfalls can be avoided. NBRNM follows this standard in both old and new

decisions, following the country's jurisdiction. To develop better regulation of liquidity risk management, NBRNM included the implementation of the ninth principle of the Sound principles in their new decision. This principle is about managing collateral positions and monitoring the encumbered and unencumbered assets, the location where the collateral is held, the legal unit, and the preparation method in a specific period.

3.2 Adequate maturity structure

The fifth principle also presents the time horizon, which should be integrated and managed with various factors. The bank's potential cash flows for assets, liabilities, off-balance sheet commitments, and derivatives should be measured and estimated under normal conditions and circumstances of severe stress, which means that difficulties in liquidity needs and funding capacity should be presented on an intraday basis, liquidity needs and funding capacity on a short-term, medium-term and long-term time horizons (BCBS, 2008a, p. 11).

With the previously established decision on managing banks' liquidity risk, NBRNM required banks from North Macedonia to monitor the maturity structure of asset and liability positions so that the assets and liabilities will be matched by their contractual residual maturity (NBRNM, 2011). Banks should allocate inflows and outflows of funds (for monitoring the maturity equivalent purpose) that are based on individual asset and liability positions within a period until seven days, in the time between seven days and one month, from one month to three months, within three to six months and up to twelve months (NBRNM, 2011, pp. 5-6). According to the new decision, when establishing, maintaining, and monitoring the adequate maturity structure of assets for residual maturity equivalent, banks should allocate them in proper time frames (NBRNM, 2020, p. 33).

When general market stress occurs, counterparties or parent banks may retain, delay or postpone payments to the bank when they view the failure to settle payments when a sign of financial weakness is expected to occur, which can cause liquidity pressures, and additionally, counterparties may end up with a lower degree of funds, the ability to fulfil the payment obligation might be damaged, and the smooth operation of the payment and settlement system might be disturbed (BCBS, 2008a, pp. 20-23).

Determining the maturity of claims and liabilities by initiating and monitoring their anticipated residual maturity is another obligation that banks from North Macedonia need to complete, apart from maturity monitoring through the contractual residual maturity, and the expected residual maturity can be established by defining and using adequate assumptions that present information on the value of cash inflows and outflows in a particular time frame, considering the probability of occurrences of a certain cash inflow and outflow (NBRNM, 2011, pp. 5-6).

Moreover, by following the new decision on the methodology for liquidity risk management (NBRNM, 2020, p. 33), the maturity structure of assets for residual maturity match should be monitored on an aggregate basis and by significant currency, including the determining and monitoring of the expected maturity, considering the bank's development plan and

business policy. When calculating the expected maturity, banks should use adequate assumptions for the size of cash inflows and outflows in time frames that consider the probability of cash inflow and outflow (NBRNM, 2020, p. 33).

The intraday liquidity positions, mentioned in the eighth principle of the Sound principles, should be consistently managed to fulfil payment and settlement obligations, to recognise and set priorities for the time-specific and other severe obligations to fulfil them when they are anticipated, to settle less critical obligations promptly, regularly on time, under normal and stressed events, and if the bank is unsuccessfully managing and measuring the intraday liquidity, the liquidity position can be affected gravely, which could become unable to meet its payment obligations at the anticipated time period (BCBS, 2008a, pp. 20-23).

The aspect that is not used in the old or the new decision when it comes to determining adequate maturity is intraday liquidity management. This is a significant aspect to be actively managed for achieving payment and settlement obligations on time, under normal and stressed conditions. NBRNM should include the obligation for the banks to manage their intraday liquidity so that they can avoid the impossibility of meeting their payment obligations on time and influencing their liquidity position and the position of other entities.

3.3 Monitoring the sources of funds and their concentration

In the sixth principle, a brief explanation of the banks' necessity of monitoring the liquidity risk exposures and funding needs regularly is presented, which should be inside and beyond the legal units, currencies, and business motions, which should consider certain types of limitations and regulations, such as regulatory, legal and operational limitations, up until the transferability of liquidity (BCBS, 2008a, pp. 29-30).

Banks are supposed to dynamically monitor and control liquidity risks on a bank level, their foreign branches and subsidiaries, and a group bank as a whole, which should include operations and procedures of gathering information across numerous various systems so that they can develop and advance a group-wide perspective of the liquidity risk positions and exposures, and recognise transfer constraints of the liquidity inside the group as a whole, despite the organisational structure and the level of centralised or decentralised liquidity risk management (BCBS, 2008a, pp. 17-18).

Another thing that can be used in the liquidity risk monitoring process is the cross-entity funding channels, which is a method that can be used as an instigator for liquidity pressures that can be either alleviated or expanded among the whole group and this method could help release the liquidity pressures on a single entity, but every bank should ponder about establishing the internal limits and restrictions on the liquidity risk of the intragroup to alleviate the risk of contamination in a stress event (BCBS, 2008a, pp. 17-18).

The cruciality of monitoring the sources of funds and the concentration level is presented in the NBRNM's previous decision to manage the liquidity risk. Before using the new decision, NBRNM explained the process of monitoring the funding sources and defined the features

that the monitoring of the funding sources should include (NBRNM, 2011, pp. 6-7). The new NBRNM's decision on the liquidity risk management methodology briefly explains the process of monitoring the funding sources and their concentration. According to this decision, every funding source of the bank should be monitored on an aggregate basis and by significant currency (NBRNM, 2020, p. 34).

The process of monitoring the funding sources should include the following aspects (NBRNM, 2011, pp. 6-7): the method of establishing the level of stability of every kind of deposit, considering the features of the depositor and the deposit; initiating and controlling the other motion of the funding sources; instituting and maintaining regular and consistent contacts with the major depositors, correspondent banks and other significant business partners; and monitoring the diversification of funding sources (the largest depositors should be well included as significant funding sources in the monitoring process).

Within the seventh principle, the necessity of establishing a funding strategy is presented, in which it is recommended for banks to attempt to maintain a continuing presence in their funding markets and robust relationships with fund providers, including the fact that the diversification of funding sources should be conducted on short, medium and long-term. The diversification goals should be included in the medium to long-term plans, thus it should be aligned with the planning of business and budgeting (BCBS, 2008a, pp. 18-20).

To follow the twelfth principle, set by the BCBS, a cushion of high-quality liquid assets (unencumbered) should be created and maintained by the banks, which will represent insurance against the scope of liquidity stress scenarios, and when it comes to the bank's elasticity to liquidity stress, the aspect of an adequate cushion of unencumbered, high-quality liquid assets (which can be sold for obtaining funds in a variety of stress scenarios) that are constantly available, can be very critical (BCBS, 2008a, pp. 29-30).

Furthermore, the size of the cushion is a significant objective that is detained as liquidity stress insurance to the estimates of liquidity needs during stress circumstances, and these estimates should include contractual and non-contractual cash flows, where the possibility of funds being withdrawn can be included (BCBS, 2008a, pp. 29-30).

As stated by the new decision, the monitoring process of funding sources should include monitoring the funding sources' concentration, which will include the depositors and the type of instruments, monitoring the funding sources' price and maturity, by sort of depositors, sort of funding sources and instruments, and monitoring the probability for the funding sources' update, considering the segregation of funding sources, established by the type of depositors, type of funding, the funding sources' maturity and the likelihood of using new funding sources (NBRNM, 2020, p. 34).

The main focus of the old decision, established by NBRNM, is monitoring the funding sources in which the deposits and the largest depositors are included. The banks need to monitor the level of stability of the deposits, the movement of other funding sources, the establishment of regular contacts with the larger depositor, and the diversification of the

funding sources. However, the types of limitations were not mentioned in this decision (such as regulatory, legal, and operational restrictions), as well as the level of monitoring and controlling the liquidity risk (individual level, subsidiaries, and the bank as a whole), which was presented in the Sound Principles in order to develop a perspective of the liquidity risk positions and exposures on a group level. NBRNM included in their old decision the necessity of developing a funding strategy for providing the diversification of the funding sources, which is according to the seventh principle of the Sound Principles.

Recently, NBRNM established a new decision for liquidity risk management, in which they try to get closer to international regulation. In this decision, they considered following the sixth principle by implementing the need for the banks to monitor every funding source on an aggregate level and by significant currency. The new decision also anticipates maintenance of the HQLA cushion, according to the twelfth principle of the Sound Principles.

3.4 Liquidity ratios

To develop solid liquidity risk management and enhance the liquidity profile and position, BCBS has generated two regulatory standards for the banks to use in their liquidity risk supervision. In 2010 to encourage elasticity of the liquidity risk outline and to strengthen the liquidity framework, such as LCR and NSFR (Hong, Huang, & Wu, 2013), these two objectives should be repeatedly applied widely on a global level by the banks, so that the resilience will be increased when liquidity shocks or difficult situations occur. When the standards were in development, they were built to encompass and harmonise the parameters internationally, although some parameters have items designed on a national basis to comply with the conditions of the locally precise jurisdiction, meaning that the regulations of every jurisdiction should clearly define the parameters so that the clarity will be available on a local and global level (BCBS, 2010a).

LCR can be explained as an objective to support short-term flexibility by establishing security that the bank contains enough high-quality liquid assets for surviving a severe stress circumstance that has a time period of 30 days and has an objective to enlarge liquidity buffers on individual bank level, as opposed to NSFR, which is here to promote long-term flexibility by inciting the banks to fund their activities and operations with more stable and secure funding sources and the NSFR standard intends to improve the funding stability of the banking sector (BCBS, 2010a).

This means that accumulating high-quality liquid assets will help survive liquidity shocks in financial stress, which will enable the banks to regularly meet their obligations, which can result in reducing the influence of liquidity shocks on a wider financial system (BCBS, 2010a, p. 5). In North Macedonia, NBRNM requires banks to determine, monitor, and maintain LCR as a ratio between high-quality liquid assets (hereinafter: HQLA) and the net cash outflow, and LCR as a ratio between HQLA in the respective significant currency and the net cash outflow in the respective significant currency (NBRNM, 2020).

3.4.1 Liquidity coverage ratio

BCBS defines the LCR as an object that is developed to ensure the fact that banks maintain enough HQLA (assets that are convertible into cash) to meet the liquidity necessities and survive within a 30-calendar day liquidity stress scenario (the time horizon of 30 days is supposed to be an adequate period for the banks and their supervisors to take corrective measures in stress scenarios) (BCBS, 2013b). Within 30 days, some mismatches or inconsistencies may occur, which should be considered by the supervisors of the banks so that they can ensure an adequate level of liquidity assets are collected to meet any cash flow gaps during the period (Pohl, 2017, p. 3).

LCR ought to be a significant element when it comes to implementing a supervisory approach in which supervisors should determine a detailed evaluation of the liquidity risk management, which will be according to the Sound Principles (BCBS, 2013b). The calculation of the LCR can be established when dividing the stock of HQLA by the net cash outflow in the interval of 30 days. The value of this ratio should be a minimum of 100%, meaning that the stock of HQLA and the total amount of net cash outflows (hereinafter: NCO) should be at least equal, and the scenario of this standard should be a combination of the idiosyncratic and market-wide stress event (Pohl, 2017, p. 3). The calculation of LCR can be established with the equation (1) (BCBS, 2013b):

$$LCR = \frac{Stock\ of\ HQLA}{Total\ net\ cash\ outflow\ over\ the\ next\ 30\ days} \geq 100\% \quad (1)$$

To ensure that the liquid assets are of high quality, a method of sale or secured borrowing is determined, and their liquidity-generating capacity is supposed to endure complete and undamaged even in severe idiosyncratic and market stress periods; thus, this process is well outlined in the characteristics of the HQLA, defined in the Basel III regulations, set by BCBS for measuring and monitoring the liquidity risk on an international level, presented in Table 4 (BCBS, 2013b).

Table 4: Characteristics of HQLA

Fundamental characteristics	**Market-related characteristics**
Low credit and market risk	Active and sizable market
Effortlessness and certainty of valuation	Low volatility
Low correlation with risky assets	Flight to quality (occur in systemic crisis)
Recorded on a developed and recognised exchange market	

Source: BCBS (2013b).

HQLA can be defined in two categories, Level 1 and Level 2 (which can be divided in Level 2A and Level 2B). In Table 5, the categories of HQLA are presented (Pohl, 2017, p. 3).

HQLA, or assets that are easily converted into cash with a small or no value loss, contain liquidity that relies on the considered timeframe, the monetised volume, and the underlying stress scenario, which should be available at central banks, especially when there is a need of fulfilling intraday liquidity necessities and overnight liquidity facilities, and central banks should hold assets for the banks to provide supplementary confidence in times of severe stress situations (BCBS, 2013b). What ensures that HQLAs are liquid assets even during stress periods are composition floors and haircuts (Pohl, 2017, p. 3).

Table 5: Categories of HQLA

HQLA		
Level 1	**Level 2**	
	Level 2A	**Level 2B**
Cash, central bank holdings, or substitutes like bonds with 0% risk weight should contain at least 60% of the total HQLA (that might be incorporated without haircuts).	Claims on or guaranteed by central banks, public sector entities, sovereigns, or multilateral development banks with 20% risk weight and corporate debt securities that are highly rated, which should be up to 40% of the HQLA, although a 15% minimum haircut is relevant.	Equities contained in a defined main index, lower-rated plain vanilla senior corporate bonds, and certain residential mortgage-backed securities, in which haircuts of 25%, 50%, or more can be applied. National discretion might be implemented for this level, which is restricted at 15% of the total HQLA and included in the 40% permitted for Level 2 HQLA as a whole.

Source: Pohl (2017, p. 3).

The total expected cash outflows subtracted by the total expected cash inflows presents a result of total net cash outflows in a specific stress situation for the following 30 days, and BCBS explained this calculation of the total NCO as a multiplication of the outstanding balances of different categories of liabilities and off-balance sheet commitments and the rates that they are expected to run off or be drawn down (outflow rates), and the calculation of the total net cash inflows is defined as the multiplication of the outstanding balances of different types of contractual receivables and the inflow rates under the scenario that an aggregate cap of up to 75% of total expected cash outflows (Pohl, 2017, p. 3). The total net cash inflows are limited to 75% of the outflows, which means that HQLA must cover 25% of the outflows, and the total NCO is calculated with the equation (2), which is presented below (BCBS, 2013b and Pohl, 2017, p. 3):

$$Total\ net\ cash\ outflow = outflow - min\{inflow; 75\% * outflow\} \quad (2)$$

3.4.2 Net stable funding ratio

Moreover, another object mentioned in the Basel III Regulation that is important to use by the banks and is worth mentioning is the NSFR. BCBS developed this object to encourage medium and long-term funding of the assets and actions of banking entities, which can be defined as a feature to ensure and confirm that banks maintain a stable funding profile and position (the amount of available stable funding and required stable funding and amounts of equity and liability with expected reliability of funding sources over a one-year time horizon under extended stress conditions), and this is concerning the structure of their assets and the off-balance sheet actions, with a time horizon of one year (Pohl, 2017, p. 4).

This object can be calculated by dividing the total available stable funding (hereinafter: ASF) by the total required stable funding (hereinafter: RSF), and this ratio should be at least 100%, which results in a presentation of the concept that the ASF exceeds the RSF, meaning that the long-term assets should be funded with at least quantity of stable and solid liabilities in proportion with the liquidity risk outline, as well as it should be enhanced by supervisory evaluations (BCBS, 2014). The purpose of NSFR is to restrict the dependence on short-term wholesale funding and concentrate on maintaining a stable funding profile (Pohl, 2017, p. 4). The NSFR can be estimated with the equation (3) (BCBS, 2014):

$$NSFR = \frac{Available\ amount\ of\ stable\ funding}{Required\ amout\ of\ stable\ funding} \geq 100\% \quad (3)$$

BCBS defines the ASF as a measurement based on comprehensive features of the relative stability of the bank's funding sources, in which the contractual maturity of its liabilities can be included with the varieties in the tendency of various categories of funding providers for funding withdrawal, and the RSF is defined as a measurement based on comprehensive features of the liquidity risk position of the assets and off-balance sheet exposures of the bank (BCBS, 2014, pp. 3-6).

The ASF is a product of the banks' capital and liabilities, selected stock with equal to one year or higher than one-year maturity, and the amount of wholesale funding with less than a year time periods that is anticipated to remain with the bank for a prolonged period in an idiosyncratic stress circumstance, liabilities that contain one year or higher effective maturities, and the number of deposits without maturity or term deposits that have maturities of less than one year that would be anticipated to stay with the bank for an expanded period in an idiosyncratic stress situation (BCBS, 2010a, pp. 27-30).

The ASF is calculated with the carrying value of the bank's equity and liabilities that should be designated to one of the five categories presented in the Basel III Net stable funding ratio, established in 2014, and each category amount should be multiplied by its ASF factor (the sum of the calculated weighted amounts should present the total ASF) (BCBS, 2014, pp. 3-6).

On the other hand, the RSF is calculated similarly to ASF, that is, by assigning the carrying value of the bank's assets to the presented categories in the Basel III Net stable funding ratio, established in 2014, and the amount of each assigned category should be multiplied by the RSF factor (the sum of the weighted amounts should equal the total RSF) (BCBS, 2014, pp. 6-12). The difference in this part is that the amount of the off-balance-sheet activity multiplied by its RSF factor should be added to the total amount of RSF.

Other monitoring tools that supervisors use as quantitative measures for monitoring the liquidity risk positions of the banks are the following (BCBS, 2010b, p. 9):

- Contractual maturity mismatch;
- The concentration of funding;
- Available unencumbered assets;
- LCR by currency;
- Market-related monitoring tools etc.

3.4.3 Liquidity ratios used by banks from North Macedonia

With the decision on managing banks' liquidity risk from NBRNM, banks needed to calculate and maintain an adequate liquidity level of the liquidity ratio of up to 30 days that is a ratio between assets and liabilities that matures in the next 30 days and liquidity ratio of up to 180 days as a ratio among assets and liabilities that matures in the next 180 days (Petreska, 2018). These liquidity ratios should not have a minimum level below one and should be determined at the end of every month (they should be established as an average of the daily balances of the objects that are included in the calculation of these ratios for every working day of the month) (NBRNM, 2011).

For example, in stressed events, banks might not be able to fulfil and maintain the minimum level that NBRNM required, in which case, banks should submit and present a written report of the reasons for the non-fulfilment of the limit and should present the actions they will take to achieve the minimum level (NBRNM, 2011). When measuring the liquidity ratio of up to 30 days, the assets and liabilities elements that should be included are presented in Appendix 7. When measuring the liquidity ratio of up to 180 days, the assets and liabilities items that should be included are presented in Appendix 8.

In the process of establishing both ratios, banks should take into account the transaction accounts and require demands in the following amount (NBRNM, 2011):

Liquidity ratio up to 30 days:

- 30%, if the concentration level does not surpass 30%;
- 35%, if the concentration level surpasses 30%, but does not surpass 50%;
- 40%, if the concentration level surpasses 50%.

Liquidity ratio up to 180 days:

- 40%, if the concentration level does not surpass 30%;

- 45%, if the concentration level surpasses 30%, but does not surpass 50%;
- 50%, if the concentration level surpasses 50%.

Considering the before explained two liquidity ratios mandated by the NBRNM, banks should define internal liquidity indicators for monitoring the liquidity position and the liquidity risk exposure, taking into account the nature and the characteristics of the financial activities that are presented in their policies, and they should define adequate ranges of fluctuations of these indicators, adding the method of measuring and monitoring those internal liquidity indicators, which should be determined, as well as the time frame of compliance with the indicators, such as on a daily, weekly, or monthly basis (NBRNM, 2011, p. 10).

NBRNM, through the newly developed decision, defines the LCR in the new decision as a ratio between the high-quality liquid assets and the net cash outflows, and they emphasise this ratio as very crucial to determine, monitor, and maintain, for which the minimum requirement is 100%, and it must not go below that percentage (the LCR can fall below the minimum requirement, in stressed situations, in case the banks are utilising positions that are included in the high-quality liquid assets for covering net cash outflows), together with the fact that this ratio should be established and monitored on an individual and consolidated basis, which is determined at the end of each month (NBRNM, 2020, p. 8).

LCR is a product of a proportion of two objectives, such as HQLA and NLO, in which banks should first determine HQLA, which contains some positions that are determined according to the country's legislation and the internal acts of the bank, and it should fulfil the following aspects (a more detailed explanation of the HQLA requirements is presented in Appendix 9) (NBRNM, 2020, pp. 9-21):

- General and operational requirements;
- Special standards and haircuts for including in the level 1 of liquid assets;
- Special criteria and haircuts for including in the level 2 of liquid assets;
- Special standards and haircuts for including the investments in components of open investment funds in the respective level of HQLA.

These positions of HQLA should be included according to their current market value, reduced with the respective haircuts, and when establishing the HQLA structure, banks should apply some restrictions, such as (NBRNM, 2020, pp. 9-21):

- at least 60% of HQLA are positions of level 1 of the liquid assets;
- at least 30% of the HQLA are positions of level 1 of the liquid assets without the amount of the exceptional high-quality covered bonds;
- a maximum of 15% of HQLA are positions of below level 2B of the liquid assets.

The NLO should be determined as the sum of liquidity outflows (defined in the decision) reduced by the sum of liquidity inflows (defined in the decision), the result should not be less than 0, and when the calculation of NLO is applied, banks should consider liquidity

outflows and liquidity inflows taking place within the next 30 calendar days, in which the expected interest inflows and outflows within this period should be included (NBRNM, 2020, pp. 9-21). The calculation of the NLO should contain the liquidity inflows presented in Appendix 10.

The calculation of the net liquidity outflow is measured with the equation (4) (NBRNM, 2020):

$$NLO = TO - min(FEI, TO) - min(IHC, 0.9 * max(TO - FEI, 0)) - min\left(IC, 0.75 * max\left(TO - FEI - \frac{IHC}{0.9,0}\right)\right) \quad (4)$$

where:
NLO = Net liquidity outflows
TO = Total outflows
FEI = Fully exempted inflows
IHC = Inflows subject to higher cap of 90% outflows (partially exempted inflows)
IC = Inflows subject to cap of 75% of outflows (exempted inflows)

Other internal liquidity indicators that the banks can use are the indicator of the ratio between liquid assets and total assets, the indicator of the ratio between the liquid assets and total liabilities, the indicator of the ratio between liquid assets and short-term liabilities, the indicator of the ratio between liquid assets and total deposits of nonfinancial entities, the indicator of the ratio between liquid assets and household deposits, the indicator of the ratio between the total amount of credits and the total amount of deposits, (according to the Decision on the methodology for liquidity risk management, established by NBRNM, every bank should prescribe one or more internal liquidity indicators and their thresholds, including threshold for early warning (NBRNM, 2020), and some banks present the type of internal liquidity indicators in their procedure for liquidity risk management).

When defining the two standards, BCBS had a purpose for the LCR and NSFR to consist mainly of specific parameters with international harmonisation with prescribed values. LCR and NSFR are designed to be used internationally on a global level that includes some specific parameters that contain items of national discretion to reflect the conditions of the jurisdiction in certain countries, and these conditions should be outlined clearly in their regulations for the purpose to provide transparency on a local and global level. Beforehand, with the old decision, NBRNM had defined similar objects for measuring the level of liquidity, with a liquidity ratio between assets and liabilities that matures in the next 30 days and 180 days. For measuring these liquidity ratios, banks were supposed to use the asset and liability items presented in Appendix 7 and 8.

To improve the existing decision and establish the regulation of the liquidity risk management and measurement that will be according to international standards, such as Basel III regulation, by the year 2020, NBRNM developed a new decision of the liquidity risk methodology, where their main focus is to implement the LCR, which is presented in

the Basel III regulation as the one standard that is preferred to be used internationally. This decision was developed to get closer to the requirements of the Basel III regulation, and NBRNM implemented this standard successfully. They covered every aspect of the LCR measurement presented in the Basel III regulation. Since it is a newly developed decision, it is early to comment on the effects of the usage of LCR by the banks from North Macedonia.

What they are missing in the decision is the NSFR, which is also quite important, especially for maintaining a stable funding profile for a longer period. NSFR is important for restricting over-reliance on short-term wholesale funding in periods of optimistic market liquidity. It is best to support greater liquidity risk evaluation within on-balance and off-balance sheet objects. NSFR should be included in the liquidity risk measurement of banks from North Macedonia since it can provide security that there is funding for long-term assets with at least a minimum adequate quantity of stable liabilities concerning their liquidity risk profiles.

4 LIQUIDITY RATIOS IN BANKS IN EUROPE VS. BANKS IN NORTH MACEDONIA

In the last part of this thesis, I am presenting a comparative analysis of the changes in liquidity positions in the banking sector in North Macedonia and the banks in the European Union between 2008 and 2020. The outcomes for the third research question are demonstrated.

4.1 Methodology of the analysis

The main purpose of this analysis is to demonstrate if the banks from North Macedonia were implementing an acceptable strategy between 2008 and 2020 to manage their liquidity risk accurately. LCR and NSFR were primarily introduced in the Basel III regulations in 2010, but LCR was not applicable by 2014, and NSFR was not used until 2018 (Behn, Corrias & Rola-Janicka, 2019). Since I am doing a comparative analysis for the time frame between 2008 and 2020, I could not find appropriate data for the whole period to include these ratios in the study. In this research, I am using other liquidity ratios, such as Loan to Deposit Ratio (hereinafter: LTD) and Liquid Asset to Total Asset Ratio (hereinafter: LATAR). LTD is the ratio that presents the correlation between the loans and deposits (Van den End, 2013), and LATAR is a ratio that shows the share of liquid assets on total assets (Vodova, 2013). Both ratios include features that are easier to understand, which can be beneficial for calculating and trusting simple indicators in times of stress.

The data sample that I am using for this analysis is 30 banks (15 banks from countries in the European Union and 15 banks from North Macedonia) for the time period of 13 years (2008-2020), which are presented in detail in section 4.2 of this part. Furthermore, after calculating the level of LTD and LATAR for all 30 banks every year and determining the average ratio in banks from the European Union and banks in North Macedonia separately, I am using the statistical t-test approach to assess the significance of the difference between the calculated liquidity ratios of two sets of banks yearly. To determine this t-test more accurately, I am

using Stata Software for Statistics and Data Science. After collecting the results of this analysis, I am interpreting the outcomes and making conclusions about whether the banks from North Macedonia were appropriately managing the liquidity risk between 2008 and 2020.

4.2 Presenting data and sample selection

For this analysis, I am determining the level of liquidity ratios by using a sample of 15 banks from North Macedonia and 15 banks from the European Union in a time frame between 2008 and 2020. The data are presented on an annual basis at bank level. Since there are currently 13 banks in North Macedonia because, in 2020, Eurostandard Bank came to bankruptcy and did not operate anymore, there is no data available for 2019 and 2020 for this bank. In 2021 there was an acquisition of Ohridska Bank from Sparkasse Bank (for this bank, there is data available on different databases in institutions from North Macedonia).

The sample selection of 15 banks from different countries in the European Union is established by the criteria such as the data availability, the size of the banks, and the brand (some of the banks in North Macedonia are a part of a multinational group).

Table 6: Sample selection of banks from North Macedonia and European banks

		European banks			
No	**Banks from North Macedonia**	**Name of the bank**	**Country**	**Criteria**	**Data collected from**
1	Komercijalna Banka AD Skopje	Rietumu Banka AS	Latvia	Size	Annual report
2	Stopanska Banka AD Skopje	Hellenic Bank Public Company Limited	Cyprus	Size	Fitch Connect Database and Annual report
3	NLB Bank AD Skopje	Nova Ljubljanska banka d.d.	Slovenia	Brand	Annual report
4	Halk Bank AD Skopje	AS SEB Pank	Estonia	Size	Fitch Connect Database and Annual report
5	Sparkasse Bank Macedonia AD Skopje	Ceska sporitelna A.S (member of Erste Group, Austria)	Czech Republic	Brand	Annual report
6	Ohridska Banka AD Skopje	Banque Francaise Commerciale Ocean Indien	France	Size	Fitch Connect Database and Annual report
7	ProCredit Bank AD Skopje	ProCredit Bank	Romania	Brand	Annual report
8	Universal investment Bank AD Skopje	Zagrebacka Banka	Croatia	Data availability	Annual report
9	Central Cooperative Bank AD Skopje	Central Cooperative Bank	Bulgaria	Brand	Annual report
10	Capital Bank AD Skopje	Banque Internationale a Luxembourg SA	Luxembourg	Data availability	Fitch Connect Database and Annual report
11	Stopanska Banka AD Bitola	Eurobank Ergasias S.A.	Greece	Data availability	Fitch Connect Database and Annual report
12	TTK Bank AD Skopje	MKB Bank	Hungary	Data availability	Annual report
13	Silk Road Bank AD Skopje	Banca Carige S.p.A.	Italy	Data availability	Fitch Connect Database and Annual report
14	Development bank of North Macedonia AD Skopje	Tatra Banka	Slovakia	Data availability	Annual report
15	Eurostandard Bank AD Skopje	HSBC Bank Malta plc	Malta	Data availability	Fitch Connect Database and Annual report

Source: Own work.

The sample of banks chosen by brand criterion is banks in a composition of the same group but from a different country, and the data was collected at a bank level. The reason why I chose this criterion was to analyse the movement of the liquidity position of banks that belong to the same group of banks and that operate on a similar method but are from a different country.

Furthermore, the next criterion I selected was the size criterion, meaning that the banks that were singled out for this particular criterion were of similar size. This criterion aims to investigate the liquidity position from a different point of view. Is there a difference in the

liquidity management between banks from the European Union and banks from North Macedonia of similar size? For this matter, I am conducting an analysis to present the answer to the previously mentioned question.

Finally, the last criterion applied in this analysis was data availability. This criterion is the opposite of the previous one, for which banks of different sizes are used. These banks are not connected in any way. They were chosen as random samples with available data. The study of this criterion gives me information on how different banks with different features and qualities manage their liquidity. The data for the banks in North Macedonia are collected from their Annual Reports that banks present publicly every year. The data of the chosen banks from the European Union are collected from Fitch Connect Database and their Annual Reports. Considering this, in this research, I am conducting and investigating the liquidity position change from the financial crisis period up until the recent period for the selected sample of banks presented in Table 6.

4.3 Comparison of the movement of liquidity risk

LTD is a ratio between the loans and deposits of the bank, and LATAR is the ratio between the liquid assets and the bank's total assets. The banks use these ratios from North Macedonia to determine the liquidity risk. For this methodological approach, the quantitative method is used on existing data collected from Annual Reports of the banks and the Fitch Connect Database. These liquidity ratios are calculated for all 30 banks included in the data sample for 2008 to 2020 with the formulas presented in Table 7.

Table 7: Liquidity ratios used in the comparative analysis

Liquidity ratios	**Measurement**	**Formula**
Loan to Deposit ratio	LTD	Total loans/Total deposits*100
Liquid Asset to Total Asset ratio	LATAR	Liquid assets/Total assets*100

Source: Murphy (2021); Vodova (2013).

To expand the comparative analysis by comparing the dynamics of LTD and LATAR in the banks from countries in the European Union as opposed to banks from North Macedonia between the period 2008 and 2020, I am using the test of significance approach or the two-tail paired t-test to demonstrate the statistically significant difference between the two variables (the usage of LTD and LATAR in banks from European Union and the banks in North Macedonia). I decided to do a paired t-test because the variables are connected with a specific year from 2008 to 2020 (for example, I am calculating the dynamics of LTD and LATAR for the year 2008 for both European Union banks and banks from North Macedonia).

This test of the significance of regression coefficients is a method of statistical testing hypothesis, which is a process where sample outcomes are implemented to validate if the null hypothesis is true or false, and when deciding whether to reject H_0, we should consider

estimating the value of the test statistic acquired from the collected data (Gujarati & Porter, 2009, p. 115).

Table 8: T-test of significance approach (two-tail hypothesis)

Type of hypothesis	H_0:	H_1:	Reject H_0 if
Two-tail	$\mu_{EU} = \mu_{NM}$	$\mu_{EU} \neq \mu_{NM}$	$\lvert t \rvert > t_{\alpha/2,\, df}$

Source: Gujarati & Porter (2009, p. 118).

Moreover, the null hypothesis shows no statistically significant difference between the samples tested against the alternative hypothesis or H_1 (the alternative hypothesis can be simple or composite) (Bozeman, 2016). By conducting paired t-test, we can reject the null hypothesis or not reject it (Gujarati & Porter, 2009). In order to determine whether to reject or not reject the null hypothesis, we need to compute the t-test with n-2 degrees of freedom. For the t-test to be determined, we need to calculate the t-value with the following formula (Bozeman, 2016):

$$t - value = \frac{|\overline{x_1} - \overline{x_2}|}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}} \tag{5}$$

In the equation (5) $\overline{x_1}$ and $\overline{x_2}$ are the calculated group means, S_1^2 and S_2^2 are the variances and the n_1 and n_2 are the number of observations.

What is also of great importance when conducting a t-test is the critical value, which can be presented as the confidence limits, the endpoints of the confidence interval (Gujarati & Porter, 2009). We can estimate the critical value by using a p-value of 0.05 and n-2 degrees of freedom, and if the t-value is higher than the critical value, we reject the null hypothesis (Bozeman, 2016). Using a p-value of 0.05 indicates that there is less than a 5% chance that the data is random but greater than a 95% probability that the data is significant. If the t-test (p-value) is lower than 0.05 (Bozeman, 2016), we reject the null hypothesis, which means that the statistic is significant (Gujarati & Porter, 2009), and if it is higher than 0.05, we do not reject the null hypothesis, meaning that the statistic is insignificant. Thus, what we are looking for when performing a t-test is if the data is significantly different or is it just random or not different at all.

$$Pr\left[\left(x^* - \left(t_{\frac{\alpha}{2}}\right) \times \left(se(\bar{x})\right)\right) \leq \bar{x} \leq \left(x^* + \left(t_{\frac{\alpha}{2}}\right) \times \left(se(\bar{x})\right)\right)\right] = 1 - \alpha \tag{6}$$

In the mathematical expression (6) x^* is the value of x under H_0, $se(\bar{x})$ is the estimated standard error of estimator, and $-t_{\alpha/2}$ and $t_{\alpha/2}$ are the critical values, which presents the interval in which $\bar{x}$ (t-value) will fall with 1-α probability, where $x = x^*$ (Gujarati & Porter, 2009, pp. 115-116). Scientifically, it is better to incorporate the t-test approach to determine the significant difference between data sets than to look at their means.

4.3.1 Loan to deposit ratio

Generally, banks operate by collecting funds through deposits and using those funds to grant loans. One way for determining and evaluating the liquidity of a bank can be by using the LTD. The calculation of the LTD presents information about the allocation of the bank's deposit base, and if the loans are higher than the deposits, banks experience a funding gap that can be covered by financial markets (it is better for the funding gap to be lower since the higher it gets, the higher the market funding will get, which can be more expensive than funding from customers' deposits) (Van den End, 2013).

This ratio helps investors and analysts compare the total amount of loans and the total amount of bank deposits in the same time frame, and when calculating this ratio, if the percentage is too high, the liquidity level of the bank is too low to protect the bank from unpredicted fund requirements and stress events, and if the result is too low, the earnings of the bank are not on a satisfactory level, which means that the results of this ratio present the capability of a bank to protect itself from loan losses and customers' withdrawals, and when an economic decline occurs (Murphy, 2021).

In addition, this ratio is of solid importance because it can help present information about the bank's ability to attract and retain customers, which means that the funds for granting loans to customers are collected from deposits, and if the bank does not issue more deposits than grant loans, they will have to borrow more funds and increase their debt, which has higher rates than deposits (Murphy, 2021). The ratio is not regulated internationally because the proportion between the loans and the deposits depends on the domestic financial system, which can differ in each country (Van den End, 2013).

Thus, we can conclude that the total amount of loans should not be higher than the total amount of deposits since the higher the ratio, the more banks depend on borrowed funds (Murphy, 2021). Some of the banks from North Macedonia set a recommended LTD ratio level in their liquidity risk management procedures, which is suggested not to increase above 100%. The recommended level of LTD is from 80% to 90%, but it should not go above 100% (Murphy, 2021) since the bank will have to depend on borrowed capital.

In this part of the thesis, I am calculating the dynamics of the LTD from the collected data of 15 banks in the European Union and 15 banks from North Macedonia between the time period of 2008 and 2020. In 2008 the LTD of the banks from the European Union was more turbulent and not stable in some banks, assuming that this liquidity level was a result of the 2008 financial crisis. However, as the period passes, until 2020, the LTD becomes more stable for most of the European Union banks included in this research. The detailed results of this ratio for the banks from the European Union are presented in Appendix 11.

In this thesis, I am calculating the LTD by using the total amount of loans and the total amount of deposits. More detailed results for LTD for the banks from North Macedonia are presented in Appendix 12 of this research. We can notice from the results that throughout the time period used in this thesis, the LTD of some banks in North Macedonia is also

turbulent, especially in 2010, when we can see a fall in the ratio. Some banks maintain a very small ratio, but some maintain an LTD higher than 100%. Even though there are some instabilities with LTD management, some banks from North Macedonia maintain a stable ratio of around 70% to 90%.

By using the statistical approach t-test for the dynamics of LTD between the results of 15 European Union banks and the outcomes of 15 banks from North Macedonia in the time frame between 2008 and 2020, a test of hypothesis in Stata is conducted for every year separately to investigate whether there is a statistically significant difference in the LTD motion between European Union banks and banks from North Macedonia (that are included in the sample selection from Table 6) yearly, by using the command *ttest var1==var2* (var1 is the group of European Union banks and var2 represent the banks from North Macedonia) for the two-tail paired t-test.

Table 9: Results of conducted t test on LTD with confidence level of 95%

Year	Mean		Std. Dev.		Std. Err.		t-value (in apsolute value)	level of significance	hypothesizing
	EU (%)	NM (%)	EU	NM	EU	NM			
2008	89.53	86.18	25.18	38.15	6.73	10.19	0.2659	0.7945	Do not reject H0
2009	92.47	80.28	26.37	28.88	6.81	7.46	1.2610	0.2279	Do not reject H0
2010	92.15	71.11	23.61	24.47	6.31	6.54	2.7654	0.0161	Reject H0
2011	91.68	68.85	23.66	27.61	6.11	7.13	2.8284	0.0134	Reject H0
2012	89.94	67.95	19.75	27.12	5.10	7.00	2.9311	0.0109	Reject H0
2013	88.73	69.99	16.61	26.28	4.29	6.78	2.7221	0.0165	Reject H0
2014	85.33	70.71	18.07	24.54	4.67	6.34	2.0544	0.0591	Do not reject H0
2015	82.29	73.98	19.91	24.54	5.14	6.34	1.1160	0.2832	Do not reject H0
2016	81.76	74.85	20.43	24.14	5.27	6.23	0.8761	0.3957	Do not reject H0
2017	80.49	75.67	18.19	25.24	4.70	6.52	0.5965	0.5604	Do not reject H0
2018	83.24	74.99	17.92	24.81	4.63	6.40	1.0167	0.3265	Do not reject H0
2019	78.15	75.98	23.66	25.62	6.32	6.85	0.2460	0.8095	Do not reject H0
2020	74.95	74.91	23.45	26.16	6.27	6.99	0.0047	0.9963	Do not reject H0

Adapted from Fitch Connect Database and Annual Reports (2022, May 3).

We can notice that Table 9 shows some variations in the results received in Stata for LTD, and the hypothesis is different as the years pass. H_0 is mostly not rejected, which we can see from the level of significance that is higher than 0.05, and we can conclude that there is statistical insignificance between the outcomes of both groups of banks in 7 of 13 years that are included in the research. What does this mean? For the years when H_0 is not rejected, there is no statistically significant difference between the two groups, and we can see from Table 9 and Appendices from 15 to 27 that for the years 2008, 2009, and 2014 to 2020, the results for LTD ratio are similar.

The outcomes give us a perception of volatile dynamics between the two groups, and we can detect the difference, which is higher from 2010 until 2013. After that, as the period reaches 2020, the management similarity becomes higher between both banks. Although, in 2020, a worldwide pandemic was declared on a global basis, which was a serious challenge to the economy and the economic development around the world, the results of the LTD, compared to both groups, are almost equal, and the liquidity level is stable.

4.3.2 Liquid asset to total asset ratio

Another way of calculating the liquidity in banks is by using the LATAR. This ratio presents information on the number of liquid assets contained in the bank's total assets. It should represent the banks' liquidity absorption capacity in stress events (Vodova, 2013, p. 28). Other than investing the funds into loans to customers, banks can retain some of the funds as liquid assets. A liquid asset can be defined as a type of asset that can be transformed into cash easily in a short time (such as lower than one year) (Chen, 2021). What can be included in the concept of liquid assets are cash, reserves in the central bank, securities such as Treasury bills and bonds, derivatives, financial assets at fair value through profit and loss upon initial recognition, etc. (Alger & Alger, 1999, p. 1). Commercial bills and movement of the short-term foreign currency assets in foreign banks can also be included in liquid assets (NBRNM, 2018, p. 34).

In the calculation of LATAR in this thesis I used the following liquid assets:

- Cash and cash equivalents;
- Financial assets at fair value through profit and loss;
- Loans and advances from banks;
- Financial instruments available for sale.

Most of the banks in the European Union maintain this ratio at a low level, especially the bigger banks. There is no turbulent movement of the ratio throughout the time period. However, different banks maintain different levels of this ratio, depending on the size of the bank and the location. Some banks, mostly bigger ones, tend to preserve the ratio slightly above 0, and some prefer keeping this ratio above 20%. More detailed results of this ratio for the rest of the banks from the European Union are given in Appendix 13.

Some banks from North Macedonia prefer to retain a LATAR above 20% in case of stress events and economic downturn. They initiate this level in their procedures and policies of liquidity risk management. The LATAR has a stable movement throughout the research period, and most of the banks from North Macedonia maintain their ratio above 20%. There were no volatile movements from the period of the financial crisis until 2016. The detailed calculations of LATAR for the banks from North Macedonia are given in Appendix 14 of this thesis.

Similarly, a performance of hypothesis testing is established for the LATAR dynamics for every year, between the outcomes of 15 European Union banks and the results of 15 banks from North Macedonia in the time frame between 2008 and 2020 (Appendices from 15 to 27). This approach is implemented to test whether there is a statistically significant difference in the LATAR dynamics between banks from the European Union and banks from North Macedonia with a yearly two-tail paired t-test.

From Table 10, we can notice that for the period between 2008 and 2015, the significance level is lower than 0.05, meaning that the null hypothesis is rejected (considering that the

confidence level is 95%). The t-value is negative in this timeframe because European Union banks tend to maintain a lower LATAR than banks from North Macedonia (the t-value is an absolute value, which means that there is no difference in the results, whether they are positive or negative). Since H_0 is rejected in this time interval, we can see a statistically significant difference between the means of both groups. The highest difference can be noticed from 2009 to 2014.

Table 10: Results of conducted t test on LATAR with confidence level of 95%

Year	Mean		Std. Dev.		Std. Err.		t-value (in apsolute value)	level of significance	hypothesizing
	EU (%)	NM (%)	EU	NM	EU	NM			
2008	16.45	30.86	12.60	13.07	3.37	3.49	2.9715	0.0108	Reject H0
2009	15.98	30.79	12.30	7.61	3.17	1.97	4.6500	0.0004	Reject H0
2010	15.52	33.21	12.98	8.04	3.47	2.15	4.2770	0.0009	Reject H0
2011	17.28	33.75	13.89	11.25	3.59	2.91	3.6377	0.0027	Reject H0
2012	18.01	33.83	11.77	11.37	3.04	2.94	3.9337	0.0015	Reject H0
2013	18.66	32.93	12.18	7.37	3.14	1.90	4.0108	0.0013	Reject H0
2014	19.01	33.74	11.90	6.75	3.07	1.74	4.0615	0.0012	Reject H0
2015	20.62	29.95	14.19	7.33	3.70	1.89	2.2582	0.0404	Reject H0
2016	21.87	28.64	14.60	7.72	3.77	1.99	1.4838	0.1600	Do not reject H0
2017	19.84	27.69	15.83	8.08	4.09	2.09	1.6070	0.1304	Do not reject H0
2018	19.73	27.07	15.07	7.86	3.89	2.03	1.7472	0.1025	Do not reject H0
2019	22.56	27.33	17.05	6.83	4.56	1.83	1.0534	0.3114	Do not reject H0
2020	22.96	24.01	16.18	5.75	4.32	1.54	0.2496	0.8068	Do not reject H0

Adapted from Fitch Connect Database and Annual Reports (2022, May 5).

However, from 2016 until 2020, the difference gets lower, and the H_0 is not rejected (the results are statistically insignificant), which means that as the years pass by towards the last tested year, the management of LATAR from both groups becomes more similar. The pandemic declared in 2020 did not affect the liquid assets either, as the outcomes of both groups present information that the LATAR is acceptable and solid, and the results of both groups are almost identical.

4.4 Interpretation of the acquired results

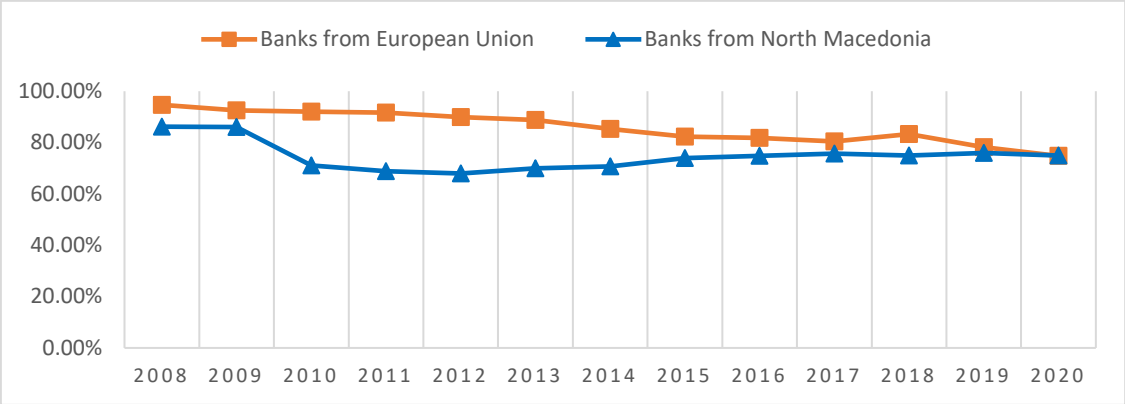
4.4.1 Loan to deposit ratio

From the previous comparative analysis of the changes in the liquidity ratios in the European Union and the banks in North Macedonia, we can conclude that most banks have serious methods when it comes to liquidity risk management. One of this research's main questions is whether the banks from North Macedonia have an acceptable liquidity risk management strategy. There is a similarity in the results between the two groups of banks when it comes to analysing the LTD ratio.

The data presented in Figure 4 is calculated on average for all the bank samples from both groups. Some banks in North Macedonia should attempt to increase the level for a short amount to enhance their earnings by attracting and retaining customers. Namely, Figure 4 shows us that there are some similarities in the maintenance of the LTD ratio between the

two groups of banks. There is a certain difference between the years 2010 and 2013. It is noticeable that the difference is getting lower as the period moves forward, which may be a result of the implementation of the liquidity regulation from NBRNM in 2011. In conclusion, banks from North Macedonia have a solid approach and strategy to manage the liquidity risk and contain the ability to cover the loans with deposits.

Figure 4: Loan to Deposit Ratio comparative analysis



Adapted from Fitch Connect Database and Annual Reports (2022, May 3).

The results from Figure 4 can be justified by the results of the conducted t-test of the LTD ratio presented in Table 9. The difference can be seen in both methods of comparative analysis, which means that even though the difference was a little bit higher in 2010, it decreased until 2014. From 2015 until 2020, the resemblances of the methods of LTD management are much more prominent. This can also be seen in Table 9, where the null hypothesis is rejected from 2010 to 2013, which proves that there is a statistically significant difference in the results of the LTD ratio between the two groups of banks. Since both of the groups have a mean that is below 100%, on an average level, we can conclude that both banks from European Union and banks from North Macedonia maintain a total amount of deposits that are higher than the total amount of loans, which means that they have stable liquidity and lower liquidity risk.

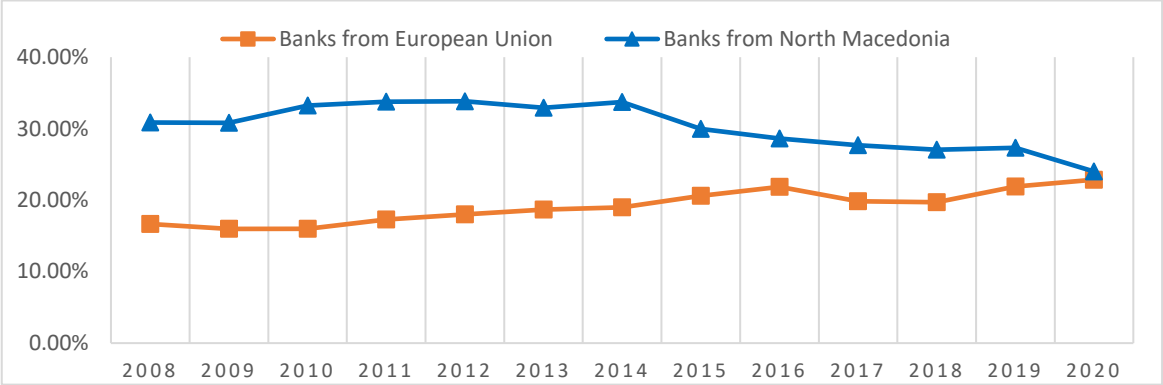
4.4.2 Liquid asset to total asset ratio

When it comes to retaining enough liquid assets, both groups have different strategies. European Union banks with larger sizes prefer to keep a lower level of liquid assets, according to the calculation and the results collected from Fitch Connect Database. Some banks from European Union (mostly smaller banks) implement the strategy of maintaining a higher amount of liquid assets throughout the time period established in this thesis. This concept guides us to claim that smaller banks might be more liquid than bigger ones.

Figure 5 presents the results of the dynamics of LATAR, calculated on average, for the bank samples from both groups. Thus, the results for the European Union banks inform us that the ratio on an average basis is below 20%, from 2008 until 2014, as opposed to the results from the banks from North Macedonia that have a ratio level on an average level above 20%,

throughout the whole tested period. From 2015 until 2020, the average ratio reached above 20%, meaning that banks from the European union included more liquid assets in their operations.

Figure 5: Liquid Asset to Total Asset Ratio comparative analysis



Adapted from Fitch Connect Database and Annual Reports (2022, May 3).

The preference and the strategy of the banks from North Macedonia are to keep their liquidity asset level above 20%, and the results presented in Figure 5 inform us that most banks abide by their strategy, which makes them liquid banks. All through the time interval between 2008 and 2020, the part of the liquid assets in the total assets managed to maintain a stable level, in which the short-term liabilities and household deposits can be included with satisfactory coverage.

We can conclude from the generated t-test for the LATAR on an annual basis, presented in Table 10 that the null hypothesis is rejected from 2008 to 2014, meaning that there is a statistically significant difference in this time frame between the two variables. However, the significant difference is getting lower from 2015, and the null hypothesis is not rejected, reaching the year 2020 when the results are almost overlapping. Thus, we can conclude that both groups had different strategies in a certain time frame when it comes to managing liquid assets, yet as time passed by from a certain point (the year 2015), the strategies became more similar. We can notice from Figure 5 that as time passes, both groups prefer to maintain this ratio at an equivalent level.

4.4.3 Summary of the results of both ratios

At the beginning of this part, a sample of 30 banks from the European Union and North Macedonia was determined by employing three criteria, such as brand, size, and data availability, to analyse banks' liquidity position. Using this sample, I calculated both liquidity ratios for some banks, and for some, I collected the data from the Fitch Connect database. Surely, when comparing the ratios between the two sample groups, we should consider that the structure of the domestic financial system differs in every country, which means that some countries (especially bigger ones) in European Union have a more developed domestic financial system, which can result to better liquidity management in turbulent events than smaller countries, such as North Macedonia.

From the results (presented in Appendix 11, 12, 13, and 14), I can conclude that banks with a parent bank from a different country mostly do not manage their liquidity position with a similar method, and the results are mostly different. Some of them prefer to sustain more loans than deposits, some of them maintain more liquid assets than others, some were probably affected by the financial crisis in 2008, as their results got better as the time passed by, and other banks were maybe at the beginning of their operation, and so on. Different banks from a different country (not related to those banks that have parent banks in other countries from the European Union) but are of the same size, mostly have similar LTD. However, there are differences in the ratio of liquid assets to total assets. As opposed to the banks from North Macedonia, some European Union banks favour having fewer liquid assets. Some banks from this criterion operate with a different management strategy for maintaining the liquidity position than others.

Different from the second criterion, banks of different sizes (mostly bigger banks from the European Union and smaller banks from North Macedonia) that are not related in any matter but that were chosen by their data availability generally have a similar management strategy to LTD when it comes to managing the liquidity position, except for those banks who at the beginning of the time period have higher LTD. From the group of European Union banks for this criterion, bigger banks are chosen. Bigger banks from countries that are in European Union tend to manage lower LATAR as opposed to the banks from North Macedonia.

From the results of the calculated liquidity ratios, we can notice that banks from European Union were more affected by the financial crisis of 2008 than the banks from North Macedonia, as was previously stated in the introduction of this thesis. In addition, even though banks from North Macedonia mostly retain higher LATAR, European Union banks brought more diversified liquid assets into play. Subsequently, more developed countries from European Union can manage the liquidity better than smaller countries, such as North Macedonia. Probably that is one of the reasons why banks from North Macedonia are set to maintain a higher level of LATAR and lower than 100% LTD (this level is determined as recommended in some of the policies developed by banks from North Macedonia).

From the results of the annually conducted t-tests, we can conclude that there is a more statistically significant difference between both groups of banks for LATAR than for LTD. However, as the final year of this analysis reaches, the similarity of the liquidity management of both groups for both ratios is extremely high. In conclusion, the LTD ratio is more similarly managed between both groups than the LATAR (the liquid assets). However, in 2020, both ratios are managed equally between both sets of banks, even though a worldwide pandemic was declared (which can be a dangerous threat to the whole economy). Generally, we can conclude that banks from North Macedonia have an acceptable strategy when it comes to liquidity risk management by implementing both LTD and LATAR.

CONCLUSION

The main purpose of this Master's Thesis is to establish a comparative analysis of the regulation of the banks' liquidity risk management in North Macedonia and the Basel III Regulation conducted by BCBS. Within this thesis, alongside the determination of the compatibility of the regulation for the liquidity risk management, established by NBRNM with the Sound Principles and the Basel III Regulation, the following aspects are incorporated: the level of equality of the liquidity stress testing methodology that the banks implement in North Macedonia with the stress testing framework of ECB, the comparative analysis between the methods of measuring and monitoring the liquidity risk among the requirements from NBRNM and the Sound Principles and the assembly of ECB, and the motion of liquidity positions between the banking sector in North Macedonia and the banks from countries that are in the European Union in the time frame from 2008 to 2020.

Namely, in this thesis, the importance of liquidity risk management was well presented, which was enhanced after the financial crisis of 2008. The first hypothesis of this thesis is to present the alignment of the regulation of the NBRNM for liquidity risk management with the Sound Principles. In 2020, NBRNM decided to enhance its methodology of liquidity risk management by developing a new Decision on the methodology for liquidity risk management so that the regulation of liquidity risk management in the banking sector of North Macedonia will be closer to the Basel III Regulation. The previous decision has some similarities with the Basel III Regulation. However, with the establishment of the new one, NBRNM broadened its horizons regarding management, measurement, and monitoring of the liquidity risk. The only thing that is missing in this combination is the enhancement of the liquidity stress test methodology. Mainly, NBRNM has a methodology of liquidity stress testing that mostly fulfils the requirements of the Sound Principles and the ECB framework.

However, stress testing has been outdated since 2008. There is so much more to include in this crucial aspect, which can determine the level of liquidity for exposure to maintain banking stability in normal and stressed events, which is the response to the second research question, the synchronisation of the methodology of liquidity stress testing, that banks in North Macedonia apply with the framework of the ECB. Even though NBRNM is using an outdated methodology, banks from North Macedonia are still conducting a more similar version of liquidity stress testing to the one the banks from the European Union use, which is a more updated version. Nevertheless, NBRNM should improve the stress testing methodology by diversifying the scenario design and quantifying the impact on cash flows and the time horizon.

Regarding the development of the liquidity risk management system, both previous and new decisions of liquidity risk management were implementing the international jurisdiction of the Sound Principles. Mainly both local and international regulations settle for implementing adequate internal control, an efficient management information system, and a proper organisational structure. What NBRNM's regulation lacks when determining the development of CFPs by the banks is the importance of testing and gaining the ability to

acquire additional sources on a different basis in serious events. NBRNM needs to develop a detailed framework of the CFP, including thorough contingency procedures, roles, and responsibilities.

Moreover, in monitoring and measuring the liquidity risk, NBRNM generally follows the one mandated in the Sound Principles. The regulations of NBRNM significantly use the planning and monitoring of the inflows and outflows since it is crucial to monitor and evaluate the cash inflows and outflows, including the off-balance sheet aspects. When developing an adequate maturity structure, NBRNM does not use intraday liquidity management, which is important for establishing payment and settlement obligations on time under normal or stressed conditions.

Monitoring the funding sources and their concentration is considerably included in the regulation of NBRNM, which is focused on the level of stability of the depositors, the changes of other funding sources, etc. With the new decision, NBRNM made the right call to include the calculation, analysis, and evaluation of LCR, which is one of the most important liquidity ratios established by the Basel III Regulation. Nevertheless, they also need to incorporate the NSFR in their regulation, which can be used in cases where a stable funding profile for a more extended period should be retained.

Finally, to answer the third research question of this thesis, an empirical analysis, in which a statistical method of test hypothesis is included, is conducted on two ratios, LTD and LATAR, on the dynamics of the liquidity positions in the banking sector of North Macedonia compared to the banks from European Union in a time frame between 2008 and 2020. The conducted analysis introduces information that banks from North Macedonia mostly have a similar strategy to banks from the European Union regarding maintaining an appropriate LTD level.

When it comes to LATAR, some European Union banks prefer maintaining a lower amount of liquid assets from the year of the financial crisis until 2014, which is not the case for some banks from North Macedonia. However, the difference in the LATAR management between both groups of banks becomes lower as time passed. Despite that, on average, banks from North Macedonia maintain both ratios close to the level they determined in their liquidity management policies. From this analysis, I can conclude that most banks in North Macedonia maintain a stable level of these ratios and can be described as liquid banks with a solid liquidity risk management strategy.

In conclusion, NBRNM are implementing an adequate regulation of the liquidity risk management that banks from North Macedonia should abide by. This regulation follows the one the Basel Committee requires international banks to abide by to retain an appropriate level of liquidity and minimise the liquidity risk. However, the development of a stress testing methodology is also significant, which NBRNM should improve on a higher level, including the development of CFP, intraday liquidity risk management, and NSFR liquidity ratio.

REFERENCE LIST

1. Alger, G., & Alger, I. (1999). *Liquid assets in banks: Theory and practice* (internal material). Lyon: GREMAQ, Universite des Sciences Sociales.
2. Andreeva, N. (2010, June 15-17). *Liquidity risk standards and measurement - Macedonian measures during and after the crisis*. [Conference presentation]. 23rd Annual BSCEE Conference, NBRNM, Ohrid, North Macedonia.
3. Arsovski, D. (1998). *Risks in Banking operations*. Skopje: Economy Press.
4. Bangia, A., Diebold, F. X., Schuermann, T., & Stroughair, J. D. (1998, December 21). *Modelling Liquidity Risk: With Implications for Traditional Market Risk Measurement and Management*. New York: Oliver, Wyman & Co., NYU.
5. Banerjee, R. N., & Mio, H. (2014). *The Impact of Liquidity Regulation on Banks*. (Working paper No. 470). Bank for International Settlements.
6. Bank for International Settlements. (2017) *Basel III: International regulatory framework for banks*. Retrieved September 10, 2021 from https://www.bis.org/bcbs/basel3.htm
7. Banks, E. (2005). *Liquidity risk: Managing asset and funding risk*. Basingstoke: Palgrave Macmillan.
8. BCBS. (2008a). *Principles for Sound Liquidity Risk Management and Supervision* (Working paper No. 138). Bank for International Settlements.
9. BCBS. (2008b). *Liquidity Risk: Management and Supervisory Challenges* (Working paper No. 136). Bank for International Settlements.
10. BCBS. (2010a). *Basel III: International framework for liquidity risk measurement, standards and monitoring* (Working paper No. 188). Bank for International Settlements.
11. BCBS. (2010b). *Basel III: A global regulatory framework for more resilient banks and banking systems* (Working paper No. 189). Bank for International Settlements.
12. BCBS. (2013a). *Liquidity stress testing: A survey of theory, empirics and current industry and supervisory practices* (Report No. 24). Bank for International Settlements.
13. BCBS. (2013b). *Basel III: The Liquidity Coverage Ratio and liquidity risk monitoring tools* (Working paper No. 238). Bank for International Settlements.
14. BCBS. (2014). *Basel III: The net stable funding ratio* (Working paper No. 295). Bank for International Settlements.
15. Baudino, P., Goetschmann, R., Henry, J., Taniguchi, K., & Zhu, W. (2018). *Stress testing banks - a comparative analysis* (Working paper). Bank for International Settlements.
16. Behn, M., Corrias, R., Rola-Janicka, M. (2019, October 29). *On the interaction between different bank liquidity requirements.* European Central Bank. Retrieved December 4, 2021 from https://www.ecb.europa.eu/pub/financial-stability/macroprudential-bulletin/html/ecb.mpbu201910_2~3237802727.en.html
17. Bozeman Science. (2016, April 16). *Student's t-test* [YouTube]. Retrieved September 9, 2021 from https://www.youtube.com/watch?v=pTmLQvMM-1M&t=490s&ab_channel=BozemanScience
18. Chen, J. (2021, June 10). *Liquid Asset*. Investopedia. Retrieved June 18, 2021 from https://www.investopedia.com/terms/l/liquidasset.asp

19. Cornett, M. M., McNutt, J. J., Strahan, P. E., & Tehranian, H. (2010). Liquidity risk management and credit supply in the financial crisis. *Journal of financial economics*, *101*(2), 297-312.
20. De Guindos, L. (2019, September 4). *The evolution of stress-testing in Europe, speech by Luis de Guindos*. European Central Bank. Retrieved March 16, 2021 from https://www.ecb.europa.eu/press/key/date/2019/html/ecb.sp190904_2~4c8236275b.en.html
21. ECB. (2008). *Eu Banks' Liquidity Stress Testing and Contingency Funding Plans*. (Working paper)
22. ECB. (2010, December). Basel III. *Financial Stability Review, December 2010*, 125–132.
23. ECB. (2012). Liquidity Regulation as A Prudential Tool: A Research Perspective. *Financial Stability Review*, 116-124.
24. Gauthier, C., & Tomura H. (2011). *Understanding and Measuring Liquidity Risk: A Selection of Recent Research*. Ottawa: Bank of Canada.
25. Gomes, T., & Khan, N. (2011). *Strengthening Bank Management of Liquidity Risk: The Basel III Liquidity Standards*. Ottawa: Bank of Canada
26. Gujarati, D.N. and Porter, D.C. (2009). *Basic Econometrics* (5th ed). New York: McGraw Hill Inc.
27. Hong, H., Huang, J. Z., & Wu, D. (2014). The information content of Basel III liquidity risk measures. *Journal of Financial Stability*, 15, 91-111.
28. Hull, J. (2015). *Risk management and financial institutions* (4th Ed.). New Jersey: John Wiley & Sons.
29. Kumar, M., & Yadav, G. C. (2013). Liquidity risk management in Bank: A Conceptual Framework. *AIMA Journal of Management & Research, 7*(2/4), 1-10.
30. Matz, L., & Neu, P. (2007). *Liquidity risk measurement and management: A practitioner's guide to Global Best Practices*. Hoboken, NJ: John Wiley & Sons.
31. Muranaga, J., & Ohsawa, M. (1997). Measurement of liquidity risk in the context of market risk calculation. *A BIS volume entitled The Measurement of Aggregate Market Risk* (pp. 195-196). Tokyo: Institute for Monetary and Economic Studies, Bank of Japan.
32. Murphy, C. B. (2020, July 12). *Loan-to-Deposit Ratio (LTD)* Investopedia. Retrieved May 19, 2021 from https://www.investopedia.com/terms/l/loan-to-deposit-ratio.asp#:~:text=The%20loan%2Dto%2Ddeposit%20ratio%20is%20used%20to%20assess%20a,deposits%20for%20the%20same%20period
33. NBRNM. (2008). *Basic implementation guidelines of stress testing - liquidity risk* (Working paper). Skopje: NBRNM.
34. NBRNM. (2011). *Decision on managing banks' liquidity risk.* PE Official Gazette No. 126/11. Skopje: NBRNM.
35. NBRNM. (2018). *Report on The Risks in The Banking System of The Republic of Macedonia* (Report). Skopje: NBRNM
36. NBRNM. (2019). *Decision on the methodology of risk management.* PE Official Gazette No. 113/19. Skopje: NBRNM.

37. NBRNM. (2020). *Decision on the methodology for liquidity risk management.* PE Official Gazette No. 146/20. Skopje: NBRNM.
38. Negret, F. M. (2009). The Heavenly Liquidity Twin: The Increasing Importance of Liquidity Risk. *World Bank Policy Research Working Paper*, (5139).
39. Nikolaou, K. (2009). *Liquidity (risk) concepts definitions and interactions* (Working paper No. 1008). European Central Bank.
40. Nikolaou, K., & Drehmann, M. (2009). *Funding Liquidity Risk definition and Measurement* (Working paper No. 1024). European Central Bank.
41. Petreska, B. (2018). *Liquidity risk in Macedonian Banking System* (Working paper). Skopje: Second International Scientific Conference on Economics and Management - EMAN.
42. Pohl, M. (2017). *Basel III liquidity monitoring tools: Possible application of the additional tools* (Working paper No. 14). Bank for International Settlements.
43. Popovska, J. (2014). Modelling Financial Stability: The Case of The Banking Sector in Macedonia. *Journal of Applied Economics and Business 2*(14), 68-69.
44. Saunders, A., & Cornett, M. M. (2008). *Financial institutions management: A risk management approach* (6th Ed.). New York: McGraw-Hill Education.
45. Shen, C. H., Chen, Y. K., Kao, L. F., Yeh, C. Y. (2009). Bank Liquidity Risk and Performance. *Review of pacific basin financial markets and policies, 21*(01), 3.
46. Strahan, P. E. (2012). *Liquidity Risk and Credit in the Financial Crisis* (Report No. 2012-15). San Francisco: FRBSF Economic Letter.
47. Venkat, S., Mikulka, A., & Magstadt, B. (2010). Liquidity Risk Management: Staying Afloat in Choppy Seas. *PricewaterhouseCoopers The Journal*, (0910), 2-5.
48. Vodová, P. (2013). Determinants which affect liquid asset ratio of Czech and Slovak commercial banks. *Financial Assets and Investing, 4*(1), 25-41.
49. Van den End, J. W. (2016). A macroprudential approach to address liquidity risk with the loan-to-deposit ratio. *The European Journal of Finance, 22*(3), 237-253.
50. Wong, E., & Hui, C. H. (2009, March 27). *A liquidity risk stress-testing framework with interaction between market and credit* (Working Paper No. 06/2009). Hong Kong: Hong Kong Monetary Authority.

APPENDICES

Appendix 1: A summary of the Master's Thesis in Slovenian Language

Glavni namen tega magistrskega dela je analizirati in raziskati upravljanje likvidnostnega tveganja v bančnem sektorju v Republiki Severni Makedoniji ter izvesti primerjalno raziskavo o upravljanju likvidnostnega tveganja, kot ga Baselski odbor za bančni nadzor (v nadaljevanju: BCBS) zahteva od mednarodnega bančnega sektorja za ohranjanje ustrezne ravni likvidnosti in zmanjšanje likvidnostnega tveganja. V tem magistrskem delu sem predstavila raziskavo ureditve likvidnostnega tveganja, ki jo izvaja in usklajuje Narodna banka Republike Severne Makedonije (v nadaljnjem besedilu: NBRNM), in njeno upoštevanje zdravih načel ter primerjala metodologijo merjenja sorazmernega števila bank iz Severne Makedonije in evropskih bank.

Do finančne krize je prišlo, ker je svetovni finančni sistem naletel na nujne denarne zahteve iz različnih virov, kot so kratkoročni upniki, nasprotne stranke in obstoječi posojilojemalci. Pred tržnimi pretresi predpisi niso obravnavali likvidnostnega tveganja in njegove resnosti na visoki ravni. Metodologija upravljanja likvidnostnega tveganja je po svetu različno razvita. V tej magistrski nalogi je glavni poudarek na primerjalni analizi ureditve upravljanja likvidnostnega tveganja med ureditvijo NBRNM ter ureditvijo BCBS in Evropske centralne banke (v nadaljevanju: ECB).

Poleg tega se je v času finančne krize stresno testiranje uporabljalo predvsem za ugotavljanje kapitalskih primanjkljajev na ravni bank in za izboljšanje tržne discipline, to pa je bilo doseženo z objavo doslednih informacij na ravni bank. Da bi razvili trdno upravljanje likvidnostnega tveganja ter izboljšali likvidnostni profil in položaj, je BCBS oblikoval dva regulativna standarda, ki ju morajo banke uporabljati pri nadzora likvidnostnega tveganja, kot sta količnik likvidnostnega kritja in količnik neto stabilnega financiranja.

Ko je leta 2007 prišlo do svetovne finančne krize, se je pokazalo, da je treba več pozornosti nameniti stabilnosti finančnega sistema, zlasti v bančnem sektorju. Težave, ki so se pojavile, ko se je likvidnost na finančnih trgih začela odločilno zmanjševati. Banke so zaradi likvidnostnih težav pri financiranju zavračale medsebojno posojanje, to pa je bilo povezano z dvomom o izpostavljenosti njihovih strukturiranih produktov. V Severni Makedoniji so bile posledice pretresov zaznane v letih 2008 in 2009. Da bi povečala stabilnost bančnega sistema, je NBRNM takoj sprejela številne ukrepe in dejavnosti. V nasprotju z razvitimi državami učinki finančne krize v državah v razvoju, kot je Severna Makedonija, niso bili tako hudi, čeprav je bančni sistem kazal znake upočasnitve dejavnosti in slabosti finančnih ukrepov.

Poleg tega bo za dosego temeljnega namena predstavljena metodologija analitičnega pristopa s proučitvijo treh raziskovalnih vprašanj. Prvo vprašanje je: v kolikšni meri je ureditev NBRNM za upravljanje likvidnostnega tveganja usklajena z BCBS načeli? Drugo vprašanje je, ali je metodologija likvidnostnega stresnega testiranja, ki jo uporabljajo vse banke v Severni Makedoniji usklajena z okvirom ECB? Tretje vprašanje pa je, kakšno je gibanje likvidnostnih pozicij v bančnem sektorju Severne Makedonije v primerjavi z evropskimi bankami v časovnem okviru med letoma 2008 in 2020?

V magistrski nalogi sem ugotovila naslednje vidike: stopnjo skladnosti predpisov NBRNM za upravljanje likvidnostnega tveganja z BCBS načeli, sinhronizacijo metodologije likvidnostnega stresnega testiranja, ki jo banke v Severni Makedoniji izvajajo, z okvirom ECB, primerjavo metod merjenja in spremljanja likvidnostnega tveganja med zahtevami NBRNM ter BCBS načeli in strukturo ECB. V zadnjem delu magistrske naloge sem predstavila primerjavo sprememb likvidnostnih pozicij v bančnem sektorju v Severni Makedoniji in bankah v Evropi v obdobju med letoma 2008 in 2020 z uporabo dveh količnikov, kot sta razmerje med posojili in vlogami ter razmerje med likvidnimi sredstvi in celotnimi sredstvi.

Za razširitev primerjalne analize s primerjavo gibanja LDR in LATAR v evropskih bankah v primerjavi z bankami iz Severne Makedonije v časovnem obdobju 2008 in 2020 sem za dokazovanje statistično pomembne razlike med spremenljivkama (uporaba LDR in LATAR v evropskih bankah in bankah v Severni Makedoniji) uporabila pristop testa pomembnosti oziroma dvostranski parni t-test, za natančnejšo določitev tega t-testa pa sem uporabila programsko opremo Stata Software for Statistics and Data Science.

Appendix 2: Responsibilities of the bank's management groups mandated by NBRNM

According to the Decision on managing banks' liquidity risk, developed by NBRNM, banks should have an adequate organisational structure of liquidity risk management with management groups that will have the following responsibilities (NBRNM, 2011):

Supervisory Board:

- to review and approve the policy of the liquidity risk management and observe the implementation (we can incorporate here the monitoring and the approval of the Liquidity Contingency Plan);
- at least once a year to review the adequacy of the adopted policy;
- to validate the exposure of the limits of the liquidity risk;
- to inspect the liquidity risk reports and the stress – testing results;
- to observe the efficiency of the internal control;
- to implement and monitor the development of the system of liquidity risk management;
- and to approve implementing new products, services or activities that from analysis can determine if they may have significant influence on the acceptable level of liquidity risk.

The Risk Management Board:

- to determine analysis of the reports that are presenting the exposure of the liquidity risk management and to monitor the risk management, as well as to establish and audit internal liquidity indicators and risk exposure limits on regular basis;
- to evaluate the liquidity risk management;
- to specify exceptions that are possible when determining the limits and to appoint the responsibility of deciding on implementation of these exceptions;

- to create procedures and a method of stress–test performance and to evaluate the results of the conducted stress-testing;
- to initiate, observe and present proposals for control of the liquidity risk management policy and to observe the efficiency of the functioning of the internal control systems;
- to implement and observe the application of the policy and to determine short-term and long-term strategy for liquidity risk management;
- to analyse the effects of liquidity risk management on the performance of the bank, to analyse the effects of the suggested strategies for the liquidity risk management and to determine and control the internal liquidity indicators and limits of the liquidity risk;
- to present reports to NBRNM for the changes in risk positions, changes in the strategy for risk management and the effects of the risk management;
- and to be accountable for other activities that are according to the Banking Law and the liquidity risk management procedure.

Managing Board (Special Body):

- to develop and sustain the efficiency of the system of the monitoring, measurement, reporting and controlling the liquidity by separate currencies, that have significant influence on bank's overall liquidity;
- to develop conditions for respecting and obeying the policy of liquidity risk management;
- to incorporate an appropriate system of reporting of any possible exceedances of the liquidity risk exposure limits to the Supervisory Board and the Risk Management Board;
- to determine and execute appropriate procedures for liquidity risk management;
- to observe the maturity structure of assets and liabilities in domestic currency (denars) and foreign currency;
- to institute procedures for defining and monitoring the deposit stability and for evaluating the result of new products on the liquidity risk exposure;
- to determine the financial instruments for liquidity risk management, to examine the reports for liquidity risk exposure and reports on the results from stress-testing, and to provide circumstances for undertaking activities from the results of stress-testing;
- to implement an information system that allows preparation of reports for monitoring the liquidity risk management;
- to surveil the potential liabilities and the exposure which is based on bank's off–balance sheet activities.

Appendix 3: Liquidity reports, defined by NBRNM that every bank from North Macedonia should prepare for liquidity risk management purposes

In the new decision (Decision on the methodology for liquidity risk management), established in 2020 by NBRNM, every bank from North Macedonia should prepare the following liquidity reports (NBRNM, 2020):

- Reports on LCR on aggregate level and as a separate significant currency;

- Reports on established internal liquidity indicators and respecting the determined internal thresholds and limits in order to restrict and control the liquidity risk exposure, as well as monitoring the abidance by the allowed exceptions;
- Reports on the composition of the HQLA and cash inflows and outflows that are included in the net cash outflows establishment;
- Reports on the number of deposits that are withdrawn before the maturity date, no matter if the fine for withdrawal is foreseen or not;
- Reports on the maturity framework of assets and liabilities on aggregate basis and as a separate significant currency;
- Reports on the degree of deposit stability, particularly deposits on which a 0% outflow rate can be applied;
- Reports on the results of the conducted stress – testing;
- Reports on the movement and the amount of different types of cash inflows and outflows, from the basis that the assumptions are determined for the expected maturity structure in a longer time period;
- Reports on the price of the funding sources and their maturity;
- Reports on the possibility for sale of certain kinds of assets using an adequate database for the movement of the market price;
- Reports on available unencumbered assets, collectively and as a separate significant currency;
- Reports on the sources of funds and their concentration by depositors and by kinds of instruments, or products and by each significant currency.

Liquidity reports that should be prepared on monthly basis are the following:

- Report on observing and monitoring the concentration of the sources of assets by utmost depositors;
- Report on the price of the sources of funds and their maturity;
- Report on establishing the available unencumbered assets;
- Reports on the maturity composition of assets and liabilities on aggregate basis and by each significant currency;
- Report on internal liquidity indicators;
- Report on LCR on aggregate basis and by each significant currency;
- Report on monitoring the concentration of funding sources by instruments or goods;
- Report on the probability renewal of the sources of assets.

Appendix 4: Qualitative evaluation in a liquidity stress test model developed by NBRNM in 2008

In order to coordinate a qualitative evaluation, which is a part of a liquidity stress-test model developed by NBRNM, banks should present data on the following questions (NBRNM, 2008):

- Can the bank apply the requirements that are specified in the previously implemented Decision of the liquidity risk management and the current Decision on the methodology for liquidity risk management, without any major difficulties?
- What are the general results of the individual scenario's implementation, regarding the internal limits of the bank, in relations to the assets and the liabilities, revenues and expenses and regarding the size of the individual funds and the capital adequacy ratio?
- Does the bank apply internal restrictions for the purpose of the liquidity risk management?
- Does the bank manage the liquidity risk in accordance with the decisions for liquidity risk management (if it is not fully harmonised, it should present the reason of the noncompliance)?
- If the bank operates a stress test analysis for liquidity risk, the bank should describe the main features of the applied model, such as methods, scope, effects of the applied liquidity shocks, principal scenarios and the method of implementation of the gained results of the liquidity risk management process.
- How does widespread shocks and stress circumstances influence the bank's liquidity position on the composition of the financial sources and expenditures?
- Given that the stress test analysis contains scenarios that cover occurrences of the worldwide markets, does the results of those scenarios truly presented the influences of the current occurrences? If the bank's stress test analysis does not contain scenarios that present the happenings of worldwide frameworks, they should present information if and when they intend to upgrade the stress test analysis with this type of information.
- Describe the main features of the established CFP.
- Has the CFP been initiated so far by the bank? What are the reasons of activation of the Plan and were the initiated activities conducted according to the CFP?

Appendix 5: The scenarios that are being used for the quantitative analysis in the liquidity stress test model

The quantitative analysis is another part of the liquidity stress-test model, developed by NBRNM, and this analysis contains the following scenarios (NBRNM, 2008):

- Scenario 1: The parent bank withdraws all deposits and loans. The assumption in this scenario is that since the liquidity shocks in the foreign countries, the parent bank does not have the possibility to finance the bank within the domestic country and this is the reason why the parent bank withdraws the deposits and other loans of the subsidiary bank. In this case, the scenarios of this analysis that should be conducted are one-time withdrawal of 10% of the liabilities with three months maturity towards the parent bank, one-time withdrawal of 10% all the liabilities to the parent bank, regardless of the maturity and one-time of 50% of the liabilities with three months maturity toward the parent bank.

- Scenario 2: Withdrawing the deposits of other banks (except the parent bank), which leads to a withdrawal of the deposits of citizens and non-citizens and this can impact on reduction of the confidence in the bank or the banking system of the Republic of North Macedonia. This scenario can result to withdrawal of the deposits of the foreign banks, banks might lose liquidity support, the deposits of the residents are less sensitive to this type of shock and there is a probability that 20% of the deposits will be withdrawn, 80% of the deposits might be withdrawn by the foreign banks, international deposits will be fully withdrawn by the foreign banks, the parent bank cannot provide additional liquidity support, in spite the fact that it will not withdraw the deposits from the bank, and there is a possibility of immediate withdrawal of the deposits and it will affect the liquidity ratios.
- Scenario 3: A combination of the first and the second scenario. This scenario is established by the assumption that the parent bank withdraws all the deposits in the bank. There can be a withdrawal of 80% of the deposit withdrawals from non-citizens, including the foreign banks, as well as 20% withdrawal of the deposits by the citizens and a full withdrawal of the international deposits from the domestic banks. The liquidity deficiency and the reduction of deposits happen suddenly.

Appendix 6: Answers of the conducted survey for liquidity stress testing on banks from North Macedonia

Table A. 1: Survey for liquidity stress testing methodology conducted on banks from North Macedonia

Questions from the survey	Bank 1	Bank 2	Bank 3	Bank 4	Bank 5	Total
1) Does your bank quantify its liquidity risk tolerance?						
a) Yes	✓	✓	✓	✓	✓	5
b) No						0
c) Undetermined						0
2) What types of stress test scenarios does your bank consider?						
a) Idiosyncratic shocks (bank specific liquidity stress scenarios)		✓	✓			2
b) Adverse market conditions (market-wide stress scenarios)						0
c) Combination of both	✓			✓	✓	3
d) Other						0
e) None of the above						0
3)Which of the following assumptions does your bank make within your idiosyncratic liquidity stress test scenarios, if these types of scenarios are used in your bank?						
a) Operational risk	✓					1
b) Withdrawal of corporate and retail deposits	✓	✓	✓	✓	✓	5
c) Large credit loses	✓		✓	✓		3
d) Rumors	✓				✓	2

e) Reduction in counterparty limits	✓		✓		2
f) A run on the bank or shortage of liquidity in the market	✓		✓		2
g) Reduced access to wholesale funding	✓		✓		2
h) Increased haircuts and collateral calls	✓		✓	✓	3
i) Reduction in asset prices	✓				1
j) Reduction in credit lines available	✓	✓	✓		3
k) Utilisation of credit commitments	✓			✓	2
l) Inability to draw down on recommitted lines	✓				1
m) Currency conversion	✓	✓			2
n) Increase in demand for financial funding by the entities within the group	✓		✓		2
o) Other					0
p) Not used in the bank					0
4)Which of the following assumptions does your bank make within the market-wide stress scenarios, if these types of scenarios are used in your bank?					
a) Severe global market crisis	✓		✓		2
b) Sub-prime market liquidity crisis			✓	✓	2
c) Government crisis or change in monetary policy			✓		1
d) Sudden and deep economic recessions	✓				1
e) Increase in bond yields					0
f) Drop in stock prices	✓				1
g) Rise in credit spreads or interest rates			✓		1
h) Appreciation/ depreciation of domestic currency	✓		✓		2
i) Marketable securities cannot be sold immediately and only at a lower price than may be considered a fair price				✓	1
j) Repo markets and unsecured interbank markets are closed			✓		1
k) Granted credit lines are drawn by corporate clients			✓		1

l)Professional demand deposits are withdrawn				✓	✓	2
m) Retail deposit stability decreases				✓	✓	2
n) Foreign exchange market dislocation				✓		1
o) No capital market funding	✓			✓		2
p) Other						0
q) Not used in the bank		✓	✓			2
5)What is the maximum time horizon of your three most important market scenarios?						
a) 1 week						0
b) 2 weeks						0
c) 1 month	✓					1
d) 2 months						0
e) 4 months						0
f) 1 year				✓		1
g) 3 years					✓	1
h) Other		✓	✓			2
6)At which level do you perform your liquidity stress test?						
a) Entity level	✓		✓		✓	3
b) Group level		✓				1
c) Combination of both				✓		1
d) None of the above						0
7)What type of measurement approach do you adopt for your liquidity position?						
a) Cash flow maturity mismatch	✓					1
b) Liquidity stock approach						0
c) Balance-sheet maturity mismatch					✓	1
d) Liquidity coverage ratio		✓	✓	✓		3
e) Current liability ratio						0
f) Other						0
8)Does your bank publicly disclose the results of its liquidity stress tests?						
a) Regularly	✓				✓	2
b) Upon request						0
c) Never						0
d) Not foreseen		✓	✓	✓		3
9)How would you rank the benefits for your bank of standardisation of liquidity stress tests? (From 5 = most important to 1 = least important)						
a) 5	✓	✓		✓		3
b) 4						0
c) 3			✓		✓	2
d) 2						0
e) 1						0
10)Given standardisation of liquidity stress tests, would disclosure requirements foster market discipline in liquidity risk management?						
a) Yes	✓			✓	✓	3

b) No			0
c) Undetermined	✓	✓	2

Source: *ECB (2008), survey from BSC (answered survey from banks in North Macedonia).*

Appendix 7: Items of measuring the liquidity ratio of up to 30 days

Table A. 2: Assets and liabilities elements when measuring liquidity ratio of up to 30 days according to NBRNM regulation

Asset items	**Liability items**
Assets in the NBRNM, including the part of the mandatory reserve available to the bank	80% of time deposits that mature in the next 30 days
Debt instruments that are issued by NBRNM	Transaction accounts and demand deposits
Credits, interests, fees and other receivables (except the receivables based on securities) on central banks, central governments, domestic and foreign banks with credit rating of at least BBB- (S&P) or Baa3 (Moody's), non-financial institutions with credit risk exposure which are categorised in at least "A" and "B" risk categories, that mature in the following 30 days	All forward transactions, opened uncovered letters of credit, irrevocable credit lines, warrantees and other off-balance sheet items with risk classifications of C, D and E, that mature in the next 30 days
Securities and assets that NBRNM accepts as collateral when implementing the monetary operations	Financial liabilities at fair value through the income statement
Other cash and cash equivalents	15% of the approved overdrafts of the transactional accounts and credit cards
Dept instruments that are saved until their maturity, which mature in the following 30 days, and that carry a risk weight of maximum 20%	All other on-balance sheet liabilities that mature within the following 30 days
Financial assets that are calculated at fair value through the income statement, established as such at the initial recognition, trading derivatives, embedded derivatives and derivatives kept for risk management that carry a risk weight of maximum 20%	
Trading securities, available for sale, that carry a risk weight of maximum 20%	
Securities that are kept for trading, available for sale or calculated at fair value through the income statement, established as such at	

the initial recognition and the ones that belong to a liquidity level of 1	
Warrantees, letters of credit, forward transactions which are estimated as a potential inflow for the bank that matures within the next 30 days, not including the off-balance sheet items connected to specific on-balance sheet asset elements	

Source: NBRNM (2011).

Appendix 8: Items of measuring the liquidity ratio of up to 180 days

Table A. 3: Assets and liabilities elements when measuring liquidity ratio of up to 180 days according to NBRNM regulation

Asset items	**Liability items**
Assets in the NBRNM, including the part of the mandatory reserve available to the bank	80% of time deposits that mature in the next 180 days
Debt instruments that are issued by NBRNM	Transaction accounts and demand deposits
Credits, interests, fees and other receivables (except the receivables based on securities) on central banks, central governments, domestic and foreign banks with credit rating of at least BBB- (S&P) or Baa3 (Moody's), non-financial institutions with credit risk exposure which are categorised in at least "A" and "B" risk categories, that mature in the following 180 days	All forward transactions, opened uncovered letters of credit, irrevocable credit lines, warrantees and other off-balance sheet items with risk classifications of C, D and E, that mature in the next 180 days
Securities and assets that NBRNM accepts as collateral when implementing the monetary operations	Financial liabilities at fair value through the income statement
Other cash and cash equivalents	15% of the approved overdrafts of the transactional accounts and credit cards
Dept instruments that are saved until their maturity, which mature in the following 30 days, and that carry a risk weight of maximum 20%	All other on-balance sheet liabilities that mature within the following 180 days
Financial assets that are calculated at fair value through the income statement, established as such at the initial recognition, trading derivatives, embedded derivatives	

and derivatives kept for risk management that carry a risk weight of maximum 20%	
Trading securities, available for sale, that carry a risk weight of maximum 20%	
Securities that are kept for trading, available for sale or calculated at fair value through the income statement, established as such at the initial recognition and the ones that belong to a liquidity level of 1	
Warrantees, letters of credit, froward transactions which are estimated as a potential inflow for the bank that matures within the next 180 days, not including the off-balance sheet items connected to specific on-balance sheet asset elements	

Source: NBRNM (2011).

Appendix 9: Requirements established by NBRNM that HQLA should meet

Banks from North Macedonia should determine HQLA, which should fulfil the following requirements (NBRNM, 2020):

General requirements:

- Being liberated from any encumbrance over the next 30 days.
- Assets must not be owned or issued by the bank entity, its parent bank, the bank subsidiary or some other parent subsidiary which performs securitisation actions that are connected to the bank.
- The assets must not be from another bank or issued by it, unless the bank is a public sector entity. The assets must also not be from investment firm, insurance undertaking, reinsurance undertaking, financial holding company, mixed-financial holding company and other financial entities with the exception of the legal entity with a special purpose that is designed for performing securitisation activities.
- The value of the positions should be determined by the market participants, which can be monitored with ease in the market or what is mostly needed is a determining of the value on the basis of simple calculation which can be applied with publicly available inputs and is dependent on realistic assumptions.
- To be specified on a regulated market or traded with outright sale or repo transaction.

Operational requirements:

- The bank should develop policies, procedures or other internal acts with established limits to ensure diversification of positions, between different levels and sub-levels of liquid assets, within the positions of the same level and sub-level of liquid assets, and by type of issuer, counterparty or geographical location.

- The banks should have immediate access to the positions and should be able to monetise those positions at any time within the next 30 days with outright sale or repurchase agreement.
- The person or the organisation that is responsible for the bank's liquidity risk management might monetise the position at any point in the next 30 days, according to the bank's business policy.
- The currency structure of HQLA positions should be consistent with the currency structure of the net liquidity outflows.
- At least once a year, the bank should monetise a sufficient representative HQLA sample with outright sale or repurchase agreement that conducts tests of the access to the respective market, establishes the efficiency of the bank's determined operations for timely monetisation of positions, and restricts the risk of sending a negative signal to the market as a result of monetisation of the HQLA during a stress event.
- When the bank conducts protection of the market risk that is connected with the HQLA positions, it should make sure that the first ten points from the operational requirements are fulfilled and the net liquidity outflows or inflows that would turn out as a result of the early closure of the protection are taken into account in the valuation of the relevant positions.

Special standards and haircuts for including in the level 1 of liquid assets:

- Coins and banknotes.
- Exposure that is guaranteed by the NBRNM and the funds of the bank in the NBRNM, if the bank is allowed to withdraw these assets under stressed events.
- Positions that constitute the guaranteed exposure by the ECB, the guaranteed exposure by the central bank of other country and the funds of the bank that are kept in the ECB and in the central bank.
- Guaranteed exposure by the central government of the Republic of North Macedonia, the central government of other country, regional governments, local authorities or public sector entity in the North Macedonia and the regional government or local authorities in other country.
- Positions that represent guaranteed exposure by the central government or the central bank of other country and funds held in the central bank.
- Exposure to the Development Bank of North Macedonia
- Extremely high-quality covered bonds which should comply with all of the requirements established by NBRNM.
- Positions issued by other banks that are incorporated by the central government, regional government or local authority in an EU member state and are promotional lenders on a non-competitive, non-profited basis for the purposes of implementing the EU member states policies.
- Guaranteed exposures by multilateral banks and international organisations that are assigned a 0% risk weight, according to the NBRNM's regulation.

- The positions from point 3 and point 5 are included in HQLA with a haircut of at least 7%.

Special criteria and haircuts for including in the level 2 of liquid assets:

- Level 2 of liquid assets is a sum of two sublevels, such as level 2A assets and level 2B assets.
- In the level 2A, the positions that should be followed are: the guaranteed exposure by central governments, central banks, regional governments, local authorities or public sector entities, if they are assigned a 20% risk weight; high quality covered bonds with defined requirements by NBRNM; covered bonds issued by banks in another countries with determined requirements by NBRNM in the decision; and corporate debt securities with certain requirements from NBRNM that are presented in the decision.
- In the level 2B, there are also certain assets that should be included, which are: exposures with asset-back securities form if it is a simple securitisation framework, which provides an easy identification and monitoring f the underlying assets (with some requirements that need to be met presented in the decision); high quality covered bonds exposure that should meet the requirements mandated by NBRNM; corporate debt securities which meet the requirements presented in the decision; shares with the outlined requirements form NBRNM; restricted-use committed liquidity facilities which may be provided by the central bank with requirements form NBRNM; and asset-backed securities exposures that should be certified as level 2B securitisation, where the presented requirements in the decision should be met.

Special standards and haircuts for including the investments in components of open investment funds in the respective level of HQLA:

- The components of open investment funds should qualify as HQLA when depending on the aspects of the invested property up to the absolute denar equivalent of 100 million euros with the requirements such as: the management company of the open investment funds should be based in the Republic of North Macedonia or in another country where the company is supervised by a competent supervisory authority; the relevant regulation of the open investment funds should have data on the type of invested property, and when it comes to defined limitations on investments, it should have data on the amount and the method of calculation; the bank should have information on the open investment funds' operations at least once a year, within a range of property, liabilities, income and activities during the reporting period; and the open investment funds should invest only in HQLA positions or in derivatives in which the derivatives investments are only made with a purpose to protect against interest rate risk, currency risk or credit risk in the portfolio.
- Banks should have a robust method to measure the market value and haircuts for units in open investment funds.
- The bank should implement the minimum haircuts to the value of their units in open investment funds, that depend on the category of the invested property, as the

following: 0% for coins, banknotes and exposures to central banks; 5% for level 1 liquidity assets besides the extremely high quality covered bonds; 12% for extremely high quality covered bonds; 20% for level 2A liquidity assets; 30% for level 2B securitisations backed by subcategories of assets (the assigned credit assessment by a nominated ECAI that has a credit quality of at least step 1 and the underlying assets that are portfolios of exposures); 35% for level 2B covered bonds; 40% for level 2B securitisations backed by the subcategories if assets (the position that is the most senior tranche of securitisation and that possesses the highest level of superiority during the ongoing life of the transaction); and 55% for level 2B corporate debt securities and shares.

Appendix 10: Liquidity inflows that are used in the calculation of the NLO by NBRNM

To calculate the NLO, banks from North Macedonia should use the following liquidity inflows (NBRNM, 2020):

- The fully unlimited inflows which should be the sum of the following liquidity inflows: inflows from the parent bank or a subsidiary of the bank or other subsidiary of the same parent bank or subsidiary that should be included in the consolidated financial reports of the bank, inflows from deposits that are invested in another bank that is a member of the same bank group in the country or abroad if the presented requirements in the decision from the NBRNM are fulfilled, and inflows from mortgage lending loans, promotional loans or loans that are approved by the bank as a mediator of multilateral development bank or a public sector entity.
- The lower of the partially exempted inflows (banks that are specialised for approving credit for motor vehicles or approving consumer credit, have limitation on the total inflows of 90% if they fulfil the requirements that are asked form NBRNM in the decision) and the 90% of the outflows. The total liquidity inflows of the Bank cannot be higher than 75% from the total liquidity outflows with some exceptions defined in the legislation of the Republic of North Macedonia.
- The exempted inflows should include the liquidity inflows that fail to fulfil the requirements that are mentioned in the first two points.

Appendix 11: Results of LTD for banks in countries from European Union

Table A. 4: Calculations of LTD for banks from European Union

LTD for Banks from European Union (in %)	Year												
Name of the bank	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Rietumu Banka AS	113.15	119.05	131.26	137.99	117.02	104.33	92.31	83.50	85.54	90.38	93.99	53.87	62.85
Hellenic Bank Public Company Limited	73.59	68.08	77.33	78.43	71.12	79.02	68.65	70.72	69.22	67.76	74.49	43.14	45.48
Nova Ljubljanska banka d.d.	139.41	126.30	103.30	117.04	117.87	96.04	80.68	80.93	78.50	73.37	64.41	59.49	52.51
AS SEB Pank	99.72	104.42	106.09	110.34	109.46	109.04	95.54	98.11	93.22	95.81	96.53	102.02	106.33
Ceska sporitelna A.S (member of Erste Group, Austria)	79.24	86.23	87.83	77.36	75.64	71.73	74.17	71.47	66.56	67.64	84.60	72.90	68.60
Banque Francaise Commerciale Ocean Indien	107.02	107.93	107.06	106.56	105.84	106.13	101.21	95.94	99.91	102.65	108.81	104.82	103.47
ProCredit Bank	85.59	77.21	91.21	86.43	96.75	92.07	97.75	96.57	97.00	92.59	95.81	108.28	110.94
Zagrebacka Banka	105.43	98.68	102.20	104.52	106.80	104.12	108.19	98.42	93.70	86.22	78.04	73.31	70.72
Central Cooperative Bank	70.40	75.31	61.66	54.79	54.82	53.79	48.53	49.98	48.32	45.50	44.68	48.89	45.84
Banque Internationale a Luxembourg SA	38.18	39.93	50.63	59.96	69.22	73.38	71.68	68.42	66.78	71.16	71.27	67.47	68.98
Eurobank Ergasias S.A.	93.21	86.54	82.46	75.29	76.46	77.95	81.39	84.41	90.92	98.76	86.70	78.00	71.77
MKB Bank	108.78	91.70	92.63	85.21	84.32	93.75	80.95	53.35	52.12	52.66	60.44	69.30	49.13
Banca Carige S.p.A.	166.90	148.31	132.11	119.96	104.36	108.79	118.71	127.64	126.40	104.19	108.47	117.27	97.96
Tatra Banka	69.32	80.42	84.06	90.37	87.79	86.79	92.74	87.85	90.99	90.86	94.34	95.36	94.72
HSBC Bank Malta plc	70.43	76.88	71.45	71.00	71.65	74.01	67.39	67.10	67.28	67.75	86.06	78.19	72.37
Average	**94.69**	**92.47**	**92.09**	**91.68**	**89.94**	**88.73**	**85.33**	**82.29**	**81.76**	**80.49**	**83.24**	**78.15**	**74.78**

Adapted from Fitch Connect Database and Annual Reports.

Appendix 12: Results of LTD for banks in North Macedonia

Table A. 5: Calculations of LTD for banks from North Macedonia

LTD for Banks from North Macedonia (in %)	Year												
Name of the bank	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Komercijalna Banka AD Skopje	85.58	92.97	89.91	66.23	67.38	62.88	69.88	67.51	63.05	55.83	49.19	51.55	44.51
Stopanska Banka AD Skopje	89.26	76.61	75.84	78.01	77.11	76.34	78.04	82.18	84.01	85.70	83.85	80.30	82.00
NLB Bank AD Skopje	91.05	84.89	76.46	84.01	80.74	80.95	82.99	85.18	85.85	82.96	83.47	81.10	77.75
Halk Bank AD Skopje	119.13	94.61	85.69	102.95	70.54	95.75	95.77	99.63	98.83	92.30	98.54	92.48	86.46
Sparkasse Bank Macedonia AD Skopje	102.91	107.58	84.41	84.49	87.21	81.29	79.14	77.23	81.48	88.02	87.35	85.93	98.84
Ohridska Banka AD Skopje	62.51	86.21	81.57	78.47	75.30	86.22	80.32	90.33	91.92	96.65	95.73	92.35	92.52
ProCredit Bank AD Skopje	98.47	93.50	0.00	109.70	119.30	114.45	114.35	112.79	107.16	111.61	100.30	111.17	104.91
Universal investment Bank AD Skopje	86.61	72.24	73.74	74.08	76.53	71.70	75.34	79.68	81.44	84.64	81.35	86.49	85.31
Central Cooperative Bank AD Skopje	20.26	36.26	42.92	20.46	25.46	35.34	51.54	64.64	72.96	81.11	80.38	76.00	80.43
Capital Bank AD Skopje	149.95	100.29	58.43	66.53	78.04	77.70	66.20	71.48	68.82	59.69	73.92	74.28	80.43
Stopanska Banka AD Bitola	98.98	118.43	92.09	63.48	51.65	63.05	69.26	77.55	78.58	82.36	86.11	86.11	61.10
TTK Bank AD Skopje	87.38	76.72	77.91	65.73	74.09	77.26	68.11	65.27	63.36	71.52	70.67	71.59	74.53
Silk Road Bank AD Skopje	0.00	81.46	66.72	65.36	61.77	57.29	69.60	68.77	69.83	68.35	72.27	74.38	79.90
Development bank of North Macedonia AD Skopje	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Eurostandard Bank AD Skopje	114.48	82.46	89.90	73.32	74.16	69.56	60.15	67.50	75.49	74.31	61.70	0.00	0.00
Average	**86.18**	**86.02**	**71.11**	**68.85**	**67.95**	**69.99**	**70.71**	**73.98**	**74.85**	**75.67**	**74.99**	**75.98**	**74.91**

Adapted from Fitch Connect Database and Annual Reports.

Appendix 13: Results of LATAR for European banks

Table A. 6: Calculations of LATAR for banks from European Union

LATAR for Banks from European union (in %)	Year												
Name of the bank	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Rietumu Banka AS	41.18	39.18	36.94	39.76	25.04	27.58	17.69	30.99	40.01	40.68	41.33	51.12	47.05
Hellenic Bank Public Company Limited	20.51	17.38	34.04	41.87	40.67	44.41	42.96	42.50	38.36	33.30	28.86	39.07	32.24
Nova Ljubljanska banka d.d.	16.45	22.32	13.49	12.30	11.25	14.12	16.21	45.79	47.23	48.28	43.27	51.03	53.14
AS SEB Pank	1.25	0.02	0.03	4.28	5.02	7.38	7.43	4.66	17.60	5.25	5.43	15.98	14.74
Ceska sporitelna A.S (member of Erste Group, Austria)	18.12	23.07	28.33	21.21	26.45	24.69	25.78	29.30	31.19	29.23	20.46	20.02	25.86
Banque Francaise Commerciale Ocean Indien	19.77	18.09	17.47	18.77	18.32	18.80	21.70	25.71	11.03	8.60	6.79	14.75	12.61
ProCredit Bank	25.31	29.29	22.38	28.21	22.59	24.17	24.22	21.71	23.91	21.27	21.29	20.92	18.94
Zagrebacka banka	32.58	30.96	28.29	26.60	26.07	26.18	24.00	27.47	29.46	30.23	36.70	33.87	36.59
Central Cooperative Bank	21.81	19.43	24.04	31.40	33.81	35.40	35.53	26.34	33.76	38.92	37.25	36.23	35.85
Banque Internationale a Luxembourg SA	2.35	0.54	0.69	0.52	0.58	0.55	0.40	0.41	0.34	0.30	0.50	0.23	0.20
Eurobank Ergasias S.A.	1.23	1.03	0.73	0.65	20.56	17.05	15.41	11.65	9.33	8.25	10.60	15.53	18.62
MKB Bank	12.30	8.84	10.66	14.52	19.94	15.99	19.64	6.99	10.03	6.33	8.72	7.72	14.41
Banca Carige S.p.A.	4.26	3.66	2.31	1.39	1.12	0.76	0.02	0.02	0.00	0.01	0.06	0.05	0.05
Tatra Banka	27.35	20.99	14.86	11.36	11.05	14.51	8.13	12.99	13.25	11.04	9.18	9.27	11.12
HSBC Bank Malta plc	5.57	4.86	5.41	6.35	7.72	8.34	26.06	22.72	22.51	15.92	25.50	13.04	21.49
Average	**16.67**	**15.98**	**15.98**	**17.28**	**18.01**	**18.66**	**19.01**	**20.62**	**21.87**	**19.84**	**19.73**	**21.92**	**22.86**

Adapted from Fitch Connect Database and Annual Reports.

Appendix 14: Results of LATAR for banks from North Macedonia

Table A. 7: Calculations of LATAR for banks from North Macedonia

LATAR for Banks from North Macedonia (in %)	**Year**												
Name of the bank	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Komercijalna Banka AD Skopje	27.80	28.19	33.46	33.11	32.54	34.82	35.77	39.62	44.38	44.85	48.05	44.41	39.79
Stopanska Banka AD Skopje	20.35	29.31	32.02	32.09	36.34	34.56	32.76	31.54	29.42	27.28	26.46	27.84	23.61
NLB Bank AD Skopje	28.58	35.94	39.07	35.95	32.50	27.56	27.02	23.81	20.38	23.12	18.90	20.90	18.52
Halk Bank AD Skopje	22.27	32.01	26.15	24.47	41.19	26.59	33.73	23.10	20.75	18.88	18.36	23.52	21.07
Sparkasse Bank Macedonia AD Skopje	23.85	31.45	16.60	16.48	14.29	26.55	34.25	30.81	27.13	20.82	19.87	25.34	18.71
Ohridska Banka AD Skopje	40.96	37.04	35.31	35.85	32.58	33.89	35.28	28.73	26.81	20.33	21.18	25.19	23.42
ProCredit Bank AD Skopje	20.51	22.18	0.00	21.94	22.95	23.41	20.19	18.85	16.64	17.77	25.10	21.53	24.51
Universal investment Bank AD Skopje	21.23	36.85	31.33	28.10	28.07	25.66	24.34	23.11	23.50	23.86	24.54	21.83	23.33
Central Cooperative Bank AD Skopje	62.79	48.06	51.83	66.15	62.62	49.12	47.91	33.80	25.45	20.76	20.45	26.63	21.10
Capital Bank AD Skopje	49.09	29.75	39.12	35.85	31.26	32.43	38.53	17.44	30.41	33.39	26.54	21.22	17.29
Stopanska Banka AD Bitola	40.87	26.78	36.26	43.12	47.18	37.85	38.37	33.53	34.19	32.30	27.49	37.46	30.00
TTK Bank AD Skopje	25.09	26.76	26.33	30.33	24.31	28.16	30.31	39.04	39.73	34.47	31.02	31.64	27.57
Silk Road Bank AD Skopje	0.00	17.14	32.97	35.40	40.28	44.96	33.46	33.81	27.58	34.99	28.37	23.85	21.39
Development bank of North Macedonia AD Skopje	31.47	37.48	36.18	38.65	35.49	38.80	41.14	40.75	38.48	37.61	36.04	31.23	25.78
Eurostandard Bank AD Skopje	17.19	22.98	28.31	28.81	25.87	29.63	33.08	31.31	24.71	24.98	33.67	0.00	0.00
Average	**30.86**	**30.79**	**33.21**	**33.75**	**33.83**	**32.93**	**33.74**	**29.95**	**28.64**	**27.69**	**27.07**	**27.33**	**24.01**

Adapted from Fitch Connect Database and Annual Reports.

Appendix 15: Results of LTD and LATAR for 2008 calculated in Stata

Table A. 8: Paired t-test on LTD and LATAR for 2008

Paired t test — LTD (mean in percentage)

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
EU	15	94.69133	8.115424	31.4309	77.28548	112.0972
NM	15	80.43867	11.09449	42.96877	56.64335	104.234
diff	15	14.25267	16.01101	62.01039	-20.08754	48.59287

mean(diff) = mean(EU - NM) t = 0.8902
Ho: mean(diff) = 0 degrees of freedom = 14

Ha: mean(diff) < 0 — Pr(T < t) = 0.8058
Ha: mean(diff) != 0 — Pr(|T| > |t|) = 0.3884
Ha: mean(diff) > 0 — Pr(T > t) = 0.1942

Paired t test — LATAR (mean in percentage)

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
EU	14	16.44857	3.366373	12.59582	9.175965	23.72118
NM	14	30.86071	3.494432	13.07497	23.31145	38.40997
diff	14	-14.41214	4.850119	18.14748	-24.89019	-3.934097

mean(diff) = mean(EU - NM) t = -2.9715
Ho: mean(diff) = 0 degrees of freedom = 13

Ha: mean(diff) < 0 — Pr(T < t) = 0.0054
Ha: mean(diff) != 0 — Pr(|T| > |t|) = 0.0108
Ha: mean(diff) > 0 — Pr(T > t) = 0.9946

Adapted from Fitch Connect Database and Annual Reports.

Appendix 16: Results of LTD and LATAR for 2009 calculated in Stata

Table A. 9: Paired t-test on LTD and LATAR for 2009

Paired t test — LTD (mean in percentage)

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
EU	15	92.466	6.808626	26.3697	77.86295	107.0691
NM	15	80.282	7.457259	28.88184	64.28777	96.27623
diff	15	12.184	9.662461	37.42255	-8.539918	32.90792

mean(diff) = mean(EU - NM) t = 1.2610
Ho: mean(diff) = 0 degrees of freedom = 14

Ha: mean(diff) < 0 — Pr(T < t) = 0.8860
Ha: mean(diff) != 0 — Pr(|T| > |t|) = 0.2279
Ha: mean(diff) > 0 — Pr(T > t) = 0.1140

Paired t test — LATAR (mean in percentage)

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
EU	15	15.97733	3.174833	12.29608	9.167993	22.78667
NM	15	30.79467	1.965227	7.611293	26.57967	35.00966
diff	15	-14.81733	3.1865	12.34126	-21.6517	-7.982969

mean(diff) = mean(EU - NM) t = -4.6500
Ho: mean(diff) = 0 degrees of freedom = 14

Ha: mean(diff) < 0 — Pr(T < t) = 0.0002
Ha: mean(diff) != 0 — Pr(|T| > |t|) = 0.0004
Ha: mean(diff) > 0 — Pr(T > t) = 0.9998

Adapted from Fitch Connect Database and Annual Reports.

Appendix 17: Results of LTD and LATAR for 2010 calculated in Stata

Table A. 10: Paired t-test on LTD and LATAR for 2010

Paired t test — LTD (mean in percentage)

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
EU	15	92.08533	5.875324	22.75503	79.48402	104.6866
NM	15	66.37267	7.715493	29.88198	49.82458	82.92075
diff	15	25.71267	8.486943	32.86979	7.509983	43.91535

mean(diff) = mean(EU - NM) t = 3.0297
Ho: mean(diff) = 0 degrees of freedom = 14

Ha: mean(diff) < 0 Pr(T < t) = 0.9955
Ha: mean(diff) != 0 Pr(|T| > |t|) = 0.0090
Ha: mean(diff) > 0 Pr(T > t) = 0.0045

Paired t test — LATAR (mean in percentage)

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
EU	14	15.52071	3.467965	12.97594	8.028632	23.0128
NM	14	33.21	2.149184	8.041509	28.56697	37.85303
diff	14	-17.68929	4.135877	15.47503	-26.6243	-8.754267

mean(diff) = mean(EU - NM) t = -4.2770
Ho: mean(diff) = 0 degrees of freedom = 13

Ha: mean(diff) < 0 Pr(T < t) = 0.0005
Ha: mean(diff) != 0 Pr(|T| > |t|) = 0.0009
Ha: mean(diff) > 0 Pr(T > t) = 0.9995

Adapted from Fitch Connect Database and Annual Reports.

Appendix 18: Results of LTD and LATAR for 2011 calculated in Stata

Table A. 11: Paired t-test on LTD and LATAR for 2011

Paired t test — LTD (mean in percentage)

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
EU	15	91.68333	6.108959	23.6599	78.58092	104.7857
NM	15	68.85467	7.129638	27.61297	53.56312	84.14622
diff	15	22.82867	8.0711	31.25924	5.517878	40.13945

mean(diff) = mean(EU - NM) t = 2.8284
Ho: mean(diff) = 0 degrees of freedom = 14

Ha: mean(diff) < 0 Pr(T < t) = 0.9933
Ha: mean(diff) != 0 Pr(|T| > |t|) = 0.0134
Ha: mean(diff) > 0 Pr(T > t) = 0.0067

Paired t test — LATAR (mean in percentage)

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
EU	15	17.27933	3.585195	13.8854	9.589854	24.96881
NM	15	33.75333	2.905647	11.25352	27.52134	39.98533
diff	15	-16.474	4.528695	17.53956	-26.18708	-6.760917

mean(diff) = mean(EU - NM) t = -3.6377
Ho: mean(diff) = 0 degrees of freedom = 14

Ha: mean(diff) < 0 Pr(T < t) = 0.0013
Ha: mean(diff) != 0 Pr(|T| > |t|) = 0.0027
Ha: mean(diff) > 0 Pr(T > t) = 0.9987

Adapted from Fitch Connect Database and Annual Reports.

Appendix 19: Results of LTD and LATAR for 2012 calculated in Stata

Table A. 12: Paired t-test on LTD and LATAR for 2012

Paired t test — LTD (mean in percentage)

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
EU	15	89.94133	5.09887	19.74784	79.00534	100.8773
NM	15	67.952	7.001527	27.1168	52.93522	82.96878
diff	15	21.98933	7.502084	29.05545	5.898963	38.0797

mean(diff) = mean(EU - NM) t = 2.9311
Ho: mean(diff) = 0 degrees of freedom = 14

Ha: mean(diff) < 0 Pr(T < t) = 0.9945
Ha: mean(diff) != 0 Pr(|T| > |t|) = 0.0109
Ha: mean(diff) > 0 Pr(T > t) = 0.0055

Paired t test — LATAR (mean in percentage)

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
EU	15	18.01267	3.037758	11.76518	11.49732	24.52801
NM	15	33.83133	2.936527	11.37312	27.53311	40.12956
diff	15	-15.81867	4.021349	15.57462	-24.4436	-7.193732

mean(diff) = mean(EU - NM) t = -3.9337
Ho: mean(diff) = 0 degrees of freedom = 14

Ha: mean(diff) < 0 Pr(T < t) = 0.0007
Ha: mean(diff) != 0 Pr(|T| > |t|) = 0.0015
Ha: mean(diff) > 0 Pr(T > t) = 0.9993

Adapted from Fitch Connect Database and Annual Reports.

Appendix 20: Results of LTD and LATAR for 2013 calculated in Stata

Table A. 13: Paired t-test on LTD and LATAR for 2013

Paired t test — LTD (mean in percentage)

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
EU	15	88.72933	4.289536	16.6133	79.52919	97.92947
NM	15	69.98533	6.784594	26.27662	55.43383	84.53684
diff	15	18.744	6.885744	26.66837	3.97555	33.51245

mean(diff) = mean(EU - NM) t = 2.7221
Ho: mean(diff) = 0 degrees of freedom = 14

Ha: mean(diff) < 0 Pr(T < t) = 0.9917
Ha: mean(diff) != 0 Pr(|T| > |t|) = 0.0165
Ha: mean(diff) > 0 Pr(T > t) = 0.0083

Paired t test — LATAR (mean in percentage)

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
EU	15	18.662	3.144023	12.17675	11.91874	25.40526
NM	15	32.93267	1.902084	7.366739	28.8531	37.01223
diff	15	-14.27067	3.558066	13.78033	-21.90196	-6.639375

mean(diff) = mean(EU - NM) t = -4.0108
Ho: mean(diff) = 0 degrees of freedom = 14

Ha: mean(diff) < 0 Pr(T < t) = 0.0006
Ha: mean(diff) != 0 Pr(|T| > |t|) = 0.0013
Ha: mean(diff) > 0 Pr(T > t) = 0.9994

Adapted from Fitch Connect Database and Annual Reports.

Appendix 21: Results of LTD and LATAR for 2014 calculated in Stata

Table A. 14: Paired t-test on LTD and LATAR for 2014

Paired t test — LTD (mean in percentage)

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
EU	15	85.326	4.666299	18.0725	75.31778	95.33421
NM	15	70.71267	6.33654	24.54131	57.12214	84.30319
diff	15	14.61333	7.113103	27.54893	-.6427547	29.86942

mean(diff) = mean(EU - NM) t = 2.0544
Ho: mean(diff) = 0 degrees of freedom = 14

Ha: mean(diff) < 0 Pr(T < t) = 0.9705
Ha: mean(diff) != 0 Pr(|T| > |t|) = 0.0591
Ha: mean(diff) > 0 Pr(T > t) = 0.0295

Paired t test — LATAR (mean in percentage)

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
EU	15	19.012	3.073458	11.90345	12.42009	25.60391
NM	15	33.74267	1.741705	6.745595	30.00708	37.47825
diff	15	-14.73067	3.626913	14.04697	-22.50962	-6.951713

mean(diff) = mean(EU - NM) t = -4.0615
Ho: mean(diff) = 0 degrees of freedom = 14

Ha: mean(diff) < 0 Pr(T < t) = 0.0006
Ha: mean(diff) != 0 Pr(|T| > |t|) = 0.0012
Ha: mean(diff) > 0 Pr(T > t) = 0.9994

Adapted from Fitch Connect Database and Annual Reports.

Appendix 22: Results of LTD and LATAR for 2015 calculated in Stata

Table A. 15: Paired t-test on LTD and LATAR for 2015

Paired t test — LTD (mean in percentage)

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
EU	15	82.294	5.141588	19.91328	71.26639	93.32161
NM	15	73.98267	6.337088	24.54344	60.39096	87.57437
diff	15	8.311333	7.447282	28.8432	-7.661498	24.28416

mean(diff) = mean(EU - NM) t = 1.1160
Ho: mean(diff) = 0 degrees of freedom = 14

Ha: mean(diff) < 0 Pr(T < t) = 0.8584
Ha: mean(diff) != 0 Pr(|T| > |t|) = 0.2832
Ha: mean(diff) > 0 Pr(T > t) = 0.1416

Paired t test — LATAR (mean in percentage)

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
EU	15	20.61667	3.663377	14.1882	12.7595	28.47383
NM	15	29.95	1.893647	7.334064	25.88853	34.01147
diff	15	-9.333334	4.133173	16.00771	-18.19811	-.4685594

mean(diff) = mean(EU - NM) t = -2.2582
Ho: mean(diff) = 0 degrees of freedom = 14

Ha: mean(diff) < 0 Pr(T < t) = 0.0202
Ha: mean(diff) != 0 Pr(|T| > |t|) = 0.0404
Ha: mean(diff) > 0 Pr(T > t) = 0.9798

Adapted from Fitch Connect Database and Annual Reports.

Appendix 23: Results of LTD and LATAR for 2016 calculated in Stata

Table A. 16: Paired t-test on LTD and LATAR for 2016

Paired t test — LTD (mean in percentage)

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
EU	15	81.764	5.274126	20.4266	70.45212	93.07587
NM	15	74.852	6.23198	24.13635	61.48573	88.21827
diff	15	6.911999	7.889123	30.55444	-10.00849	23.83249

mean(diff) = mean(EU - NM) t = 0.8761
Ho: mean(diff) = 0 degrees of freedom = 14

Ha: mean(diff) < 0 Pr(T < t) = 0.8021
Ha: mean(diff) != 0 Pr(|T| > |t|) = 0.3957
Ha: mean(diff) > 0 Pr(T > t) = 0.1979

Paired t test — LATAR (mean in percentage)

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
EU	15	21.86733	3.769452	14.59902	13.78266	29.952
NM	15	28.63733	1.99449	7.724626	24.35958	32.91509
diff	15	-6.77	4.562611	17.67092	-16.55583	3.015828

mean(diff) = mean(EU - NM) t = -1.4838
Ho: mean(diff) = 0 degrees of freedom = 14

Ha: mean(diff) < 0 Pr(T < t) = 0.0800
Ha: mean(diff) != 0 Pr(|T| > |t|) = 0.1600
Ha: mean(diff) > 0 Pr(T > t) = 0.9200

Adapted from Fitch Connect Database and Annual Reports.

Appendix 24: Results of LTD and LATAR for 2017 calculated in Stata

Table A. 17: Paired t-test on LTD and LATAR for 2017

Paired t test — LTD (mean in percentage)

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
EU	15	80.48667	4.696441	18.18924	70.4138	90.55953
NM	15	75.67	6.516305	25.23754	61.69392	89.64608
diff	15	4.816668	8.075478	31.27619	-12.50351	22.13685

mean(diff) = mean(EU - NM) t = 0.5965
Ho: mean(diff) = 0 degrees of freedom = 14

Ha: mean(diff) < 0 Pr(T < t) = 0.7198
Ha: mean(diff) != 0 Pr(|T| > |t|) = 0.5604
Ha: mean(diff) > 0 Pr(T > t) = 0.2802

Paired t test — LATAR (mean in percentage)

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
EU	15	19.84067	4.088559	15.83492	11.07158	28.60975
NM	15	27.694	2.086638	8.081514	23.21861	32.16939
diff	15	-7.853334	4.886864	18.92674	-18.33461	2.627946

mean(diff) = mean(EU - NM) t = -1.6070
Ho: mean(diff) = 0 degrees of freedom = 14

Ha: mean(diff) < 0 Pr(T < t) = 0.0652
Ha: mean(diff) != 0 Pr(|T| > |t|) = 0.1304
Ha: mean(diff) > 0 Pr(T > t) = 0.9348

Adapted from Fitch Connect Database and Annual Reports.

Appendix 25: Results of LTD and LATAR for 2018 calculated in Stata

Table A. 18: Paired t-test on LTD and LATAR for 2018

Paired t test — LTD (mean in percentage)

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
EU	15	83.24267	4.625868	17.91591	73.32116	93.16417
NM	15	74.98867	6.404854	24.80589	61.25162	88.72571
diff	15	8.253999	8.118236	31.44179	-9.157885	25.66588

mean(diff) = mean(EU - NM) t = 1.0167
Ho: mean(diff) = 0 degrees of freedom = 14

Ha: mean(diff) < 0 Pr(T < t) = 0.8367
Ha: mean(diff) != 0 Pr(|T| > |t|) = 0.3265
Ha: mean(diff) > 0 Pr(T > t) = 0.1633

Paired t test — LATAR (mean in percentage)

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
EU	15	19.72933	3.891232	15.07068	11.38347	28.0752
NM	15	27.06933	2.030194	7.862908	22.715	31.42367
diff	15	-7.34	4.20103	16.27052	-16.35031	1.670313

mean(diff) = mean(EU - NM) t = -1.7472
Ho: mean(diff) = 0 degrees of freedom = 14

Ha: mean(diff) < 0 Pr(T < t) = 0.0512
Ha: mean(diff) != 0 Pr(|T| > |t|) = 0.1025
Ha: mean(diff) > 0 Pr(T > t) = 0.9488

Adapted from Fitch Connect Database and Annual Reports.

Appendix 26: Results of LTD and LATAR for 2019 calculated in Stata

Table A. 19: Paired t-test on LTD and LATAR for 2019

Paired t test — LTD (mean in percentage)

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
EU	14	78.15143	6.323859	23.66172	64.48956	91.8133
NM	14	75.98071	6.846041	25.61554	61.19074	90.77069
diff	14	2.170715	8.823998	33.01638	-16.89237	21.2338

mean(diff) = mean(EU - NM) t = 0.2460
Ho: mean(diff) = 0 degrees of freedom = 13

Ha: mean(diff) < 0 Ha: mean(diff) != 0 Ha: mean(diff) > 0
Pr(T < t) = 0.5952 Pr(|T| > |t|) = 0.8095 Pr(T > t) = 0.4048

Paired t test — LATAR (mean in percentage)

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
EU	14	22.55643	4.556491	17.04883	12.71273	32.40013
NM	14	27.32786	1.825661	6.830996	23.38376	31.27196
diff	14	-4.771429	4.529644	16.94838	-14.55713	5.014272

mean(diff) = mean(EU - NM) t = -1.0534
Ho: mean(diff) = 0 degrees of freedom = 13

Ha: mean(diff) < 0 Ha: mean(diff) != 0 Ha: mean(diff) > 0
Pr(T < t) = 0.1557 Pr(|T| > |t|) = 0.3114 Pr(T > t) = 0.8443

Adapted from Fitch Connect Database and Annual Reports.

Appendix 27: Results of LTD and LATAR for 2020 calculated in Stata

Table A. 20: Paired t-test on LTD and LATAR for 2020

Paired t test — LTD (mean in percentage)

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
EU	14	74.95	6.267904	23.45235	61.40902	88.49098
NM	14	74.90643	6.990976	26.15784	59.80334	90.00951
diff	14	.0435723	9.189735	34.38484	-19.80964	19.89679

mean(diff) = mean(EU - NM) t = 0.0047
Ho: mean(diff) = 0 degrees of freedom = 13

Ha: mean(diff) < 0 Ha: mean(diff) != 0 Ha: mean(diff) > 0
Pr(T < t) = 0.5019 Pr(|T| > |t|) = 0.9963 Pr(T > t) = 0.4981

Paired t test — LATAR (mean in percentage)

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
EU	14	22.95857	4.3244	16.18042	13.61627	32.30087
NM	14	24.00643	1.5358	5.746437	20.68853	27.32432
diff	14	-1.047857	4.198305	15.70862	-10.11774	8.022028

mean(diff) = mean(EU - NM) t = -0.2496
Ho: mean(diff) = 0 degrees of freedom = 13

Ha: mean(diff) < 0 Ha: mean(diff) != 0 Ha: mean(diff) > 0
Pr(T < t) = 0.4034 Pr(|T| > |t|) = 0.8068 Pr(T > t) = 0.5966

Adapted from Fitch Connect Database and Annual Reports.