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MASTER'S THESIS

Impact of the Basel III Liquidity Rules on EU Banks

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Declaration of Authorship

The author hereby declares that he compiled this thesis independently; using only the listed resources and literature, and the thesis has not been used to obtain a different or the same degree.

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Prague, July 29, 2016

Signature

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Abstract

New liquidity rules introduced under the Basel III framework define the Net Stable Funding Ratio (NSFR) that requires banks to possess an adequate long-term liquidity. The NSFR will enter into force on January 1, 2018 and banks are concerned that this regulation will lower their profitability. In this thesis the Basel III liquidity rules are analysed. The research seeks to define characteristics and triggers of the NSFR, using a sample of 500 EU banks. We find that smaller banks (by asset size) are more likely to fulfil the NSFR requirements, so are the banks with higher non-interest share of income and lower capital ratio, among other characteristics. Further, the NSFR's impact on the banks' performance is assessed. It is found that a higher NSFR negatively impacts the return on average equity, although it does not seem to translate into lower returns on average assets nor net interest margin.

JEL Classification	E58, G21, G28, G32
Keywords	NSFR, Basel III, liquidity, banks, EU, profitability, capital rules, regulation

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Abstrakt

Nová pravidla likvidity zavedená v rámci Basel III definují ukazatel čistého stabilního financování (NSFR), který zajišťuje dostatečnou likviditu bank v dlouhodobém horizontu. NSFR vstoupí v platnost v roce 2018 a banky se obávají následného snížení profitability. V této práci analyzujeme likviditní požadavky Basel III a definujeme vlastnosti NSFR. Dále se věnujeme dopadu splnění ukazatele na profitabilitu bank na vzorku více než 500 institucí v EU. Docházíme k závěru, že menší banky (dle velikosti aktiv) spíše splňují NSFR, stejně tak jako banky s vyšším podílem neúrokových příjmů a nižší kapitálovou přiměřeností. Také potvrzujeme, že vyšší NSFR negativně ovlivní návratnost průměrného vlastního kapitálu, nicméně vyšší hodnoty ukazatele se nepromítají do nižších výnosů z průměrných aktiv, ani do čisté úrokové marže.

Klasifikace	E58, G21, G28, G32
Klíčová slova	NSFR, Basel III, likvidita, banky, EU, profitabilita, kapitálová přiměřenost, regulace

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Acronyms

ASF Available Stable Funding

BCBS Basel Committee for Banking Supervision

BIS Bank for International Settlements

CNB Czech National Bank

CRD Capital Requirement Directive

CRR Capital Requirement Regulation

ECB European Central Bank

EU European Union

G-SIB Globally Systematically Important Bank

HQLA High Quality Liquid Assets

LCR Liquidity Coverage Ratio

NIM Net Interest Margin

NSFR Net Stable Funding Ratio

OLS Ordinary Least Squares

QIS Quantitative Impact Studies

ROAA Return on Average Assets

ROAE Return on Average Equity

RSF Required Stable Funding

SIFI Systematically Important Financial Institution

SMEs Small and Medium Enterprises

TBTF Too Big To Fail

WLS Weighted Least Squares

Master's Thesis Proposal

Author:	Bc. Dana Klímová
Supervisor:	PhDr. Boril Šopov, MSc., LL.M.
Defense Planned:	September 2016

Proposed Topic:

Liquidity measurement tools of the Basel III

Motivation:

The banking regulations have been pressuring the banks in the banking union in order to make them stronger in good times and prepare mechanisms for crisis solutions (good overview of the changes was studied by the KPMG that also came up with "pressure index" of the new regulations in past and for the future). Each country has regulations of the banking sector on a different level and overall harmonization is more than necessary since the sector is interconnected, especially within the Eurozone. Eurozone has recently introduced the SSM and SRM. The most crucial part of these new Basel 3 regulations is the introduction of new capital requirements as well as new liquidity and solvency regulations. In this thesis I want to focus on the liquidity measures as it is fairly new inclusion to banking regulations and it will influence the financial and operational positions of commercial banks. The liquidity regulations are still in development and therefore it will be interesting to research the options of measuring liquidity throughout the Eurozone and possibly come up with measures for its influence on the banks. The Liquidity Coverage Ratio (LCR) measuring the short-term banks' liquidity was put in use in the beginning of 2015, measuring the high quality liquid assets (HQLA) to the cash outflow in banks. Although, the HQLA are not specified and measurements differ from country to country and from bank to bank. Long-term liquidity is measured by the net stable funding ration (NSFR) that should start functioning in 2016 based on report from banks on their liquidity position coming up in December 2015. According to the EY, BCG and McKinsey reports this part of banking regulation interconnects with other regulations, it is fairly new and will certainly have a significant influence on the commercial banks' positions as well as on the credit rates. It will also be interesting to find different measures of liquidity in banks and compare them. It is an important part of the CRD IV regulation that has been quiet overshadowed by the capital requirements. Paper *The Liquidity Coverage Ratio: the need for further complementary ratios?* also suggests there should be additional liquidity ratios as additions to the LCR and NSFR as these include multiple gaps.

Hypotheses:

1. Hypothesis #1: Liquidity measurements differ among Eurozone banks not allowing harmonization of banking regulations in the union. HQLA not specifically identified allowing for banks to adjust their results to their advantage.
2. Hypothesis #2: Most of the Eurozone commercial banks would fail fulfilling the liquidity requirements measured by the LCR and NSFR if implemented to 100% right away, therefore future changes need to be made by the banks.

3. Hypothesis #3: New liquidity measures will have crucial influence on the financial position of the banking sector and on the credit rates.

Methodology:

The hypotheses will be tested by meta-analysis of multiple researches and studies published by consulting companies above mentioned. These researches focused on the change of the credit rate with the increased liquidity pressure on the banks. The goal is to study these in detail and come up with one comprehensive measure of the impact of future reforms. Moreover, research will be conducted on the different ways of measuring HQLA and case studies of banking union banks will be made. One option is also to consider Czech banks and look on how these would comply with new liquidity measures since data might be more available. A test has been conducted by the ECB some time ago testing whether banks comply with new regulations and especially capital requirements. Banks are now collecting data needed for LCR and NSFR improvements and as soon as these will be published I want to look closely at the results and conclude what is the classification of HQLA and possible issues banks will face with that.

Expected Contribution:

First part of the contribution would be a meta-analysis of reports and articles on the topic as well as comparison of various impact studies outlining the impact of the regulations on individual banks as well as on the banking sector in general (eg. Credit rates). Furthermore the focus will be on the specification on HQLA and the options variety of LCRs derived from these by commercial banks. Last but not least, the further harmonization of liquidity measurement tools for the future will be suggested in order to have an efficient CRD IV as planned.

Outline:

First part will include an analysis of the LCR and NSFR, qualification of the HQLA and the regulations connected with the liquidity measurements. Further part of the thesis will include some case studies analysing different approaches of commercial banks toward liquidity measurements and their compliance with the LCR and NSFR. Additionally the impact of the liquidity requirements, especially on credit rates, will be assessed based on the studies of selected consulting companies and ECB forecasts. Last but not least, additional measures or changes to existing ones will be suggested.

Core Bibliography:

1. Capital Requirements Directive IV a Basel 3 – Přínosy, nová pravidla a jejich dopad, Tomáš Šťastný, Tomáš Čech, ACTA OECONOMICA PRAGENSIA 6/2013
2. AGGREGATE REPORT ON THE COMPREHENSIVE ASSESSMENT, European Central Bank, October 2014, ISBN 978-92-899-1464-2
3. Evolving Banking Regulation: From Design to Implementation, KPMG, March 2015
4. Jan Willem van den End & Mark Kruidhof, 2012."Modelling the liquidity ratio as macroprudential instrument,"
5. DNB Working Papers 342, Netherlands Central Bank, Research Department.
6. Jeanne Gobat & Mamoru Yanase & Joseph Maloney, 2014.IMF Working Papers, 14/106, International Monetary Fund.
7. Patty Duijm & Peter Wierts, 2014."The Effects of Liquidity Regulation on Bank Assets and Liabilities," Tinbergen Institute Discussion Papers 14-018/IV/DSF72, Tinbergen Institute.

8. Ojo, Marianne, 2015. "The unintended consequences and challenges of the Basel III Leverage Ratio: supplementary leverage ratios," MPRA Paper 61330, University Library of Munich, Germany.
9. http://www.mckinsey.com/insights/financial_services/basel_iii_now_the_hard_part_for_european_banks
10. https://www.bcgperspectives.com/search?SearchQuery=liquidity%20coverage%20ratio

Author **Supervisor**

1 Introduction

The net stable funding ratio (NSFR) was introduced by the BCBS in 2010 as a part of the liquidity rules included in the Basel III framework. In the EU, banks will have to follow the NSFR requirement defining whether they possess sufficient amount of long-term liquidity from 2018 onwards. Basel III also includes the Capital Requirements and Leverage Ratio, which have been thoroughly studied by researchers as well as consulting companies and deliberated by banks. Despite its potential impact, the liquidity rules that are transposed to EU law trough the CRR/CRD IV have not been extensively researched, and there is a need for further study of this part of the Basel III Framework. New regulations are seldom welcomed by the banking sector, and Basel III is no exception; although additional regulations are inevitable after the Great Financial Crisis (GFC). The banks in the EU and elsewhere have raised concerns that fulfilment of the NSFR will lead to lower profits. Moreover, banks and financial institution have protested that the NSFR is more compatible with certain business specializations and a specific balance sheet structure, and therefore should offer a more nuanced approach so that it may be better tailored to particular types banks. The BCBS has been conducting assessments of the rules and implemented some changes to the regulation in 2014.

The aim of this thesis is to find the relationship between the NSFR and banks' performance indicators: return on average assets (ROAA), return on average equity (ROAE) and the net interest margin (NIM). This is analysed by applying the OLS and WLS methods and data withdrawn in 2014 from more than 500 EU banks. The 3 models are further supported by the model analysing drivers (representing the balance sheet structure) of the NSFR and looking at whether small banks and a certain specific type of a bank is more likely to fulfil the NSFR than other. The findings have capacity to fill the gap in the literature concerning the impact of the new liquidity rules on the EU banks that are told to be influenced the most. The outcome is expected to support the banks' concerns that the fulfilment of the NSFR will indeed lead to lower profits caused primarily by the needed change of a balance sheet structure. Additionally, we expect smaller banks to be more likely to fulfil the rule as they often participate in less risky activities than the larger banks and maintain their liquidity to a greater extent.

The thesis is structured as follows: Chapter 2 gives a review of the relevant literature that inspired this work. Chapter 3 defines liquidity and explains the liquidity risk and its management. Chapter 4 starts to focus on the Basel III framework including primarily the capital requirements and giving a context of where the liquidity rules fit in the regulations. The NSFR and LCR are researched in detail in Chapter 6 where the ratios are defined and a detail of its reporting is given. In Chapter 7 we start the empirical part of the thesis beginning with the methodology, followed by variables and data description in Chapter 8. The crucial part of the thesis is Chapter 9 that presents the results of the empirical analyses and detailed deductions from the research. Chapter 10 is then dedicated to a short overview of the situation in the Czech Republic and a brief look at the position of selected Czech banks. At last, Chapter 11 summarizes the findings.

2 Literature Review

Before getting to the factual background and the actual empirical part of the thesis, this chapter reviews the most relevant literature concerning the topic of new liquidity measurement tools in Basel III with focus on the NSFR and its impact on the banking sector in Europe and beyond.

The NSFR was defined and has been improved and implemented by the BCBS that outlines definition, recommendations and requirements as well as specific balance sheet factors for determining the ratio in its reports where the most recent is *The Net Stable Funding Ratio* from 2014 that replaced the original report from 2010 (BCBS, 2014). BCBS has also been monitoring the potential impact of the liquidity regulations where banks voluntarily participated in a sample assessment by the Macro Assessment Group. The BCBS official documents on the Basel III regulation are the main factual source for the theoretical chapters. It has been often brought up by the financial sector that the new liquidity requirements are not suitable for all banking institutions as the individual business models differ, moreover the sector has been raising complaints that such new regulations will not strengthen their positions, but will contrarily lead to decline in financial institutions' profitability. The effect of Basel III liquidity standards has been a relatively scarcely researched topic, as the studies concerning Basel III often focus on capital and leverage requirement despite unsufficient liquidity being an important trigger of the 2008 great financial crisis. A. Dietrich, K. Hess and G. Wanzenried raise this particular issue of NSFR importance in their article *The good and bad news about the new liquidity rules of Basel III in Western European countries* (Dietrich, Hess, & Wanzenried, 2014), where they analyse characteristics and drivers of the NSFR for a samle of 921 Western European banks between 1996 and 2010. The authors made a good approximation of the NSFR from the banks' balance sheets raw data, since the NSFR has not been publicly reported yet. Authors chose bank specific (financial), ownership and market data to show what drivers determine whether a bank fulfils the NSFR, historically. Their second model specification then was the impact of those variables together with the NSFR on the banks' profitability measures. For the estimation, GMM was used to yield robust results. The article concludes that the majority of studied banks had not been fulfilling the NSFR criteria, in particular larger and faster growing banks, and those active in investment banking and other risky activities. Similar topics were also raised in the IMF Staff Position Note *Impact of Regulatory Reforms on Large and*

Complex Financial Institutions (Ötker-Robe & Pazarbasioglu, 2010), right after the NSFR issuance. This paper studies particularly the ASF and RSF factors assigned to the relevant balance sheet items (although some of those were changed in the 2014 NSFR update). The authors also pay a close attention to the fact that the core issue for the banks will be the impact of such requirements on their business models and the need of some crucial changes that could be very costly. Indeed the models confirm these theories that banks will most likely have to adjust their business strategies in favour of more stable funding. The IMF Working Paper *The NSFR: Impact and Issues for Consideration* (Gobat, Yanase, & Maloney, 2014) brings up an idea of potential specific NSFR surcharges for specific banks in order to level the standardization of the liquidity rules. Such surcharges would be based on the interbank activities and importance of specific banks for the financial system. The NSFR impact is further researched for the US sector in the *The Net Stable Funding Ratio of US Bank Holding Companies: A Retrospective Analysis* (Arvanitis & Drakos, 2015) where the historical results confirm that small banks have higher NSFR because larger banks can bear riskier portfolios.

The authors of above mentioned studies used the IBCA Bankscope database as the source of the balance sheet bank specific data as it is the most comprehensive database covering banks with 90% of the total world banking sector assets. In the following chapters of this thesis we study all potential NSFR drivers as well as its impact on the sample of the EU banks that are told to be influenced by the liquidity rules most significantly.

3 Liquidity

3.1 Definition

Liquidity in its economic sense is defined as "*the ability of an economic agent to exchange his or her existing wealth for goods and services or for other assets"* (Nikolau, 2009, p. 10). Funding liquidity in a bank is understood as the ability to pay all its obligations in a timely manner without incurring any large losses. In an extreme case of a bank's need for liquidity, it is the central bank of the country (or the ECB in the Eurozone) that acts as a liquidity provider. Central bank is then liquid if it is capable of injecting the liquidity into the financial system when needed. According to (Nikolau, 2009, p. 13) "*an entity is liquid as long as inflows are bigger or at least equal to outflows"*. Funding liquidity is based on institution's core activities and can often be triggered by a maturity mismatch between its lending and depositing.

When a bank is becoming illiquid, it can raise liquidity from multiple sources. First would be the depositors, then market (through selling assets, securitization), interbank lending (when liquidity surplus banks transfer funds to liquidity deficit banks) and as a last resort the central bank, operating according to its monetary policy.

3.2 Liquidity risk

Accordingly, liquidity risk is when a bank (or an institution) is not able to fulfil its obligations in a timely manner. *"Thus, funding liquidity risk is the risk that firm will not be able to meet its current and future cash flow and collateral needs, both expected and unexpected, without materially affecting its daily operations or overall financial condition"* (Lopez, 2008, p. 3). Funding liquidity risk is a probability that a bank will not be able to cover their liabilities, the bigger the probability of such failure, the bigger the funding liquidity risk. Wrong management of such risk and lack of focus on this issue was one of the main triggers of the financial crisis in 2008. Regulators are now trying to mitigate all central bank liquidity risk, market liquidity risk and certainly the funding liquidity risk. All of these are closely interconnected. Special attention is given to the G-SIBs as those often follow the too big to fail (TBTF) theory and behave riskier. Also their illiquidity would cause significant issues on the entire market.

3.3 Measurement and Management

Managing liquidity risk in a bank is one of the major tasks in order to maintain stability while conducting daily operations and assuring the bank will be able (in a certain set period) to meet its funding needs. The firm needs to incorporate both expected and unexpected funding demands that may occur, including internal costs and costs arising from unexpected stress situations on the market. Active management assures that the bank always have extra liquidity even in good times, while maintaining its operations to reach profitability targets. "*The goal of liquidity risk management is to identify potential future funding problems. To do so, a firm must assess the expected value of its net cash flows and the fungibility of its assets*" (Lopez, 2008, p. 8).

Before CRD IV there was no common measurement of bank's liquidity in the EU. Banks use multiple measurements at the same time to assess the risk. Liquidity ratios based on banks' balance sheet positions are a main source of funding liquidity risk information. Some examples of liquidity ratios are liquid asset ratio (liquid assets ÷ total assets), net loans to total or customer deposits, net loans to stable funds or for instance more specific interbank assets to liabilities. Apart from ratios, banks are widely using stress testing in order to project how the bank would react to a crisis situation. Firm specific activities as well as market behaviour stress tests should be carried out on an on-going basis. More sophisticated measurement tools we know are gap analysis that is used to measure credit risk together with the liquidity risk, and maturity ladder method used to capture the maturity mismatch in a bank. Together with stress testing, one of the newer methods is Value at Risk that is used to measure the maximal possible losses in a set time period that are probable to occur, at set confidence level.

Such dispersion of methods used to measure the banks' liquidity made it complicated for the regulators to have an overview how all the banks are doing in the financial system, that was one of the reasons to set a mandatory system-wide liquidity ratios, the LCR and NSFR (via CRR/CRD IV in the EU).

4 Basel III Framework

4.1 Basel III rules

In the wake of the Great Financial Crisis (GFC) of 2008-2009 the governments and regulators had to revise and figure out what went wrong and whether there are any possible steps to be taken in order to prevent such event from repeating itself. The Basel Committee on Banking Supervision (BCBS) decided to update the rules levied on the banking sector by strengthening the micro prudential regulation associated with the previous Basel Accords (such as Basel II) while also adding a macroprudential overlay. Basel III is aiming on increased stability of the individual banks as well as the financial sector as a whole. The Basel III proposal divided the current Capital Requirement Directive (CRD) into two legislative instruments: a Directive (CRD IV) and a Regulation (Capital Requirement Regulation – CRR), collectively known as the "CRD IV package". The revisions to Basel II and new proposals for enhancement of capital strength and liquidity requirements started in 2009 and was finalized in 2011, although updates to the liquidity requirements were made in January 2014 and expected to be further updated in upcoming years (NSFR).

Basel Accord are recommendations on banking laws and regulations applying to the BCBS members. [1] Based on the lessons learned from the crisis, Basel III newly aims on mitigating the liquidity risk, systemic and procyclical risk and counterparty risk for derivatives. Basel III in general consists of two main parts:[2]

1. Strengthening the global capital framework – Capital requirements and buffers, tightened capital definition, the introduction of counterparty credit risk for derivatives and the new leverage ratio.

[1] Respective central banks or financial supervisors of Argentina, Australia, Brazil, Canada, China, European Union, Hong Kong SAR, India, Indonesia, Japan, Korea, Mexico, Russia, Saudi Arabia, Singapore, South Africa, Switzerland, Turkey, United Kingdom and United States.

[2] Framework can be divided differently, eg. in 3 sections: Capital requirements, liquidity requirements and systemic risk and interconnectdness as in (McNamara, Wedow, & Metrick, 2014), or governance.

1. Introducing a global liquidity standard – The liquidity coverage ratio (LCR) and the net stable funding ratio (NSFR).

Both of these sections include multiple interconnected sub-sections. The requirements together should enhance the financial stability of the banking system and prepare it for potential crisis situation. Moreover it should mitigate the systemic risk that might have been an important aspect leading to the GFC in 2008.

4.2 Capital requirements

The most crucial change to the previous framework is the introduction of increased capital levels to be held by the banks. Existing rules are impacted in three ways: Increased capital requirements and buffers, tightened capital definition and the introduction of counterparty credit risk for derivatives. BCBS divides capital requirements into 3 pillars. Pillar 1 contains the capital, risk coverage, and leverage. Pillar 2 is about the risk management and supervision and Pillar 3 about market discipline. These three pillars are applicable to all banks. As addition to that, the BCBS developed extra rules for the Systematically Important Financial Institutions (SIFIs), for detail, see Appendix A: Basel III summary table. Although we follow a structure more applicable for individual banks when understanding the Basel III: capital requirements and definition, capital buffers, risk coverage and the leverage ratio. Basel III came up with a phase-in plan making it feasible for the banks to adjust their activities to meet the new requirements. Detailed phase-in timeline can be seen in the Figure 4.1 and relevant ratios and rules are outlined in following sections.

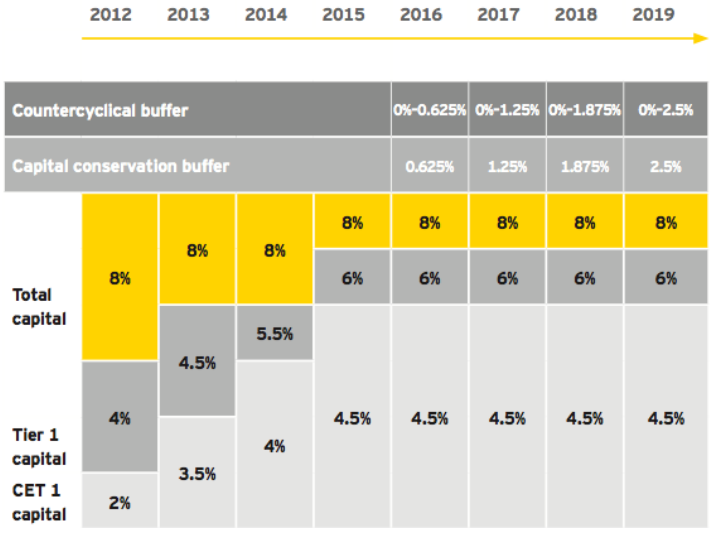


Figure 4.1: Phase-in arrangements

Source: Basel III: Ernst & Young Approach

4.2.1 Capital definition and new minimums

The CRD IV package (from here on as "CRD IV") seeks to increase the quality of eligible capital as well as to increase the quantity of capital held. It does so by setting significantly higher minimum capital ratios. Total regulatory capital consists of the sum of following elements:

1. Tier 1 Capital (going-concern capital):
    a. Common Equity Tier 1 (CET 1)
    b. Additional Tier 1
2. Tier 2 Capital (gone-concern capital)

Instruments have to fulfil set of criteria before being included in a relevant category. The complete and detailed set of these criteria can be found in (BCBS, 2010). Capital is divided into tiers according to the following characteristics: Loss absorbency, permanency, ranking for repayment on winding up, obligation to pay dividends or interest. Higher quality forms of capital satisfy these conditions to a greater extent. CET 1 Capital represents the highest quality capital. It absorbs losses in a going concern and, among other characteristics, does not have an obligation to pay dividends. Among CET 1 elements are for example the ordinary share capital, share premium or retained earnings. Additional Tier 1 instruments are for example the perpetual non-cumulative shares. Tier 2 capital is eg. perpetual cumulative preference shares and perpetual subordinated debt.

"All elements above (1a, 1b and 2) are net of the associated regulatory adjustments and are subject to the following restrictions:

- *CET 1 must be at least 4.5% of risk-weighted assets at all times.*
- *Tier 1 Capital must be at least 6.0% of risk-weighted assets at all times.*
- *Total Capital (Tier 1 Capital plus Tier 2 Capital) must be at least 8.0% of risk- weighted assets at all times"*

(BCBS, 2010, p. 12).

Basel III also introduces additional capital deductions that should be made to capital resources to reflect capital that may not be available to the firm or assets of uncertain value. Deductions at most influence the intangibles, holding of financial instruments, deferred tax assets and minority interest.

4.2.2 Capital buffers

In order to reduce the pro-cyclicality, CRD IV introduces 3 new capital buffers: Capital conservation buffer, Countercyclical buffer and Systemic buffers. Here are some definitions setting the ground floor for the buffer theory. Individual buffers are supposed to complement each other and prevent all relevant issues causing financial crises.

Capital conservation buffer *"is designed to ensure that banks build up capital buffers outside period of stress, which can be drawn down as losses are incurred. A capital conservation buffer of 2.5%, comprised of Common Equity Tier 1, is established above the regulatory minimum capital requirement. Such buffer can be utilized only in exceptional circumstances" (BCBS, 2010, p. 54, 55).*

Countercyclical buffer *"is an institution specific buffer of CET 1 capital. It aims to ensure that banking sector capital requirements take account of the macro-financial environment in which banks operate. It will be deployed by national jurisdictions when excess aggregate credit growth is judged to be associated with a build-up of system-wide risk to ensure the banking system has a buffer of capital to protect it against future potential losses"* (BCBS, 2010, p. 57). It will be based on a weighted average of buffer rates for each member state and thus takes exposure location into account. Buffer rates will be between 0% and 2.5% (KPMG, 2013).

Systemic buffers *"can be divided into 3 buffers: Global Systematically Important Institutions' (G-SII) buffer is a mandatory one of 1% to 3.5% CET 1 and applies to banks deemed to be G-SII. The criteria determining G-SII status include size, cross border activities and interconnectedness. This includes domestically important institutions as well as EU important institutions and this buffer has a limit of 2% CET 1"* (KPMG, 2013, p. 7). Regulatory authorities can also include additional buffers in their requirements for so called "other" significant institutions in their specific countries (banks that are important for the domestic market). These buffers are supposed to prevent spreading the risk in the market and cause other banks' failures.

4.2.3 Risk Coverage

"CRD IV strengthens the requirements for the management and amount of capital to be held against counterparty credit risk (CCR). The regulatory changes include an additional capital charge for potential losses associated with deterioration in the credit quality of counterparties" (KPMG, 2013, p. 4). The CRD IV introduces a new capital requirement for credit valuation adjustment (CVA). CCR will be integrated in market-risk VaR through CVA. In general Basel III changes in CCR will increase the risk weighted assets (RWA) of the banks. According to the EBA report on Basel III monitoring issued in March 2013, the CVA risk capital charge lead to an 8.4% increase in total RWA for a sample of 85 Group 1 banks that provided the relevant data.

4.2.4 Leverage ratio

The Committee agreed to introduce a simple, transparent, non-risk based leverage ratio that is calibrated to act as a credible supplementary measure to the risk based capital requirements. The basis of calculation is the average of the monthly leverage ratio over the quarter based on the definitions of capital (the capital measure) and total exposure (the exposure measure). The leverage ratio is intended to achieve the following objectives set in (BCBS, 2010):

- Constrain the build-up of leverage in the banking sector; and
- Reinforce the risk-based requirements with a simple, non-risk based "backstop" measure.

The leverage ratio is calculated as follows: $Leverage\ Ratio = \frac{Tier\ 1\ Capital}{Total\ Exposure} \geq 3\%$

"It should act as a simple and non-risk based measure that would prevent banks from building up excessive on- and off-balance sheet leverage" (KPMG, 2013, p. 4). The leverage ratio becomes binding in January 2017.

4.3 Liquidity ratios: Where do NSFR and LCR fit in

The liquidity and leverage measures are being introduced via Basel III framework and in the EU as a part of the CRD IV. The most discussed requirements from this directive are the capital rules. In hand with the capital minimums, BCBS introduces the liquidity ratios in order to support the stability of the banking sector, because even though minimum capital is a necessary condition, it wouldn't be sufficient by itself. The GFC in 2008 showed that in times of crisis banks need a quick liquidity. Before Basel III there was no harmonized standard that would ensure a level playing field in that case. The liquidity measures are discussed to be complementary, but maybe also contradictory to the capital measures (discussed further). The BCBS believes that together with the capital minimums and capital buffers the banking sector should become more stable, monitored and prepared for possible crisis scenario.

The two new ratios that were introduced are the Liquidity Coverage Ratio (LCR) and the Net Stable Funding Ratio (NSFR) ensuring that banks meet their liquidity needs in the short term and long term, respectively.[3] The minimum LCR will be phased in from 2015 to 2019 and the NSFR is expected to be binding in January 2018.

[3] Details of the LCR and NSFR are outlined and discussed in Chapter 6 of the thesis

5 Banking regulations' development

The crisis revealed gaps in the banking sector regulations and the need for an update of the capital, systemic and liquidity risk measures from Basel II. BCBS decided to gradually strengthen the regulation by the introduction of Basel III in 2010 that focuses on the changes of regulations lowering the capital, systemic and liquidity risk. Basel II rules are applied in the EU through the existing CRD. It takes the form of a Directive (requires implementing legislation to be passed by each Member State in order for it to become law), and allows Member States to use discretion in the way in which it is implemented at a national level. Basel III is implemented within the EU through a combination of a new Directive which contains rules on the new capital conservation and counter-cyclical buffers (the "CRD IV Directive"), and new Regulation which captures quality and quantity of capital, counterparty risk rules and liquidity and leverage management (the "CRR IV Regulation"). A Regulation becomes law in each Member State without further implementing legislation being required. The proposed standards were issued by the Committee in mid-December 2010 (and were subsequently revised). The December 2010 versions were set out in Basel III: International framework for liquidity risk measurement, standards and monitoring and *Basel III: A global regulatory framework for more resilient banks and banking systems*. The enhanced Basel framework revised and strengthen the three pillars established by Basel II. (BCBS, 2015)

The 2008 financial crisis was the real test of the insufficient banking regulations. "*During the early "liquidity phase" of the financial crisis, many banks – despite adequate capital levels – still experienced difficulties because they did not manage their liquidity in a prudent manner"* (BIS, 2010, p. 3). Many central banks had to intervene to save systematically important institutions, among other. Banks learned that illiquidity can evaporate quickly and last even for extended period of time. The difficulties experienced by some banks were due to lapses in basic principles of liquidity risk management. In response, as the foundation of its liquidity framework, the Committee in 2008 published *Principles for Sound Liquidity Risk Management and Supervision*. *"The Sound Principles provide detailed guidance on the risk management and supervision of funding liquidity risk and should help promote better risk management in this critical area, but only if there is full implementation by banks and supervisors. As such, the Committee will coordinate rigorous follow up by supervisors to ensure that banks adhere to these fundamental*

principles." (BCBS, 2010, p. 8) In order to build on the Sound Principles, the Committee decided to develop the 2 ratios to set an international standard in terms of the funding liquidity. This time the ratios are set clearly with a border number that cannot be excessed and in the EU is enforced through a mandatory law.

6 LCR and NSFR

Both ratios were developed as part of the Basel III liquidity measures and are complementary to each other. The LCR describes the short-term liquidity measurements through the holding of a sufficient amount of the high quality liquid assets to survive a 30-day stress scenario. On the other hand the NSFR is aiming for the resilience of a bank in a 1-year horizon using its more stable sources of funding. NSFR provides a sustainable structure of assets and liabilities of the banks on an ongoing basis. LCR will be adopted in phases from 2015 until January 2019, starting at 60% and rising incrementally to 100% by 2019.

The NSFR will be binding to be 100% in January 2018. Both ratios are additionally complementary to the capital requirements that would not be sufficient by themselves. Discussions about the impact of those to ratios on the functioning and profitability of banks lead to revision and loosening of the requirements in 2014 (original recommendation from 2010). Studies by the BIS and MAG show that most participating banks comply with the regulations and reach given thresholds, although the more systematically important banks seem to have lower ratios due to participation in riskier activities. In the following sections we will focus solely on these two ratios as the Basel III liquidity measurement tools, what drives them and what could the potential impact be on the European banking sector.

6.1 LCR

The liquidity coverage ratio (LCR) will require banks to have sufficient high-quality liquid assets to withstand a 30-day stressed funding scenario that is specified by supervisors. The ratio is new although many jurisdictions have maturity mismatch reporting requirements (e.g. Central Bank of Ireland Liquidity Reporting Requirements) (KPMG, 2013). This standard aims to ensure that a bank has an adequate stock of unencumbered high quality liquid assets (HQLA).

The LCR is expressed as:

$$LCR = \frac{Stock\ of\ HQLA}{Total\ net\ cash\ outflows\ over\ the\ next\ 30\ calendar\ days} \geq 100\ \%$$

The ratio has 2 components, the value of HQLA and the total net cash outflows, each being defined in detail by the BCBS. The standard requires that the value of the ratio will be at least 100% for all banks, absent periods of stress. In the periods of stress banks may use their HQLA to meet their liquidity obligations and thereby allow the ratio to fall below 100%. Banks are expected to meet the LCR minimum on an ongoing basis and at all times hold a stock of HQLA at least equal to their net cash outflows. LCR will be reported at least monthly with the capacity to report weekly/daily and is phased-in gradually. The LCR minimum was set to 60% on 1 January 2015 and will rise in equal annual steps to reach the 100% on 1 January 2019.

Table 6.1: LCR phase-in arrangement

	1/1/2015	1/1/2016	1/1/2017	1/1/2018	1/1/2019
Minimum LCR	60%	70%	80%	90%	100%

Source: (BCBS, 2013)

"The scenario for this standard entails a combined idiosyncratic and market-wide shock resulting in multiple shortcomings. It incorporates many shocks that happened during the GFC (e.g. run-off of a proportion of retail deposits or a partial loss of unsecured wholesale funding capacity) into one significant stress scenario" (BCBS, 2013, P. 12). Such stress test is the minimum supervisory requirement set for the banks, each bank should also perform internal stress tests in order to define the amount of liquid assets to hold above the minimum in order to cover longer periods of illiquidity stress than 30 calendar days.

6.1.1 HQLA

The numerator of LCR is the stock of High Quality Liquid Assets. To be classified as "HQLA", assets have to be unencumbered and liquid in the markets in the periods of stress; they can be easily and immediately converted into cash at little or no loss of value. Such assets are generally eligible to use in central banking operations, except in limited circumstances. The liquidity of assets depends on the stress scenario, period length and the volume to be converted, although some fundamental and market characteristics can be derived for certain assets, according to the Basel Committee on Banking Supervision's report *Basel III: The Liquidity Coverage Ratio and liquidity risk monitoring tools*:

"Fundamental characteristics:

- *Low risk*
- *Ease and certainty of valuation*
- *Low correlation with risky assets.*
- *Listed on a developed and recognised exchange.*

Market-related characteristics:

- *Active and sizable market*
- *Low volatility – Prices of assets should be relatively stable.*
- *Viewed as safe at times of "flight to quality""*

(BCBS, 2013, p. 13-14).

Apart from being generally unencumbered, other operational requirements are outlined by the BCBS. *"Unencumbered means free of legal, regulatory, contractual or other restrictions on the ability of the bank to liquidate, sell, transfer, or assign the asset"* (BCBS, 2013, p. 15). *"The stock of HQLA should be well diversified within the asset classes themselves (except for sovereign debt of the bank's home jurisdiction or from the jurisdiction in which the bank operates; central bank reserves; central bank debt securities; and cash)"* (BCBS, 2013, p. 17).

HQLA are divided into 3 categories: Level 1 Assets, Level 2A Assets and Level 2B Assets, according to the level of liquidity. Level 1 Assets have to be minimum 60% of the HQLA amounts with Level 2 taking maximum 40% of the total amount. Details and examples of individual categories are outline in Table 6.2. BCBS defines an assessment of eligibility for alternative liquidity approaches (ALA) for jurisdictions with insufficient HQLA. Some specified criteria have to be met to qualify for one of the options of an alternative treatment.[4]

[4] Criteria and potential options for alternative treatment are outlined in detail in the BCBS document *Basel III: Liquidity Coverage Ratio and liquidity risk monitoring tools* from 2013

Table 6.2: Categories of High Quality Liquid Assets

	Level 1 Assets	Level 2A Assets	Level 2B Assets
Proportion of HQLA rule	Unlimited share of the pool (Min. 60%)	Max. 40%	
			Max. 15%
Characteristics	Highly liquid (generally those risk-weighted at 0% under the Basel III standardized approach for capital)	Generally include assets that would be subject to a 20% risk-weighting under Basel III	Least liquid assets in the HQLA stock, risk-weighted above 20%
Haircuts	0%, but based on, among other, their duration, credit and liquidity risk & typical repo haircuts	15% haircut is applied to the current market value of each Level 2A asset held in the stock of HQLA	RMBS[5] rated AA or higher (subject to 25% haircut), Corporate debt between A+ and BBB- (50% haircut), common equity shares (50% haircut) – of specific conditions
Examples	Cash, Central Bank Reserves, Sovereign Securities of specific conditions	Central bank Securities, Sovereign Securities of specific conditions, Covered Bonds, Corporate debt rated AA- or higher (including commercial paper)	

Source: Basel Committee for Banking Supervision (BCBS, 2013, Annex 4), Author

[5] Residential mortgage-backed securities

6.1.2 Total net cash outflows

"The term total net cash outflows is defined as the total expected cash outflows less the total expected cash inflows in the specified stress scenario for the period of subsequent 30 calendar days. Total expected cash outflows are calculated by multiplying the outstanding balances of various categories or types of liabilities and off-balance sheet commitments by the rates at which they are expected to run off or be drawn down. Total expected cash inflows are calculated by multiplying the outstanding balances of various categories of contractual receivables by the rates at which they are expected to flow in under the scenario up to an aggregate cap of 75% of total expected cash outflows" (BCBS, 2013, p. 26).

The term is expressed as:

Total net cash outflows over the next 30 calendar days = Total expected cash outflows – Min {total expected cash inflows; 75% of total expected cash outflows}

Net cash outflow under stressed conditions in LCR is based on run-off and inflow hypotheses; deposits are treated favourably.

6.2 NSFR

The NSFR aims to ensure that banks have stable funding in place to support operations during a stressed period of one year. Funding will need to be matched in 3-month time buckets out to 1 year (KPMG, 2013). NSFR, measuring the availability of long term (1 year) liquidity, is complementary measure to the short term LCR (30 days period). The NSFR should ensure bank's resilience to the year-long failure of the wholesale funding market. This ratio does not have a phase-in implementation process and so it will become a minimum standard by 1 January 2018. European Commission will have to present a draft of the legislation to the Parliament and the Council by December 31st 2016 or otherwise decide not to implement the NSFR alongside the LCR. In 2010, the Committee agreed to review the development of the NSFR over an observation period. In this period the BCBS was improving the NSFR design in terms of "*(i) the impact on retail business activities; (ii) the treatment of short-term matched funding of assets and liabilities; and (iii) analysis of sub-one year buckets for both assets and liabilities"* (BCBS, 2014, p.6). It aims to better match the duration of bank's assets and funding by promoting institutions' liquidity risk profiles towards more stable long term funding activities. *"The NSFR is defined as the amount of available stable funding relative to the amount of required stable funding. This ratio should be equal to at least 100% on an ongoing basis. "Available*

stable funding" is defined as the portion of capital and liabilities expected to be reliable over the time horizon considered by the NSFR, which extends to one year" (BCBS, 2014, p. 6).

The NSFR formula is expressed as:

$$NSFR = \frac{Available\ amount\ of\ stable\ funding}{Required\ amount\ of\ stable\ funding} \geq 100\ \%$$

NSFR should be reported quarterly, but be available on an ongoing basis. "*The stress event for the net stable funding ratio (NSFR) must also cover the following conditions: (i) A significant decline in profitability or solvency resulting from credit, market or operational risk; (ii) A potential downgrade in debt, counterparty credit or deposit rating; (iii) A material event that calls into question the reputation or credit quality of the institution"* (EY, 2015).

NSFR definitions mirror those outlined in the LCR, unless otherwise specified. When calibrating the required and available stable funding it is assumed that longer-term liabilities are more stable than short-term liabilities. NSFR is also calibrated under the assumption that deposits from retail customers funding provided by SMEs are more stable than wholesale funding of the same maturity (BCBS, 2014).

6.2.1 Available stable funding (ASF)

The amount of available stable funding (ASF) is measured based on the broad characteristics of the relative stability of an institution's funding sources, including the contractual maturity of its liabilities and the differences in the propensity of different types of funding providers to withdraw their funding. The amount of ASF is calculated by first assigning the carrying value of an institution's capital and liabilities to one of the ASF factors (for our approximation see Appendix B: RSF and ASF factors used for the derivation of NSFR). "*The amount assigned to each category is then multiplied by an ASF factor, and the total ASF is the sum of the weighted amounts. Carrying value represents the amount at which a liability or equity instrument is recorded before the application of any regulatory deductions, filters or other adjustments"* (BCBS, 2014, p 7). For determining the ASF for liabilities, the weighting factors vary from 100% for Tier 1 and Tier 2 capital, to 90% for core retail deposits, to 50% for unsecured wholesale funding (KPMG, 2013). Among ASF is the following: (i) Demand deposits and term deposits with remaining maturity less than one year provided by retail or small business customers (weights 90 and 80% depending on stability); (ii) Wholesale demand deposits and term deposits with remaining maturity less than one year provided by non-financial

corporates, sovereigns, central banks, multilateral development banks, and public sector entities (50%); (iii) Other equity and liability categories (weighted at 0%).

6.2.2 Required stable funding (RSF)

"The amount of required stable funding is measured based on the broad characteristics of the liquidity risk profile of an institution's assets and OBS exposures. The amount of required stable funding is calculated by first assigning the carrying value of an institution's assets to the categories listed. The amount assigned to each category is then multiplied by its associated required stable funding (RSF) factor, and the total RSF is the sum of the weighted amounts added to the amount of OBS activity (or potential liquidity exposure) multiplied by its associated RSF factor. Definitions mirror those outlined in the LCR, unless otherwise specified" (BCBS, 2014, p. 10). The assets are divided into categories based on their quality (maturity and liquidity value) and there the RSF factors are assigned individually. The factors are intended to approximate the value of a certain asset that is being funded. Required stable funding definitions and individual categories are described in a great detail in the (BCBS, 2014, p. 10-14). For summary of asset categories and the RSF factors used in this thesis, see Appendix B: RSF and ASF factors used for the derivation of NSFR.

6.3 Reporting

Banks and financial institutions are expected to meet the liquidity requirements on a continuous basis. The LCR ratio, as a short-term measurement of liquidity, should be reported on at least a monthly basis, but the banks should have the capacity to increase reporting up to daily basis in times of liquidity pressure in the market. NSFR will be calculated and reported to the supervisor at least quarterly. "*The time lag in reporting should be as short as feasible and ideally should not surpass two weeks for the LCR and for the NSFR, the allowable time-lag under the capital standards. The standards and monitoring tools should be applied to all internationally active banks on a consolidated basis, but may be used for other banks and on any subset of entities of internationally active banks as well to ensure greater consistency and a level playing field between domestic and cross-border banks"* (BCBS, 2010, p. 45). Recommendations by the BCBS will only be effective in Europe if introduced throughout the EU, via the CRD IV package. The Directive and Regulation adds other requirements for the EU banks and investments firms, such as

enhanced supervision and the single rulebook.[6] The liquidity measurements are implemented through the Regulation. In this work we focus solely on the EU banks to which the CRD IV applies. Basel III applies to "all internationally active banks", in the EU it has always applied to all banks (more than 8300) and investment firms (European Commission, 2015). In the EU the measurements are enforced legally, Basel III is not a law and the banks join the impact studies voluntarily. Banks will report their compliance with the law to their national supervisors. The Commission proposal follows the timelines as agreed in the Basel Committee: entry into force of the new legislation on 1 January 2013, and full implementation on 1 January 2019 (European Commission, 2015).

6.4 Revision of the rules from 2010 to 2014

The original BCBS proposal from January 2010 was revised by the Committee and a final version of the LCR measure was published in January 2013 and came into effect in January 2015. The latest revised version of the NSFR is from January 2014.

LCR revisions Since the first introduction the HQLA calculation was trialled and further specified and the restrictions on inclusion of bank's assets among the HQLA were loosened. The revision included the Level 2B assets, subject to higher haircuts and a limit. Furthermore the committee developed a set of alternative treatments (alternative liquid asset framework) and clarified expressions regarding the operational requirements for HQLA as well as exclusion of certain central bank reserves. Most crucial change regarding the inflows and outflows is reduction of outflow rate on certain insured deposits and non-financial corporate deposits, derivatives and on maturing secured funding transactions with central banks. *"The drawdown rate on the unused portion of committed liquidity facilities to non-financial corporates was lowered from original 100% to 30%. The new internationally agreed phase-in of the LCR raising by 10% yearly from 2015 to 2019 was introduced"* (BCBS, 2013, p. 37). Moreover, securitisation assets category was broadened in order to be classified as liquid assets, this includes primarily residential

[6] In addition to Basel III implementation, the CRR/CRD IV proposal introduces a number of important changes to the banking regulatory framework in the EU. In the Directive: enhanced governance, sanctions, enhanced supervision and it seeks to reduce to the extent possible reliance by credit institutions on external credit ratings. In the Regulation it is the "single rulebook".

mortgage backed securities. All LCR changes are precisely documented in Annex 2 of the (BCBS, 2013).

NSFR revisions NSFR was originally proposed in 2010 and changed in 2014 via a new proposal, but it hasn't come into force yet. NSFR has been tested and reported by the large banks from historical years' data as manageable. The changes made NSFR easier to reach, as it was shown in the study where 2012 year-end data resulted in an average NSFR of 100%. After the re-proposal, using the 2013 data, the NSFR ratio reached 111% (PwC, 2014). The revision loosened up some of the rules that were reported unmanageable by the banks. The new proposal is particularly welcomed by smaller size banks, because it includes *"more favourable treatment of operational, retail, and small business deposits and loans by assigning higher ASF weightings to these deposits and lower RSF weightings to these loans"* (PwC, 2014, p. 1). The assets in NSFR's ASF and RSF are aligned with the qualification of LCR's HQLA. An example of factors assigned can be the assignment of 100% RSF to net derivatives assets and the 0% to net derivatives liabilities. Detailed changes are reported in a PwC's report (PwC, 2014). The schedule for NSFR is a full implementation remained by January 1, 2018. BCBS left couple of issues open to strengthen the proposal at the end of 2015 (postponed). Among these is for instance the incorporation of off-balance sheet exposures that has raised a lot of questions by the banks.

6.5 Issues with the rules from the literature

BCBS is monitoring the impact of the new regulations via Macro Assessment Group's studies using historical data of relevant banks. Meanwhile the literature is bringing up potential issues and challenges the NSFR and LCR will bring up. IMF Working Paper: The Net Stable Funding Ratio: Impact and Issues for Consideration (Gobat, Yanase, & Maloney, 2014) brings up the dependence of the NSFR on the bank size, profitability etc. and states that individual banks' characteristics should be taken into consideration in the overall assessment of implications. The authors also state that the surcharge on the NSFR could be added to account for specific systemic risk of the bank (such as capital pillars for G-SIBs) as well as a time-varying surcharge and country-specific surcharge. Arvantis & Drakos, in their article The Net Stable Funding Ratio of US Bank Holding Companies: A Retrospective Analysis, calculate that most of the banks are compatible with the NSFR, but that small banks have significantly higher NSFR, because the bigger banks are more able to bear risky portfolios or they behave according to the "too big to fail" theory. NSFR is also highly sensitive to market conditions (Arvanitis & Drakos, 2015). The article The

information content of Basel III liquidity risk measures (Hong, Huang, & Wu, 2014) uses time hazard model to show the relationship between liquidity measures and failures of the banks in the US emphasizing that liquidity risk management needs to target liquidity risk at both the individual level and the system level.

Most issues are discussed in The good and bad news about the new liquidity rules of Basel III in Western European countries in the Journal of Banking & Finance. This article says that the majority of Western banks did not fulfil the requirements retrospectively between 1996 and 2010, larger banks less. According to the authors the implementation of new Basel III rules leads to more capital and liquidity-efficient business models and products. They also say that the biggest impact has the Basel III on the European banks. Their GMM model's results show that banks with higher capital ratio have stronger structural liquidity, banks with higher growth have lower NSFR and traditional banks have higher NSFR. NSFR, according to the authors, does not have an impact on banks' performance. Authors also tested various bank characteristics as drivers of the NSFR, such as ownership, crisis and country-specification (Dietrich, Hess, & Wanzenried, 2014).

6.6 Questions on the impact

Some academics have raised the importance of the connection between the new liquidity ratios and a monetary policy led by the central banks in the Eurozone. The Euro system has been monitoring whether the liquidity requirements will have an influence on functioning of multiple market segments, including money market and central banking operations. One of the worries is that banks will need to hold their HQLA to fulfil LCR criteria and will use non-HQLA as a collateral for banking operations within the Eurozone because its definition of eligible collateral is wider than the HQLA LCR's definition.

In general, Eurozone's monetary policy is operated in the liquidity deficit environment and the banks go to the central bank if they need any additional funding to raise their liquidity. Therefore the questions on impact of the new liquidity requirements need to be further explored (ECB tried to test the possible outcome, but so far cannot separate the influence of the crisis on the money market from the liquidity regulations' influence). *"The LCR does not imply a specific preference for banks to hold liquidity with the central bank rather than with other banks. The potential increase in demand for central bank liquidity would depend on the opportunity cost of obtaining liquidity funding from the Euro system"* (ECB, 2013, p. 82) Together with the central bank funds, we expect the increase of demand for the

public debt, as it is also qualified as a HQLA (Level 1) in the LCR and receives one of the highest weightings in the NSFR's stable funding requirements. This could lead to the shift from private lending towards public financing and in the macroeconomic perspective to a backing up of the public spendings by a country's banking system. This is not desirable especially during a sovereign crisis. Despite the BCBS's goal of mitigating the riskiness of another crisis, the supported holding of sovereign debt by the banks is contradictory to such aim.

The potential shift towards the public sector might decrease the credit provided to private sector and subsequently causing the increase of interest rates. Such increase could be harmful to the economy through the small size lenders primarily dependent on the banks' support such as households and small and medium enterprises (SMEs). To a further extent, we could even expect a small decrease in the scope of investments by the SMEs caused by such rise in the interest rates. The topic of interest rates was tested as a part of BIS' Qualitative Impact Studies (QIS), but cannot be confirmed due to its increases as a reaction to other Eurozone forces. The ECB bulletin also speculates on the topic of the bidding power of some Eurozone banks that will have enough of ECB usable collateral and use it to obtain funding and resources to later meet their LCR criteria.

By its definition, the LCR is aiming to decrease the amount of short term unsecured funding of the Eurozone banks and switch the system towards secured funding options. This could lead to an overall decline in the money market, if a long term unsecured funding wouldn't be raised correspondingly. The reliance is now on the sovereign debt and central bank resources as a primary source of liquidity. The interbank money market allows the system to distribute the liquidity among the financial institutions (transferring between deficit and surplus banks). Such transactions balance could be disrupted by the LCR and the increased interest rates on the loans in the unsecured money market, making also, as discussed, the monetary policies less effective. This effect was tested in detail by the Dutch banking sector and is developed particularly in the paper *The Impact of the LCR on the Interbank Money Market* by Clemens Bonnera and Sylvester Eijffingerb (Bonner & Eijffinger, 2012) and further discussed in the Australian banking sector by the Reserve Bank of Australia in (Bech & Monnet, 2013). *"Basel III liquidity risk regulation framework may induce an additional term premium in the unsecured money market (as demand might not be fully matched by supply). At the same time, by reducing liquidity risk, the LCR may lead to lower liquidity risk premia. The overall effect of these two countervailing forces is unclear"* (ECB, 2013, p. 80).

When it comes to yet not applied NSFR, the banks are worried that because of its unclear definitions (to be revised in 2016) and very complex categorizations it will add on too much work and bureaucracy in the bank procedures and reporting (especially when it comes to derivatives reporting) (Driver, 2014). On a microeconomic level, this regulation forces banks to invest in less risky and therefore less profitable assets (that are more liquid) causing a potential negative impact on their income statements.

Another possible impact of the strengthened regulations could be the increase of the volume of shadow banking that rises, when not regulated on the same or stricter level. We can possibly expect multiple financial innovations created for the regulatory arbitrage that in the worst scenario can seriously impact the financial stability of the system. As mentioned in Chapter 6.4 about ratios' revisions, the NSFR revision brings an advantage to smaller financial institutions, because of its loosened restrictions of retail banking regulations. The question coming up in this matter is whether these would not lead to a disruption in competition within the Eurozone or whether it is perhaps beneficial to support the smaller players through future regulation.

7 Methodology of the Empirical Research

7.1 Cross Sectional Data Estimation

The method adopted in this thesis is based on multiple regression analysis of cross sectional data estimated by the Ordinary Least Squares (OLS). OLS has been the main tool for an econometric analysis since Gauss publication in 1809. A regular set of unweighted normal equations for a least squares solution assumes that the response variable of each equation is equally reliable and should therefore be treated accordingly. The OLS is a Maximum Likelihood Estimator (MLE) if the model estimated is i.i.d. But when the standard deviation of the error term is not constant over all values of the predictor or explanatory variables - the data displays heteroskedasticity; OLS is no longer a MLE and so no longer efficient (Wasserman, 2006). If heteroskedasticity is detected by one of the tests (for instance Breusch-Pagan test or the White test), a possible response is to use heteroskedasticity-robust statistics after estimation by OLS. Although, more efficient than OLS in this case is the Weighted Least Squares (WLS), if the form of variance is correctly specified (as a function of the explanatory variable) (Wooldridge, 2010). Heteroskedasticity in this paper is tested with the use of White test, and the homoskedasticity hypothesis is rejected; therefore the model estimation is proceeded using the WLS method. Gauss considered differences in precision of β coefficients assuming a known variance σ_i^2 (i=1, 2, … n) and generalized this method of least squares with weights as inverses of the square root of variances (Shin, 2013). Another way to weight the equation properly is by sampling weights when the most impactable variable is indicated. In practice the weights are typically unknown and need to be estimated.

Instead of minimizing the residual sum of squares

$$RSS(\beta) = \sum_{i=1}^{n}(y_i - \overline{x_i}\beta)^2 ,$$

we minimize the weighted sum of squares

$$WSS(\beta, \overline{w}) = \sum_{i=1}^{n} w_i(y_i - \overline{x_i}\beta)^2.$$

The variables are further transformed using the square root of the residuals as their weights, or residuals in other form (in this thesis we use the $\exp(\sigma^2)$). The general idea of the WLS is that the weight is given to the observations with a higher error variance (OLS gives each observation the same weight). The WLS estimators are the values of the β_j that make

$$\sum_{i=1}^{n}(y_i - \beta_0 - \beta_1 x_{i1} - \beta_2 x_{i2} - \ \ldots - \beta_k x_{ik})^2 / h_i$$

as small as possible, where h(x) is some function of the explanatory variables that determines the heteroskedasticity. Bringing the square root of $1/h_i$ inside the squared residual shows that the weighted sum of squared residuals is identical to the sum of squared residuals in the transformed variables (Wooldridge, 2010).

The disadvantage of the WLS is that its theory is based on the fact that the weights are known exactly, which is almost never the case in real application, therefore estimated weights are used instead. The experience with this method indicates that small variations in the weights due to estimation do not often affect a regression analysis and its interpretation (Wasserman, 2006).

8 Variables and Data Description

8.1 Data

This section presents the data used for the analysis as its description and sources. Moreover we describe and explain the methodology for derivation of selected data in the dataset. This holds specifically for the NSFR data series computed from the underlying raw balance sheet items. The data is compiled from the Fitch-IBCA Bankscope database, widely regarded as the most comprehensive, global database of information on banks and financial institutions.

Selected bank specific as well as macroeconomic financial data are employed in this research. The most complex is the NSFR that we compute separately and its derivation from the auxiliary data is detailed in section 8.1.1. As country-specific macroeconomic variable we use the GDP growth as an overall economic situation proxy. The bank-specific data used in our model as well as in descriptions of specific bank groups are bank specialization, entity type and Bankscope independence indicator (ownership structure proxies), country rank by assets, total assets (as a size proxy), capital ratio (total equity over total assets), year-on-year growth of the net loans, loan loss ratio (loan loss provisions over total net loans), loan to deposit ratio, net interest margin, overheads share on average total assets, Return on Average Assets (ROAA), Return on Average Equity (ROAE), non-interest share on total income (as a proxy of the business model of selected banks) and funding costs (total interest expense over average customer deposits; this ratio is of interest for the major regulators. Profitability data is used as dependent variable and other data act as explanatory variables of changes in the banks' NSFR or profitability, depending on model specification.

Filter criteria applied to the dataset include year of observations available (2014), narrowing the dataset down to 556 banks and institutions. Additional filters take into account outliers filtering out banks with 2014 NSFR below 25% and above 255%, narrowing the dataset down to 534 banks. Eliminating additional outliers the final dataset includes 514 observations (banks and financial institutions).

8.1.1 NSFR Computation

NSFR values are not specifically reported by European banks, and therefore must be computed separately from underlying raw balance sheet and off-balance sheet data sourced from Bankscope. The ratio is defined as Available Stable Funding (ASF) over Required Stable Funding (RSF) and the ratio of these two absolute values gives us a percentage result. Data for calculation of the NSFR series are available for roughly 600 EU banks. The ASF is calculated as a weighted sum of following data (those being weighted by more than 0%): total customer deposits, total long term funding, reserves for pensions and other, preferred shares and hybrid capital accounted for as debt and as equity, total equity, loan loss reserves, securities revaluation reserves and forex revaluation reserves. The RSF is then a weighted sum of net loans (less reserves for impaired loans), memo: mandatory reserves, remaining earning assets, total securities, total non-earning assets (less cash and due from banks), off-balance sheet assets items (eg. Guarantees). A summary of the specific ASF and RSF factors as applied in this research representing a simplified version of the (BCBS, 2014) rules is provided in Appendix B: RSF and ASF factors used for the derivation of NSFR. The approach for assigning weights and deriving the final NSFR values is inspired by the approaches of Dietrich, Hess, & Wanzenried, 2014 and Ötker-Robe & Pazarbasioglu, 2010. NSFR requires precise calculation that is not yet fully finalized and not all detailed variables are reported, therefore our approximation should be well feasible, based on the aforementioned studies.

8.2 Variables

The crucial variable in this research is the NSFR for year 2014 which is a dependent variable in the Model (1) specification that explains the drivers of the ratio, and an explanatory variable in the separate Models (2), (3) and (4) specifications where its potential influence on the profitability of banks is studied. The dependent variables in models (2), (3) and (4) are NIM, ROAA and ROAE, respectively. The explanatory variables cover bank specific measures of risk and financial position as well as their decision dependence on holding companies and particular business line. Selected macroeconomic variables represent the environment of host countries and the economic position of the regions. In order to report all values for selected countries in EUR, the year average exchange rates from the national currencies to the EUR as reported by the Oxford Economics are used. All data is reported for the year 2014.

Net Stable Funding Ratio [%] Ratio of ASF to RSF should be over 100% for the banks to fulfil this Basel III liquidity criterion. The NSFR is reported as a percentage value and is computed assigning set factors to selected balance sheet (and off-balance sheet) items (see Appendix B: RSF and ASF factors used for the derivation of NSFR). In this study only those banks reporting the NSFR over 25% and below 255% in 2014 are used to eliminate the outliers. The NSFR is not officially reported by the banks yet and therefore our computation is a close approximation to the actual value where additionally non-reported balance sheet items can be included. The ratio represents a measure of long term liquidity of banks that was defined in 2010 and will be implemented from January 2018. NSFR is counted from the year-end balance sheet banks' data in the Bankscope database.

Return on Average Assets [%] As reported by Bankscope the ROAA is net income over average total assets expressed as a percentage and is one of the measures of bank's performance, used as a dependent variable in the Model (2) Specification. It measures the efficiency of a bank in using its assets to generate net income.

Return on Average Equity [%] ROAE is similarly reported by Bankscope as the net income over average total equity expressed as a percentage. It can be used as an alternative measure of bank performance and efficiency over a fiscal year. It can provide a more accurate picture of the bank`s profitability than a basic ROE, in particular in situations where the value of shareholder's` equity has changed significantly during the financial year.

Net Interest Margin [%] NIM is defined as the net interest income over average total assets for the fiscal year and reported as a percentage value by Bankscope. It is a measure of the difference between the interest income generated by banks or other financial institutions and the amount of interest paid out to their lenders (for example, deposits), relative to the amount of their (interest-earning) assets. It represents a measure of bank's performance and is used as a dependent variable in this research.

Total Assets [EUR th] The amount of total assets is used as a proxy of the bank size and is used in its logarithmic form in the models. It is the main explanatory variable as it answers one of the core questions whether the smaller banks are more likely to satisfy the NSFR requirements. This item is also reported as a year-end value in thousands of EUR.

Capital Ratio [%] Ratio defined as total equity over total assets is in line with the Basel III financial leverage rules. With the use of tis ratio we check for the relationship between the capital and structural liquidity in the banking sector. The

ratio is a measure of bank's solvency and the higher the percentage, the less of a business is leveraged and therefore a higher percentage is desired.

Non-Interest Share [%] Ratio defined as a non-interest income over total income reported at the end of a fiscal year. This ratio is used as a proxy of the business model of the bank and its riskiness. Non-interest income is bank and creditor income derived primarily from fees including mainly the deposit and transaction fees. Banks with higher non-interest share are often perceived as riskier.

Growth of Net Loans [%] Variable representing the annual credit expansion of a bank. It is expected that banks that are massively expanding their credit will be less likely to satisfy the NSFR as they would be more likely funded by short-term resources, although they might be more profitable.

Funding Costs [%] Cost of funds ratio is derived as the total interest expense over average customer deposits. The cost of funds is major input costs item for a financial institution, since a lower cost will generate better returns when the funds are deployed in the form of short-term and long-term loans to borrowers. The spread between the cost of funds and the interest rate charged to borrowers represents one of the main sources of profit for most financial institutions. It is a ratio that is of interest especially for bank regulators, both national and at the EU level.

Commercial Bank [dummy] Our dataset includes multiple specializations of present banks. Most common specializations are commercial banks, savings banks and cooperative banks, the latter unfortunately defined differently in dataset countries. Commercial banks are of our biggest interest as they form the core of the banking system and are the ones most often raising complaints on the negative impact of NSFR on their profitability. Therefore a dummy variable is created representing whether a bank is defined as commercial.

Independent Entity [dummy] Bankscope reports entity type of the financial institutions and an independence indicator. Both are created by the IBCA-Fitch and indicate the overall level of entity's dependence on a mother company. If the company is defined as either Global Ultimate Owner or an Independent Co. having independence indicators A and B, then we define it as Independent. The bank is not independent if it displays an independence indicator C or D and is defined as Controlled Subsidiary or Single Location.

Global-Systematically Important Financial Institution [dummy] Dummy variable GSIFI indicates whether a bank is included in any of the GSIFI buckets defined by the Basel III requirements. A list of GSIFIs is regularly updated and issued by the BCBS and is publicly available. GSIFIs have in general stricter solvency and stability requirements as they are significant for the entire financial market.

Country Top 10 [dummy] Variable indicates whether a bank ranks among the top 10 in its country of residence, by the amount of total assets. The ranking is available in the Bankscope database and applies to the end-of-year financial result.

Overheads [%] Ratio defined as the total overhead expenditure over average total assets. The share of overheads could have a significant impact on the bank's performance and therefore is included in some models.

GDP Growth [%] The growth of GDP is used as a proxy of the economic situation of a country where the bank is registered and controls for the impact of economic environment of the country on its banking sector. It represents an annual growth of the real GDP (in EUR) as reported for every year by the Oxford Economics.

Interest Rate Yield Curve [%] A measure used as a proxy for the country's financial sector situation representing the difference between short term and long term interest rates in a specific country, expressed in a percentage form and reported by the World Bank, among others.

8.3 Descriptive Statistics

After the application of multiple filters in order to eliminate outliers and get more homogenous sample, the dataset is represented by 10 EU countries, with the majority of banks being German, followed by French and Austrian. The detail is provided in Table 8.1. Overall this is a little unbalanced representation of the EU countries, but generally all levels of development as well as bank types and sizes are represented. From Table 8.1 we can also deduct that France together with Denmark belong among the countries where the majority of banks, 60.1% and 69.2% respectively, does not yet fulfil the NSFR criteria (as of 2014). This is in line with the IMF Staff Note (Ötker-Robe & Pazarbasioglu, 2010) that also criticized France for no improvement in liquidity stability of the financial sector, although it is one of the most important ones within the EU. For instance one of the biggest banks (by assets), Société Générale, had the NSFR of only 56.7% in 2014 which even declined when

compared to 2013 and 2012. On the other hand from the bigger samples, Austria performed much above the average with 113 banks fulfilling the NSFR out of 124, displaying a strong long-term liquidity position.

For detail of all variables presented in the models please refer to the Table 8.2. The total number of observations for the models of cross sectional data is 514. The *NSFR14*'s mean is 114.7% which indicates that majority of represented banks, precisely 72.8% of the sample, fulfils this Basel III criterion. For the total assets variable, we used its logarithmic form, as the proportion of change is more feasible in the estimation than absolute values. Among the variables are 4 dummy variables: *Commercial, Independent, GSIFI and CntryTop10*. We bear in mind and control for the multicorrelation, as the above mentioned are mostly based on the size of a bank, but also its interbank connection and systemic importance.

Table 8.1: Countries' representation in the sample

Country	Number of banks	Share of banks with NSFR≥100% [%]	Average NSFR [%]	Bank Assets [EUR bn]
AT	124	91.1	126.9	1,291
BE	21	76.2	110.1	1,493
BG	4	100.0	153.7	18
CY	2	100.0	161.6	42
CZ	7	100.0	128.1	133
DE	218	80.7	120.0	13,480
DK	13	30.8	100.0	2,018
FI	7	57.1	95.2	517
FR	113	38.9	91.4	18,266
HR	5	80.0	122.1	43
Total	514	72.8	114.7	37,299

Source: Bankscope, author’s computations.

Table 8.2: Descriptive statistics of the variables

Variable	Number of observations	Mean	Standard deviation	Min	Max
NSFR14	514	114.686	33.054	25.309	255.221
NIM14	514	1.849	0.988	-2.923	9.408
ROAA14	514	0.325	0.506	-6.142	2.940
ROAE14	514	3.867	7.588	-96.332	26.374
Commercial	514	0.206	0.405	0	1
Independent	514	0.506	0.500	0	1
GSIFI	514	0.016	0.124	0	1
CntryTop10	514	0.132	0.339	0	1
lAssets14	514	15.920	1.943	11.661	21.530
CapRatio14	514	7.925	3.479	0.720	25.681
GrowthLoans14	514	2.687	17.929	-81.048	205.989
Overhead14	514	1.838	1.090	0.047	11.818
NonIntrst14	514	22.544	13.949	-9.935	90.921
FundCosts14	514	4.983	14.104	0.121	145.455
GDPgrowth14	514	0.927	0.696	-2.495	1.980

Source: Author's computations, Bankscope

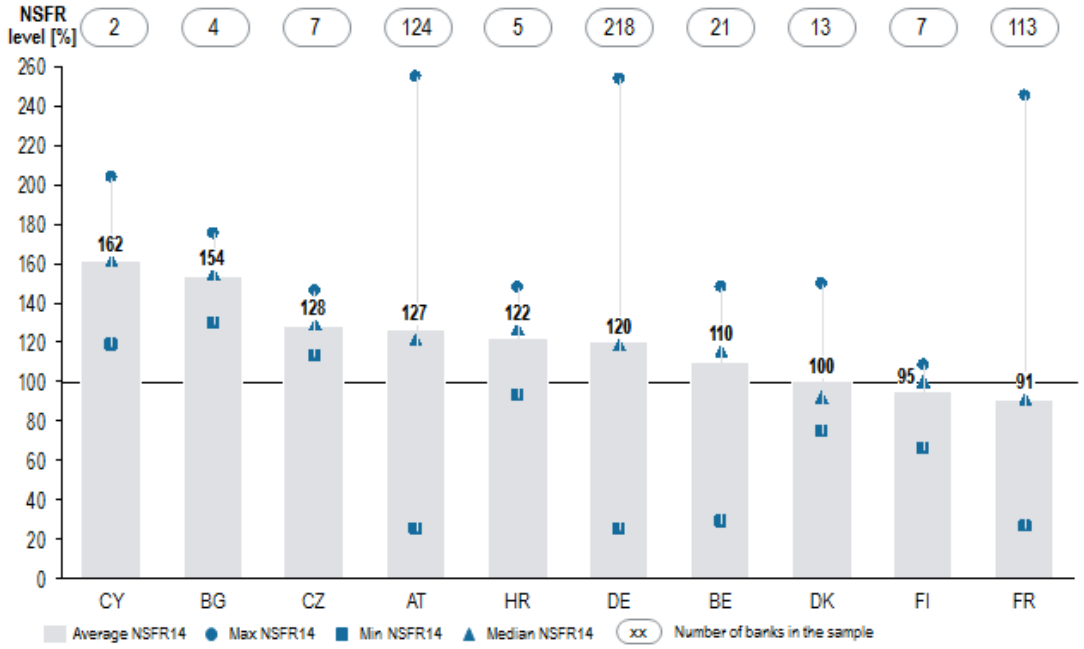


Figure 8.1: NSFR distribution by countries

Source: Author's computations, Bankscope

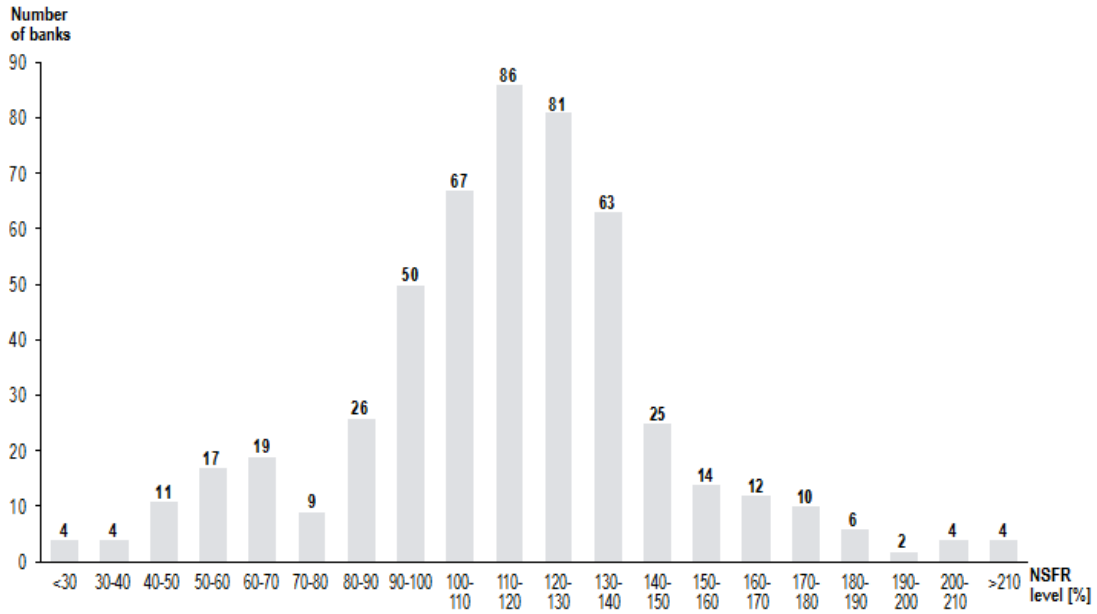


Figure 8.2: NSFR distribution by Asset group

Source: Author's computations, Bankscope

9 Models' Structure and Results

The core models are estimated separately. Model (1) explains the bank specific and market wide drivers of the NSFR for the EU banks. Models (2), (3) and (4) use similar variables representing core bank specific financial indicators, together with NSFR to determine whether the NSFR and its mandatory fulfilment could have an impact on banks' profitability. The liquidity measures were specified in 2010 as part of the Basel III rules and many banks in Europe and beyond raised the question, whether they will have to change their business models and adjust their balance sheets in order to fulfil the NSFR. Therefore this research studies the triggers of the NSFR and defines some specific characteristics banks fulfilling the criterion possess. Moreover we study whether the banks that are currently fulfilling the NSFR are overall less profitable. IMF as well as BCBS position papers state that there is no impact of the NSFR on the profitability, but banks in general suggest otherwise.

9.1 Model 1: Drivers of the NSFR

In Model (1) we search for the potential drivers of the NSFR and for any specific types of banks that are more likely to fulfil the liquidity rules, set in the EU by the CRD IV.

The following model is estimated:

$$NSFR14_i = \beta_0 + \beta_1 Commercial_i + \beta_2 Independent_i + \beta_3 GSIFI_i + \beta_3 CntryTop10_i + \beta_4 lAssets14_i + \beta_5 CapRatio14_i + \beta_6 GrowthLoans14_i + \beta_7 NonIntrst14_i + \beta_8 FundCosts14_i + \beta_9 GDPgrowth14_i \quad (1)$$

Where i=1,2,…514 and represents the individual banks in the dataset and GDP growth corresponds to the country where the bank is registered. This model reflects the original regression without any further specifications and corrections for multicollinearity and non-significant variables. We do not use the NSFR13 (1 year lagged) as an explanatory variable as it was displayed in (Dietrich, Hess, & Wanzenried, 2014), because it would explain 90% of the model and the rest of the results for all other explanatory variables would not be accurate. See Appendix C: NSFR Drivers Model (1).

Model (1) is first estimated using the OLS, see Table 9.1: Model (1) - NSFR Drivers. But the White Test reveals heteroskedasticity of the estimators, even at the last specification of Model (1). Since we are not capable of determining the exact weights, we use the estimated weights of the inverse squared residuals of the last specification variables and estimate the last specification with the use of Weighted Least Squares. Such estimation is more efficient than the OLS and yields more accurate results.

The hypothesis is that the NSFR as a liquidity measure applicable to all banks (where Basel III, or particularly CDR IV is enforced) is standardized in a way that it should not be easier for a certain size or a type of banks to fulfil it. Therefore the hypothesis is that the size presented by the amount of assets in 2014 is not one of the NSFR drivers. Generally expected second hypothesis, also put forward by the BCBS, is that a business line of the banks, here represented by the non-interest share, has also no impact on the NSFR value. Banks are raising concerns when already trying to fulfil the ratio (voluntarily in the BCBS assessments) that it cannot be applied in the same form to all types and sizes of banks. Therefore we expect that our model will reject both of the previous hypotheses and confirm the concerns publicly presented by the financial institutions. We expect that it is perhaps easier for smaller banks to fulfil the criteria as it often does not have the capabilities and the backing by its holding company to perform risky activities.

9.1.1 Specifications and Results

The initial specification of the model includes additional variables *Commercial*, *GSIFI* and *GrowthLoans14*, none of them being statistically significant. Those are eliminated in order to make the model more accurate. The final specification is then estimated using the OLS method, but the White general test confirms the presence of heteroskedasticity. Since it is not possible to specify the exact cause of heteroskedasticity (multiple variables have the potential) the residuals are used as a weight in the Weighted Least Squares method (precisely $1/\exp(\sigma^2)$). The WLS yields an efficient estimator. The OLS specifications and results and its comparison to the WLS are outlined in Appendix B: RSF and ASF factors used for the derivation of NSFR

After needed specifications, all variables presented in the final table are statistically significant even at 1% level. The detail of WLS result described in the following paragraphs is presented in Table 9.1. Model (1) explains the triggers of the

NSFR. 514 banks were observed for the model and the R-squared reported using the WLS method is roughly 97%[7].

The crucial outcome of the model is that the larger the amount of bank's total assets in 2014 (*lAssets14*), the lower NSFR the bank has in the respective year. Total assets are used as a proxy to bank size. Every 10 percentage increase in the amount of total assets is associated with the decrease of the bank's NSFR by 31.9 bps ($-769.41 * \log\left(\frac{110}{100}\right) \approx 31.9$), holding other variables constant. Therefore it confirms our prediction that small sized banks are more likely to fulfil the NSFR and we can reject a hypothesis by the BCBS that there is no difference and that the size of a given bank does not matter. It is indeed a fact that larger banks have access to more forms of funding for their riskier operations, moreover they often maintain more short-term funding not counted in the NSFR amount. Historically, it could be observed that the crisis (for instance the GFC in 2008) was caused by illiquidity of a number of the bigger banks and their consequential failures. Liquidity therefore remains a problem for the larger financial institutions, especially as their actions have a greater impact on the financial system due to the interconnected nature of the industry (not necessarily GSIFI).

The model further shows that the banks we define as independent (according to its ownership type and independence indicator reported by Bankscope) also have lower NSFR, by 674.4 bps. These findings indicate that when the bank is a controlled subsidiary it is more likely to fulfil the NSFR criteria. This is most likely caused by the ability of the mother institution to provide its subsidiary with the needed funding to maintain liquidity. Moreover, the holding companies might be more regulated in their residence and therefore require strict and less risky behaviour from its subsidiaries, although the first theory of these two is more likely. The *CntryTop10* is a dummy variable indicating whether a bank is among the top 10 according to the amount of their total assets within its country. In the dataset there are 68 such banks, out of which 40 fulfil the NSFR criteria and the overall average of the 68 banks' NSFR value is 112%. The results say that if the banks among the top 10 in respective country have NSFR roughly 950 bps points higher than those that are not. This is

[7] R^2 is significantly improved under the WLS regression, although it reflects the extent to which outlying data points have been trimmed from the dataset during weighting. The R^2 in reality does not increase in the transition from OLS to WLS analysis because the act of fitting by OLS serves to minimize the sum of squared distances of the observed data from the fitted line with consequent maximization of R^2. The goodness of fit can be further re-interpreted by several methods.

consistent with our hypothesis that such banks are likelier to have a larger customer base and also often belong to an international parent company. Relevant examples are represented in the dataset by 6 Czech banks that are among the top 10 in the Czech Republic; all of them fulfil the NSFR (values between 114 and 145), and 5 of them are dependent on their mother companies (eg. Česká Spořitelna – Erste, ČSOB – KBC or Komerční Banka – Société Générale). A noteworthy outcome of the model is that it seems that higher capital ratio has a negative effect on the NSFR. This is undesirable since the capital ratio in its broader sense reflects the Basel III leverage requirements, and the higher the capital ratio the more solvent the bank is. This suggests that the banks' fears that the regulations do not complement each other, and at times even contradict - resulting in a trade-off between the two, might be substantiated. The influence is not as crucial in this model since even though 100 bps increase in capital ratio corresponds to -143.4 bps change of the NSFR, the relative influence wouldn't be as high since the NSFR values range from 25 to 250 perc. points and the values of the capital ratio in the dataset from 0.7 to 25.7 percentage points. Despite this, a negative relationship between the two ratios is neither what the regulators would expect nor desire. Another variable describing the specific bank activities and balance sheet items potentially driving the NSFR is the funding costs ratio. Already from its nature it is logical that the *FundCosts14* impacts the levels of *NSFR14* negatively. Higher interest expenses over customer deposits lower funding resources available in the long as well as short term. An increase of 100 bps in the funding costs ratio leads to a NSFR decrease of ~60.0 bps, holding all other variables constant. A GDP growth as a proxy to country's economic expansion indicates that a 100 bps increase in the GDP growth of the bank's country of residence would lead to almost ~1072.3 bps increase in the NSFR. More than the numbers it is important to note that the country's level of growth is significant in the model, and is a positive driver of this long-term liquidity ratio.

Another statistically significant driver of the NSFR is the non-interest share of the banks' income. We would predict that a larger share of the non-interest of the total income would cause lower NSFR, but the opposite seems to be true. A 100 bps increase in non-interest share corresponds to a ~20.7 bps increase in the NSFR. This is explained in the paper on *Non-Interest Income Activities and Bank Lending* (Abedifar, Molyneux, & Tarazi, 2014) where non-interest income activities and the riskiness of banks was studied on over 8,000 US banks over 8 years. The authors find that banks that have higher income from fiduciary activities also have lower credit risk. The findings suggest that fiduciary activities induce managers to behave more prudently in lending because such activities are found to increase banks' franchise value (Abedifar, Molyneux, & Tarazi, 2014).

Table 9.1: Model (1) - NSFR Drivers

NSFR14	Coeff.[8]	Std. Err.
Independent	-6.7443*	(0.4091)
CntryTop10	9.5044*	(0.5257)
lAssets14	-7.6941*	(0.1342)
CapRatio14	-1.4335*	(0.0410)
NonIntrst14	0.2065*	(0.0084)
FundCosts14	-0.5996*	(0.0185)
GDPgrowth14	10.7231*	(0.3010)
_cons	239.2553*	(2.1901)
WLS weight[9]	$1/\sigma^2$	
R-squared[10]	0.9661	
Number of observations	514	

Source: Author's computations, Bankscope
*p<0.01

[8] The variables and coefficients are reported in "percentage points", equivalent to 100 bps

[9] Equivalent results are obtained as if weighted by $1/\exp(\sigma^2)$

[10] R^2 is significantly improved under the WLS regression, although it reflects the extent to which outlying data points have been trimmed from the dataset during weighting. The R^2 in reality does not increase in the transition from OLS to WLS analysis because the act of fitting by OLS serves to minimize the sum of squared distances of the observed data from the fitted line with consequent maximization of R^2. The goodness of fit can be further re-interpreted by several methods.

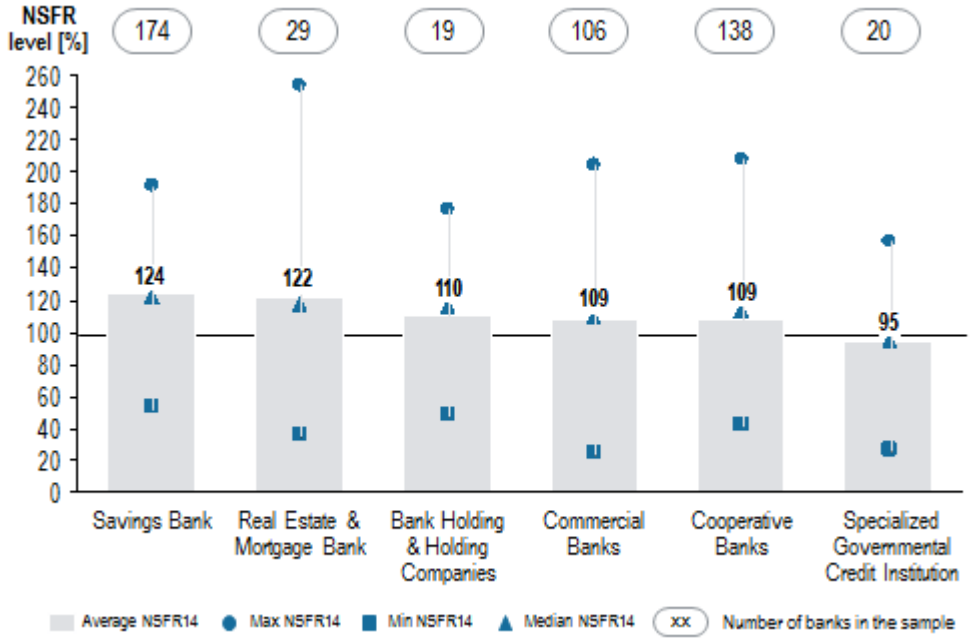


Figure 9.1: NSFR distribution by bank specialization

Source: Author's computations, Bankscope

Figure 9.2: NSFR development in each of the Asset groups

Source: Author's computations, Bankscope

9.1.2 NSFR Drivers: Conclusion

We estimated model (1) indicating the potential triggers of the NSFR using a WLS method in order to control for heteroskedasticity. The estimation yielded 7 statistically significant variables, having an impact on the level of the NSFR of the 514 banks in the dataset. The main findings indicate what could be the favourable models for banks and financial institutions under the new Basel III liquidity framework, or how the rules could be adapted by the regulators to various banks to which CRD IV is applicable. We found that smaller banks, in terms of the total assets size, are more likely to fulfil the 100% NSFR rule. It confirms the NSFR's more favourable treatment of operational, retail, and small business deposits and loans. The drivers that have a negative impact on the NSFR level are funding costs, capital ratio and whether a bank is independent. The capital ratio is especially undesirable as it suggests the Basel III rules may be in a way contradictory. On the other hand positive drivers of the NSFR are the non-interest share of income, economic environment of a respective country and whether a bank is among the country's top 10 largest banks in the country (no matter what position has the bank in terms of size in the dataset). Additional to the finding of smaller banks being more likely to have relatively larger amount of available stable funding, it is also the banks with lower share of interest expenses compared to non-interest expenses that seem to have higher NSFR. Banks dependent on their mother companies also seem to behave more prudently. Based on these findings it could be interesting to see the shifts in the business models of banks in the system in the future in order to fulfil both capital and liquidity requirements of the CRD IV. An interesting point for further research would be whether the regulators could be able to regulate liquidity both at the system level as well as on individual level perhaps with additional layers of the NSFR.

9.2 Models 2-4: Impact of the NSFR on profitability

In Models (2), (3) and (4) we estimate the impact of some core bank position ratios including the NSFR on three performance measures: Return on Average Assets (ROAA), Return on Average Equity (ROAE) and Net Interest Margin (NIM). Together, these three ratios are used to assess the performance and profitability of banks.

The following model is estimated with NIM14 as dependent variable:

$$NIM14_i = \beta_0 + \beta_1 NSFR14_i + \beta_2 lAssets14_i + \beta_3 CapRatio14 + \beta_4 NonIntrst14_i + \beta_5 GDPgrowth14_i + \beta_6 Overhead14_i \quad (2)$$

The following model is estimated with ROAA14 as dependent variable:

$$ROAA14_i = \beta_0 + \beta_1 ROAA13_i + \beta_2 NSFR14_i + \beta_3 GrowthLoans14_i + \beta_4 CntryTop10_i + \beta_5 CapRatio14_i + \beta_6 Independent14_i + \beta_7 YieldCrv14_i \quad (3)$$

The following model is estimated with ROAE14 as dependent variable:

$$ROAE14_i = \beta_0 + \beta_1 ROAE13_i + \beta_2 NSFR14_i + \beta_3 GrowthLoans14_i + \beta_4 CapRatio14_i + \beta_5 Independent14_i \quad (4)$$

In the above models, for explanation of the ROAA14 and ROAE14 we use its lagged variables in order not to exhibit an omitted variable bias. In case of the NIM14, its lagged value would explain around 90% of the model and suppress other explanatory variables, therefore we omit it, lowering R-squared for model (2)[11]. In general, NIM is a very different measure of the bank performance, compared to the ROAA and ROAE that are in basics quiet similar. Therefore different explanatory variables are used in order to yield the most accurate results.

Model (2) is estimated with the use of WLS method in order to account for heteroskedasticity. The model is initially estimated using the OLS, but according to the White test, severe heteroskedasticity is present. We therefore select the significant variables that are relevant for the model to a final specification. After multiple tests and graphic interpretation, we detect that the heteroskedasticity problem is not caused by a single variable and the core of the problem cannot be set. Therefore the equation is weighted by a function of the residuals. In order to control for a division by zero and other issues we use $aw = 1/\exp(residua^2)$.[12] Models (3) and (4) examining the NSFR's impact on the ROAA and ROAE are estimated with te use of OLS as it is the best linear unbiased estimator and no heteroskedasticity is detected here. The final specifications of the models do not include statistically non-significant variables.

[11] It is important to note that omitting the lagged variable does not change the relationship of other explanatory variables towards the dependent one

[12] aw = analytical weight

9.2.1 Model 2: NSFR's impact on NIM

We regress the Net Interest Margin (NIM) in 2014 on the year's NSFR, total assets, capital ratio, non-interest share of income and overhead costs. The aim is to find out whether there exists an association between the NSFR and NIM level. From the estimated results, the NSFR is not statistically significant among other variables and hence we can say that a higher, nor lower, levels of the NSFR in anyway impact the NIM. We also regress the NIM on the NSFR from the previous year (2013), as sometimes the bank's plans are based on previous results, but neither NSFR 2013 would statistically significant in the model. Such result is supported by the regulator's assessments that report that NSFR will have no influence on bank's performance. Hereby we can support that this holds for case of NIM as a performance measure.

The net interest margin has other triggers. Statistically significant on the 5% level is the amount of total assets (*lAssets14*). It suggests that a 1% increase in the total amount of assets is associated with a ~0.8 bps decrease of the NIM. Hence it seems that the smaller institutions are more likely to possess higher margins. Share of non-interest income is another variable having a negative impact on the NIM. Hereby a 100 bps higher ratio of non-interest income share (lower share of the interest income on total income) is associated with ~2.8 bps lower NIM. The institutions that possess higher capital ratio are also more likely to have a higher NIM, a 100 bps increase of capital ratio is associated with ~6.2 bps increase in NIM, holding other variables constant. The one variable that would be predicted differently at the first sight is the share of overhead expenses on total assets, because from the results its increase also corresponds to an increase of NIM. The NIM is wider in the banks where capital ratio and overhead expenses are higher according to our research as well as for instance according to papers *"Why are interest margins across countries so different?"* (Dietrich, Wanzenried, & Cole, 2009) and "*Regulations, Market Structure, Institutions, and the Cost of Financial Intermediation*" (Demirgüç-Kunt, Laeven, & Levine, 2003). The *Overhead14* variable provides information on variation in bank operating costs across banking systems. The higher are the costs for screening and monitoring the higher is the expected interest rate. Consequently, firms that incur high unit costs will logically need to work with higher margins to enable them to cover their operating costs (Dietrich, Wanzenried, & Cole, 2009). Hence higher overhead costs ratio (as a proxy for operating costs) leads to wider net interest margin, a 100 bps increase in overheads is associated with roughly 74.1 bps increase in the NIM.

9.2.2 Model 3: NSFR's impact on ROAA

In model (3) we examine multiple variables and their impact on the banks' ROAA. For this estimation we use the OLS method which is best linear unbiased estimator in this case. It is efficient since the White Test rejects heteroskedasticity. We have included the lagged value of ROAA (*ROAA13*) in order to control for omitted variable. The R-squared of this model (3) specification is ~0.39 which is not substantially high but for this estimation more than acceptable. Higher R-squared reported would signify lower variability of the data, but in this model the core findings are the trends of the individual variables that remain the same. We specify the model with multiple variables and gradually eliminate those that are not statistically significant up to 10%. The only variable left even when not significant at this level is the *NSFR14* which is our examined explanatory variable. We also additionally estimated by other methods such as WLS, but the results showed low efficiency of such estimation; although for our control, the relationships of the dependent and independent variables remain the same. The total number of observations in this model is 514.

The crucial question when estimating this model is the impact of the NSFR on ROAA. The *NSFR14* variable is not statistically significant even at 10% level and it is hence not explanatory to the dependent ROAA14. Therefore we cannot empirically support the banks in their expression that the fulfilment of the NSFR might lead to decrease of their profitability – at least in terms of ROAA and NIM. From the results, maintenance of a higher level of NSFR does not mean the bank worsens its performance measured by the ROAA.

The model shows that what influences the ROAA negatively is whether a bank is independent and the country's yield curve in a respective year. If the bank is independent, it possesses from the results roughly 7.7 bps lower ROAA in 2014. This is a result supporting the theory that mother companies provide their subsidiaries with more funding for their riskier and often more profitable activities. Moreover these banks are able to have a wider reach to clients and seem more attractive than completely independent banks. Managers of the dependent banks also behave more prudently and their focus is often ROAA or ROAE as it is the main measure of their performance reported to the mother company. The yield curve signifies that the bigger spread there is between the interest rates, the lower ROAA would banks in the respective countries indicate.

From the bank specific variables that have an impact on the ROAA the most significant one in our model is the capital ratio. This result confirms our model (1) as it has a different impact on the profitability than the NSFR. The capital ratio as another Basel III requirement proxy should show the stability of the. The banks that have stronger capital ratio report higher ROAA in 2014. 100 bps rise in the capital ratio corresponds to ~4.4 bps increase in the ROAA. Our empirical results also confirm that banks that are among the country's top 10 banks perform better regarding their ROAA (these don't have to necessarily be the biggest banks in our sample, just in their countries of residence). From experience these banks are usually backed by a large international player and can perform riskier activities leading to higher profitability and overall better performance. Despite their liquidity often being at stake. That likewise in relation with the annual growth of net loans that in general has a negative impact on liquidity of banks (when banks are expanding fast or excessively), although a positive effect on returns. Loans and interest income are in most cases the core source of income for banks and it is something that the institutions are aiming for. The more favourable the lending market is to supporting the expansion of net loans, the higher ROAA we are experiencing.

9.2.3 Model 4: NSFR's impact on ROAE

Model (4) of our research examines the association of the NSFR variable, among others, with the Return on Average Equity (ROAE), another banks' performance measure, in 2014. We first include additional variables in the model such as *Commercial*, *Overhead14*, *NonIntrst14*, *GDPgrowth14*, etc. but in order to have a relevant and efficient model the last specification includes only those variables that are statistically significant, see Table 9.2: Models (2), (3) and (4) results – Impact of the NSFR on banks' performance. The model reports the R-squared of ~0.29 which is not particularly high but it is more than sufficient for the use in this study. The coefficients estimate the trends while R-squared represents the scatter around the regression line. The interpretations of the significant variables are the same for both high and low R-squared models. Low R-squared would be problematic if we needed precise numeric predictions which is not the case. The OLS estimation is efficient as also the homoscedasticity is proven by the White Test. We include the lagged ROAE variable in order to control for the omitted variable bias and be able to explain the relationship of additional variables towards the *ROAE14*. And naturally the *ROAE13* variable is significant and has a major positive impact on the ROAE in 2014.

The most statistically significant variables, at the 1% level of significance, are the *NSFR14* and *GrowthLoans14*. Positive changes in the NSFR are associated with negative changes in the ROAE. This result confirms our hypothesis and theory from model (3) where the resulting impact of the NSFR on the ROAA was also negative and significant. A 100 bps increase in the NSFR corresponds to a ~28.9 bps decrease in the bank's ROAE. Such result also confirms the theories of the banks and other relevant financial institutions that the new liquidity regulations will decrease their profitability, especially through needed changes in their business models and activities. The banks that are more likely to fulfil the NSFR are more likely to report lower ROAE. Annual growth of net loans on the other hand shows a positive association with the response variable ROAE. If the bank is expanding in terms of the amount of the net loans, a 100 bps increase in this predictor variable is associated with a 5.7 bps increase in the ROAE. In line with the previous models as well as with the regulatory aims is the positive relationship between the capital ratio and the ROAE. An increase in capital ratio as a stability measure is associated with an increase in the ROAE, holding other variables constant. Last but not least, whether the bank is defined as an independent is also significant for the ROAE determination. Independent financial institution reports around 119.41 bps lower ROAE. This might primarily be the result of increased prudency of the managers that are dependent on their holding company since the returns are one of the main reported results of their performance within the group.

Table 9.2: Models (2), (3) and (4) results – Impact of the NSFR on banks' performance

	NIM14 (WLS)	ROAA14 (OLS)	ROAE14 (OLS)
ROAA13		0.5185***	
		(0.0409)	
ROAE13			0.2888***
			(0.0223)
NSFR14	0.0003	-0.0008	-0.0284***
	(0.0005)	(0.0005)	(0.0087)
Independent		-0.0766**	-1.1941**
		(0.0371)	(0.5758)
NonInterst14	-0.0280***		
	(0.0013)		
CntryTop10		0.1283**	
		(0.0575)	
lAssets14	-0.0184**		
	(0.0087)		
CapRatio14	0.0619***	0.0440***	0.1564*
	(0.0047)	(0.0055)	(0.0833)
GrowthLoans14		0.0027***	0.0568***
		(0.0010)	(0.0160)
Overhead14	0.7412***		
	(0.0260)		
FundCosts14			
YieldCrv14		-0.0990**	
		(0.0478)	
_cons	0.8903***	0.0300	5.2314***
	(0.1983)	(0.0924)	(1.2555)
R-squared	0.7624[13]	0.3791	0.2876
Weight	$1/\exp(\sigma^2)$	n.a.	n.a.
Number of observations	514	514	514

Source: Author's computations, Bankscope
*p<0.10, **p<0.05, ***p<0.01

[13] R^2 is significantly improved under the WLS regression, although it reflects the extent to which outlying data points have been trimmed from the dataset during weighting. The R^2 in reality does not increase in the transition from OLS to WLS analysis because the act of fitting by OLS serves to minimize the sum of squared distances of the observed data from the fitted line with consequent maximization of R^2. The goodness of fit can be further re-interpreted by several methods.

9.2.4 Models 2-4 Conclusion

In this chapter we studied the impact of the NSFR on performance of the banks in selected countries of the EU. To measure banks performance and profitability we chose NIM, ROAA and ROAE as dependent variables. Using the OLS and WLS methods we can conclude that fulfilling the NSFR seems to have a negative impact on the ROAE, although it is not influencing the levels of ROAA nor the width of NIM. Hence there is an option that NSFR could have a negative impact on the banks' profitability, although only in terms of the ROAE. This result does not necessarily mean that banks having to fulfil the NSFR will immediately possess lower ROAE. However, it might mean that they have to adapt their business models to a one that optimises long-term liquidity funding.

From additional explanatory variables we can conclude that the capital ratio impacts all three performance measures positively and significantly. More stable and solvent banks, also according to the BCBS seem to have higher return ratios as well as NIM. Banks also report higher profitability measures when experiencing higher annual growth of net loans as it increases primarily their interest income, despite the fact that it has a negative impact on liquidity (and NSFR specifically). Apart from the NSFR influence, all in all better performance represented by the ROAA and ROAE seem to have banks that maintain higher capital ratio, are independent and experience higher annual growth of net loans. Higher level of NIM additionally report smaller institutions with lower non-interest share of income and higher overhead costs ratio.

10 Czech Republic

Czech banks are in general very stable and profitable. The Czech National Bank (CNB) has surveillance over the Czech financial system and sets the liquidity and capital measures much stricter than the EU average. In our model the Czech banks report one of the highest NSFR as well as the capital ratio that is in fact among the highest in the EU when averaged for all banks in the Czech Republic. The average NSFR in 2014 was 128% for the 7 banks reported in the Bankscope database, see Figure 10.1: NSFR level in the Czech banking sector. In 2014 the CNB reported 18 Czech banks, 22 foreign subsidiaries and 5 building societies among the total number of banks, from which four banks are classified as "large", whose share in the total active assets in the banking system was 57.1% (Czech National Bank, 2014). The Czech banking sector has had a stable position and sufficient funding in the long term, having a high ratio of customer deposits to customer credit, among other. A slight drop in the NSFR approximation in 2011 and 2012, see Figure 10.2: Average NSFR development in the Czech Republic, was caused primarily by an impaired economic situation of the country and the decrease of customer deposits, but has been increasing since. There are few reservations that the Czech banks would be able to fulfil the Basel III criteria in terms of capital, leverage or liquidity in the future.

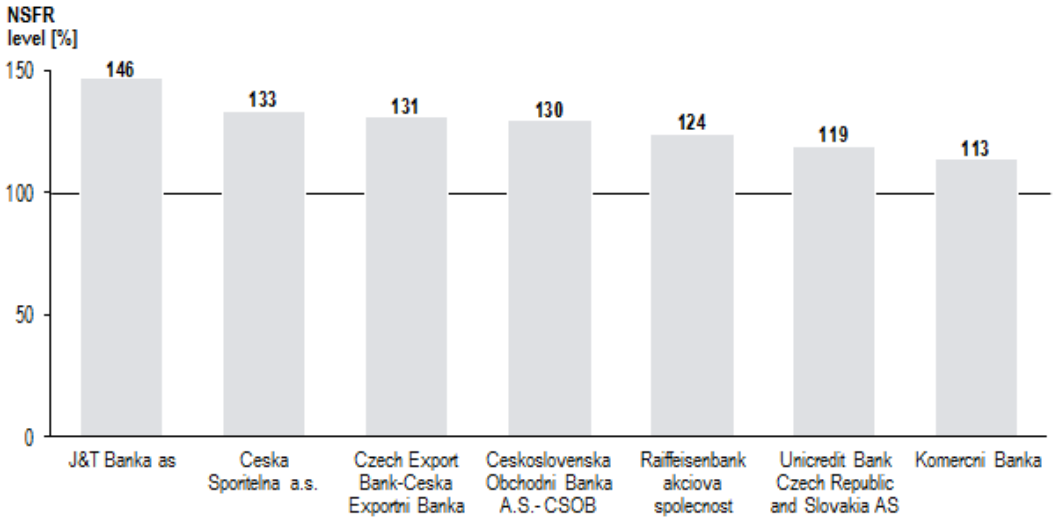


Figure 10.1: NSFR level in the Czech banking sector

Source: Author's computations, Bankscope

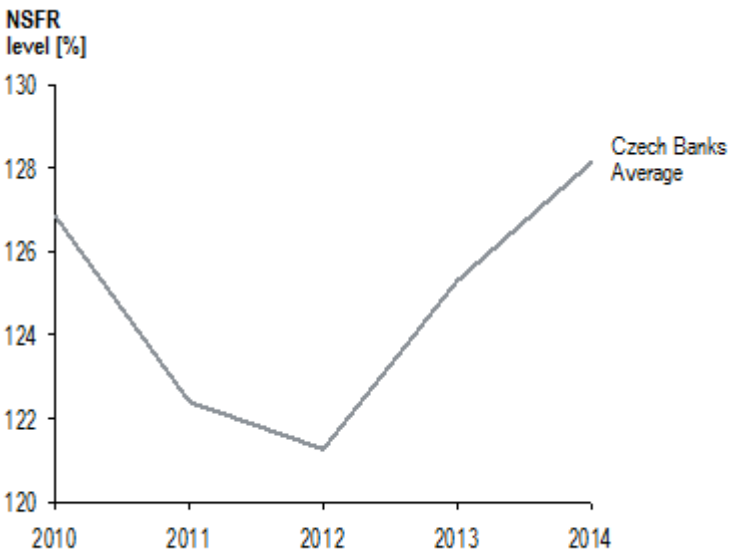


Figure 10.2: Average NSFR development in the Czech Republic

Source: Author's computations, Bankscope

11 Conclusion

The BCBS has introduced new liquidity measures, LCR and NSFR, as a part of a regulatory package Basel III that is transposed into an EU law via CRR/CRD IV. The impact of Basel III capital requirements has been thoroughly researched, but the impact of liquidity rules, and especially NSFR, has still been unclear and questioned. The regulations will start to apply from January 2018, and the banks are concerned that the newly brought changes will lower their profitability. In this work we studied the impact of the long-term liquidity requirement, the NSFR, on banks in 10 EU Member States. Currently, only a couple of papers address this issue, and those that do focus primarily on a single country, or the US banks. This thesis analysed a sample of more than 500 banks from several EU countries with differences in specializations, capital ratios as well as asset size. We investigated to what extent any of these specifications have an impact on the bank's NSFR (in 2014). Using additional three models, we further studied whether the NSFR differences are associated with differences in banks performance measures NIM, ROAA and ROAE, in order to confirm or reject the banking system's worries about the potential decline of banks' profitability when NSFR is introduced.

In this work we first researched liquidity as a concept, and specific sections of the Basel III framework, including all capital, leverage and liquidity rules and how they interlink. Subsequently, the focus was turned to the LCR and NSFR, including potential issues arising from these requirements mentioned in the literature. The second half of this work was dedicated to econometric analysis of four models. The first one studied the drivers of the NSFR and the following three models analysed whether the NSFR has an impact on the profitability measures. We used the Bankscope database as the source for all data, although the NSFR had to be approximated and computed from individual balance sheet items for all banks based on the BCBS, (Ötker-Robe & Pazarbasioglu, 2010) and (Dietrich, Hess, & Wanzenried, 2014) methodologies, as the ratio is not being reported.

We found that the smaller banks, in terms of the total assets size, are more likely to fulfil the 100% NSFR rule. This might be due to the fact that larger banks have the resources to bear more risky activities resulting in lower liquidity. The drivers that have a negative impact on the NSFR level are funding costs, capital ratio and whether a bank is independent. Capital ratio being of special interest as it

suggests that Basel III measures may be contradictory. On the other hand positive triggers of the NSFR are the non-interest share of income, economic situation of a respective country and whether a bank is among the country's top 10 largest banks. Based on these results, it is possible we might see alterations in banks' business models in the future. In terms of the impact of the NSFR on banks' profitability we can conclude that fulfilling the NSFR seems to have a negative impact on the ROAE, although it is not influencing the levels of ROAA nor the NIM. This result does not necessarily mean that the banks' fulfilment of the NSFR will directly lead to the decrease of ROAE. Although it means that banks might have to change their business models to more optimal ones to possess more liquidity funding in the long term. It would be interesting to further study the implications as banks' approach the implementation of the NSFR in upcoming years, as well as the overall effect on the profit of the bank connecting the three measures. Apart from the NSFR influence, all in all better performance represented by the ROAA and ROAE seem to have banks that possess higher capital ratio, are independent and experience higher annual growth of net loans. Higher level of NIM additionally report smaller institutions with lower non-interest share of income and higher overhead costs ratio.

To summarize, the banks might face some limitations when fulfilling the liquidity requirements in the future. The NSFR seems to impact the banks' ROAE, despite not being associated with any differences in ROAA nor NIM. We showed these relationships between the liquidity rules, banks' balance sheet structure and profitability measures to set the potential challenges and possible changes of the banks' business lines. Further research could increase the number of banks in the sample, analyse them historically and also research the changes in banks' balance sheet structure in the years approaching the adoption of the NSFR. Moreover the impact of the ratios on the potential changes in systems' interest rates could also be an interesting field to explore.

Bibliography

Abedifar, P., Molyneux, P., & Tarazi, A. (2014). *Non-Interest Income Activities and Bank Lending.* University of St Andrews, Bangor University, Université de Limoges. St Andrews: Management School of University of St Andrews.

Arvanitis, P., & Drakos, K. (2015). The Net Stable Funding Ratio of US Bank Holding Companies: A Retrospective Analysis. *Interntional Journal of Economic Sciences, IV*(2), 1-9.

BCBS. (2010). *Basel III: A global regulatory framework for more resilient banks and banking systems.* Basel, Switzerland: Bank for international Settlements.

BCBS. (2010). *Basel III: International framework for liquidity risk measurement, standards and monitoring.* Basel: Bank for International Settlements.

BCBS. (2013). *Basel III: The Liquidity Coverage Ratio and liquidity risk monitoring tools* . Basel Committee on Banking Supervision. Basel: Bank for International Settlements.

BCBS. (2014). *Basel III: the net stable funding ratio* . Basel Committee for Banking Supervision. Bank for International Settlements.

BCBS. (2015). *A brief history of the Basel Committee.* Basel Committee on Banking Supervision. Bank of International Settlements.

Bech, M., & Monnet, C. (2013). The Impact of Unconventional Monetary Policy on the Overnight Interbank Market. *Conference Volume 2013*, 147-177. Reserve Bank of Australia.

BIS. (2010). *Basel III: A global regulatory framework for more resilient banks and banking systems* . Basel, Switzerland: Bank for international Settlements.

Bonner, C., & Eijffinger, S. (2012). The Impact of the LCR on the Interbank Money Market . *Series N. 9124*. The netherlands: entre for Economic Policy Research Discussion Papers.

Czech National Bank. (2014). *Zpráva o výkonu dohledu nad finančním trhem.* Prague: CNB.

Demirgüç-Kunt, A., Laeven, L., & Levine, R. (2003). *Regulations, Market Structure, Institutions, and the Cost of Financial Intermediation.* The World Bank, University of Minnesota and the NBER.

Dietrich, A., Hess, K., & Wanzenried, G. (2014). The good and bad news about the new liquidity rules of Basel III in Western European countries . *Journal of Baning & Finance, 44*, 13-25.

Dietrich, A., Wanzenried, G., & Cole, R. A. (2009). *Why are net-interest margins across countries so different?* Institute of Financial Services IFZ, Lucerne University of Applied Sciences.

Driver, R. (2014). *BBA response to BCBS 271: Basel III: The Net Stable Funding Ratio*. British Bankers' Association . London: bba.

EBF. (2014). *EBF response to the Basel Consultative Document Basel III: The Net Stable Funding Ratio (BCBS CD271).* Brussels: European Banking Federation.

ECB. (2013, April). Liquidity Regulation and Monetary Policy Implementation. *ECB Monthly Bulletin*, pp. 73-89.

European Commission. (2015, 10 22). *European Commission*. Retrieved 12 18, 2015, from EC Press Release Database europa.eu: http://europa.eu/rapid/press-release_MEMO-11-527_en.htm?locale=en#footnote-4

EY. (2015). *Banking & Capital Markets: Basel III liquidity requirements and implications*. (E. &. Limited, Producer) Retrieved 11 20, 2015, from EY Web site: http://www.ey.com/GL/en/Industries/Financial-Services/Banking---Capital-Markets/Basel-III-liquidity-requirements-and-implications---Required-stable-funding--RSF--and-available-stable-funding--ASF-

Gobat, J., Yanase, M., & Maloney, J. (2014). *The Net Stable Funding Ratio: Impact and Issues for Consideration.* International Monetary Fund.

Greene, W. H. (2012). *Econometric Analysis* (Seventh Edition ed.). (S. Yagan, Ed.) Harlow, Essex, England: Pearson Education Limited.

Hong, H., Huang, J.-Z., & Wu, D. (2014). The information content of Basel III liquidity risk measures . *Journal of Financial Stability, 15*, 91-111.

James, B., & Forde, A. (2011). *Comparison between Capital Requirements Directive IV and Basel III.* London: Linklaters LLP.

KPMG. (2013). *CRD IV: Single Rule Book for EU Banking Regulation - Changes and Implications.* Ireland.

Lis, S. F., Santillana, V., & García, j. (2015). *EU loss-absorbing capacity requirement: final MREL guidelines* . BBVA, Research. European Regulation Watch.

Lopez, J. A. (2008, October 24). *Federal reserve Bank of San Francisco*. Retrieved January 2016, from Economic Research: http://www.frbsf.org/economic-research/publications/economic-letter/2008/october/liquidity-risk/

Marks, E. L., & Nicolaides, C. M. (2014). *Understanding Basel III.* Latham & Watkins LLP.

McNamara, C. M., Wedow, M., & Metrick, A. (2014). *Basel III B: Basel III Overview* (Vols. 2014-1B-V1). Yale University: Yale Program on Financial Stability Case Study.

Mišková, M., & Országhová , L. (2015). *MREL: Gone Concern Loss Absorbing Capacity.* Národná banka Slovenska, Banking Regulation. BIATEC.

Nikolau, K. (2009, February). Liquidity (risk) concepts: definitions and interactions . *Working paper series, 1008*.

Ötker-Robe, I., & Pazarbasioglu, C. (2010). *Impact of Regulatory Reforms on Large and Complex Financial Institutions.* Monetary and Capital Markets Department. International Monetary Fund.

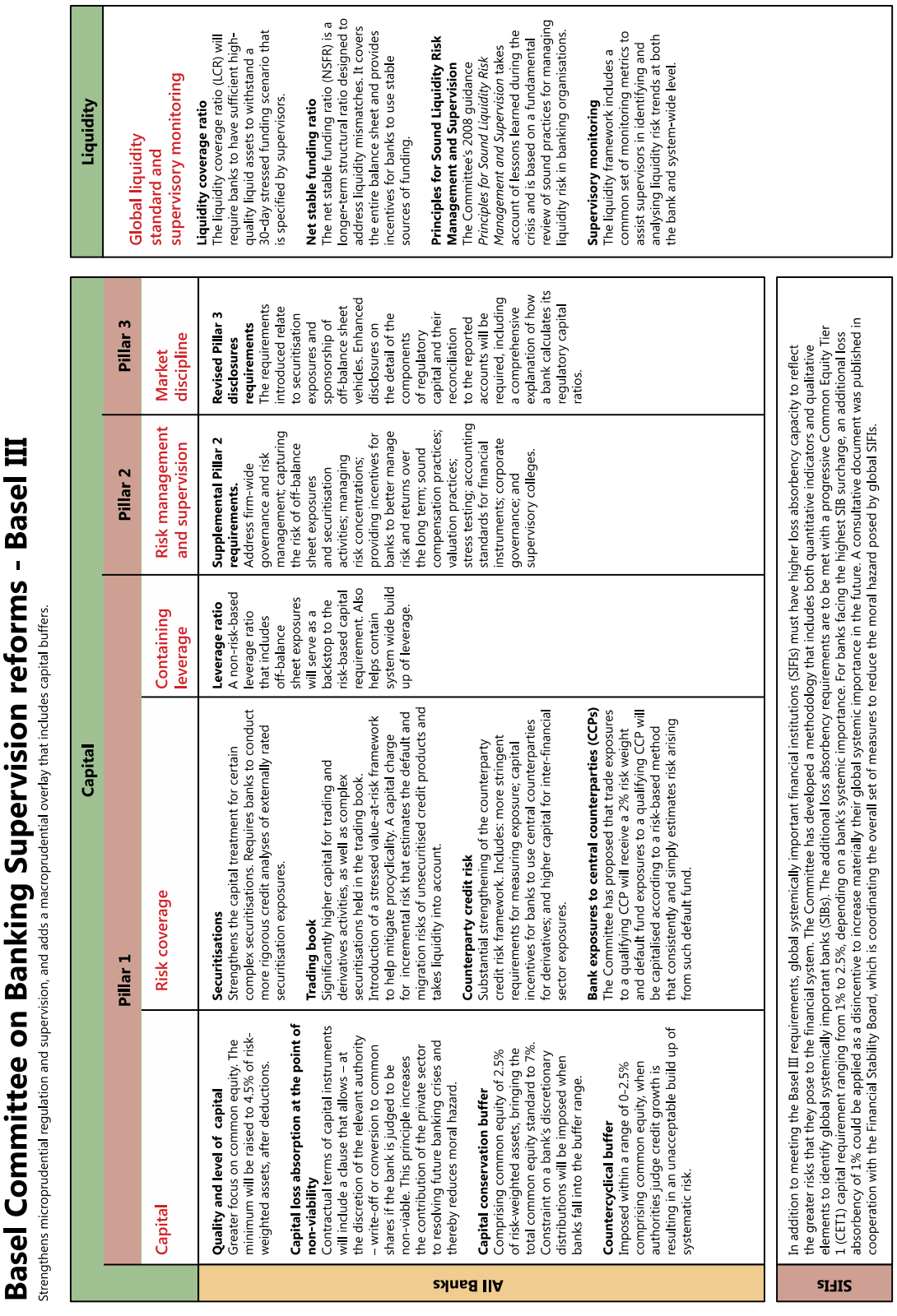
PwC. (2014). *First take: Ten key points from Basel's final NSFR.* Delaware: PricewaterhouseCoopers LLP .

Shin, H.-C. (2013). *Weighted Least Squares Estimation with Sampling Weights.* National Center for Health Statistics.

Wasserman, L. (2006). *All of Nonparametric Statistics.* Pittsburgh, PA: Springer.

Wooldridge, J. (2010). *Econometric Analysis of Cross-Section and Panel Data* (2nd Edition ed.). Boston, USA: MIT Press.

Appendix A: Basel III summary table



Source: Bank for International Settlements

Appendix B: RSF and ASF factors used for the derivation of NSFR

ASF	Factor	RSF	Factor
1.Deposits		1.Net Loans	
Total Customer Deposits	0.95	*Residential mortgage loans*	0.85
Current Deposits		*Other mortgage loans*	0.85
Savings Deposits		*Other consumer/retail loans*	0.85
Term Deposits		*Corporate & Commercial l.*	0.85
Deposits from Banks	0.00	*Other loans (if applicable)*	0.85
Other deposits and shor-term borrowings	0.00	*Reserves for impaired loans/NPLs*	1.00
2.Other Interest bearing liabilities		*MEMO: Mandatory reserves*	1.00
Derivative liabilities	0.00	2.Other earning assets (loans)	
Trading liabilities	0.00	*Loans and advances to banks*	0.00
Total long term funding	1.00	*Total securities*	0.50
Res. for pensions & other	1.00	*Government securities*	
Preferred shares & hybrid capital	1.00	*Trading securities (FV)*	
3.Other non-interest bearing liabilities	0.00	*Available for sale sec.*	
4.Total Equity	1.00	*Held to maturity sec.*	
5.Loan Loss Reserves	1.00	*Other securities*	
6.Other Reserves	1.00	*Reverse Repos & Cash collateral*	
Securities revaluation res.		*Remaining earning assets*	1.00
ForEx revaluation res.		3.Non-earning assets less cash and due from banks	1.00
		4.Off-Balance Sheet items	0.05
		Guarantees	
		Acceptances&Credits off-BS	
		Commited credit lines	
		Other contingent liabilities	
		Managed securitized assets	
		Other off-BS exposure to sec.	

Source: Author based on Bankscope balance sheet reported items and papers (BCBS, 2014), (Ötker-Robe & Pazarbasioglu, 2010) and (Dietrich, Hess, & Wanzenried, The good and bad news about the new liquidity rules of Basel III in Western European countries , 2014)

Appendix C: NSFR Drivers Model (1)

NSFR	OLS (First Specif.)	OLS (Final Specif.)	WLS (Final Specif.)
Commercial	-3.0547 (3.7581)		
Independent	-6.7736** (2.6545)	-6.7887*** (2.5526)	-6.7443*** (0.4091)
GSIFI	-12.9052 (10.7952)		
CntryTop10	12.2713*** (4.6887)	9.7526** (4.1756)	9.5044*** (0.5257)
lAssets14	-7.5097*** (0.8016)	-7.7858*** (0.7638)	-7.6941*** (0.1342)
CapRatio14	-1.5729*** (0.3712)	-1.5008*** (0.3673)	-1.4335*** (0.0410)
GrowthLoans14	-0.0356 (0.0702)		
NonIntrst14	0.2487*** (0.0968)	0.2101** (0.0928)	0.2065*** (0.0084)
FundCosts14	-0.6134*** (0.0911)	-0.6087*** (0.0909)	-0.5996*** (0.0185)
GDPgrowth14	10.6527*** (1.8641)	10.8110*** (1.8475)	10.7231*** (0.3010)
_cons	237.0119*** (13.8074)	240.9417*** (13.3132)	239.2553*** (2.1901)
R-squared	0.3297	0.3265	0.9661
Weight	n.a.	n.a.	$1/\sigma^2$
df	514	514	513

Source: Bankscope, author's computations.
* p<0.1, ** p<0.05, ***p<0.01

Appendix D: Model (2) detail

```
39 . reg  NIM14 NSFR14 CapRatio14 NonIntrst14 GDPgrowth14  Overhead14
```

Source	SS	df	MS		
Model	248.927813	5	49.7855626	Number of obs	= 514
Residual	251.547684	508	.495172607	F(5, 508)	= 100.54
				Prob > F	= 0.0000
				R-squared	= 0.4974
				Adj R-squared	= 0.4924
Total	500.475498	513	.975585765	Root MSE	= .70369

NIM14	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
NSFR14	-.0009711	.0010159	-0.96	0.340	-.0029671	.0010248
CapRatio14	.0546816	.009591	5.70	0.000	.0358386	.0735245
NonIntrst14	-.0330718	.0026676	-12.40	0.000	-.0383127	-.0278309
GDPgrowth14	-.058746	.047013	-1.25	0.212	-.1511099	.0336178
Overhead14	.6659357	.0361473	18.42	0.000	.5949192	.7369522
_cons	1.102683	.1438355	7.67	0.000	.8200974	1.385269

```
40 . estat imtest, white

White's test for Ho: homoskedasticity
         against Ha: unrestricted heteroskedasticity

         chi2(20)     =    403.78
         Prob > chi2  =    0.0000

Cameron & Trivedi's decomposition of IM-test
```

Source	chi2	df	p
Heteroskedasticity	403.78	20	0.0000
Skewness	75.09	5	0.0000
Kurtosis	4.64	1	0.0312
Total	483.51	26	0.0000

```
41 . reg  NIM14 NSFR14 lAssets14 CapRatio14 NonIntrst14  Overhead14
```

Source	SS	df	MS		
Model	251.657445	5	50.331489	Number of obs	= 514
Residual	248.818052	508	.489799316	F(5, 508)	= 102.76
				Prob > F	= 0.0000
Total	500.475498	513	.975585765	R-squared	= 0.5028
				Adj R-squared	= 0.4979
				Root MSE	= .69986

NIM14	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
NSFR14	-.0022877	.0010696	-2.14	0.033	-.0043891	-.0001864
lAssets14	-.0499817	.0186901	-2.67	0.008	-.0867012	-.0132623
CapRatio14	.0489745	.0098175	4.99	0.000	.0296865	.0682624
NonIntrst14	-.0322885	.0025789	-12.52	0.000	-.0373552	-.0272218
Overhead14	.6480305	.0364508	17.78	0.000	.5764175	.7196434
_cons	2.055423	.3984087	5.16	0.000	1.272691	2.838154

```
42 . predict r5NIM , r
```

```
43 . reg  NIM14 NSFR14 lAssets14 CapRatio14 NonIntrst14  Overhead14 [aw = 1/exp(r5NI
(sum of wgt is   4.3270e+02)
```

Source	SS	df	MS		
Model	154.768026	5	30.9536051	Number of obs	= 514
Residual	48.2241996	508	.094929527	F(5, 508)	= 326.07
				Prob > F	= 0.0000
Total	202.992225	513	.395696345	R-squared	= 0.7624
				Adj R-squared	= 0.7601
				Root MSE	= .30811

NIM14	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
NSFR14	.0003256	.0005082	0.64	0.522	-.0006728	.0013239
lAssets14	-.0183834	.0087459	-2.10	0.036	-.0355659	-.0012009
CapRatio14	.0619055	.0047331	13.08	0.000	.0526065	.0712044
NonIntrst14	-.0279582	.001282	-21.81	0.000	-.0304768	-.0254395
Overhead14	.7411705	.0259817	28.53	0.000	.6901257	.7922153
_cons	.8902706	.1982918	4.49	0.000	.5006978	1.279844

```
44 .
```

Appendix E: Model (3) detail

```
. reg  ROAA14 ROAA13 NSFR14 GrowthLoans14 CapRatio14  CntryTop10 Independent lOverhead14   YieldCrv14
```

Source	SS	df	MS		
Model	49.9550212	8	6.24437765	Number of obs	514
Residual	81.631599	505	.161646731	F(8, 505)	38.63
				Prob > F	0.0000
Total	131.58662	513	.256504133	R-squared	0.3796
				Adj R-squared	0.3698
				Root MSE	.40205

ROAA14	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ROAA13	.5146151	.0414021	12.43	0.000	.4332735	.5959567
NSFR14	-.0008738	.0005742	-1.52	0.129	-.002002	.0002544
GrowthLoans14	.0026069	.0010106	2.58	0.010	.0006215	.0045924
CapRatio14	.042931	.0057459	7.47	0.000	.0316422	.0542199
CntryTop10	.1308469	.057723	2.27	0.024	.0174402	.2442536
Independent	-.0813251	.0379199	-2.14	0.032	-.1558253	-.0068249
lOverhead14	.0213377	.0336142	0.63	0.526	-.0447032	.0873787
YieldCrv14	-.1017359	.0480288	-2.12	0.035	-.1960967	-.0073751
_cons	.0485924	.0969686	0.50	0.617	-.1419193	.239104

```
. reg  ROAA14 ROAA13 NSFR14 GrowthLoans14 CapRatio14  CntryTop10 Independent  YieldCrv14
```

Source	SS	df	MS		
Model	49.8898857	7	7.12712653	Number of obs	514
Residual	81.6967345	506	.161455997	F(7, 506)	44.14
				Prob > F	0.0000
Total	131.58662	513	.256504133	R-squared	0.3791
				Adj R-squared	0.3706
				Root MSE	.40182

ROAA14	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ROAA13	.5184674	.0409308	12.67	0.000	.4380522	.5988825
NSFR14	-.0007596	.000545	-1.39	0.164	-.0018303	.0003112
GrowthLoans14	.0026612	.0010064	2.64	0.008	.0006841	.0046384
CapRatio14	.043984	.0054981	8.00	0.000	.0331822	.0547858
CntryTop10	.1282853	.0575477	2.23	0.026	.0152233	.2413472
Independent	-.0766168	.0371655	-2.06	0.040	-.1496345	-.0035991
YieldCrv14	-.0990266	.0478105	-2.07	0.039	-.1929581	-.005095
_cons	.0300306	.0924002	0.33	0.745	-.1515046	.2115659

```
. estat imtest, white

White's test for Ho: homoskedasticity
         against Ha: unrestricted heteroskedasticity

         chi2(33)     =     30.35
         Prob > chi2  =    0.5995
```

```
. estat imtest, white

White's test for Ho: homoskedasticity
         against Ha: unrestricted heteroskedasticity

         chi2(33)     =     30.35
         Prob > chi2  =    0.5995

Cameron & Trivedi's decomposition of IM-test
```

Source	chi2	df	p
Heteroskedasticity	**30.35**	**33**	**0.5995**
Skewness	**6.54**	**7**	**0.4784**
Kurtosis	**1.06**	**1**	**0.3022**
Total	**37.96**	**41**	**0.6066**

Appendix F: Model (4) detail

```
50 . reg ROAE14  ROAE13 Commercial Independent CntryTop10 NSFR14 CapRatio14 GrowthLo
   > s14 lAssets14
```

Source	SS	df	MS		
Model	8780.12009	11	798.192736	Number of obs	= 514
Residual	20759.7865	502	41.3541564	F(11, 502)	= 19.30
				Prob > F	= 0.0000
				R-squared	= 0.2972
				Adj R-squared	= 0.2818
Total	29539.9066	513	57.582664	Root MSE	= 6.4307

ROAE14	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ROAE13	.2792595	.0268348	10.41	0.000	.2265373	.3319818
Commercial	.9979948	.8872487	1.12	0.261	-.7451834	2.741173
Independent	-1.023116	.6147108	-1.66	0.097	-2.230839	.1846072
CntryTop10	.6126023	1.092349	0.56	0.575	-1.533536	2.758741
NSFR14	-.0343593	.0104609	-3.28	0.001	-.0549119	-.0138068
CapRatio14	.1024986	.0913023	1.12	0.262	-.0768831	.2818804
GrowthLoans14	.0473896	.0164813	2.88	0.004	.0150089	.0797704
Overhead14	.1938852	.3386739	0.57	0.567	-.4715076	.8592781
NonIntrst14	.0265535	.0249962	1.06	0.289	-.0225566	.0756636
FundCosts14	-.0046462	.026767	-0.17	0.862	-.0572354	.047943
lAssets14	-.1597649	.1963905	-0.81	0.416	-.5456135	.2260837
_cons	7.640703	4.025684	1.90	0.058	-.2685612	15.54997

```
51 . estat imtest, white

   White's test for Ho: homoskedasticity
            against Ha: unrestricted heteroskedasticity

            chi2(74)     =     88.54
            Prob > chi2  =    0.1193

   Cameron & Trivedi's decomposition of IM-test
```

Source	chi2	df	p

Heteroskedasticity	88.54	74	0.1193
Skewness	10.44	11	0.4913
Kurtosis	1.11	1	0.2931
Total	100.08	86	0.1422

```
52 . reg ROAE14  ROAE13 Commercial Independent CntryTop10 NSFR14 CapRatio14 GrowthLo
```

Source	SS	df	MS		
Model	8750.53131	9	972.281257	Number of obs	= 514
Residual	20789.3753	504	41.2487605	F(9, 504)	= 23.57
Total	29539.9066	513	57.582664	Prob > F	= 0.0000
				R-squared	= 0.2962
				Adj R-squared	= 0.2837
				Root MSE	= 6.4225

ROAE14	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ROAE13	.2816906	.022427	12.56	0.000	.2376286	.3257526
Commercial	.9429055	.8830183	1.07	0.286	-.7919447	2.677756
Independent	-.9798619	.6006149	-1.63	0.103	-2.159879	.2001554
CntryTop10	.279794	1.002231	0.28	0.780	-1.689272	2.24886
NSFR14	-.0307466	.0092067	-3.34	0.001	-.0488348	-.0126583
CapRatio14	.120176	.0886113	1.36	0.176	-.0539169	.294269
GrowthLoans14	.0488357	.0163712	2.98	0.003	.0166715	.0809999
Overhead14	.2248761	.3335759	0.67	0.501	-.4304945	.8802466
NonIntrst14	.0284092	.0246203	1.15	0.249	-.0199618	.0767802
_cons	4.441185	1.331024	3.34	0.001	1.826147	7.056223

```
53 . reg ROAE14  ROAE13 Commercial Independent  NSFR14 CapRatio14 GrowthLoans14 Overl
```

Source	SS	df	MS		
Model	8747.31653	8	1093.41457	Number of obs	= 514
Residual	20792.5901	505	41.1734457	F(8, 505)	= 26.56
Total	29539.9066	513	57.582664	Prob > F	= 0.0000
				R-squared	= 0.2961
				Adj R-squared	= 0.2850
				Root MSE	= 6.4167

ROAE14	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ROAE13	.2819164	.022392	12.59	0.000	.2379234	.3259093
Commercial	1.06726	.7617355	1.40	0.162	-.4293007	2.563821
Independent	-.9775617	.6000099	-1.63	0.104	-2.156385	.2012613
NSFR14	-.0308488	.009191	-3.36	0.001	-.0489062	-.0127915
CapRatio14	.1198253	.0885214	1.35	0.176	-.0540903	.2937409
GrowthLoans14	.0489296	.0163528	2.99	0.003	.0168017	.0810575
Overhead14	.2165642	.3319411	0.65	0.514	-.4355913	.8687198
NonIntrst14	.0283867	.0245976	1.15	0.249	-.0199396	.076713
_cons	4.480564	1.322319	3.39	0.001	1.88264	7.078488

```
54 . estat imtest, white

   White's test for Ho: homoskedasticity
            against Ha: unrestricted heteroskedasticity
```

```
          chi2(42)      =     71.63
          Prob > chi2   =    0.0029
```

Cameron & Trivedi's decomposition of IM-test

Source	chi2	df	p
Heteroskedasticity	71.63	42	0.0029
Skewness	9.63	8	0.2920
Kurtosis	1.10	1	0.2936
Total	82.36	51	0.0035

```
55 . reg ROAE14  ROAE13 Independent  NSFR14 CapRatio14 GrowthLoans14
```

Source	SS	df	MS
Model	8496.1666	5	1699.23332
Residual	21043.74	508	41.4246851
Total	29539.9066	513	57.582664

```
Number of obs =     514
F(  5,   508) =   41.02
Prob > F      =  0.0000
R-squared     =  0.2876
Adj R-squared =  0.2806
Root MSE      =  6.4362
```

ROAE14	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ROAE13	.2887589	.0222768	12.96	0.000	.2449929	.3325249
Independent	-1.194084	.575849	-2.07	0.039	-2.325422	-.0627448
NSFR14	-.0284111	.0086692	-3.28	0.001	-.045443	-.0113791
CapRatio14	.1563919	.0833028	1.88	0.061	-.0072684	.3200522
GrowthLoans14	.056848	.0159894	3.56	0.000	.0254345	.0882615
_cons	5.231371	1.255491	4.17	0.000	2.764777	7.697966

```
56 . estat imtest, white

   White's test for Ho: homoskedasticity
            against Ha: unrestricted heteroskedasticity

            chi2(19)      =     26.54
            Prob > chi2   =    0.1159

   Cameron & Trivedi's decomposition of IM-test
```

Source	chi2	df	p
Heteroskedasticity	26.54	19	0.1159
Skewness	7.02	5	0.2189
Kurtosis	1.09	1	0.2957
Total	34.66	25	0.0946

```
57 . reg ROAE14  ROAE13 Independent  NSFR14 CapRatio14 GrowthLoans14 , beta
```

Source	SS	df	MS		
Model	8496.1666	5	1699.23332	Number of obs	= 514
Residual	21043.74	508	41.4246851	F(5, 508)	= 41.02
				Prob > F	= 0.0000
Total	29539.9066	513	57.582664	R-squared	= 0.2876
				Adj R-squared	= 0.2806
				Root MSE	= 6.4362

ROAE14	Coef.	Std. Err.	t	P>|t|	Beta
ROAE13	.2887589	.0222768	12.96	0.000	.4903009
Independent	-1.194084	.575849	-2.07	0.039	-.0787503
NSFR14	-.0284111	.0086692	-3.28	0.001	-.1237552
CapRatio14	.1563919	.0833028	1.88	0.061	.0716971
GrowthLoans14	.056848	.0159894	3.56	0.000	.1343188
_cons	5.231371	1.255491	4.17	0.000	.

Appendix G: ROAA,NIM and NSFR development

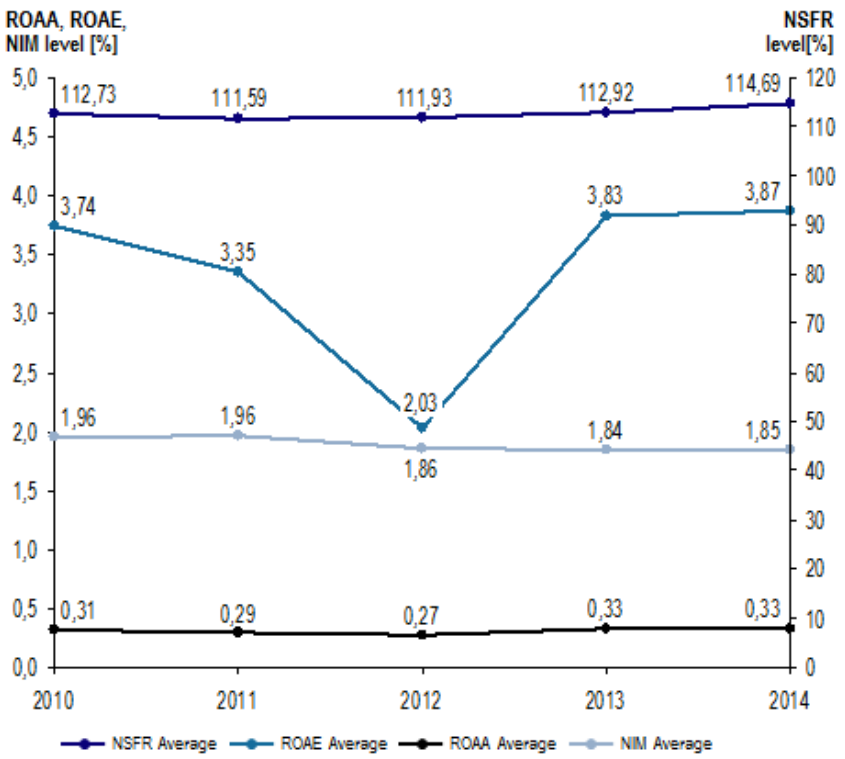


Figure G.1: ROAA,NIM and NSFR development from 2010 to 2014

Source: Author's computations, Bankscope