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Basel III long-term liquidity standard in the context of the profitability of banks and volatility of their stock prices – quantitative analysis for the euro area

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Contents

Abstract

The paper is devoted to the Net Stable Funding Ratio (NSFR) - the liquidity regulation included in the Basel III recommendations. The aim of the article is to verify the impact of stable funding structure measured by estimated NSFR on the profitability of banks and the volatility of their stock prices.

It embraces the data of the 100 biggest banks in the euro area which are listed on stock exchanges. The research area of this article is divided into two parts. The first one is devoted to the relation between the NSFR and bank profitability. In the second one, the relation between the NSFR and a bank's valuation (stock prices) and the volatility of stock prices on the capital market is presented. Models with financial and macroeconomic variables were used. The research results showed that there is a positive and statistically significant relation between the level of the NSFR in banks and their profitability measured by the return on average assets (ROAA), the return on average equity (ROAE) and the net interest margin (NIM). Furthermore, a growing NSFR has a positive influence on changes of stock prices and a negative influence on the level of their volatility.

JEL codes: C33, G10, G15, G17, G21

Keywords: banking sector, regulation, funding structure, liquidity, Basel III, Net Stable Funding Ratio (NSFR), volatility of stock prices

1. Introduction

The nature of the recent financial crisis in 2007-2010 which was primarily caused by disorders in the banking sector, prompted the actions of supervisors and regulators on macro-prudential policy. These activities are aimed mainly at reducing the incidence of negative externalities in the banking sector. It was recognized that through the instruments of macro-prudential policy, focused largely on banking institutions, it is possible to reduce systemic risk and the pro-cyclicality of the financial system. Pre-crisis supervisory policy was often characterized by a micro-prudential perspective influencing financial institutions. The area of interest of macro-prudential policy is, however, the state of the entire financial system and its impact on the economy and the relationship between financial institutions and their financial condition. Micro-prudential and macro-prudential policy use similar instruments [Bańbuła 2013, pp. 54-56].

The post-crisis regulations are important instruments of macro-prudential policy. After a long period of liberalization and deregulation, as a result of problems in the financial system the cycle of tightening regulations began. Financial market regulations are intended to reduce the level of systemic risk and lower the probability and frequency with which crises occur. However, in the case of adverse developments in the banking sector, they have to, inter alia, protect the credit institutions from insolvency. Furthermore, in the case of bankruptcy and the necessity to rescue certain banks, they ought to reduce the scale of the fiscal burden on state budgets. This involves the problems of financial institutions of systemic importance (Systemically Important Financial Institutions - SIFIs).

The soundness of the entire financial sector is often associated with the safety of the banking sector. This is especially the case of the German-Japanese (continental) financial system model, where the banking sector plays the most important role (compared with the other segments of the financial sector). Among others, this is the case of Poland [Iwanicz-Drozdowska 2012].

It is worth noting that the financial crisis from 2007-2009 started in the banking sector. Later, the crisis spread to other segments of the financial system. Finally, this affected the real economy. In its early stages, it manifested itself mainly through the banking crisis.

The importance of the banking sector in the financial system, and the role it played in the transmission of negative impulses during the last crisis, justify the validity of the subject. This means that macro-prudential tools (regulations) relating to the banking sector are very

important factors contributing to a safer financial system. Thus, it constitutes a justification for the selection of this research problem.

It is important to note that participants of a financial market have to comply with a broad range of regulations. Some of them have a significant impact on the banking sector and the capital market. The examples of such regulations are Markets in Financial Instruments Directive (MIFID and MIFID II) and European Markets Infrastructure Regulation (EMIR). Therefore, the activities of financial institutions are regulated in a wide range [Flotyński 2015a; Flotyński 2015b]

The supervisors' and regulators' actions were targeted on a change in macro-prudential policy in the European Union (EU). As a result of the financial crisis, researchers deepened their interests significantly in the issue of a liquidity risk in banks. Liquidity is crucial in the banking sector. Many economists indicate that its lack is one of the most significant causes of the occurrence of crises [Laeven and Valencia 2012; Lastra and Wood 2010; Borio 2009; Cabral 2010; Claessens and Kose 2013].

Consequently, one of the macro-prudential policy tools which is helpful in maintaining financial soundness, and has not been thoroughly verified in practice yet, is additional systemic liquidity limits related to items on banks' balance sheets. They have been developed in the Basel III recommendations by the Basel Committee on Banking Supervision. They were implemented into European Union law by the regulatory package of CRD IV / CRR (the Capital Requirements Directive IV and the Capital Requirements Regulation).

Liquidity is a particularly important issue in the banking sector. Many economists indicate [Acharya, Philippon, Richardson and Roubini 2009;Thakor 2015; Verick and Islam 2010; Allen and Carletti 2010; European Commission 2009; Blundell-Wignal, Atkinson and Lee 2008; Cornett, McNutt, Strahan and Tehranian 2011] that liquidity shortages are one of the most important factors raising the risk in the banking sector. During the recent financial crisis in 2007-2009 the problem of a maturity mismatch between banks' assets and liabilities was very clearly visible. The financing of long-term assets (e.g. mortgage loans) with short-term liabilities (e.g. weekly loans from the wholesale market) created an urgent need for very frequent rollovers. While raising finances is normally easily achievable on the efficient interbank market, when confidence among market participants fell during the crisis there were serious difficulties with access to new sources of funding. As a result, the risk of liquidity and funding rose significantly. This led some banks to the edge of insolvency, and

ultimately even to collapse. This was one of the most important determinants of the crisis [Berrospide 2013; Acharya and Mora 2013]. The increased level of liquidity risk and unmatched balance sheet structure led to the increased risk of a potential crisis at the micro level (individual banks) and macro level (the entire banking sector). Therefore, after the crisis, researchers' interest in the liquidity and funding structure of banks has increased remarkably.

Basel III introduces a short-term and long-term liquidity standard. Before the Basel III recommendations the issues of liquidity were left to national supervisors. In Basel III, liquidity standards have been introduced – the short-term Liquidity Coverage Ratio (LCR) and the long-term Net Stable Funding Ratio (NSFR). The latter (NSFR) has been chosen for this study. The NSFR addresses problems which were very clearly evident during the recent crisis: the shortage of long-term liquidity and the maturity mismatch of banks' assets and liabilities. According to the document of the European Systemic Risk Board [2013] the NSFR will mitigate funding risk and excessive maturity mismatch. Consequently, it may make the system more resilient to excessive amounts of credit in the economy and the overuse of financial leverage. It is worth noting that work on the NSFR in the European Union is still under way. In particular, consultations are being carried out [European Commission 2017].

The research undertaken by the author includes a discussion of the consequences of the CRD IV / CRR regulatory package, which is the implementation of the Basel III recommendations in EU law. This fact justifies the demand for the analysis of the potential effects of liquidity regulation in the banking sector. The NSFR, which is planned to be introduced from 2018, will entail major changes in the functioning of the banking sector. From the perspective of financial supervision of commercial banks or a central bank, it is very important to predict the possible consequences of the implementation of this standard for the financial soundness of the banking sector. In terms of their potential effects, any adjustments should be thoroughly analyzed. The analysis of the impact of regulation on the banking sector is strongly oriented to the future. If regulators make a decision on the application of macro-prudential instruments, it is very important to examine the effectiveness of their actions. Deep knowledge about the possible consequences of the regulations may entail changes in the plans of economic entities or financial policy of a state. Therefore, this study may be treated as a response to the need for an analysis of the interaction between the regulation and the profitability of the banking sector.

The paper focuses on the issue of macro-prudential regulation. The main subject of the article is the profitability and stock valuation of bank stocks in the euro area in the context of the newly implemented NSFR. It focuses on answering the question of what the changes (as well as direction) of banks profitability would be. The second thing is the issue of stock price volatility in the context of stable funding measured by the NSFR.

The main scientific objective of the paper is to investigate the impact of the stable funding structure measured by estimated NSFR on bank profitability and the volatility of their stock prices.

The literature includes mainly such scientific areas as finance and banking, as well as financial analysis. In the descriptive sections there are references to articles in international journals (the vast majority of them were published after the recent financial crisis in the years 2007-2009). In the theoretical part, issues related to the liquidity and funding structure of banks during the financial crisis are included. On the basis of the literature, a picture of the current situation has been obtained. It embraces research on the regulations and standards of liquidity in the banking sector. Looking at the broader context of regulation in the banking sector was essential. The collection of articles about the new liquidity standards (the LCR and NSFR) was used to identify and define the specific research problems.

The research area of Basel III liquidity standards has been poorly researched in the literature around the world so far. As a result, the article fills a research gap existing in the literature internationally, regarding the effects of the introduction of liquidity regulation in credit institutions.

The research embraces the 100 biggest banks in the euro area which are quoted on European stock exchanges. The data comes from the years 2004 to 2014. The term ‘valuation’ in the paper has been defined mainly in the context of bank stock prices and their volatility.

In order to obtain a great deal of information for empirical study, data provided by Orbis Bank Focus was used. A lot of information from the financial web portals such as bankier.pl, stooq.pl and money.pl was utilized.

The majority of the research embraces, however, a quantitative analysis. The methods used in the paper are descriptive statistics, statistical analysis, ratio analysis, analysis of the financial statements of institutions and analysis of the correlation between variables.

The most important role in the study is played by panel regression models of one and several variables.

It is very important to be aware of the changes that must take place in the structure of a bank's balance sheet to meet the standard of stable funding. These adjustments will have a significant influence on the efficiency of banking institutions. In the present situation, it is difficult to assess what the effects of the regulations in terms of the functioning of institutions on the financial market will be. Moreover, the effectiveness of institutions and the entire financial system should also be assessed. Therefore, the study has an innovative character and contributes to the greater understanding of this field of science.

It is very important to emphasize that the whole research – the general idea as well as the carefully drawn-up detailed method, has been worked out by the author of this article. The main contribution of this paper is the study of the relation between:

- the NSFR and bank profitability,
- the NSFR and bank valuation (stock prices) - the volatility of stock prices on stock exchanges.

Due to the implications for the stability of banks, the above-mentioned issues are of practical importance for financial supervisors, as well as for investors on the capital market.

The structure of this article is as follows. At the beginning, theoretical background is presented. Then, the research hypotheses are put forward. After that, the research methodology is discussed. It begins with the description of the research methods as well as all the assumptions in the substantial, time and spatial dimensions. Then, the consecutive stages of the research are presented. The last subsection is connected to the discussion of the results and the final comments on the impact of the NSFR on bank profitability and stock prices. Then, conclusions are drawn and the hypotheses are verified.

2. Theoretical background

It is worth noting that the regulation of the financial market and the financial stability belong to the most important research areas in modern finance. The literature abounds in studies related to the recommendations of the Basel Committee on Banking Supervision (BCBS). Currently, most studies refer to Basel III. The BCBS set of recommendations is reflected in the Capital Requirements Directive IV (CRD IV) and Capital Requirements Regulation (CRR). They cover a wide range of regulations, among others, capital requirements, liquidity standards, countercyclical buffers or leverage. These regulations have been introduced in the European Union on the basis of a single set of rules (single rule book), valid in the whole Community.

Previous studies were devoted mainly to the guidelines which were already in force, primarily the increased capital requirements (Tier 1, including CET1 and Tier 2). There have also been many studies concerning the impact of the above mentioned standards on the economy. Many articles have also been published on the necessary changes in the balance sheets of banks and credit institutions in order to meet the new requirements in terms of capital adequacy. Other regulations, such as buffers and leverage, have been studied far more seldom.

Thus, the new indicators of Basel III – the LCR (concerning liquidity risk) and the NSFR (relating to liquidity and funding) form part of a clear need for regulation of the banking sector. The LCR is to ensure that a bank which meets this requirement will have a sufficient amount of liquid assets of high quality and low credit risk for a 30-day period of market stress. Consequently, it will be able to cover sudden cash outflows. The intention of the LCR's introduction was to relieve the central bank's role as a lender of last resort. In the event of a sudden loss of confidence in the interbank market (which took place at the beginning of the crisis in 2007-2009), it is difficult to carry out transactions between entities with liquidity shortages and entities with cash surpluses. Market tensions may cause excessive use of the liquidity instruments of the central bank [Niedziółka 2015, pp. 208-210].

The NSFR is calculated as the ratio of the available amount of stable funding (liabilities) and those items that require stable sources of funding (assets). The formula is as follows:

$$NSFR = \frac{\text{ASF}}{\text{RSF}}$$

where:

ASF - available stable funding

RSF - required stable funding

Thus, banking institutions should cover the liquidity risk associated with liabilities and risk-weighted assets. The intention of the regulator was to reduce the dependence of banking institutions on funding from the wholesale money market. This is unfavorable in the case of tensions and the lack of confidence in the market [Niedziółka 2012, pp. 40-44; Niedziółka 2015, pp. 211]. According to the BCBS [BIS 2014a; BIS 2014b] the NSFR will reduce the risk of an outbreak of financial crises.

So far, scholars and business practitioners demonstrated far less interest in the NSFR than the other regulations of Basel III, including the LCR indicator of the short-term liquidity. Primarily, this is due to the implementation schedule of the NSFR: it will be applied from January, 2018, while most of the remaining regulations have already been (at least partially) applied. Therefore, the author's interest in the NSFR indicator fills a research gap.

It is worth mentioning that the liquidity issues prior to the issuance of the Basel III recommendations were left largely to national supervisors. It should be noted that the regulator's intention was to reduce the likelihood of a crisis. The introduced liquidity regulations change the level of systemic risk. This affects the functioning and the stability of the financial system. Thus, the new ratios implemented under the Basel III are in line with the clear need for banking regulation.

It is worth emphasizing that the NSFR can be perceived from a macro and a micro perspective. Though most often it is described in a macro-prudential context, sometimes it is treated as a micro-prudential liquidity standard as well. The NSFR is intended to lessen banks' fragility caused by liquidity shocks. Because the funding problems of consecutive banks cannot be assessed, despite the risk to the entire financial system, the NSFR links the macro- and the micro-perspective [Bica, Bunea and Weadow 2014]. Gobat, Yanase and Maloney [2014], for example, present the NSFR as a micro-prudential tool incentivizing banks to select the proper balance sheet structure from a risk management point of view. The reason why the NSFR is partly a micro-prudential tool is that it addresses a bank's

maturity mismatch and overreliance on unstable sources of funding [Legroux, Rahmouni-Rousseau, Szczerbowicz, Valla 2017]. However, the NSFR is usually considered more from a macro-perspective as a macro-prudential tool. This is more obvious when regarding financial stability issues. As a macro-prudential instrument, the NSFR is focused mainly on ensuring the stable and harmonious functioning of the entire financial system, with the aim of avoiding shocks and turbulences. The NSFR refers to the risk of financing. Its introduction is expected to reduce the scale of maturity mismatches between assets and liabilities. Compliance with this standard in banks will force changes in the structure of their assets and sources of financing. A highly pronounced mismatch of the maturity structure of assets and liabilities of banks and the lack of stable, long-term financing is a serious threat to the stability of the banking sector. In the minds of regulators, the NSFR should contribute to limiting the scale of this phenomenon. Due to this fact, the NSFR is an important macro-prudential tool limiting the systemic liquidity risk.

As a consequence, the NSFR is a response to the practical problems of a lack of long-term liquidity and the improper structure of assets and liabilities in banks. In the context of the need to bolster the stability of the financial system, the NSFR is becoming increasingly important and requires a careful research. In the article, Basel III's liquidity indicators were limited to the structural liquidity ratio of NSFR. As mentioned above, the NSFR has been quite rarely discussed in the literature, so far. Certainly, it has been given less attention than the LCR standard. The considerations on the NSFR are, therefore, a part of the research gap. In particular, there are few studies dealing with the relationship between changes in the NSFR and the stability of banks. It should also be stressed that banks have a range of instruments that potentially can cover short-term liquidity shortages signaled by low LCR values. These include, among others, operations with the central bank. Long-term liquidity shortages, maturity mismatches of assets and liabilities on balance sheets are structural problems that pose a serious threat to the stability of banks. These impediments translate into systemic risk. Before the financial crisis in 2007-2009, this problem was rarely noticed. In later times, it gained in popularity. Nevertheless, due to the relatively small number of studies on regulations of the maturity mismatch, there is a clear need for putting more emphasis on structural liquidity (NSFR) than on short-term liquidity (LCR).

3. Literature review

The topicality of NSFR-related research and the small number of studies (especially empirical) on the NSFR mean that the article is cutting-edge research. It should be noted that the majority of existing studies are descriptive and are not based on any quantitative research. The critical analysis of the literature carried out by the author shows that most often researchers have focused solely on checking the impact of the new regulations on certain variables. These variables, however, are usually isolated from the others and are only one from a large group of the profitability or valuation ratios. In fact, very few articles considered the impact of the NSFR on bank profitability, valuation and the volatility of stocks. Consequently, it is clear that there is also a lack of studies, which seek to capture the multi-faceted relationship between the NSFR and the efficiency of banking institutions as well as the volatility of their stocks. So, this is another reason why the article fills the research gap existing in the international literature regarding the effects of the introduction of the liquidity regulation in credit institutions.

So far, the research area of the Basel III liquidity standards has been poorly researched in the literature around the world. Nevertheless, some of the studies (in particular those about the NSFR) are worth quoting. They often raise the issues of adjustments to the new liquidity standards in banks' balance sheets.

To give an example, Ly, Chen et al. [2017] found that adjusting to the optimal level of the NSFR helped to reduce systemic risk. In this context, 3 variables are the most important: the value of deposits, the maturity of money market financing, and the speed of adjustment to the NSFR. Nevertheless, there are also studies leading to different conclusions. For instance, Nowak [2011] suggests that the common equity ratio is statistically significant in reducing the bankruptcy risk. The research was based on the panel regression model with individual, random effects. According to the author, the NSFR is not an effective tool for limiting the risk of bankruptcy of financial institutions.

Ashraf, Huiller and Rizwan [2015] examined the effectiveness of the NSFR requirement in the context of financial stability. The study was based on approximately 1,000 banks from 85 countries and confirmed that the NSFR improves the stability of banks. Diamond and Kashyap [2014] came to conclusion that the application of the NSFR reduces the risk of runs on banks. Cucinelli [2013] carried out research on 1,080 banks in the euro area. There were also some banks listed on stock exchanges. It is important to note that a panel regression

was chosen. The dependent variables: the NSFR and the LCR were treated as the measures of liquidity risk. The research results indicated that a bank's business profile, its size, asset quality and capitalization have an impact on liquidity measured by the the NSFR and the LCR ratios.

De Young and Jang [2015] compared banks in terms of their size. They claim that small US banks are able to adjust faster to the required 100% level of the NSFR than Systemically Important Financial Institutions (SIFIs). The authors suggest that SIFIs will need to accumulate substantial amounts of stable funding as a result of the reorganization of the liquidity risk management process. What is more, according to Chang and Chung [2016], the impact of short-term and long-term liquidity ratios on the risk of insolvency may depend on the size of the bank. For small banks, the LCR is less important than the NSFR. The reverse situation occurs for large banks. Differences for various bank sizes occur also in terms of adjustments to the required NSFR.

Another group of researchers, including Dietrich, Wanzenried and Hess [2014], King [2013], Arvanitis and Drakos [2015] calculated the potential historical value of the NSFR. They verified whether banks met the currently applicable standards in the past. Even though the NSFR has only been widely known since the financial crisis, it is possible to calculate this ratio for previous years and to verify it using past data, too. This allows us to check if financial institutions had enough available stable funding in the past to cover the required stable funding. The authors found, in the first of the above mentioned articles, that in the 1996-2010 period, Western European banks would not have been able to meet the NSFR standards at the required level of 100%. Only in the wake of the financial crisis did a large part of them began to increase its value.

Arvanitis and Drakos [2015] calculated the level of the NSFR in individual segments of banks and potential historical NSFR values too. However, in this case, banks based in the USA were the object of the survey. It was found that the differences in indicator values were statistically significant in the pre-crisis years in 2007-2009 and after the crisis.

The issue of increasing the cost of credit to bank customers was discussed in articles by King: [2010] and [2013]. This was the result of adapting activities to the new regulations. In order to have a return on equity (ROE) in a bank at the same level as before, there was a necessity to increase credit spreads. Consequently, banks intending to adjust their operations to the new regulations, shifted all the costs to the borrowers. Furthermore, the

above analyses are among the few that are devoted to the changes in bank balance sheets as a result of the implementation of the NSFR. Both of them included NSFR estimations for banks from many different states. They considered the direction of changes that must be made within consecutive items of the balance sheet (available stable funding and required stable funding) to ensure that financial institutions would meet NSFR standards. Extending the maturity of financing acquired from the interbank market and increasing the share of high-value securities belong to the most cost-effective strategies. Nevertheless, even the most favorable solutions lowered the net interest margin of banks.

Bologna [2013] was another researcher who calculated the potential historical value of the NSFR to verify whether banks met the currently applicable standards in the past. He presented results justifying the introduction of the NSFR. It was found, on the basis of logistic regression, that well-balanced funding positions (greater value of long-term deposits and a smaller liquidity gap) would actually reduce the risk of bank failures. Went [2010] stated that meeting the required level of the NSFR may reduce the profitability of banks and the entire banking sector. However, the above-mentioned studies do not provide the justification that banks with a lower NSFR level are on average more profitable. Nevertheless, there was a significant impact of the NSFR on the volatility of profits. The research has not shown that low values of the NSFR were related to the increased profitability of banks. The NSFR factor, however, was correlated with a higher volatility of banks' results.

Other financial ratios have been taken into consideration as well. Changes in the return on assets (ROA) and the net interest margin (NIM) are estimated by Handorf [2014]. The calculations indicate that an increase in the LCR or the NSFR leads to a decrease in ROA and NIM. The paper empirically presents the benefits that a bank gets from liquidity and credit risk premiums when it has an appropriate term-structure of assets and liabilities.

The research by Härle and others [2010], Went [2010] and Allen Chan, Milne and Thomas [2010] confirmed these observations. They found that the NSFR will have a negative impact on the profitability of banks and the entire banking sector. Kauko [2015] and Allen, Chan, Milne and Thomas [2010] have confirmed the perceptions of the cost of credit. Basel III regulations may reduce credit availability and contribute to slower economic growth. According to the authors, the main problem is the efficient introduction of the supervisory requirements. The liquidity regulation alone does not pose a very serious threat in itself.

It is suggested that gradual changes can be made so that financial market players have enough time to adapt to new regulations in a way that does not interrupt, to a large extent, their current operations.

The regression method for 8 Malaysian banks in 2005-2011 was examined by Said [2014]. A positive and statistically significant relationship between the NSFR and ROA, ROE and NIM was obtained. Despite the fact that the banks limited the share of low and medium quality assets in favor of high quality assets which resulted in a relative decrease in NIM, the other factors have led banks to maintain their current profitability.

Chun, Kim and Ko [2012] based the research on the presumption that bank managers will keep the ROE at the pre-regulatory level. In such circumstances, after the implementation of the NSFR regulation, the cost of credit will increase by an average of 20 basis points. Nevertheless, these results are sensitive to the definition of the NSFR and the methods of its calculation.

The European Banking Authority (EBA) released a thorough report on the NSFR [2015; 2017]. There is an estimation included of the impact of the NSFR on bank profitability. This is reckoned by summing up changes in expenses and income. The findings presented in the report concern, inter alia, the influence of various banking models on profitability. The models of savings banks or securities trading houses are in line with decreasing profits. However, universal banks can even improve their profitability when they try to meet the NSFR by balance sheet adjustments.

Alternatively to the NSFR, there was a discussion on the potential introduction of Core Funding Ratio (CFR). This ratio has been devised as a relation between the sum of retail deposits, wholesale funding (with maturity of more than 1 year), equity instruments and total liabilities [European Banking Authority 2016a]. The report was based on the same quantitative impact study data as the previous report on the NSFR from 2015. Despite its advantages, it finally appeared that the CFR cannot replace the NSFR because it can be partially misleading. The CFR does not give an overview of the entire balance sheet of a bank. Therefore, a potential funding gap may not be appropriately estimated [European Banking Authority 2016b]. It seems that in terms of systemic funding risk it would be very difficult to find other metrics that could replace the NSFR.

Above considerations emphasize that in the literature there are some studies devoted to banks profitability in the context of the NSFR. However, there is no clear consent what

would be the effects of the long-term liquidity regulations for banks income. This opens a field for thorough research. It can be stated that the second research area of this paper fills the research gap as well. There is a lack of studies devoted to the relation between the NSFR and the valuation of stock prices on stock exchanges. In the light of this research, the valuation is meant to be the level of a stock price as well as its behaviour (volatility) during a certain period of quotations on a stock market.

4. Hypotheses

There is a belief that the introduction of the NSFR will affect the financial efficiency of banks. When evaluating the potential changes in the profitability, it is important to check what banks do in terms of their balance sheet structure to achieve the desired value of the NSFR. The shape of the NSFR was devised in the Basel Committee on Banking Supervision in the Bank for International Settlements. This process lasted several years. The formula for the NSFR calculation appeared in a BCBS document [2010]. The formulae were also described in papers published 3 and 4 years later [2013; 2014]. Due to the lack of sufficient granularity of balance sheet items, the simplified method to count the NSFR was utilized.

Fulfilling the supervisory standards of the NSFR at not less than 100% can be achieved through a number of potential combinations of adjustments to the balance sheet structure of banks. There are 2 basic methods of NSFR adjustments to the required by the supervisor level (minimum value of 100%): adjustment through liabilities (Available Stable Funding - ASF) and adjustment through assets (Required Stable Funding - RSF). In Table 1, balance sheet items and the weights to calculate the NSFR are presented.

After the analysis of the weights of the subsequent items, it can be said that a bank can increase value of ASF items or can decrease value of RSF items. According to Table 1, value of the following ASF and RSF balance sheet items ought to be risen: customer deposits (current, savings, term), interest bearing liabilities (senior debt, subordinated borrowing, preference shares and hybrid capital), other long-term funding, loan loss reserves, other reserves, equity, other earning assets (loans and advances to banks, trading securities, investment securities, remaining earning assets), non-earning assets: cash and due from banks. Contrary to this, the following ASF and RSF balance sheet items may fall in order to meet the requirement: deposits and short term funding (deposits from banks, other deposits and short-term borrowings), other interest bearing liabilities (derivatives, trading liabilities), earning assets (customer loans: mortgages, other mortgage loans, other consumer/retail loans, corporate and commercial loans, other loans), reserves for impaired loans/NPLs, fixed assets, non-earning assets (goodwill, other intangibles, other assets).

It is crucial to consider the most common ways of adapting to meet the required value of the NSFR (minimum 100%). There are many potential reactions of banks (a combination of changes in the values of assets and liabilities).

Table 1: The balance sheet items and the weights needed to calculate NSFR in the research

Components of available stable funding	**Weight of ASF component**	**Components of required stable funding**	**Weight of RSF component**
Deposits and short term funding: customer deposits • Customer deposits - current	85%	Earning assets, customer loans: • Mortgages • Other mortgage loans • Other consumer / retail loans • Corporate and commercial loans • Other loans	100%
Deposits and short term funding: customer deposits • Customer deposits - savings • Customer deposits - term	70%	Earning assets: • Reserves for impaired loans / Non Performing Loans (NPLs)	100%
Deposits and short term funding: • Deposits from banks • Other deposits and short-term borrowings	0%	Other earning assets: • Loans and advances to banks • Derivatives • Other securities: trading securities, investment securities • Remaining earning assets	35%
Other interest bearing liabilities: • Derivatives • Trading liabilities	0%	• Fixed assets	100%
Other interest bearing liabilities, long term funding: • Senior debt • Subordinated borrowing • Pref. shares and hybrid capital • Other funding	100%	Non-Earning assets: • Cash and due from banks	0%
• Other (non-interest bearing) • Loan loss reserves • Other reserves • Equity	100%	Non-earning assets: • Goodwill • Other intangibles • Other assets	100%

Source: own study based on: Bank for international settlement, Basel Committee on Banking Supervision (2014), Basel III: the net stable funding ratio, Basel; http://www.bis.org/bcbs/publ/d295.pdf
Vazquez, F., Federico, P., 2012, Bank Funding Structures and Risk: Evidence from the Global Financial Crisis, IMF Working Paper, WP/12/29, International Monetary Fund.

The general rule in the context of liabilities comes down to the fact that the share of stable, long-term sources of funding should be increased. Simultaneously, the share of liabilities with a maturity of less than one year ought to be reduced. This involves a change in the approach to funding (from short-term to long-term). The most important principle in the context of assets is the increase in the share of positions requiring little coverage of stable sources of funding. This can be provided by a zero or low-weight position. Adjusting to the minimum NSFR may entail changes in the banks' balance sheets and profit and loss statements. These changes can be significant in case a bank does not fulfil the minimum standard. Otherwise, it can be even imperceptible if bank's NSFR is above 100%.

In particular, it concerns banking institutions that do not meet the NSFR standard, and banks whose assets are not sufficiently covered by long-term, stable funding.

According to the method of NSFR calculation and to fulfil the aim of the article, it is desirable to answer several research questions:

- What is the scale and direction of changes in banks' profitability as a result of the introduction of the new liquidity standard – NSFR? Will the necessary adjustments of banks' balance sheets in terms of the available (ASF) and the required (RSF) stable funding lead to a decline in profitability of banking operations?
- What are the methods of maintaining the NSFR at the required level (over 100%)? What are the possible balance sheet adjustments?
- Was the share price of institutions fulfilling the required level of the NSFR (equal to 100% or higher) more stable during the period considered than the share prices of institutions whose NSFR was well below the standard?
- Was the average NSFR for the sample of banks higher in the period before the financial crisis (2004-2006) than in 2010-2012, when economic recovery occurred?

On the basis of: the research gap, the analysis of the construction of the NSFR ratio, the possible ways of adapting the structure of the balance sheet (to achieve an NSFR value of at least at 100%) and the literature, partial hypotheses have been formulated [H]. They are to clarify the economic substance of the consequences caused by the introduction of the NSFR in individual areas of banking profitability and stock prices. Primarily, the partial hypotheses were formulated on the basis of the anticipated effects of changes in the assets and liabilities

term structure. The assumption was made that meeting the required level of the NSFR is associated with changes in the profitability of banks. Thereby, it affects the profitability of the whole banking sector. The assumption was made because the scope of the study covers a substantial portion of the assets of the whole banking sector in the EU. The objectives of the study, partial hypothesis verification and the comparison of results obtained in the various parts of the study will verify the impact of the NSFR on the profitability of the banking sector.

The main hypothesis [H] is formulated as follows:

[H]: An increase in NSFR value leads to the fall in bank profitability and the volatility of stock prices on the capital market.

In order to clarify the economic essence of the consequences of the liquidity requirements (NSFR) within Basel III, several partial hypotheses were also verified.

Hypotheses [H1]-[H3] relate to the profitability of banks:

[H1]: Net interest margin (NIM) decreases when banks strive to raise the NSFR as a result of a change in their balance sheet structure

[H2]: Return on average assets (ROAA) decreases when banks strive to raise the NSFR as a result of a change in their balance sheet structure

[H3]: Return on average equity (ROAE) decreases when banks strive to raise the NSFR as a result of a change in their balance sheet structure

Hypotheses [H4]-[H5] relate to the stock prices of banks:

[H4]: The stock price volatility of banks listed on stock exchanges decreases as a result of an increase in NSFR value

[H5]: The direction of change in NSFR value is negatively correlated with changes in beta coefficient

The above hypotheses have been put forward based on the assumption that extending the maturity of liabilities is associated with an increase in financing costs, because long-term financing is inherently more expensive. This is indicated by the yield curve. For instance,

a bank can lengthen debt maturity on the interbank market and, in particular, with maturity of over one year. Debt is often incurred for a very short time, and then another debt is incurred (following the so-called 'rolling commitments').

One of the main objectives of the implementation of the NSFR was to strengthen bank liquidity in order to make the system more resilient to shocks. Regulators have been aware that increased resilience is connected with having an increased level of stable funding on the banks' side. Raising stable funding is generally more expensive than borrowing from the wholesale interbank market. Before the recent financial crisis, banks utilized the wholesale market to raise short-term cheap funding. Such an activity was more profitable for them than utilizing other potential sources of money. The requirement to meet the NSFR standard discourages banks, at least partly, from the wholesale market. Instead, banks are prompted to seek more stable sources of funding.

At first glance, the NSFR should decrease bank profitability. The ability to generate profits is one of the most important accelerators of stock price changes. Consequently, it constitutes a motive to conduct research and to verify whether the NSFR truly poses a risk for bank profits and for investors on the stock market.

5. Assumptions, methodology and data

This subsection concentrates mainly on the research method. One of the main goals of the research is to test the influence of the NSFR on bank profitability and stock prices.

In the paper, both quantitative and qualitative methods are used. The study of NSFR levels includes an analysis of the balance sheet structure of banks, with particular emphasis on the available stable funding (long-term liabilities) and the required stable funding needed to cover long-term assets. The impact of the NSFR on the profitability of banks was determined by examining the impact of the NSFR on financial ratios such as ROAA, ROAE and NIM. These ratios were calculated on the basis of data obtained from bank balance sheets. Therefore, the paper also includes aspects related to the financial analysis of banks. It is very important to stress that the whole research – the overall idea, as well as the carefully drawn-up, detailed method was devised by the author of this article.

The research entities are commercial banks, registered and operating in the euro area in the years 2004 - 2014. The time range has been chosen in order to include the period before, during and after the financial crisis. The range of 11 years is long enough to check the changes that occurred in different periods in terms of the NSFR and the level of profitability of the banks. In order to analyze the economic impact of the NSFR, the research has been divided into several stages.

In the first stage, the group of commercial banks operating in the Eurozone is selected for study. The requirement for all selected banks is that they have been listed on at least 1 stock exchange with a registered office in a European Union member state. Another thing is that it should have a history of at least 1 year of quotations. The next step is the description of the research group. Banks selected for the study cover a significant part of the assets of the banking sector in the euro area. At the end of 2014, total assets of the euro area banking sector stood at €28.1 trillion. This figure was calculated on a consolidated basis [European Central Bank 2015]. The research embraces the 100 largest banks (in terms of value of their assets) which are publicly quoted on stock exchanges. Total assets of banks selected for the research amounted to circa €19.4 trillion in 2014. Therefore, the banks in the research embraced circa 69% of the total assets of all banks in the euro area.

It is important to note that daily quotations of share prices from stock exchanges and financial web portals were obtained. Then, it was possible to calculate daily logarithmic rates of return of stock prices. This then served to calculate standard deviation, semi-standard

deviation of stock prices and beta coefficient. The number of banks from consecutive EU member states is presented in the chart below. Additionally, the full list of banks is enclosed in the appendix in Table 15. The majority of banks operate in the universal model. There are also some investment banks. Most of the biggest banks listed in the table have a very broad range of activities and operate within various banking models.

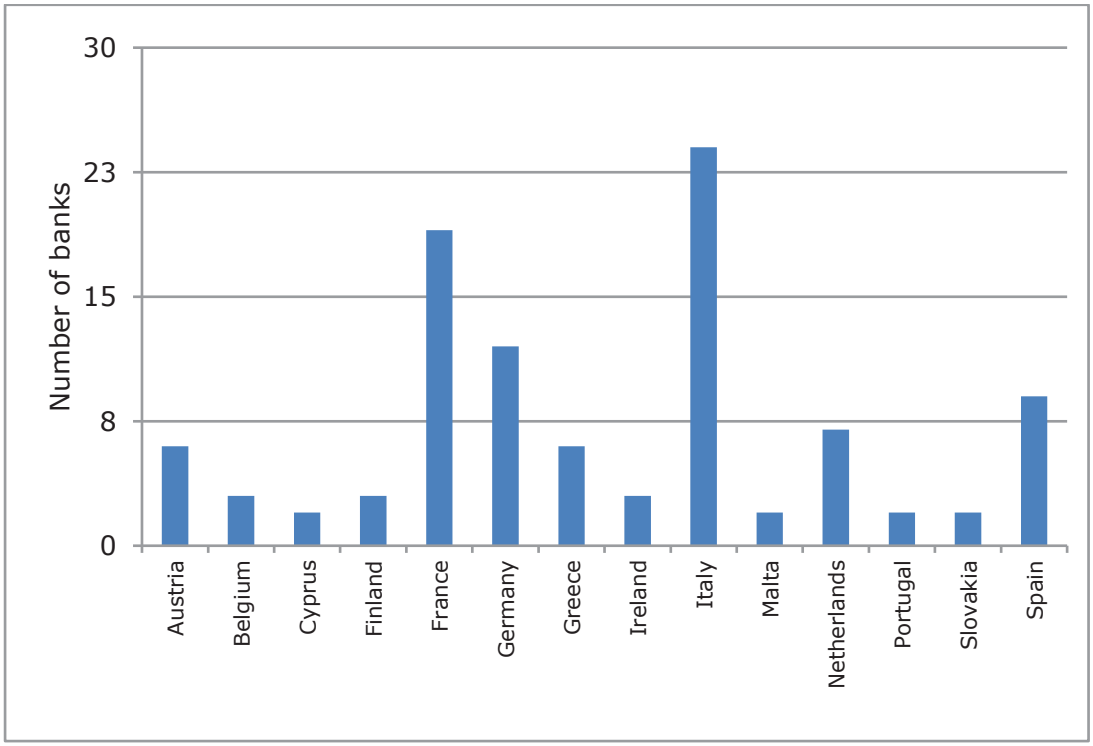

Chart 1: Number of banks in the research from EU member states
Source: own study.

In the next stage, the financial statements of banks from the BankScope (Orbis Bank Focus) database were obtained. Websites of banks and financial internet portals constitute the other sources of data. The comprehensive data set was adjusted in line with the purposes of the study. Erroneous and missing data was identified, and necessary corrections made. Databases and sources of data are listed in Table 2.

Afterwards, the documentation of factors in the NSFR of consecutive balance sheet items of the banks was completed. The NSFR was estimated for the banks selected for study. In order to do that, the items included in the annual financial statements (balance sheets) of the banks were used.

Table 2: The list of databases utilized in the research

Sources of data	Information
Orbis Bank Focus (formerly: Bankscope)	Financial statements of banks, financial ratios
• google finance • yahoo finance • Stooq.pl • euroinvestor.com • investing.com	Stock quotations
Bank for International Settlements	Statistical bulletins concerning banking
EMIS Emerging Markets Information Services	Financial statements of banks, financial ratios, news
Dealwatch (EMIS Professional)	Information about mergers and acquisitions
Banks' web pages	Financial statements
Eurostat	Macroeconomic indicators

Source: own development.

In 2014, the Basel Committee on Banking Supervision operating at the Bank for International Settlements (BIS) published a methodology for calculating the NSFR [BIS 2014a; BIS 2014b]. According to its propagators, the NSFR is an indicator of long-term liquidity, which in a crisis situation should ensure the stability of funding for a period of one year. The percentage weight of individual items of assets and liabilities vary in terms of their maturity. The weight can also be called 'coefficients' or 'factors' of the item [Iwanicz-Drozdowska 2012, p. 58]. However, due to the lack of sufficient granularity of the data in Orbis Bank Focus (and other available databases) needed to calculate the real NSFR accurately, other approaches to estimating its value are normally used. References to the methodology of the NSFR calculation are also present in the studies by Vazquez and Federico [2012], Kapan and Minoiu [2013], Dietrich, Hess and Wanzenried [2014], Gobat, Yanase and

Maloney [2014] and Hong, Huang and Wu [2014]. The calculations of the NSFR for each bank, and for each year of the analysis, were carried out using the methodology of Vazquez and Federico [2012] from the International Monetary Fund monograph. This methodology is based on assigning appropriate weight rates to certain balance sheet positions (liabilities - ASF and assets - RSF) – as listed in Table 1 in the previous section.

A banking institution should cover the liquidity risk associated with the liabilities and assets weighted by risk factors. The intention of the regulator with the introduction of this standard was to reduce the dependence of banking institutions on funding from the wholesale money market, which is unfavorable in the case of tensions and the lack of confidence in the market [Niedziółka 2012, pp. 40-44; Niedziółka 2015, p. 211]. According to the Basel Committee [BIS 2014a; BIS 2014b], the NSFR will reduce the future risk of financial crises.

To calculate the NSFR in banks, weights were allocated to respective balance sheet positions. Factors are assigned to consecutive balance sheet items in accordance with the level of maturity of assets and liabilities. In connection with the construction of the indicator, the balance sheets of banks undergo certain changes that will adjust their value to the requirements adopted by the regulator. Adaptations to the banks' balance sheets will be run in two ways: by changing the size of items on the assets side and changes in the size of items on the liabilities side [King 2013]. To meet the NSFR requirement at 100%, it is advisable to increase the numerator (available stable funding) or to decrease the value of the denominator (required stable funding, for example). When it comes to liabilities, banks will try to increase the share of items with high weights, such as capital and stable deposits, which are assigned weights of 100% and 95%, respectively. Therefore, long-term financing (which is considered to be safe) is preferred. The NSFR in banks has been calculated on the consolidated level, using the consolidated financial statements of banks.

To calculate the NSFR, consecutive financial items were used. All of them are mentioned in Table 1. The relevant financial data was obtained from the Bankscope (Orbis Bank Focus) database. The full range of the information (financial items) which is specified in Table 1 is available in the Orbis Bank Focus database and did not require further calculations or assumptions. The only activity was to assign weights to consecutive items. For instance, a position like ‘Deposits and short term funding’ was split into the following positions: ‘Customer deposits – current’, ‘Customer deposits – savings’ and ‘Customer deposits –

term'. All of these 3 items concerning current, savings or term deposits were available in the Bankscope database. They did not require any initial assumptions for the calculation from the author's side. They were treated as raw data.

Below the final formula for the NSFR calculation is presented:

{

[current deposits * 85% + (savings deposits + term deposits) * 70% + (senior debt + subordinated borrowing + preference shares and hybrid capital + other funding + other non-interest bearing funding + loan loss reserves + other reserves + equity) * 100%]

/

[(mortgages + other mortgage loans + other consumer or retail loans + corporate and commercial loans + other loans + reserves for impaired loans + fixed assets + goodwill + other intangibles + other assets) * 100% + (loans and advances to banks + derivatives + other securities: trading and investment securities + remaining earning assets) * 35%]

}

The next phase of the research includes the financial analysis of the banks. Based on the data from the banks' balance sheets, indicators are calculated. Therefore, a database of financial ratios was prepared. The ratios serve, inter alia, as measures of bank profitability. Such ratios as ROAA, ROAE and NIM are dependent variables in the models. The other financial ratios are independent variables in the model. A financial analysis of the banks was carried out. After the collection of stock data, the calculation of standard deviation, semi-standard deviation and beta coefficients was performed. The beta coefficients were estimated on the basis of covariances of stocks.

Moreover, the calculation of the descriptive statistics of the ratios was performed. The next step was to compute correlation coefficients in the correlation matrix as well as correlation of the NSFR and other variables (with significance levels).

The next research task featured a panel regression analysis of 1 variable. Regression equations were calculated - one for each group of indicators. The NSFR was the explanatory variable in each of the models. An indicator representing a given group of profitability determinants (e.g. return on assets, return on equity, net interest margin) constituted the

dependent variable. Then, the multiple panel regression analysis was performed. In this step, the equations take the following form:

- Fixed effects model (FE):

$$y_{it} = a_i + \beta x_{it} + e_{it}$$

- Random effects model (RE):

$$y_{it} = \alpha + \beta x_{it} + u_i + \varepsilon_{it}$$

where:

y_{it} – dependent variables

x_{it} – vector of independent variables

e_{it} – T-dimensional vector of values of random component $e_{it} \sim N(0, \sigma_e^2)$

a_i – individual effects

β – vector of structural parameters

u_i – unobservable individual-specific effect

α – constant

ε_{it} – random component

i = 1,2,…,N (number of objects)

T = 1,2,…,T (number of periods)

The variables utilized in the research are presented in Table 3. It gives the variables used in model A (financial variables only) and model B (with financial and macroeconomic variables). The other dependent variables which have not been listed in the table are as follows:

- Beta coefficient (absolute value and change of value)
- The standard deviation of daily logarithmic rates of return of closing prices
- The semi-standard deviation of daily logarithmic rates of return of closing prices
- The change in closing prices of stocks

Table 3: Ratios used in the research – multiple variables model A (financial) and model B (financial and macroeconomic)

Indicator	Variable in a model	Formula
Interbank ratio	A and B	$\frac{\text{Money lent to other banks}}{\text{Money borrowed from other banks}}$
Total capital ratio	A and B	$\frac{\text{Total capital}}{\text{Risk} - \text{weighted assets}}$
Net Stable Funding Ratio (NSFR)	A and B	$\frac{\text{Available Stable Funding}}{\text{Required Stable Funding}}$
Return on average assets (ROAA)	A and B	$\frac{\text{Net profit}}{\text{Average assets}}$
Return on average equity (ROAE)	A and B	$\frac{\text{Net profit}}{\text{Average equity}}$
Net interest margin (NIM)	A and B	$\frac{(\text{Investment returns} - \text{interest expenses})}{\text{Average earning assets}}$
DUMMY crisis	A and B	Binary variable; values: 1 - for years 2008-2010 0 - for other years
Cost to income ratio	A	$\frac{\text{Overhead cost}}{\text{Net interest revenue} + \text{other operating income}}$
Net loans to total assets	A and B	$\frac{\text{Net loans}}{\text{Total assets}}$
Liquid assets to deposits and borrowings	A	$\frac{\text{Liquid assets}}{\text{Deposits} + \text{borrowings}}$
Growth of total assets%	A	$\frac{\text{Total assets (current)} - \text{total assets (previous period)}}{\text{Total assets (previous period)}}$
Non-performing loans (NPL)	A and B	$\frac{\text{Non performing loans}}{\text{Gross loans}}$
Dividends ratio (%)	A	$\frac{\text{Dividends}}{\text{Net income}}$

Gross Domestic Product (GDP) change (%)	B	$\frac{GDP_{current\ year} - GDP_{previous\ year}}{GDP_{previous\ year}}$
Euro to dollar exchange rate	B	$\frac{\text{EUR}}{\text{USD}}$
Short-term interest rates in the Eurozone	B	The measure of money cost
Harmonised Index of Consumer Prices (HICP)	B	The measure of inflation
The rate of unemployment (%)	B	$\frac{Number\ of\ unemployed}{Workforce}$
Imports (change in %)	B	$\frac{Imports_{current\ year} - Imports_{previous\ year}}{Imports_{previous\ year}}$

Source: own development based on:

Eurostat, http://ec.europa.eu/eurostat

IMF, 2003, Financial Soundness Indicators—Background Paper, https://www.imf.org/external/np/sta/fsi/eng/2003/051403bp.pdf;

IMF, Financial Soundness Indicators (FSIs)—Concepts and Definitions;

IMF, 2013, Modifications to the current list of financial soundness indicators, https://www.imf.org/external/np/pp/eng/2013/111313.pdf

https://www.imf.org/external/pubs/ft/wp/2007/wp07216.pdf

http://www.investopedia.com/terms/n/netinterestmargin.asp

Reddy, K., 2012, Relative performance of commercial banks in India using CAMEL approach, International Journal of Multidisciplinary Research, Vol.2 Issue 3, March 2012, ISSN 2231 5780;

Christopoulos, A., Mylonakis, J., Diktapanidis, P., 2011, Could Lehman Brothers' Collapse Be Anticipated? An Examination Using CAMELS Rating System, International Business Research Vol. 4, No. 2; April 2011, www.ccsenet.org/ibr, doi:10.5539/ibr.v4n2p11;

Arbex Express, 1999, Camels Rating System, Supervision and examination sector, Department of Rural Banks, http://arbexpress.tripod.com/02242003/camels.pdf

Dang, U., 2011, The CAMEL rating system in banking supervision a case study, Arcada University of Applied Sciences International Business;

Kumar, M., A., Harsha, S., Anand, S., Dhruva, N., R., Analyzing Soundness in Indian Banking: A CAMEL Approach, Research Journal of Management Sciences, Vol. 1(3), 9-14, October (2012), ISSN 2319–1171;

Sandhya, Ch., 2014, Camel Framework in Banks - Indian Scenario, Volume : 4, Issue : 6, June 2014, ISSN - 2249-555X;

Mishra, S., Aspal, P., A CAMEL model analysis of state bank group, http://ssrn.com/abstract=2177099

In the regression analysis an omitted variable bias often appears. Sometimes there is a relevant explanatory variable which is correlated with the included regressors. However, it can be omitted from the model. In such cases omitted variable bias can occur. If there are unobservable omitted factors in the model which are correlated with some explanatory variables, omitted variable bias can also arise [Verbeek 2012, p. 144-145]. Sometimes, it can be assumed that the omitted variable does not change over time. Consequently, fixed effects can be used [Wooldridge 2009, p. 507-511].

In model A it is financial ratios which play the role of control variables. However, financial ratios calculated on the basis of a balance sheet or an income statement are often tightly interrelated. Often, the correlation between them is high. Therefore, in the research, model B was introduced. It covers financial ratios, as well as the macroeconomic variables whose correlation is lower. In this case, macroeconomic variables are treated as control variables which may reduce residual variance. Consequently, the use of such control variables might make the standard error of the regression estimates lower [Angrist and Pischke 2009, p. 17-18].

The following macroeconomic variables were added to model B: Gross Domestic Product (GDP) change, Euro to Dollar exchange rate, short-term interest rates in the Eurozone, Harmonised Index of Consumer Prices (HICP), imports change and the rate of unemployment. All of these were obtained from Eurostat and concern the Eurozone.

The last stages concern the analysis of the results, verification of the scientific hypotheses and deriving conclusions on the relations between the NSFR and the levels of bank profitability and volatility of their stock prices.

6. Key empirical findings

In the last section, the results of the study of the impact of the NSFR on the banks' profitability and valuation of their stocks is analyzed. This makes it possible to determine the efficiency of the NSFR regulation and its influence on certain aspects of banks' activities.

Tables 4-11 embrace the results of the panel regression estimation. In each case, the regression equations were estimated by both fixed effects and random effects models. Furthermore, 3 statistical tests were performed in order to check which of the models (fixed effects, random effects or ordinary least squares) is the most proper to estimate a given equation. First of all, the Wald test (or F-test) serves to test the equality of the individual effects of objects (banks). If the H0 hypothesis is satisfied, the difference between individual effects of objects is insignificant. Therefore, the model can be estimated by the ordinary least squares. Otherwise, it is better to use a fixed effects model. Second, the Breusch-Pagan test is utilized to verify if [H0] the variance of random component of individual effects varies insignificantly from zero. The alternative hypothesis claims that it varies significantly from zero. If H0 is satisfied, the ordinary least squares model should be estimated. Accepting the alternative hypothesis denotes that the random effects model should be used [Osińska 2007, p. 426]. Third, the Hausman test checks the correlation between explanatory variables and random effects. It can verify if the fixed effects and random effects estimators are convergent to the same vector (point). If there is no reason to reject the null hypothesis, it is advisable to use the random effects estimator, which is more effective. Satisfying the alternative hypothesis suggests using the fixed effects model [Kufel, 2013, p. 179-180; Kopczewska et. al. 2016].

In Table 4 the results of the models with one variable are presented. The explanatory variable is the NSFR. There are 3 dependent variables: net interest margin (NIM), return on average assets (ROAA) and return on average equity (ROAE). In all of the models, the NSFR is statistically significant at the 1% level (for FE and RE estimators) in equations with NIM and ROAA. It is statistically significant at the 5% level for ROAE. Contrary to the models with ROAE and ROAA, the NSFR has a negative impact on NIM value. When NSFR value rises, NIM decreases. However, when the NSFR grows, ROAA and ROAE grow too. The coefficient of determination varies from 0.13 for the ROAE model to 0.54 for the NIM model.

In Tables 5-7 the models of multiple regression are estimated. The independent variables are as follows: the NSFR, total capital ratio, cost to income ratio, interbank ratio,

net loans to total assets, liquid assets to deposits and borrowings, DUMMY_crisis, growth of total assets (in %), NPL to gross loans (in %), dividends to net income (in %). Descriptive statistics of dependent and independent variables are shown in Table 14, as well as correlation coefficients which are presented in Tables 12 and 13. The correlation coefficient was presented in Chart 3. Moreover, values of ratios and coefficients for the groups are presented in Charts 4-19. The frequency distribution of the NSFR is presented in Chart 20.

These models confirm previous results, that the NSFR has a positive influence on NIM, ROAA and ROAE. The coefficients are significant at a level of at least 5%, with the exception of the fixed effects estimator for a model with ROAE where the coefficient is statistically insignificant. It turns out that the model with NIM is very well fitted (high R^2). Therefore, the results suggest that, in general, the NSFR has a positive impact on bank profitability measured by NIM, ROAA and ROAE.

The discussed results do not support Hypotheses 1-3. The data in the tables shows that for the set of data utilized in the research, there is a positive, and in general, statistically significant relation between the NSFR and bank profitability measured by ROAA, ROAE and NIM. Therefore, it can be stated that for the data and period of the research, growth of the NSFR would accompany the growth of profitability ratios. Such a situation can be understood in several ways. Despite the fact that the banks limited the share of low and medium quality assets in favor of high quality assets, which resulted in a relative decrease in the net interest margin, other factors led banks to maintain their current profitability [Said 2014]. Khan, Scheule, Wu [2016] argue that banks have real benefits from receiving lower interest deposits as a result of having more stable sources of financing. This would increase their profitability. Thanks to strengthened capital buffers, banks have access to relatively cheaper funding through deposits collected on lower interest rates. This leads to the greater stability of these financial institutions. Another explanation of this phenomenon is given by Dietrich, Hess and Wanzenried [2014]. They claim that the disadvantages connected with fulfilling the NSFR requirement can be offset by relatively lower overhead costs, lower loan growth rates and lower loan loss reserves.

The data in tables 8-11 concern the stock prices of banks and their volatility on the capital market. The relation between the NSFR and dependent variables is statistically significant for several regression equations. The model with fixed effects estimator (Table 8) shows a statistically significant negative relation between the NSFR and the absolute value

of beta coefficient. It suggests that the NSFR can decrease the value of the measure of systemic risk of banks. Such a negative relation appears also for models with standard deviation (Table 9) and semi-standard deviation (Table 10).

This suggests that the growth of the NSFR negatively affects the level of risk. Stock prices of banks with higher NSFR are less volatile. Model estimates in Table 11 indicate that the NSFR has a positive and statistically significant influence (on 1% level) on changes of stock prices of banks. Such results are available for the fixed effects model. It implies that banks with higher NSFR values are assessed more positively by investors. Such an attitude of investors tends to be reflected in higher stock prices. The results show that the hypothesis [H4] which relates to the stock price volatility of banks listed on stock exchanges can be verified positively. It is justified due to the negative relation between the NSFR and standard deviation, semi-standard deviation and beta coefficient. A rise in NSFR value decreases the level of stock price volatility. What is more, the model with the 'price change' dependent variable has shown that banks with lower NSFR values tend to have relatively lower stock prices.

Moreover, hypothesis [H5] relates to the direction of change of the NSFR and beta coefficient. The results shown in Table 13 (correlation matrix) show that there is a negative, and statistically significant correlation between the NSFR and beta coefficient. As a consequence, stock prices of banks with higher NSFR values tend to be less 'aggressive'. As they are more 'defensive', their reaction to price changes on the whole stock market is weaker. Thus, hypothesis [H5] can be verified positively.

According to the research question concerning the difference between NSFR values in various banks, it can be stated that the share prices of institutions fulfilling the required NSFR level (equal to 100% or higher) were more stable during the period considered than the share prices of institutions whose NSFR was well below the standard. A level of the NSFR below 80% was considered to be low. Therefore, banks with the NSFR below 80% were assigned to the first group and banks with the NSFR equal to 100% or higher were in the second group. On average, the standard deviation and the semi-standard deviation of the daily logarithmic rates of return of stocks was higher in the first group than in the second group. The mean of standard deviation equals 0.035 and 0.019 in the first and second groups respectively. In addition, a test on the difference between the 2 means was performed. As a result, it was verified that the difference between the means is statistically significant (at

a level of 1%). Similarly, there is also a remarkable difference between the means of the semi-standard deviations in both groups (0.025 in the first group and 0.019 in the second group). The results show that the stock prices of banks which have a more stable funding structure are less volatile.

Tables 18-37 concern model B. They are attached in the annexes. Tables 18-25 cover the fixed effects model estimation for dependent variables: NIM, ROAA, ROAE, beta, beta absolute value, standard deviation, semi standard deviation and stock price. In Table 26 the descriptive statistics of variables in the model B are presented. Tables 27-30 are the split correlation matrix of variables. In Tables 31-36 the ordinary least squares model (OLS) and the random effects model are presented. The results shown in these tables can be treated as robustness checks for the 'main' results. The outcomes of the Wald test, Breusch-Pagan test and Hausman test are also covered. Generally, the results of the above-mentioned tests determine that the fixed effects model is more 'proper' and can be treated as a 'basic' model.

The positive and statistically significant coefficients for NSFR in Tables 18-20 confirm the positive relation between bank profitability and stable funding. The negative and statistically significant coefficients for NSFR in Tables 21-24 confirm the negative relation between beta absolute value, beta, standard deviation and semi-standard deviation of stock prices and stable funding. The analysis of data in Table 25 could lead to the conclusion that a higher level of stable funding in banks is accompanied by higher stock prices of those banks on the capital market (a positive coefficient which is statistically significant at a level of 1%). The signs of NSFR coefficient for the OLS or RE models embraced in Tables 31-36 confirm the conclusions drawn from the analysis of both model A and model B.

Another issue worth analyzing is the potential way of adjusting bank balance sheets in terms of the available (ASF) and required (RSF) stable funding in order to meet the NSFR requirement. It is also necessary to consider the methods of maintaining NSFR at the required level (over 100%) and their popularity (common use) among banks.

Under the assets, banks will seek to increase the share of low-weight items, i.e. items that do not need to be sufficiently covered by stable sources of financing. As a result, positions such as cash, central bank deposits, central bank receivables with a maturity of less than 6 months and receivables (at the date of the transaction) arising from the sale of financial instruments, foreign currencies or raw materials will not be required to be covered

by stable funding sources. Below some ways of reducing the level of required funding are mentioned.

When it comes to the assets side, the change in the composition of investments must be considered. Banks should increase the share of high-rated securities at the expense of lower-rated investments. Highly-rated securities do not require a lot of stable funding - as opposed to low-rated investments. One way to reduce the amount of required stable funding is to sell low-rated assets and convert them to cash or higher-rated assets. This may, however, be associated with a decrease in viability, as generally more risky assets (with a lower rating) yield higher rates of return. Moreover, the decrease in balance sheet can be performed by selling the bank's credit portfolio. Banks can also change the structure of the loan portfolio by having more loans with shorter than 1 year maturity. They can replace retail loans with corporate loans and mortgages. The other items require small coverage, e.g. unloaded Tier 1 assets or unloaded loans for financial institutions with a maturity of less than 6 months have 5% and 10% weight allocation respectively. Only a small part of their value must be covered. On the other hand, there are balance sheet items that require significant or even total coverage. Mortgages are an example of this. Their specificity is that repayments are spread over many years, which involves the need to provide a substantial amount of stable financing (65%). Unsecured loans must be 100% covered due to the high risk of default. Preferred positions are those that do not require long-term funding.

When it comes to liabilities, banks will seek to increase the share of items with high weights, such as capitals and stable deposits. These items are assigned 100% and 95% weight, respectively. Therefore, long-term financing, which is considered to be safe, is preferred. Below some ways to increase the level of stable sources of funding are considered. The maturity of the debt incurred on the interbank market can be extended (in particular those with maturity of more than 1 year). Debt is often taken for a very short time and then further debt is drawn. This is the case with so-called "rolling liabilities". The longer maturity is associated with an increase in funding costs, since long-term financing is by its nature more expensive (see the yield curve). Another thing is the increase in the share of deposits. Particularly, the amount of long-term deposits ought to be increased. Conversely, banks should cut the amount of short-term deposits. In addition, it will be preferable to increase the value of long-term deposits from retail and business customers and the value of equity (e.g. Tier1) [Flotyński 2017].

Obviously, the requirement to meet the NSFR standard in banks promotes changes in the structure of their balance sheets. The scale of changes will depend on the shortfall in NSFR value that must be filled in order to meet the minimum standard (100%). For banks which have already met the standard, it will not be a huge challenge to maintain the minimum value of the ratio (above 100%). However, for banks with 'NSFR shortages' the process of adjustment will lead to changes in funding structure.

The research embraces the 100 biggest banks in the euro area which are quoted on European stock exchanges. In Table 37 the information is covered which is helpful in the analysis of the relation between stable funding and bank profitability or the volatility of stock prices. It is presented for a group of banks differentiated by the amount of total assets. The population of banks was divided into 3 groups. There were 33 banks in groups I and II, and 34 banks in group III. The estimation of model B was performed for dependent variables NIM and ROAA (FE and RE models in each case). The 33 biggest banks in terms of assets are in the first group. The second group embraces middle-sized banks in the research population. The last group involves the smallest banks. The NSFR coefficients in groups I and II for FE as well as RE models are positive and statistically significant (at levels of 1% or 5%). The only negative sign occurred in group III – in the RE model for ROAA. Generally, 11 out of 12 results confirm the previous conclusions drawn from the regression analyses for the whole group of banks. The division into 3 independent groups has shown that the size of banks does not crucially change the relation between stable funding of banks and their profitability and stock price volatility. Particularly, the coefficients for group I and group II showed stability, which increases the credibility of coefficient values in consecutive groups of banks.

The main hypothesis [H] stated that an increase in NSFR value leads to a fall in bank profitability and volatility of their stock prices on the capital market. This statement covers 2 areas which were verified during the research: the impact of the NSFR on 1) profitability and 2) volatility of stock prices. The analysis conducted cannot satisfy the first part of the main hypothesis. However, it can satisfy its second part. The research showed that the required adjustment of bank balance sheets in order to meet the NSFR requirement does not necessarily lead to a decrease in their profitability. As a result, the main hypothesis cannot be verified entirely positively. According to the data used in the research, the statement that 'an increase in NSFR value leads to a rise in bank profitability and decreases the volatility of their stock prices on the stock exchanges', would be more proper.

There are also other important issues to consider. First of all, the NSFR value should be analyzed. The NSFR mean values in subsequent Eurozone member states in Charts 21-33 are presented. The banks used in the research were aggregated at country level. The classification was performed on the basis of the location of the headquarters of consecutive banks. The overview of aggregated NSFR values showed huge differences between states. For instance, the mean NSFR value of banks in France in years 2004-2014 amounted to 69% and was the lowest in the euro area. Contrary to this, the mean NSFR value of banks in Belgium in the years 2004-2014 amounted to 146%. The mean NSFR for the whole Eurozone was also calculated. It was shown in Chart 2 that the mean NSFR rose significantly since 2004 (when it amounted to 95%). In 2014 it amounted to 105%. Therefore, it can be stated that in general, on an aggregated level, banks in the euro area fulfilled the NSFR requirement.

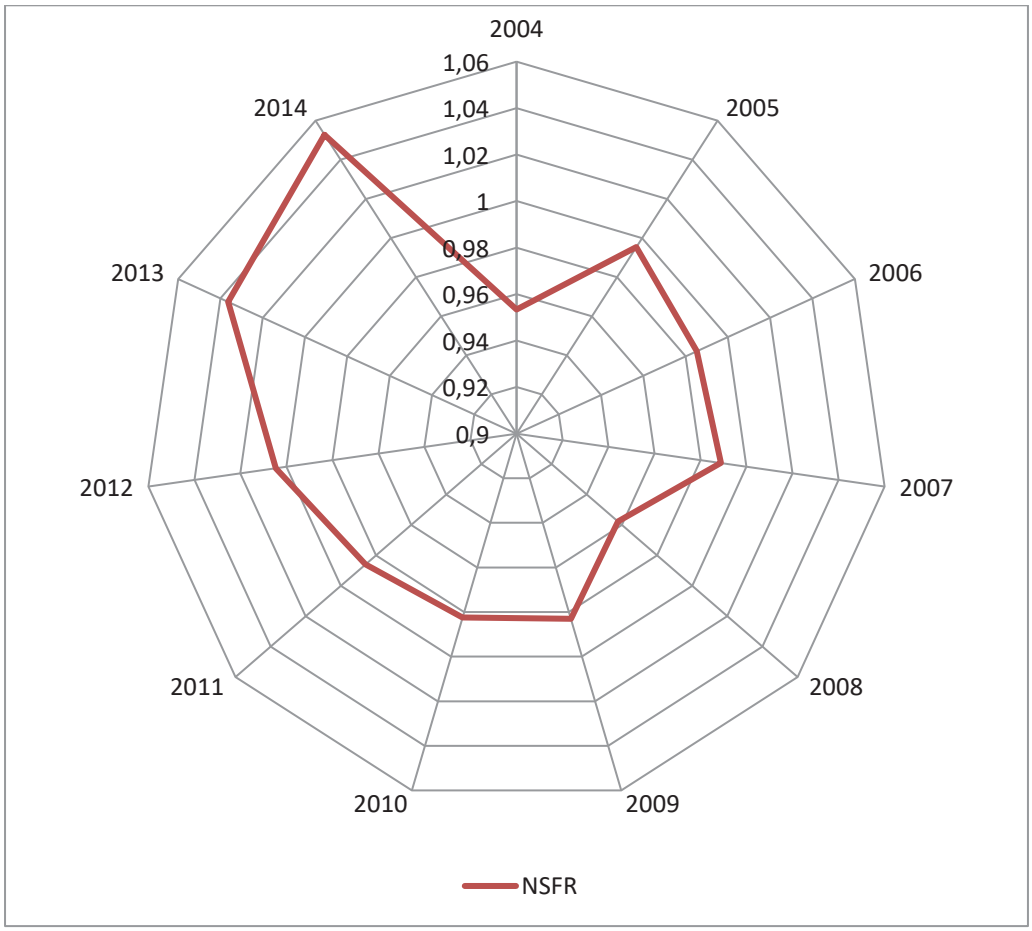

Chart 2: Value of NSFR in the euro area from 2004 to 2014 (for banks in the research sample)
Source: own calculation.

When it comes to the analysis of the NSFR value across the whole Eurozone, it must be stated that in years 2004-2006 the mean NSFR value of banks amounted to 97.81%, whereas in the years 2010-2012 the mean NSFR value of banks amounted to 99.11%. This suggests that banks tended to increase the relation between stable sources of funding and items in balance sheets that required stable funding. Such an operation was probably caused, at least in some part, by the pressure put on them by supervisors.

In order to compare some groups of banks, a test for the significance of the difference in the 2 means was performed. The first group was constituted by banks from Portugal, Ireland, Italy, Greece and Spain (i.e. 'PIIGS' countries). The second group consisted of banks from the other Eurozone member states. Such a division was used to outline the potential difference between countries which suffered more serious economic problems (and shocks in the banking sector) during the financial crisis in 2007-2009 than the rest of the Eurozone members. Therefore, 'PIIGS' states create a separate group. The results of the mean NSFR calculation are shown in Table 17. At first glance, due to the financial problems of the banking sectors in 'PIIGS' states, it could be believed that banks from these countries ought to have lower NSFR values. In particular, the assumption of lower NSFR values may be accurate during the financial crisis. However, the analysis of the data does not prove this supposition. In all periods (2004-2006, 2007-2010, 2011-2014 and 2004-2014) 'PIIGS' states had on average higher NSFR than the rest of the member states. Furthermore, this difference was tested (using t-statistics) and appeared to be significant in the following periods: 2004-2014 (1% level), 2007-2010 (10% level) and 2011-2014 (10% level). Surprisingly, banks from states which suffered serious economic stress during the crisis generally had a better proportion of assets and stable funding in their balance sheets than banks from states with a 'healthy' banking system. Regarding NSFR values of consecutive banks – within the time horizon of the research (2004-2014) – they were not obliged to publish the exact values of this standard. Often, they did not even calculate the NSFR. Therefore, it is not possible to compare the exact values to those estimated for all of the banks in the research. However, the comparison can be performed for several examples. For instance, the estimated NSFR value of Aareal Bank AG was 1.18 and 1.12 in 2013 and 2014, respectively. In the bank report [Aareal 2014a; Aareal 2014b] it was announced that it fulfilled the NSFR requirement (NSFR > 1). The estimated value for Intesa Sanpaolo in 2013 was 1.14. The bank confirmed in the financial report that it met the NSFR standard [Intesa

Sanpaolo 2014]. Banca Popolare dell'Emilia Romagna [BPER 2015] reported LCR and NSFR values in 2014 as being well above 100%. This result is in line with the author's estimation (NSFR = 103%).

While discussing the results of the research, it must be remembered that in the years 2004-2014 the NSFR liquidity standard was not binding for banks. The NSFR has to be implemented as of 2018. Before the financial crisis, bank managers did not anticipate that such a regulation would be introduced. As a consequence, banks did not have to comply with a stable funding regulation. The NSFR was rather an endogenous variable deriving from a model of bank management. However, after the financial crisis, it was announced that banking sector participants had to prepare their activities to fulfil the new requirement. It was obvious that banks would have to adjust their balance sheets to meet the minimum NSFR quite urgently. Thus, in the period when the NSFR was not yet an obligation, it constituted almost a supervisory requirement. Banks tended to make the necessary changes in order to comply with Basel III liquidity standards within a few years.

7. Conclusions

The relation between liquidity requirements and the profitability of the banking sector is a very important issue for the activities of financial institutions. The contribution of the article is to evaluate, in terms of standards of bank financing, the effectiveness of macro-prudential tools and the supranational regulation of a market. It has examined the problem of the economic impact of the regulation of liquidity, and in particular the NSFR, on the possibility of profit creation in the banking sector, value of financial institutions, their effectiveness and safety.

One of the main advantages of the paper is its empirical research. It was carried out in an area of great practical importance, in particular because financial institutions will adjust their activities in order to meet the NSFR. The methodology of NSFR calculation is based on the allocation of balance sheet positions: liabilities - ASF (Available Stable Funding) and assets - RSF (Required Stable Funding) with appropriate weightings.

When it comes to the aim of the article, research questions and hypotheses, the research results show that there is a positive and statistically significant relation between the level of the NSFR in banks and ROA, ROE and NIM. Furthermore, increasing the NSFR has a positive influence on changes in stock prices. Simultaneously, it has a negative impact on the level of stock price volatility. Those results are in line with the considerations on the changes of funding structures of banks which need to make up for 'NSFR shortages'. Moreover, the outcomes imply that banks with higher NSFR values are assessed more positively by investors. Such an attitude of investors tends to be reflected in higher stock prices of banks. The comparison of NSFR values in banks from 2004-2006 and 2010-2012 showed that regulatory pressure placed on financial institutions from the supervisory side can be effective. It was evident that after the financial crisis the level of the estimated NSFR in banks was higher than before. This difference can be explained, at least partly, by the newly implemented regulations that forced banks to adjust their funding profiles. It suggests that banks tended to increase the relation between stable sources of funding and items in balance sheets that required stable funding. Such an operation was caused probably by the pressure put on them by supervisors. Another thing is that investors on the stock market should be interested in stocks of financial institutions which display more stable sources of funding. The panel data analysis showed that institutions with higher NSFR tend to have less volatile stock prices. This would be a useful guide in portfolio management issues.

The study provides a large and up to date collection of empirical data. It contributes to clarifying the scope of the economic impact of long-term liquidity regulation on banks. The article has verified hypotheses on the conditions of the financial system of the Eurozone. Despite the fact that it concerns the effects of the NSFR for the banking sector in the euro area, the results can be significant for banking sectors in other parts of the world, too. The scale and the direction of the consequences that occur in individual states, will in fact have a strong impact in the European Union as a whole.

The conclusions drawn from the research are both of a practical and a theoretical character. By combining and presenting the research results in a synthetic way, a comparison and evaluation was conducted. The research covers crucial issues for the effectiveness of banks. Adjustments in balance sheets will significantly affect the financial statements of banks. In addition, there are broad opportunities for applications in economics and finance. The results of the research can be used in practice e.g. in shaping the structure of the balance sheets of banks and credit institutions. Additionally, it should be noted that the conclusions from the study can be used in practice to curtail maturity mismatches in financial institutions.

It must be remembered that the NSFR is not the only regulation that must be met. When it comes to Basel III, banks are obliged to comply with such standards as the LCR, capital requirements and leverage. Thus, changing the balance sheet structure in banks can be risky if it is adjusted to meet the NSFR alone. A bank's balance sheet structure must be considered in terms of fulfilling the whole set of regulations, including those mentioned above. In effect, focusing on meeting 1 regulation only would cause the situation where the other prudential standards are not met. Therefore, the adjustment of financial statements has to be well-planned in order to satisfy all the requirements.

The Basel III requirements should also be considered in the context of changes in the infrastructure of a financial market in the European Union. In the banking sector the project of a banking union is very important. This embraces a single supervisory mechanism, a single resolution mechanism and a European deposit insurance scheme [Flotyński 2016a]. Currently, very broad is the discussion about a capital market union which is aimed at strengthening the economic growth in the European Union. Above-mentioned projects are in line with other regulations and ought to be analyzed in the broad context of changes introduced after the crisis in the financial system [Flotyński 2016b].

The effects of regulations are often ambiguous. Thus, this research fulfils, to a certain extent, the need to create in-depth studies on the consequences of the regulation of the banking sector which can contribute to significant improvements in the laws introduced. The most important area of work is the realm of the necessity and effectiveness of the regulation of the financial system. All the ramifications of the regulations and costs incurred by financial institutions ought to be considered as well. Therefore, some of the conclusions from this paper might be useful for legislators and policy makers in the field of the regulatory policy, in particular, because banks, as important financial institutions, have an impact on the economic development of a state. The conclusions of the study deal with the preferred degree of restrictiveness of financial market regulations.

The results open up an area for further research. The empirical quantitative analyses of the effects of liquidity standards in the banking sector in particular should be thoroughly investigated. Thus, from the perspective of banks, it can influence the whole financial sector. This, in turn, will contribute to the development of the current knowledge about the impact of the NSFR. The scientific outcomes of the article are expected to form an appropriate starting point for further investigations in such fields as, e.g. reactions of banks to other liquidity regulations. In particular, new empirical research can be developed internationally. Such studies might be conducted in the field of financial regulation. Moreover, they could have a significant impact on further research and standardization works in the area of finance.

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Table 4: The results of panel regression estimation (independent variable: NSFR)

	Dependent variable					
	NIM		ROAA		ROAE	
	FE	RE	FE	RE	FE	RE
const	4,34 ***	3,58 ***	−1,49 ***	−0,81 **	−14,1 *	−5,08
	[0,47]	[0,52]	[0,52]	[0,37]	[8,39]	[4,03]
NSFR	−2,63 ***	−2,09 ***	2,16 ***	1,46 ***	18,07 **	8,90 **
	[0,47]	[0,41]	[0,52]	[0,33]	[8,32]	[3,71]
Wald test (p-value)	p<0,01		p<0,01		p<0,05	
Breusch-Pagan test (p-value)	p<0,01		p<0,01		p>0,1	
Hausman test (p-value)	p<0,05		p<0,1		p>0,1	
Number of groups	100		100		100	
R^2	0,54		0,23		0,13	

FE – fixed effects estimator; RE – random effects estimator; NIM – net interest margin; ROAA – return on average assets; ROAE – return on average equity; R^2 – concerns FE model; ***/**/* - statistical significance at a level of 1%/5%/10% respectively; values in brackets are standard errors. Source: own calculation.

Appendices

Table 5: The results of panel regression estimation – model A

Independent variable	Dependent variable: net interest margin			
	Fixed effects estimator		Random effects estimator	
	Coefficient	Standard error	Coefficient	Standard error
const	1,00962 **	0,41362	0,72441 *	0,37288
NSFR	0,71853 ***	0,20524	0,84489 ***	0,18010
Total capital ratio	0,00147	0,00942	−0,00397	0,00922
Cost to income ratio	−0,00978 ***	0,00241	−0,01093 ***	0,00233
Interbank ratio	0,00023	0,00018	0,00028	0,00018
Net loans to total assets	0,01730 ***	0,00378	0,02090 ***	0,00322
Liquid assets to deposits and borrowings	−0,00490	0,00303	−0,00352	0,00290
DUMMY_crisis	0,02121	0,03558	0,03446	0,03641
Growth of total assets	0,00256 *	0,00154	0,00341 **	0,00156
NPL to gross loans	−0,02384 ***	0,00532	−0,01566 ***	0,00524
Dividends to net income	0,00022	0,00025	0,00025	0,00026
Wald test (p-value)	p<0,01			
Breusch-Pagan test (p-value)	p<0,01			
Hausman test (p-value)	p<0,01			
Number of groups	100			
R^2	0,91			

***/**/* - statistical significance at a level of 1%/5%/10% respectively; R^2 – concerns FE model

Source: own calculation.

Table 6: The results of panel regression estimation - model A

Independent variable	Dependent variable: ROAA			
	Fixed effects estimator		Random effects estimator	
	Coefficient	Standard error	Coefficient	Standard error
const	−1,24724	0,86765	−0,38278	0,49498
NSFR	1,70742 ***	0,43054	1,20823 ***	0,22878
Total capital ratio	0,04175 **	0,01976	0,03056 **	0,01498
Cost to income ratio	−0,00923 *	0,00505	−0,01373 ***	0,00355
Interbank ratio	−0,00108 ***	0,00037	−0,00100 ***	0,00031
Net loans to total assets	0,01142	0,00793	0,00785 *	0,00406
Liquid assets to deposits & borrowings	0,00075	0,00635	0,00474	0,00450
DUMMY_crisis	0,01489	0,07463	0,03484	0,07048
Growth of total assets %	0,01411 ***	0,00324	0,01699 ***	0,00292
NPL to gross loans %	−0,09767 ***	0,01116	−0,07906 ***	0,00874
Dividends to net income%	0,00065	0,00053	0,00076	0,00050
Wald test (p-value)	p<0,01			
Breusch-Pagan test (p-value)	p<0,01			
Hausman test (p-value)	p<0,1			
Number of groups	100			
R^2	0,57			

ROAA – return on average assets; ***/**/* - the statistical significance at a level of 1%/5%/10% respectively;

R^2 – concerns FE model

Source: own calculation.

Table 7: The results of panel regression estimation - model A

Independent variable	Dependent variable: ROAE			
	Fixed effects estimator		Random effects estimator	
	Coefficient	Standard error	Coefficient	Standard error
const	−10,10840	23,94790	6,91414	10,9519
NSFR	11,73680	11,96090	10,32160 **	4,73644
Total capital ratio	−0,53301	0,54496	−0,17233	0,34769
Cost to income ratio	−0,16958	0,13914	−0,14859 *	0,07623
Interbank ratio	−0,01042	0,01031	−0,01358 *	0,00740
Net loans to total assets	0,32841	0,21862	0,04015	0,08530
Liquid assets to deposits & borrowings	0,22580	0,17579	0,12387	0,10204
DUMMY_crisis	−0,14091	2,05852	−1,40074	1,91179
Growth of total assets%	0,23938 ***	0,08949	0,27800 ***	0,07574
NPL to gross loans%	0,09309	0,31177	−0,30361	0,20981
Dividends to net income%	0,00815	0,01469	0,00482	0,01329
Wald test (p-value)	p>0,1			
Breusch-Pagan test (p-value)	p<0,1			
Hausman test (p-value)	p>0,1			
Number of groups	100			
R^2	0,28			

ROAE – return on average equity; ***/**/* - the statistical significance at a level of 1%/5%/10% respectively; R^2 – concerns FE model

Source: own calculation.

Table 8: The results of panel regression estimation - model A

Independent variable	Dependent variable: |beta coefficient|			
	Fixed effects estimator		Random effects estimator	
	Coefficient	Standard error	Coefficient	Standard error
const	6,85166 *	4,06657	2,84774 *	1,59138
NSFR	−5,98107 ***	2,08175	0,34247	0,69395
Total capital ratio	0,00061	0,08975	−0,02887	0,05204
Cost to income ratio	−0,01013	0,02087	−0,00589	0,01098
Interbank ratio	−0,00144	0,00249	−0,00162	0,00165
Net loans to total assets	−0,02372	0,04133	−0,02442 *	0,01259
Liquid assets to deposits & borrowings	0,07008 **	0,03077	0,00676	0,01591
DUMMY_crisis	0,54985 *	0,32023	0,47638 *	0,27608
Growth of total assets %	0,00104	0,01379	−0,00901	0,01090
NPL to gross loans%	0,09736 **	0,04587	0,05834 **	0,02843
Dividends to net income%	−0,00027	0,00211	0,00062	0,00181
Wald test (p-value)	p>0,1			
Breusch-Pagan test (p-value)	p<0,1			
Hausman test (p-value)	p>0,1			
Number of groups	100			
R^2	0,21			

***/**/* - the statistical significance at a level of 1%/5%/10% respectively; R^2 – concerns FE model

Source: own calculation.

Table 9: The results of panel regression estimation - model A

Independent variable	Dependent variable: standard deviation			
	Fixed effects estimator		Random effects estimator	
	Coefficient	Standard error	Coefficient	Standard error
const	0,21764	0,28594	−0,05713	0,11231
NSFR	−0,35803 **	0,14638	0,06204	0,04898
Total capital ratio	−0,00125	0,00631	−0,00056	0,00367
Cost to income ratio	0,00061	0,00147	0,00027	0,00078
Interbank ratio	−0,00012	0,00018	−0,00007	0,00012
Net loans to total assets	−0,00052	0,00291	−0,00033	0,00089
Liquid assets to deposits & borrowings	0,00549 **	0,00216	0,00131	0,00112
DUMMY_crisis	0,05158 **	0,02252	0,04217 **	0,01949
Growth of total assets %	0,00058	0,00097	0,00009	0,00077
NPL to gross loans %	0,00562 *	0,00323	0,00194	0,00201
Dividends to net income %	−0,00002	0,00015	0,00001	0,00013
Wald test (p-value)	p>0,1			
Breusch-Pagan test (p-value)	p>0,1			
Hausman test (p-value)	p<0,1			
Number of groups	100			
R^2	0,19			

***/**/* - the statistical significance at a level of 1%/5%/10% respectively; R^2 – concerns FE model

Source: own calculation.

Table 10: The results of panel regression estimation - model A

Independent variable	Dependent variable: semi-standard deviation			
	Fixed effects estimator		Random effects estimator	
	Coefficient	Standard error	Coefficient	Standard error
const	0,22027	0,21112	−0,03524	0,08291
NSFR	−0,28189 ***	0,10808	0,04892	0,03616
Total capital ratio	−0,00096	0,00466	−0,00062	0,00271
Cost to income ratio	0,00026	0,00108	0,00007	0,00057
Interbank ratio	−0,00009	0,00013	−0,00005	0,00009
Net loans to total assets	−0,00079	0,00215	−0,00020	0,00066
Liquid assets to deposits & borrowings	0,00398 **	0,00160	0,00104	0,00083
DUMMY_crisis	0,03844 **	0,01662	0,03209 **	0,01438
Growth of total assets %	0,00037	0,00072	−0,00007	0,00057
NPL to gross loans %	0,00276	0,00238	0,00049	0,00148
Dividends to net income%	−0,00002	0,00011	0,000005	0,00009
Wald test (p-value)	p>0,1			
Breusch-Pagan test (p-value)	p>0,1			
Hausman test (p-value)	p<0,1			
Number of groups	100			
R^2	0,19			

***/**/* - the statistical significance at a level of 1%/5%/10% respectively; R^2 – concerns FE model

Source: own calculation.

Table 11: The results of panel regression estimation - model A

Independent variable	Dependent variable: the change of stock price (%)			
	Fixed effects estimator		Random effects estimator	
	Coefficient	Standard error	Coefficient	Standard error
const	−15,79100 ***	4,94539	−3,25946	2,10035
NSFR	7,23033 ***	2,58346	−0,09488	0,92965
Total capital ratio	0,11326	0,11178	0,11771 *	0,06624
Cost to income ratio	0,04476 *	0,02506	0,02386 *	0,01404
Interbank ratio	−0,00120	0,00313	−0,00290	0,00214
Net loans to total assets	0,08023	0,05051	−0,00239	0,01623
Liquid assets to deposits & borrowings	−0,02413	0,03850	−0,00967	0,02102
DUMMY_crisis	0,04498	0,39662	−0,20836	0,35524
Growth of total assets%	0,00007	0,01683	0,03125 **	0,01383
NPL to gross loans%	0,23900 ***	0,05557	0,20752 ***	0,03630
Dividends to net income %	−0,00094	0,00253	−0,00146	0,00228
Wald test (p-value)	p>0,1			
Breusch-Pagan test (p-value)	p>0,1			
Hausman test (p-value)	p<0,01			
Number of groups	100			
R^2	0,34			

***/**/* - the statistical significance at a level of 1%/5%/10% respectively; R^2 – concerns FE model

Source: own calculation.

Table 12: Correlation matrix of variables - model A

Variable	NIM	ROAA	ROAE	Beta change	Standard deviation	Semi -standard deviation	Price change	Total capital ratio	Cost to income ratio	Interbank ratio	Net loans to total assets	Liquid assets to deposits and borrowings	DUMMY_crisis	Growth of total assets	NPL to gross loans	Dividends to net income
NIM	1	0,0688	0,0148	0,0200	-0,0104	-0,0096	-0,0030	-0,2661	-0,1552	0,0282	0,3884	-0,0582	0,0028	-0,1218	0,1888	0,0004
ROAA		1	0,3199	0,0132	-0,0317	-0,0295	0,0076	0,1601	-0,3157	0,0714	-0,1375	0,2032	-0,0313	0,1311	-0,4348	0,0291
ROAE			1	0,0091	-0,0343	-0,0401	0,0436	0,1424	-0,0849	0,0421	-0,0533	0,0862	-0,0013	0,0785	-0,1873	0,0304
Beta change				1	-0,0075	0,0019	-0,0062	0,0077	-0,0139	-0,0346	0,0582	-0,0125	-0,0366	0,0063	-0,0082	0,0503
Standard deviation					1	0,9859	0,4192	-0,0002	0,0196	-0,0084	-0,0590	0,0092	0,0933	-0,0157	0,0614	0,0169
Semi -standard deviation						1	0,0543	-0,0017	0,0150	-0,0085	-0,0586	0,0094	0,1033	-0,0159	0,0162	0,0175
Price change							1	0,0303	0,0240	-0,0395	0,0381	-0,0218	-0,0211	0,0155	0,1621	-0,0376
Total capital ratio								1	0,0582	0,0784	-0,3800	0,1902	-0,0588	-0,0544	0,0160	0,0977
Cost to income ratio									1	0,0057	-0,1640	-0,0150	0,0446	-0,0353	0,1414	0,0299
Interbank ratio										1	-0,3142	0,4311	0,0035	0,0276	-0,0406	0,0814
Net loans to total assets											1	-0,4936	0,0657	-0,1497	0,1039	-0,1914
Liquid assets to deposits and borrowings												1	-0,0238	0,0627	-0,1802	0,0009
DUMMY_crisis													1	0,0111	-0,1323	-0,0277
Growth of total assets														1	-0,1350	-0,0208
NPL to gross loans															1	-0,0148
Dividends to net income																1

NIM – net interest margin; ROAA – return on average assets; ROAE – return on average.
Source: own calculation.

Table 13: Matrix of correlation coefficients of NSFR and other variables - model A

NSFR	Variable
-0,06319 **	NIM
0,19307 ***	ROAA
0,08013 ***	ROAE
-0,05541 *	Beta change
0,00848	Standard deviation
0,00817	Semi -standard deviation
-0,02968	Price change
0,45867 ***	Total capital ratio
0,07393 **	Cost to income ratio
0,53245 ***	Interbank ratio
-0,63236 ***	Net loans to total assets
0,50017 ***	Liquid assets to deposits and borrowings
-0,02815	DUMMY_crisis
0,04614	Growth of total assets
0,08980 **	NPL to gross loans
0,11813 ***	Dividends to net income
1	NSFR

NIM – net interest margin; ROAA – return on average assets; ROAE – return on average equity;

Source: own calculation.

***/**/* - the statistical significance at level of 1%/5%/10% respectively

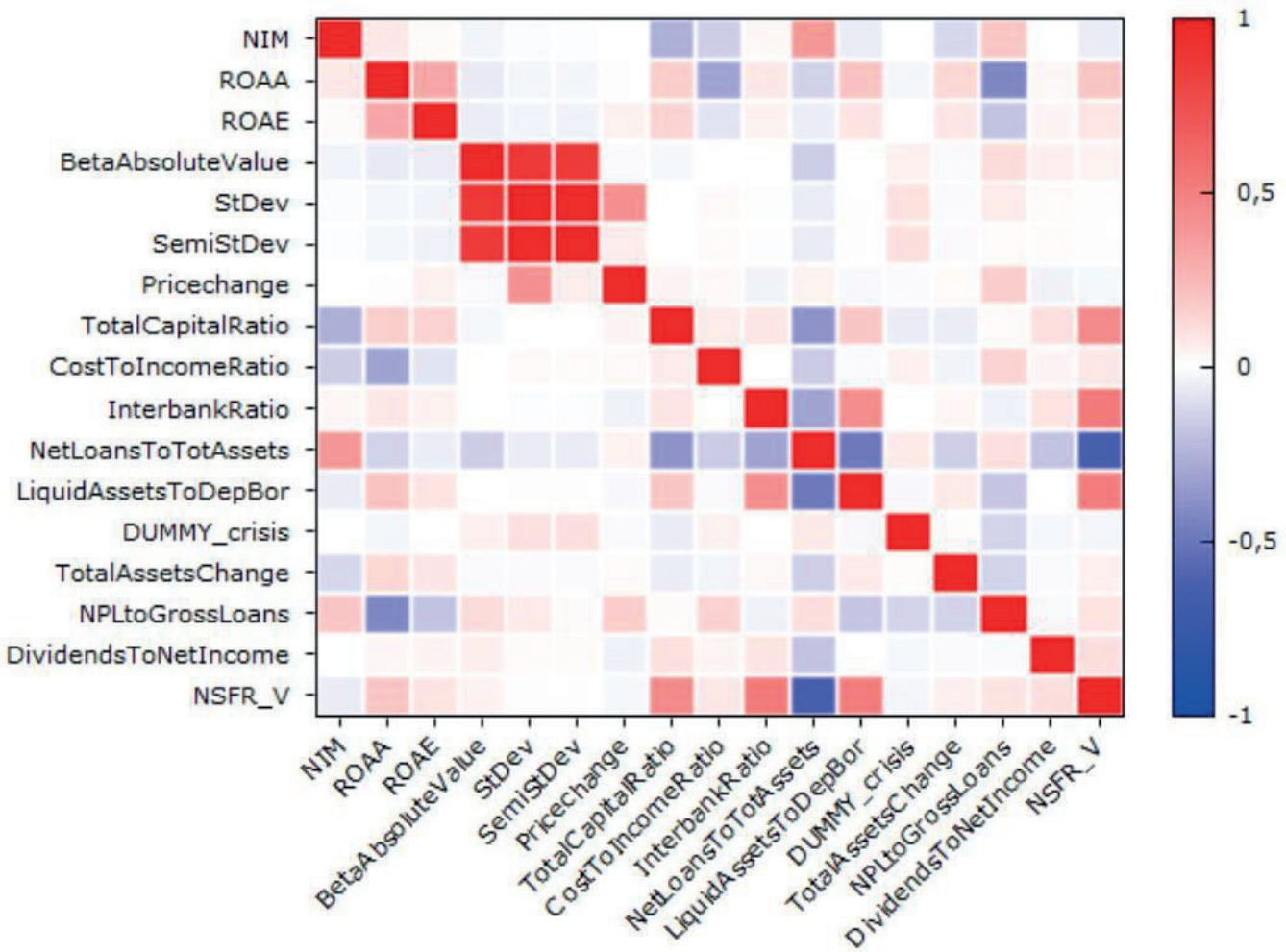

Chart 3: Correlation matrix of variables - model A
NIM – net interest margin; ROAA – return on average assets; ROAE – return on average equity
Source: own study.

Table 14: Descriptive statistics of variables - model A

Variable	Mean	Median	Minimum	Maximum	Standard deviation	Coefficient of volatility	Skewness	Kurtosis	5% percentile	95% percentile	Q3-Q1
NIM	1,728	1,789	-42,533	50,490	3,464	2,005	-1,111	107,440	0,303	3,539	1,178
ROAA	0,659	0,574	-22,404	74,535	3,049	4,625	13,612	343,820	-1,358	2,650	0,720
ROAE	3,868	7,505	-992,290	185,710	45,959	11,883	-14,214	263,380	-18,939	24,217	8,731
Beta (absolute value)	1,120	0,995	0,002	38,641	1,521	1,358	17,332	421,790	0,041	2,473	1,303
Standard deviation	0,028	0,018	0,001	2,745	0,097	3,486	25,757	717,060	0,008	0,054	0,015
Semi -standard deviation	0,019	0,012	0,001	2,016	0,071	3,784	26,037	724,860	0,005	0,040	0,010
Price change	0,301	0,030	-0,934	56,325	3,443	11,430	14,462	221,250	-0,691	0,809	0,480
Total capital ratio	13,410	12,400	-5,100	68,360	5,288	0,394	4,656	36,334	9,200	20,038	4,0000
Cost to income ratio	62,808	59,681	2,585	984,190	34,531	0,550	19,380	504,490	39,869	88,061	17,309
Interbank ratio	101,270	54,128	1,140	989,360	139,360	1,376	3,199	12,278	7,032	362,530	87,813
Net loans to total assets	56,416	61,908	0,006	92,039	21,913	0,388	-0,932	0,013	8,716	82,732	28,489
Liquid assets to deposits and borrowings	29,954	17,121	1,528	879,230	60,073	2,006	8,781	98,136	4,848	79,872	20,937
DUMMY_crisis	0,273	0,00001	0,00001	1,000	0,446	1,632	1,018	-0,963	0,000001	1,0000	1,0000
Growth of total assets	8,422	4,790	-71,890	826,620	33,715	4,003	16,690	379,140	-12,073	35,530	12,920
NPL to gross loans	6,537	4,170	0,150	53,770	7,213	1,103	2,558	8,165	0,600	21,505	5,360
Dividends to net income	44,250	33,445	-368,180	604,550	60,345	1,364	3,377	31,622	-0,118	118,120	33,468
NSFR	0,994	0,935	0,265	3,375	0,429	0,432	1,768	4,574	0,442	1,975	0,304

Source: own calculation.

Table 15: Banks in the research sample

No.	Bank	EU member state
1	BNP Paribas	France
2	Deutsche Bank AG	Germany
3	Banco Santander SA (Old)	Spain
4	Société Générale SA	France
5	ING Bank NV	Netherlands
6	Banco Bilbao Vizcaya Argentaria SA	Spain
7	Intesa Sanpaolo	Italy
8	Crédit Agricole-Crédit Agricole Group	France
9	Commerzbank AG	Germany
10	Natixis SA	France
11	UniCredit Bank AG	Italy
12	ABN AMRO Group NV	Netherlands
13	Caixabank, SA	Spain
14	Nordea Bank Finland Plc	Finland
15	Crédit Industriel et Commercial SA - CIC	France
16	Dexia SA	Belgium
17	KBC Bank NV	Belgium
18	Banco de Sabadell SA	Spain
19	Bankia, SA	Spain
20	Erste Group Bank AG	Austria
21	Bank of Greece	Greece
22	Banca Monte dei Paschi di Siena SpA	Spain
23	Exor Spa	Italy
24	Deutsche Postbank AG	Germany
25	Banco Popular Espanol SA	Spain
26	Banco Popolare di Verona e Novara	Italy
27	Unione di Banche Italiane Scpa-UBI Banca	Italy
28	Raiffeisen Bank International AG	Austria
29	National Bank of Greece SA	Greece
30	Allied Irish Banks plc	Ireland
31	Piraeus Bank SA	Greece
32	Bank of Ireland-Governor and Company of the Bank of Ireland	Ireland
33	Banco Comercial Português	Portugal
34	Wüstenrot & Württembergische	Germany
35	Eurobank Ergasias SA	Greece
36	Delta Lloyd Bankengroep NV	Netherlands
37	Mediobanca SpA-MEDIOBANCA - Banca di Credito Finanziario Società per Azioni	Italy
38	Deutsche Pfandbriefbank AG	Germany
39	Alpha Bank AE	Greece
40	Bankinter SA	Italy

41	Aareal Bank AG	Germany
42	Banca popolare dell'Emilia Romagna	Italy
43	Banca Popolare di Milano	Italy
44	Liberbank SA	Spain
45	Banco BPI SA	Portugal
46	Caisse régionale de crédit agricole mutuel de Paris et d'Ile-de-France SC-Crédit Agricole d'Ile-de-France	France
47	Credito Emiliano SpA-CREDEM	Italy
48	Banca Popolare di Sondrio Societa Cooperativa per Azioni	Italy
49	Ergycapital SPA	Italy
50	Permanent Tsb Group Holdings PLC	Ireland
51	DVB Bank SE	Germany
52	Caisse régionale de crédit agricole mutuel Nord de France SC-Crédit Agricole Nord de France	France
53	Banca Mediolanum SpA	Italy
54	Banca Carige SpA	Italy
55	Bank of Cyprus Public Company Limited	Cyprus
56	Banca Piccolo Credito Valtellinese	Italy
57	HSBC Trinkaus & Burkhardt AG	Germany
58	Caisse Régionale de Crédit Agricole Mutuel Brie Picardie SC-Crédit Agricole Brie Picardie	France
59	Caixa Economica Montepio Geral	Spain
60	Caisse Régionale de Crédit Agricole Mutuel du Languedoc SC	France
61	Groupe Bruxelles Lambert SA	Belgium
62	FinecoBank Banca FinEco SpA-Banca FinEco SpA	Italy
63	Oberbank AG	Austria
64	Caisse régionale de credit agricole mutuel Sud Rhône - Alpes SC-Credit Agricole Sud Rhône Alpes	France
65	Evonik Industries Ag	Germany
66	Comdirect Bank AG	Germany
67	Caisse Regionale de Credit Agricole Mutuel de Normandie SC	France
68	Van Lanschot NV	Netherlands
69	Oldenburgische Landesbank - OLB	Germany
70	Banco di Sardegna SpA	Italy
71	Amundi	France
72	Vseobecna Uverova Banka as	Slovakia
73	Tatra Banka as	Slovakia
74	Caisse régionale de credit agricole mutuel de la Touraine et du Poitou SC-Credit Agricole de la Touraine et du Poitou	France

75	Bank of Valletta Plc	Malta
76	Caisse régionale de crédit agricole mutuel de l'Ille-et-Vilaine SA-Crédit Agricole de l'Ille-et-Vilaine	France
77	Caisse régionale de crédit agricole mutuel Loire Haute-Loire SC-Crédit Agricole Loire Haute-Loire	France
78	Aktia Plc	Finland
79	Italmobiliare Spa	Italy
80	Caisse Régionale de Crédit Agricole Mutuel Toulouse 31 SC-Crédit Agricole Mutuel Toulouse 31 CCI	France
81	Bank für Tirol und Vorarlberg AG-BTV (3 Banken Gruppe)	Austria
82	Caisse régionale de Crédit Agricole mutuel du Morbihan SC-Crédit Agricole du Morbihan	France
83	Rothschild & Co	France
84	Banco di Desio e della Brianza SpA	Italy
85	Hellenic Bank Public Company Limited	Cyprus
86	Immofinanz AG	Austria
87	BKS Bank AG	Austria
88	Banca Ifis SpA	Italy
89	Azimut Holding SpA	Italy
90	Altarea SA	France
91	Banca Generali SpA-Generbanca	Italy
92	HSBC Bank Malta Plc	Malta
93	Alandsbanken Abp-Bank of Aland Plc	Finland
94	Flow Traders NV	Netherlands
95	Kas Bank NV	Netherlands
96	Banca Popolare di Spoleto SpA	Italy
97	Attica Bank SA-Bank of Attica SA	Greece
98	Grenke Ag	Germany
99	BinckBank NV	Netherlands
100	Banca Intermobiliare di Investimenti e Gestioni	Italy

Source: own study.

Table 16: Averages of value of standard deviation and semi-standard deviation in 2 bank groups

Mean of variable compared	Mean of variable compared in group 1 (NSFR < 80%)	Mean of variable compared in group 2 (NSFR => 100%)
Standard deviation	0,03531	0,01947
Semi-standard deviation	0,02460	0,01950

Source: own calculation.

Table 17: Values of aggregated mean NSFR in groups of states in several periods

Period	'PIIGS' states	The Eurozone with the exclusion of 'PIIGS' states
The mean of the NSFR in 2004-2006	1,00201	0,96013
The mean of the NSFR in 2007-2010	1,02392	0,94280
The mean of the NSFR in 2011-2014	1,06317	0,98618
The mean of the NSFR in 2004-2014	1,03366	0,96374

Source: own study.

Table 18: The results of panel regression estimation of fixed effects model (dependent variable: net interest margin) - model B

Independent variable	**Coefficient**	**Standard error**
Const	1,69940 ***	0,55057
NSFR	0,45936 ***	0,14289
Total capital ratio	0,01303 **	0,00648
NPL to gross loans	−0,01879 ***	0,00334
Interbank ratio	0,00029 *	0,00015
Net loans to total assets	0,01512 ***	0,00232
DUMMY_crisis	0,09437	0,06272
GDP change	3,97335	2,63217
EUR/USD	−0,51792 **	0,23209
Short-term interest rates	4,28640	4,74938
HICP	−0,00811	0,00496
Unemployment	3,16882	6,01947
Imports	−1,04985 *	0,57362
R^2	0,86299	

***/**/* - the statistical significance at a level of 1%/5%/10% respectively;

Source: own calculation.

Table 19: The results of panel regression estimation of fixed effects model (dependent variable: ROAA) - model B

Independent variable	Coefficient	Standard error
Const	0,04436	1,48161
NSFR	1,49843 ***	0,38528
Total capital ratio	0,20391 ***	0,01751
NPL to gross loans	−0,06506 ***	0,00897
Interbank ratio	−0,00130 ***	0,00041
Net loans to total assets	0,00500	0,00625
DUMMY_crisis	0,72603 ***	0,16884
GDP change	39,92070 ***	7,08297
EUR/USD	−0,48259	0,62484
Short-term interest rates	−8,32582	12,78460
HICP	−0,02757 **	0,01342
Unemployment	−2,91020	16,23340
Imports	−7,97689 ***	1,54333
R^2	0,54582	

***/**/* - the statistical significance at a level of 1%/5%/10% respectively;

Source: own calculation.

Table 20: The results of panel regression estimation of fixed effects model (dependent variable: ROAE) - model B

Independent variable	Coefficient	Standard error
Const	−18,381	76,599
NSFR	34,614 *	19,968
Total capital ratio	7,550 ***	0,905
NPL to gross loans	−0,645	0,464
Interbank ratio	−0,034	0,021
Net loans to total assets	0,301	0,323
DUMMY_crisis	25,168 ***	8,739
GDP change	1052,200 ***	366,854
EUR/USD	−10,970	32,290
Short-term interest rates	2,101	660,855
HICP	−1,219 *	0,693
Unemployment	133,590	838,854
Imports	−213,678 ***	79,883
R^2	0,267	

***/**/* - the statistical significance at a level of 1%/5%/10% respectively;
Source: own calculation.

Table 21: The results of panel regression estimation of fixed effects model (dependent variable: beta absolute value) - model B

Independent variable	Coefficient	Standard error
Const	−0,3794	3,0241
NSFR	−1,6528 **	0,7855
Total capital ratio	0,0155	0,0372
NPL to gross loans	0,0412 **	0,0187
Interbank ratio	−0,0002	0,0011
Net loans to total assets	−0,0220	0,0142
DUMMY_crisis	0,0854	0,3351
GDP change	−11,8457	14,0021
EUR/USD	−0,2371	1,2472
Short-term interest rates	39,3429	25,3621
HICP	0,0125	0,0272
Unemployment	25,3549	32,2297
Imports	1,4573	3,0455
R^2	0,2292	

***/**/* - the statistical significance at a level of 1%/5%/10% respectively;
Source: own calculation.

Table 22: The results of panel regression estimation of fixed effects model (dependent variable: beta) - model B

Independent variable	Coefficient	Standard error
Const	−0,4286	3,0440
NSFR	−1,5528 *	0,7907
Total capital ratio	0,0041	0,0375
NPL to gross loans	0,0357 *	0,0189
Interbank ratio	−0,0001	0,0011
Net loans to total assets	−0,0229	0,0143
DUMMY_crisis	0,0946	0,3373
GDP change	−11,1923	14,0945
EUR/USD	−0,3334	1,2555
Short-term interest rates	37,4325	25,5294
HICP	0,0168	0,0274
Unemployment	23,7372	32,4423
Imports	1,3054	3,0656
R^2	0,2301	

***/**/* - the statistical significance at a level of 1%/5%/10% respectively;
Source: own calculation.

Table 23: The results of panel regression estimation of fixed effects model (dependent variable: standard deviation) - model B

Independent variable	Coefficient	Standard error
Const	−0,00841	0,20820
NSFR	−0,09044 *	0,05408
Total capital ratio	0,00244	0,00256
NPL to gross loans	0,00292 **	0,00129
Interbank ratio	−0,00004	0,00007
Net loans to total assets	−0,00072	0,00098
DUMMY_crisis	0,01878	0,02307
GDP change	−0,88359	0,96402
EUR/USD	−0,01585	0,08587
Short-term interest rates	3,74285 **	1,74614
HICP	−0,00143	0,00187
Unemployment	2,46174	2,21896
Imports	0,12080	0,20968
R^2	0,17904	

***/**/* - the statistical significance at a level of 1%/5%/10% respectively;
Source: own calculation.

Table 24: The results of panel regression estimation of fixed effects model (dependent variable: semi standard deviation) - model B

Independent variable	Coefficient	Standard error
Const	0,04992	0,15364
NSFR	−0,06807 *	0,03991
Total capital ratio	0,00135	0,00189
NPL to gross loans	0,00165 *	0,00095
Interbank ratio	−0,00003	0,00005
Net loans to total assets	−0,00061	0,00072
DUMMY_crisis	0,01404	0,01703
GDP change	−0,54954	0,71138
EUR/USD	−0,03838	0,06337
Short-term interest rates	2,29213 *	1,28854
HICP	−0,00052	0,00138
Unemployment	1,20487	1,63745
Imports	0,05718	0,15473
R^2	0,17148	

***/**/* - the statistical significance at a level of 1%/5%/10% respectively;
Source: own calculation.

Table 25: The results of panel regression estimation of fixed effects model (dependent variable: stock price) - model B

Independent variable	Coefficient	Standard error
Const	1627,16	1993,70
NSFR	2289,75 ***	511,02
Total capital ratio	−85,58 ***	24,73
NPL to gross loans	−11,28	12,65
Interbank ratio	−0,74	0,71
Net loans to total assets	−16,66 *	9,45
DUMMY_crisis	22,15	222,26
GDP change	7731,72	9332,37
EUR/USD	−278,45	832,99
Short-term interest rates	−8176,41	16816,10
HICP	−0,45	18,08
Unemployment	−7791,02	21353,90
Imports	−1592,15	2032,57
R^2	0,70	

***/**/* - the statistical significance at a level of 1%/5%/10% respectively;

Source: own calculation.

Table 26: Descriptive statistics of variables - model B

Variable	Mean	Median	Minimum	Maximum	Standard deviation	Coefficient of volatility	Skewness	Kurtosis	5% percentile	95% percentile	Q3-Q1
NSFR	0,994	0,933	0,265	3,375	0,429	0,432	1,768	4,574	0,442	1,975	0,304
Total capital ratio	13,410	12,400	-5,100	68,360	5,288	0,394	4,656	36,334	9,200	20,038	4
NPL to gross loans	6,537	4,170	0,150	53,770	7,213	1,103	2,558	8,165	0,600	21,505	5,360
Interbank ratio	101,270	54,128	1,140	989,360	139,360	1,376	3,199	12,278	7,032	362,530	87,813
Net loans to total assets	56,416	61,908	0,006	92,039	21,913	0,388	-0,932	0,013	8,716	82,732	28,489
DUMMY_crisis	0,273	0	0	1	0,446	1,632	1,018	-0,963	0	1	1
GDP change	0,024	0,026	-0,035	0,056	0,024	1,016	-0,989	0,777	-0,035	0,056	0,033
EUR/USD	1,336	1,336	1,180	1,472	0,083	0,062	-0,296	-0,574	1,180	1,472	0,098
Short-term interest rates	0,018	0,014	0,002	0,046	0,015	0,808	0,710	-0,783	0,002	0,046	0,025
HICP	111,320	110,630	100	120,470	6,778	0,061	-0,153	-1,241	100	120,470	13,919
Unemployment	0,098	0,096	0,075	0,120	0,015	0,151	-0,042	-1,160	0,075	0,120	0,03
Imports	0,051	0,080	-0,171	0,157	0,084	1,623	-1,446	1,861	-0,171	0,157	0,087
NIM	1,728	1,789	-42,533	50,490	3,464	2,005	-1,111	107,440	0,303	3,539	1,178
ROAA	0,659	0,574	-22,404	74,535	3,049	4,625	13,612	343,820	-1,358	2,650	0,720
ROAE	3,868	7,505	-992,290	185,710	45,959	11,883	-14,214	263,380	-18,939	24,217	8,731
Beta (absolute value)	1,120	0,995	0,002	38,641	1,521	1,358	17,332	421,790	0,041	2,473	1,303
Beta	1,094	0,977	-1,926	38,641	1,540	1,408	16,706	402,280	-0,006	2,473	1,306
Standard deviation	0,028	0,018	0,001	2,745	0,097	3,486	25,757	717,060	0,008	0,054	0,015
Semi-standard deviation	0,019	0,012	0,001	2,016	0,071	3,784	26,037	724,860	0,005	0,040	0,010
Price change	0,301	0,030	-0,934	56,325	3,443	11,430	14,462	221,250	-0,691	0,809	0,480

Source: own calculation.

Table 27: Correlation matrix of variables (1) - model B

Variable	Imports	NIM	ROAA	ROAE	Beta (absolute value)	Beta	Standard deviation	Semi - standard deviation	Price change
Total capital ratio	-0,0857	-0,264	0,1722	0,1451	-0,0363	-0,0333	-0,0037	-0,0048	0,0279
NPL to gross loans	-0,1247	0,1627	-0,4415	-0,1948	0,1091	0,1021	0,0626	0,0205	0,1491
Interbank ratio	0,0396	0,0229	0,0813	0,0441	-0,0058	-0,0004	-0,0113	-0,0111	-0,0375
Net loans to total assets	0,0025	0,4061	-0,1375	-0,0589	-0,1496	-0,1563	-0,0523	-0,0516	0,0360
DUMMY_crisis	-0,2868	0,0039	-0,0299	-0,0001	0,0424	0,0517	0,0909	0,1004	-0,0205
GDP change	0,8711	0,092	0,119	0,0790	-0,0774	-0,0787	-0,0609	-0,0537	-0,0480
EUR/USD	-0,3711	-0,0001	0,0189	0,0250	0,0240	0,0289	0,0587	0,0542	0,0300
Short-term interest rates	0,2479	0,123	0,0964	0,0739	-0,0246	-0,0191	0,0438	0,0604	-0,0976
HICP	-0,2855	-0,1333	-0,1587	-0,1253	0,1097	0,1118	0,0439	0,0271	0,0401

Source: own calculation.

Table 28: Correlation matrix of variables (2) - model B

Variable	Unemployment	Imports	NIM	ROAA	ROAE	Beta (absolute value)	Beta	Standard deviation	Semi - standard deviation	Price change
Unemployment	1	-0,224	-0,134	-0,109	-0,090	0,050	0,043	-0,021	-0,043	0,099
Imports		1	0,064	0,067	0,025	-0,060	-0,060	-0,057	-0,051	-0,041
NIM			1	0,075	0,017	-0,038	-0,038	-0,011	-0,011	-0,004
ROAA				1	0,327	-0,068	-0,065	-0,035	-0,033	0,008
ROAE					1	-0,060	-0,059	-0,037	-0,043	0,043
Beta (absolute value)						1	0,988	0,867	0,863	-0,018
Beta							1	0,849	0,844	-0,026
Standard deviation								1	0,986	0,415
Semi-standard deviation									1	0,053
Price change										1

Source: own calculation.

Table 29: Correlation matrix of variables (3) - model B

Variable	Total capital ratio	NPL to gross loans	Interbank ratio	Net loans to total assets	DUMMY_crisis	GDP change	EUR/USD	Short-term interest rates	HICP	Unemployment
NSFR	0,45867 ***	0,08980 **	0,53245 ***	-0,63236 ***	-0,02820	-0,01396	-0,02661	-0,04288	0,04808	0,04932

***/**/* - the statistical significance at a level of 1%/5%/10% respectively;

Source: own calculation.

Table 30: Correlation matrix of variables (4) - model B

Variable	Imports	NIM	ROAA	ROAE	Beta (absolute value)	Beta	Standard deviation	Semi - standard deviation	Price change
NSFR	-0,01278	-0,06319 **	0,19307 ***	0,08013 ***	0,03714	0,04467	0,00848	0,00817	-0,02970

***/**/* - the statistical significance at a level of 1%/5%/10% respectively;

Source: own calculation.

Robustness checks - model (B) with macroeconomic and financial variables

Table 31: The results of regression estimation (dependent variable: net interest margin) - model B

Independent variable	Ordinary least squares		Random effects	
	Coefficient	Standard error	Coefficient	Standard error
Const	2,36904 **	1,02149	1,58918 ***	0,55585
NSFR	0,81487 ***	0,15646	0,53865 ***	0,13673
Total capital ratio	−0,01329	0,01066	0,01040	0,00648
NPL to gross loans	0,02327 ***	0,00484	−0,01574 ***	0,00330
Interbank ratio	0,00086 ***	0,00024	0,00034 **	0,00015
Net loans to total assets	0,02308 ***	0,00176	0,01724 ***	0,00213
DUMMY_crisis	0,06167	0,12989	0,09149	0,06349
GDP change	−0,29870	5,39144	3,79866	2,66115
EUR/USD	−0,10665	0,47738	−0,50189 **	0,23475
Short-term interest rates	6,12069	9,83492	4,42816	4,80682
HICP	−0,02333 **	0,01011	−0,00909 *	0,00502
Unemployment	0,25010	12,35750	3,02643	6,08945
Imports	−0,09107	1,17153	−1,01500 *	0,57978
Wald test (p-value)	p < 0,01			
Breusch-Pagan test (p-value)	p < 0,01			
Hausman test (p-value)	p < 0,01			

***/**/* - statistical significance at a level of 1%/5%/10% respectively; Source: own calculation.

Table 32: The results of regression estimation (dependent variable: ROAA) - model B

Independent variable	Ordinary least squares		Random effects	
	Coefficient	Standard error	Coefficient	Standard error
Const	1,09467	1,46703	0,79543	1,39257
NSFR	0,92151 ***	0,22496	1,09611 ***	0,26486
Total capital ratio	0,13147 ***	0,01531	0,16422 ***	0,01585
NPL to gross loans	−0,06082 ***	0,00695	−0,06141 ***	0,00756
Interbank ratio	−0,00053	0,00035	−0,00088 **	0,00037
Net loans to total assets	0,00237	0,00253	0,00367	0,00332
DUMMY_crisis	0,77596 ***	0,18658	0,75291 ***	0,17174
GDP change	43,05260 ***	7,74378	41,78430 ***	7,156
EUR/USD	−0,55697	0,68596	−0,55019	0,63306
Short-term interest rates	−5,85597	14,13410	−7,84766	13,0025
HICP	−0,03319 **	0,01458	−0,03003 **	0,01351
Unemployment	8,19984	17,78310	1,83663	16,4317
Imports	−8,78994 ***	1,68256	−8,47845 ***	1,5567
Wald test (p-value)	p < 0,01			
Breusch-Pagan test (p-value)	p < 0,01			
Hausman test (p-value)	p < 0,01			

***/**/* - the statistical significance at a level of 1%/5%/10% respectively;

Source: own calculation.

Table 33: The results of regression estimation (dependent variable: ROAE) - model B

Independent variable	Ordinary least squares		Random effects	
	Coefficient	Standard error	Coefficient	Standard error
Const	7,215	68,953	1,373	68,780
NSFR	21,318 **	10,614	24,829 *	13,541
Total capital ratio	5,154 ***	0,720	6,399 ***	0,790
NPL to gross loans	−0,894 ***	0,328	−0,743 *	0,381
Interbank ratio	−0,009	0,016	−0,022	0,018
Net loans to total assets	0,133	0,119	0,193	0,173
DUMMY_crisis	26,234 ***	8,782	25,682 ***	8,443
GDP change	1171,37 ***	364,789	1107,7 ***	352,285
EUR/USD	−16,233	32,246	−14,020	31,087
Short-term interest rates	20,750	664,574	−12,974	638,421
HICP	−1,204 *	0,686	−1,199 *	0,664
Unemployment	436,763	835,844	242,443	806,985
Imports	−244,632 ***	79,216	−228,572	76,600
Wald test (p-value)	p < 0,1			
Breusch-Pagan test (p-value)	p > 0,1			
Hausman test (p-value)	p < 0,01			

***/**/* - the statistical significance at a level of 1%/5%/10% respectively; Source: own calculation.

Table 34: The results of regression estimation (dependent variable: beta and beta absolute value) - model B

Independent variable	Beta absolute value - random effects		Beta - random effects	
	Coefficient	Standard error	Coefficient	Standard error
Const	−1,6361	2,6807	−1,3302	2,7042
NSFR	−0,7149	0,5318	−0,6963	0,5412
Total capital ratio	−0,0055	0,0321	−0,0096	0,0324
NPL to gross loans	0,0333 **	0,0148	0,0316	0,0150
Interbank ratio	−0,0005	0,0009	−0,0005 **	0,0009
Net loans to total assets	−0,0229 ***	0,0071	−0,0236	0,0072
DUMMY_crisis	0,1207	0,3194	0,1111 ***	0,3216
GDP change	−13,4449	13,1613	−13,7621	13,2556
EUR/USD	−0,0581	1,1915	−0,1188	1,19953
Short-term interest rates	39,8703	24,4115	37,1643	24,5726
HICP	0,0167	0,0258	0,0194	0,0260
Unemployment	25,7312	30,7947	21,5826	31,0047
Imports	1,8879	2,8595	1,9633	2,8800
Wald test (p-value)	p < 0,05		p < 0,01	
Breusch-Pagan test (p-value)	p < 0,1		p < 0,1	
Hausman test (p-value)	p < 0,01		p < 0,01	

***/**/* - the statistical significance at a level of 1%/5%/10% respectively; Source: own calculation.

Table 35: The results of regression estimation (dependent variable: standard deviation and semi standard deviation) - model B

Independent variable	Standard deviation - random effects		Semi standard deviation - random effects	
	Coefficient	Standard error	Coefficient	Standard error
Const	−0,17256	0,18356	−0,08156	0,13509
NSFR	−0,01171	0,03609	−0,00355	0,02638
Total capital ratio	0,00154	0,00219	0,00073	0,00161
NPL to gross loans	0,00206 **	0,00101	0,00101	0,00074
Interbank ratio	−0,00004	0,00006	−0,00004	0,00005
Net loans to total assets	−0,00076	0,00048	−0,00057 *	0,00035
DUMMY_crisis	0,02186	0,02191	0,01529	0,01616
GDP change	−0,92316	0,90268	−0,63950	0,66518
EUR/USD	−0,00804	0,08175	−0,02996	0,06026
Short-term interest rates	3,96235 **	1,67524	2,47119 **	1,23502
HICP	−0,00087	0,00177	−0,00010	0,00131
Unemployment	2,81606	2,11280	1,43837	1,55733
Imports	0,13274	0,19611	0,07951	0,14451
Wald test (p-value)	p < 0,01		p > 0,1	
Breusch-Pagan test (p-value)	p > 0,1		p > 0,1	
Hausman test (p-value)	p < 0,1		p < 0,01	

***/**/* - the statistical significance at a level of 1%/5%/10% respectively; Source: own calculation.

Table 36: The results of regression estimation (dependent variable: stock price) - model B

Independent variable	Ordinary least squares		Random effects	
	Coefficient	Standard error	Coefficient	Standard error
Const	1481,70	2965,07	1673,05	1986,71
NSFR	502,60	449,97	2064,16 ***	480,20
Total capital ratio	−0,12	32,23	−79,48 ***	24,28
NPL to gross loans	−23,96 *	14,28	−11,53	12,24
Interbank ratio	−1,07	0,91	−0,88	0,69
Net loans to total assets	0,71	5,02	−10,06	8,24
DUMMY_crisis	−27,41	370,15	13,11	221,62
GDP change	13426	15207,7	8537,21	9277,85
EUR/USD	−1265,07	1380,86	−391,77	830,70
Short-term interest rates	−2577,70	28396,2	−7244,03	16807,6
HICP	1,87	29,75	−2,43	18,00
Unemployment	−280,96	35526,6	−6044,48	21301,3
Imports	−3369,22	3301,53	−1823,02	2019,82
Wald test (p-value)	p < 0,01			
Breusch-Pagan test (p-value)	p < 0,01			
Hausman test (p-value)	p > 0,1			

***/**/* - the statistical significance at a level of 1%/5%/10% respectively; Source: own calculation.

Table 37: The results of regression estimation (dependent variable: net interest margin – NIM, return on average assets - ROAA) - model B

	Group I				Group II				Group III			
	NIM		ROAA		NIM		ROAA		NIM		ROAA	
	FE	RE	FE	RE	FE	RE	FE	RE	FE	RE	FE	RE
NSFR coefficient	0,69 ***	0,73 ***	1,43 **	0,98 *	0,53 ***	0,45 **	1,69 ***	1,24 **	0,80	0,62	0,12	−0,75 *

***/**/* - the statistical significance at a level of 1%/5%/10% respectively; FE – fixed effects model; RE - random effects model

Source: own calculation.

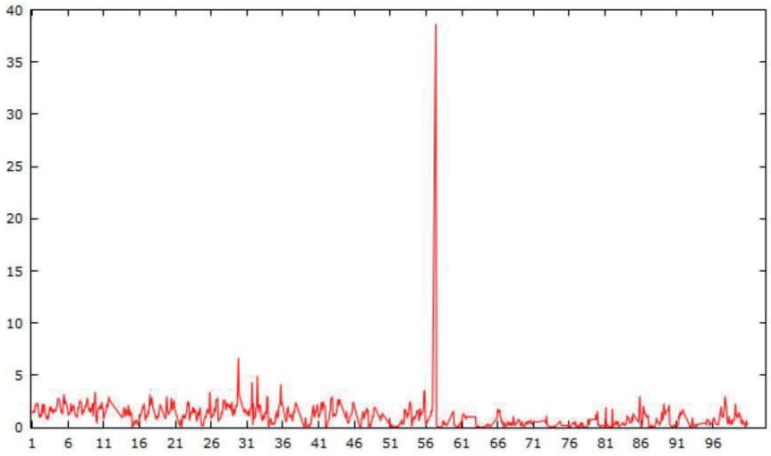

Chart 4: Values of beta coefficient (absolute values) for groups

Vertical axis: values of a beta coefficient, horizontal axis: time series for groups

Source: own estimation.

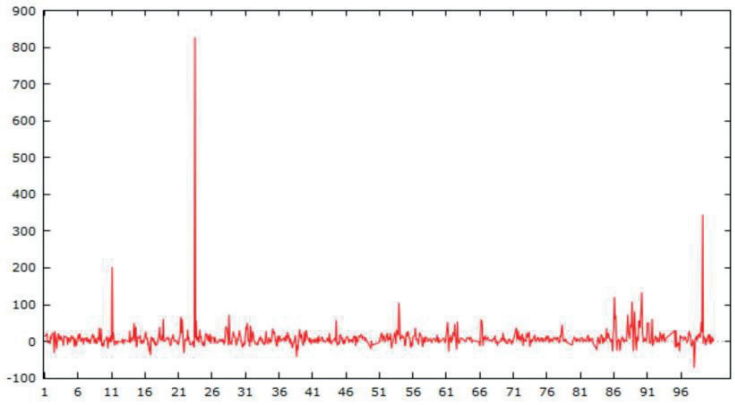

Chart 5: Growth of total assets (%) for groups

Vertical axis: Growth of total assets (%), horizontal axis: time series for groups

Source: own estimation.

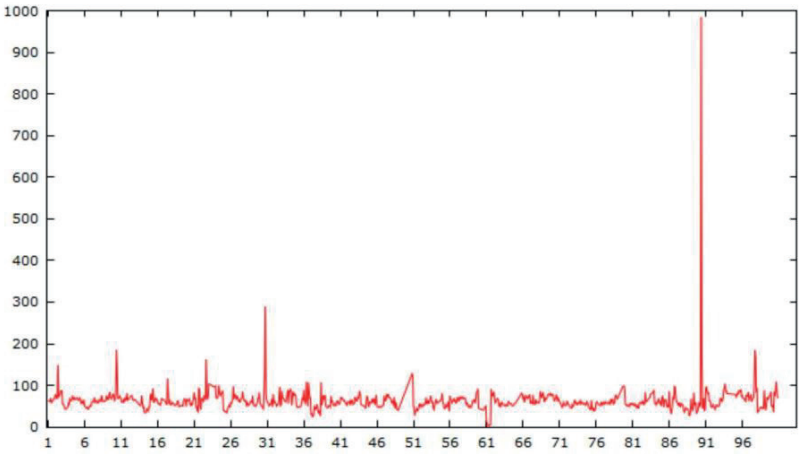

Chart 6: Cost to income ratio for groups

Vertical axis: cost to income ratio, horizontal axis: time series for groups

Source: own estimation.

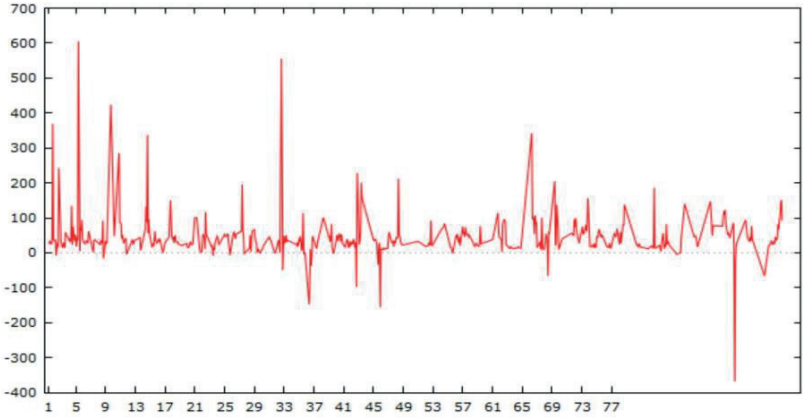

Chart 7: Dividends to net income for groups

Vertical axis: Dividends to net income, horizontal axis: time series for groups

Source: own estimation.

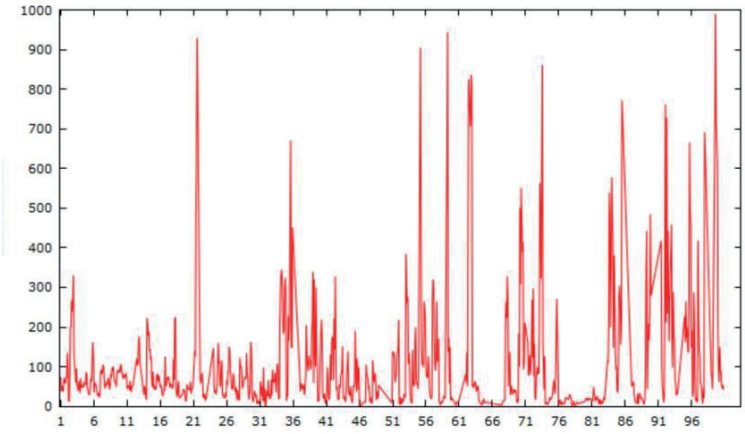

Chart 8: Interbank ratio for groups

Vertical axis: values of an interbank ratio, horizontal axis: time series for groups

Source: own estimation.

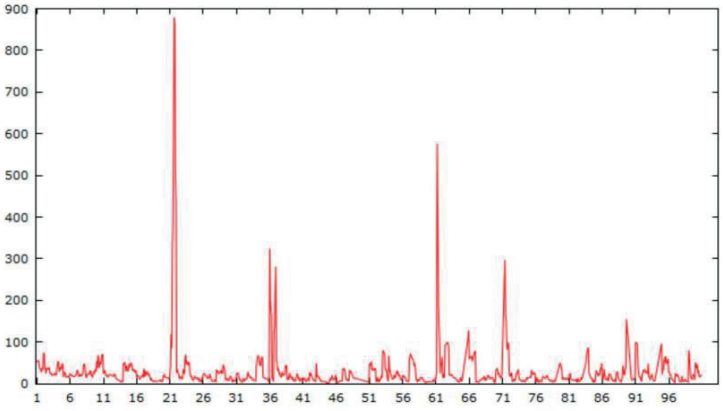

Chart 9: Liquid assets to deposits and borrowings for groups

Vertical axis: liquid assets to deposits and borrowings, horizontal axis: time series for groups

Source: own estimation.

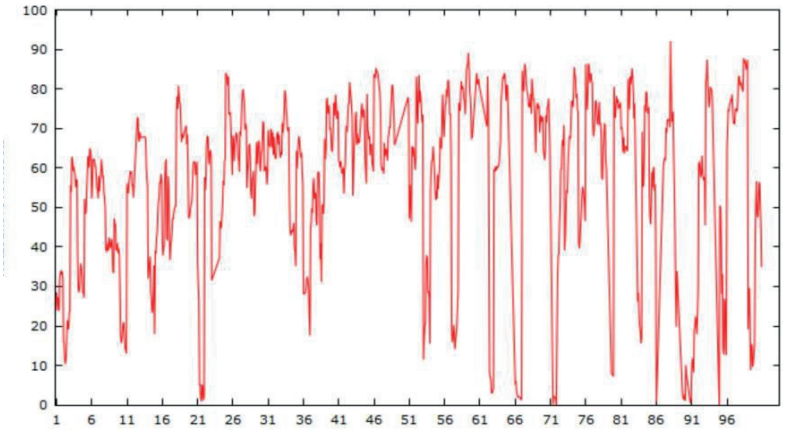

Chart 10: Net loans to total assets (%) for groups

Vertical axis: Net loans to total assets (%), horizontal axis: time series for groups

Source: own estimation.

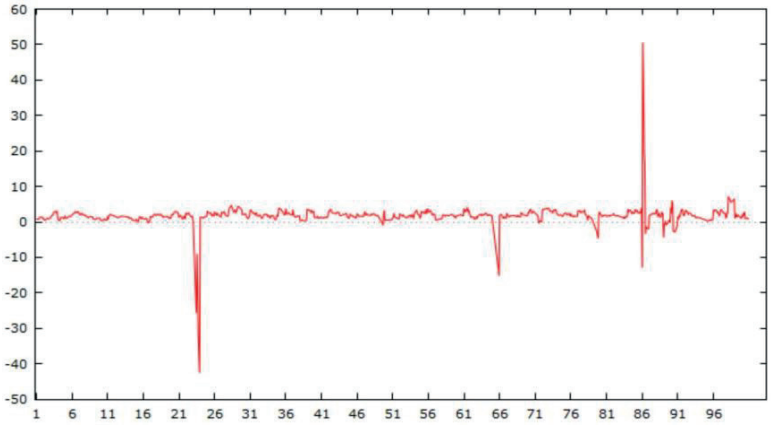

Chart 11: Net interest margins for groups

Vertical axis: Net interest margins, horizontal axis: time series for groups

Source: own estimation.

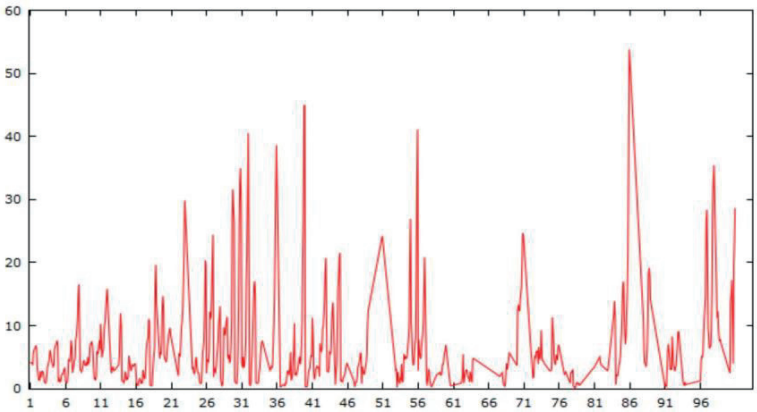

Chart 12: Non-performing loans to gross loans (%) for groups

Vertical axis: Non performing loans to gross loans (%), horizontal axis: time series for groups

Source: own estimation.

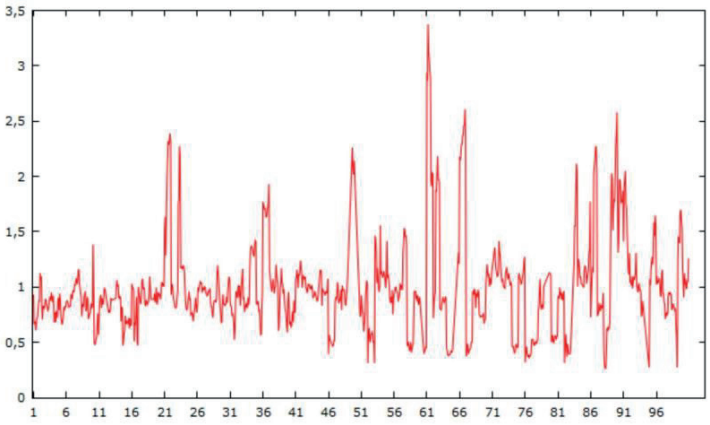

Chart 13: Net Stable Funding Ratio for groups

Vertical axis: Net Stable Funding Ratio, horizontal axis: time series for groups

Source: own estimation.

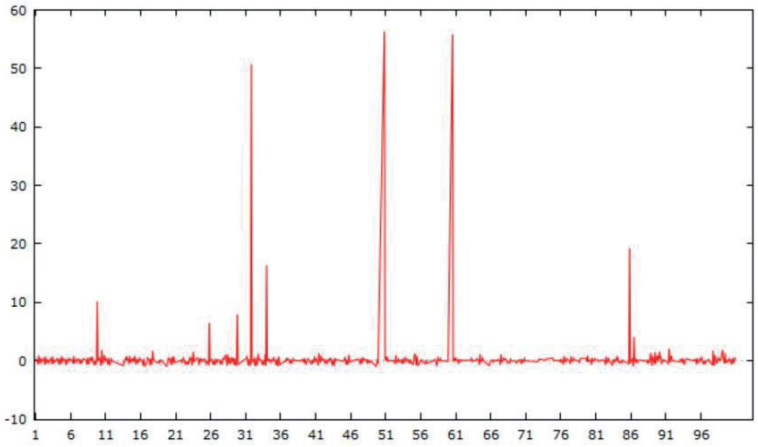

Chart 14: Yearly stock price changes for groups

Vertical axis: Yearly stock price changes, horizontal axis: time series for groups

Source: own estimation.

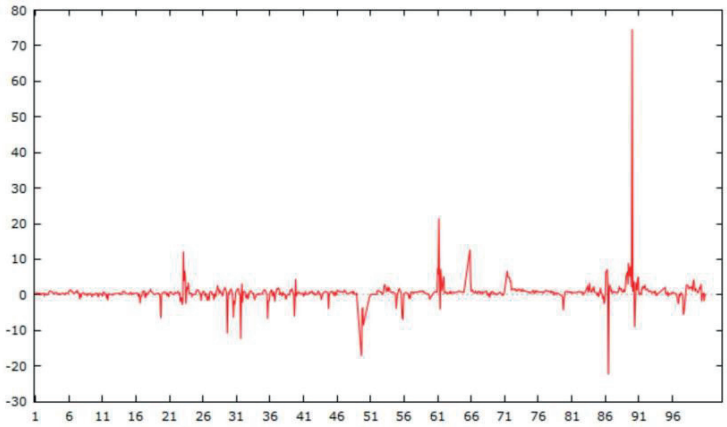

Chart 15: Return on average assets (ROAA) for groups

Vertical axis: Return on average assets (ROAA), horizontal axis: time series for groups

Source: own estimation.

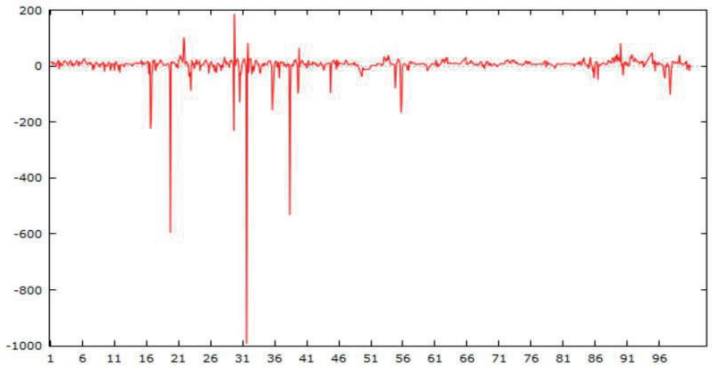

Chart 16: Return on average equity (ROAE) for groups

Vertical axis: Return on average equity (ROAE), horizontal axis: time series for groups

Source: own estimation.

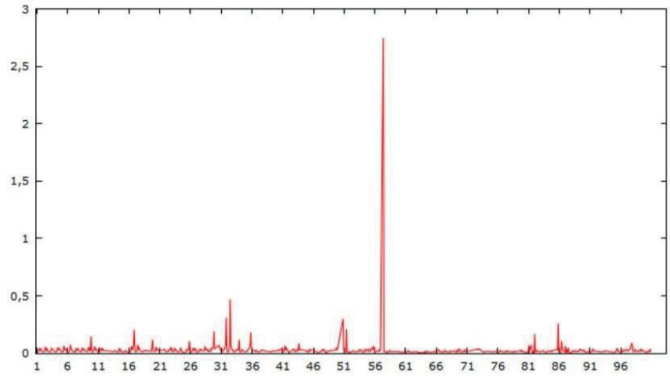

Chart 17: Standard deviation of daily logarithmic rates of return of banks stocks for groups

Vertical axis: Standard deviation of daily logarithmic rates of return of banks stock,

horizontal axis: time series for groups

Source: own estimation.

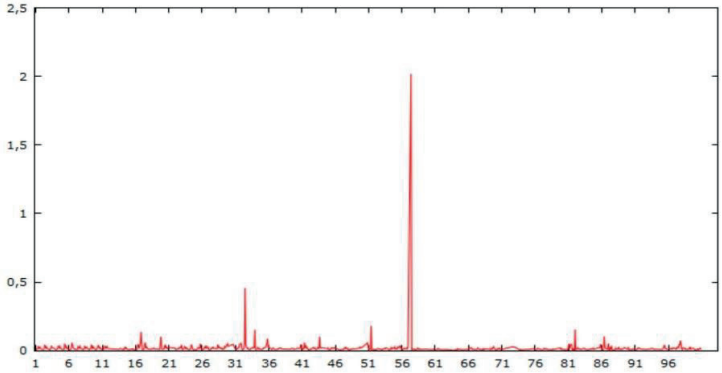

Chart 18: Semi-standard deviation of daily logarithmic rates of return of banks stock for groups

Vertical axis: Semi-standard deviation of daily logarithmic rates of return of banks stock,

horizontal axis: time series for groups

Source: own estimation.

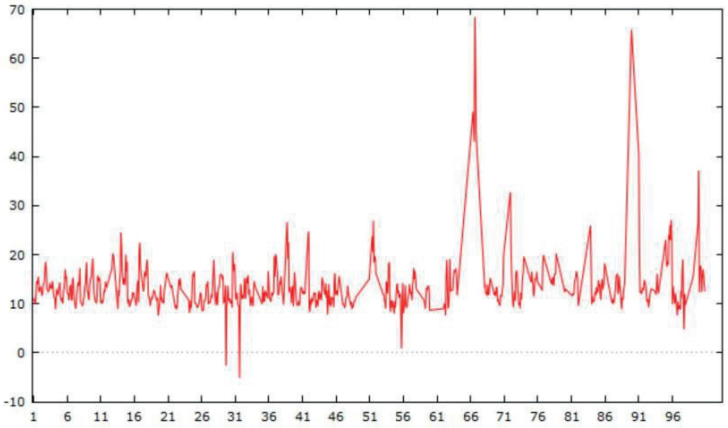

Chart 19: Values of total capital ratio for groups

Vertical axis: values of a total capital ratio, horizontal axis: time series for groups

Source: own estimation.

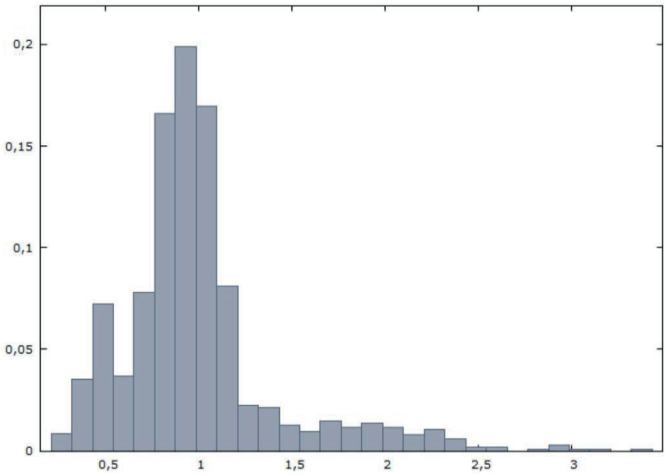

Chart 20: NSFR frequency distribution

Vertical axis: relative frequency, horizontal axis: NSFR values

Source: own estimation.

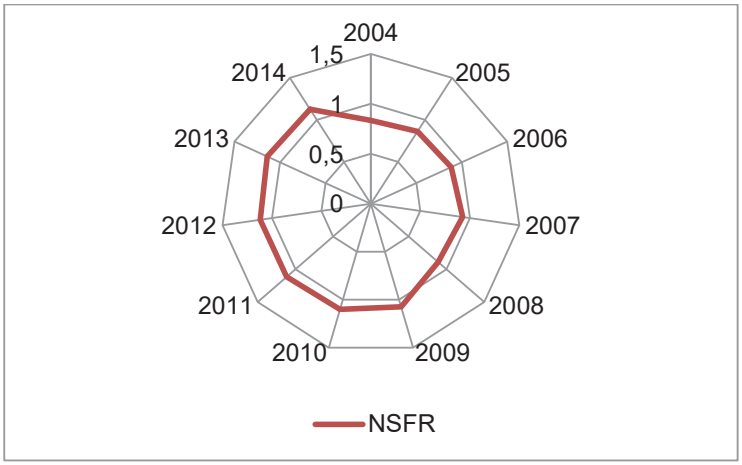

Chart 21: Value of NSFR in Austria from 2004 to 2014 (for banks in the research sample)

Source: own calculation.

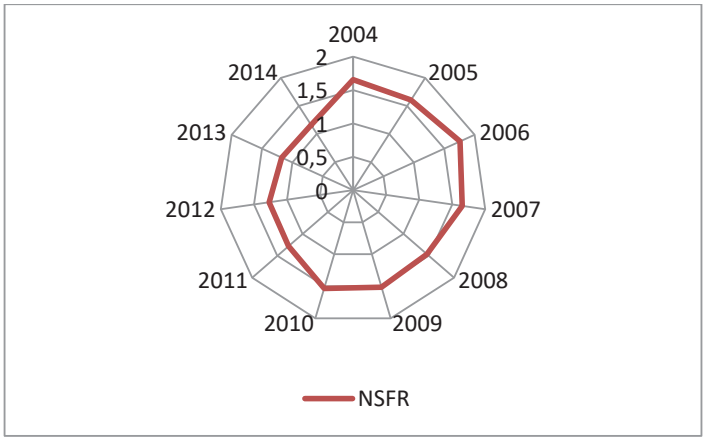

Chart 22: Value of the NSFR in Belgium from 2004 to 2014 (for banks in the research sample)

Source: own calculation.

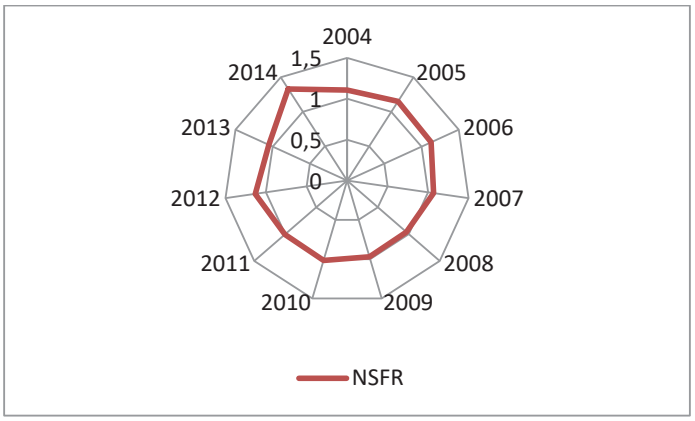

Chart 23: Value of the NSFR in Cyprus from 2004 to 2014 (for banks in the research sample)

Source: own calculation.

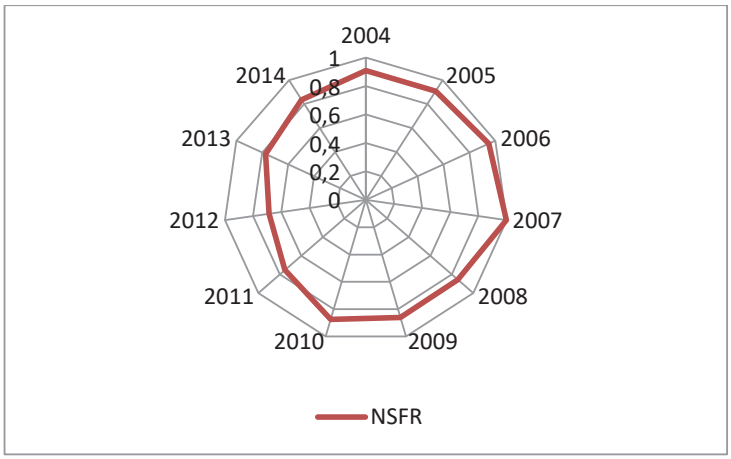

Chart 24: Value of the NSFR in Finland from 2004 to 2014 (for banks in the research sample)

Source: own calculation.

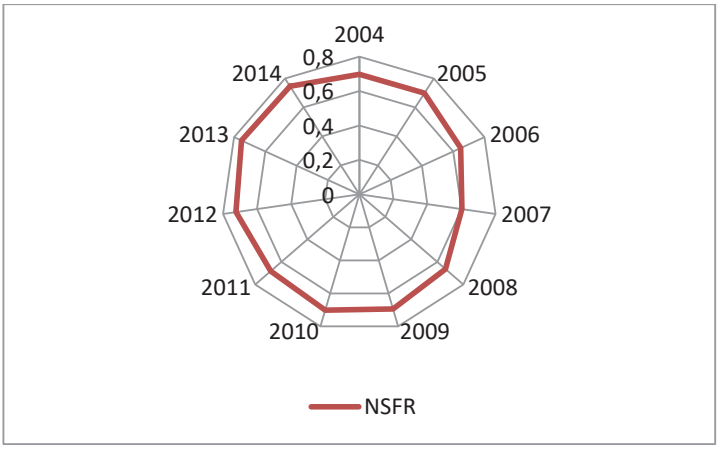

Chart 25: Value of the NSFR in France from 2004 to 2014 (for banks in the research sample)

Source: own calculation.

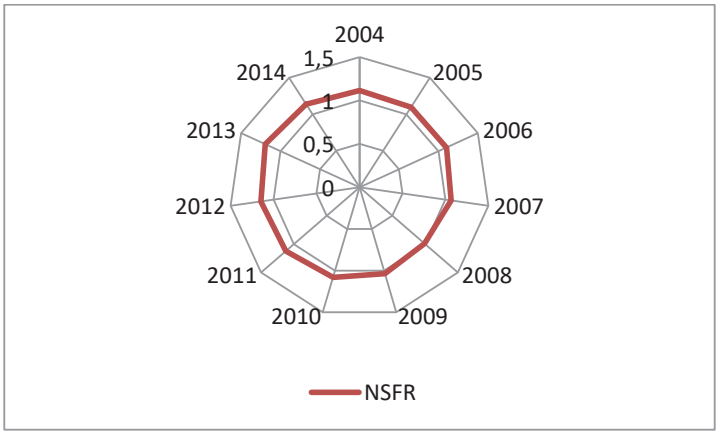

Chart 26: Value of the NSFR in Germany from 2004 to 2014 (for banks in the research sample)

Source: own calculation.

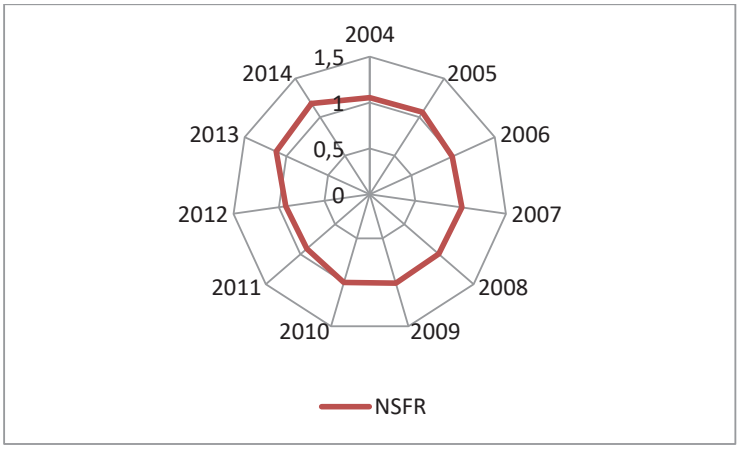

Chart 27: Value of the NSFR in Greece from 2004 to 2014 (for banks in the research sample)

Source: own calculation.

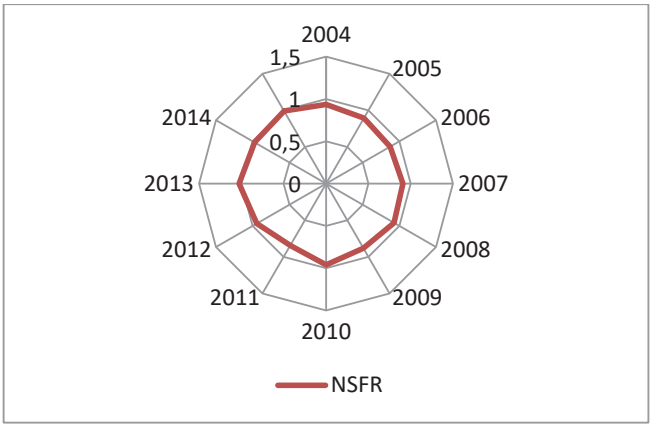

Chart 28: Value of the NSFR in Ireland from 2004 to 2014 (for banks in the research sample)

Source: own calculation.

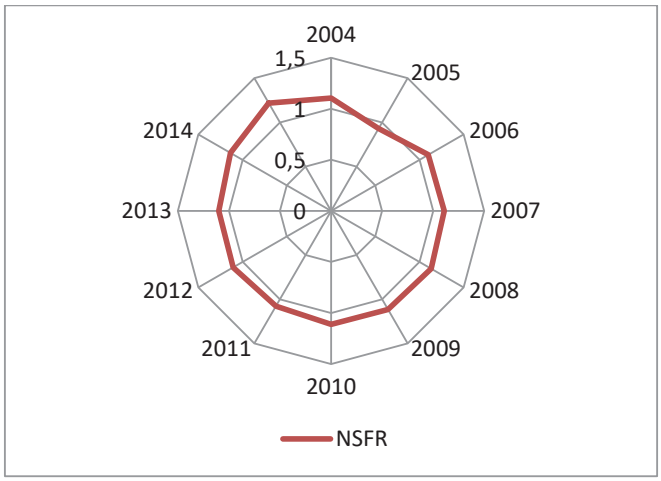

Chart 29: Value of the NSFR in Italy from 2004 to 2014 (for banks in the research sample)

Source: own calculation.

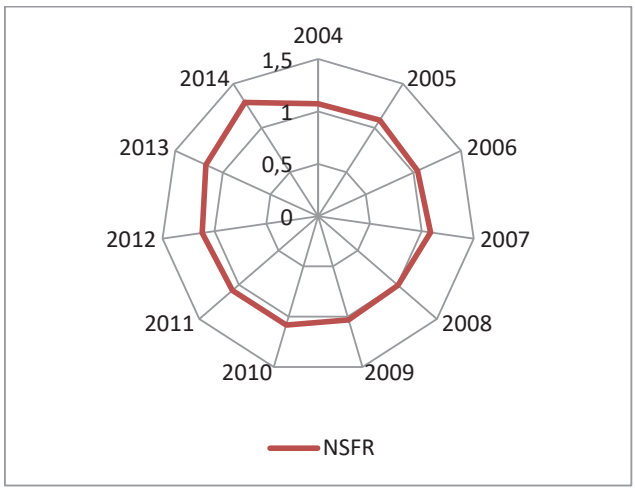

Chart 30: Value of the NSFR in Malta from 2004 to 2014 (for banks in the research sample)

Source: own calculation.

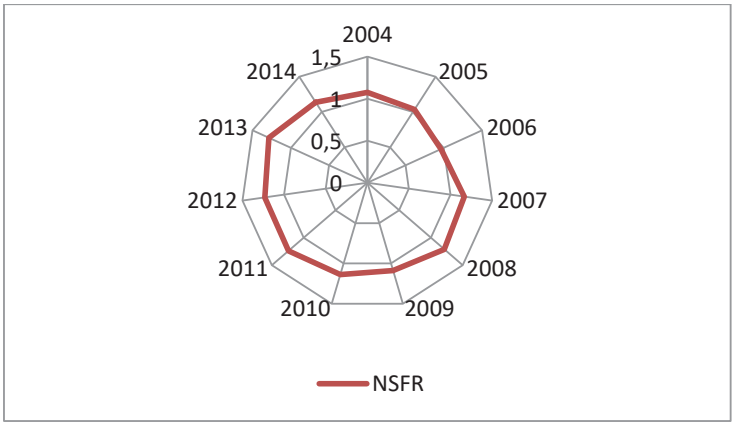

Chart 31: Value of the NSFR in the Netherlands from 2004 to 2014 (for banks in the research sample)

Source: own calculation.

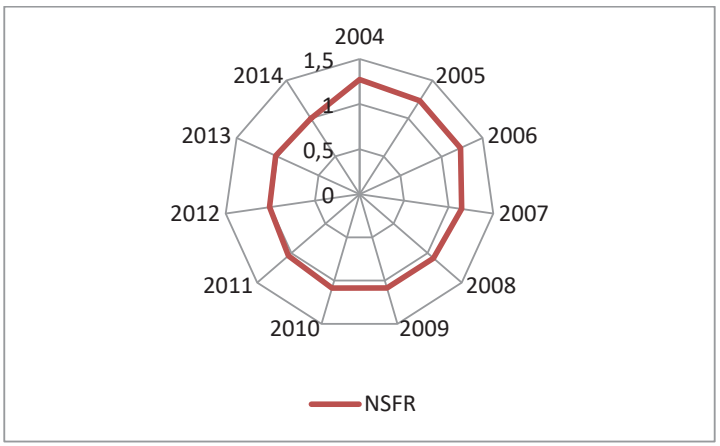

Chart 32: Value of the NSFR in Slovakia from 2004 to 2014 (for banks in the research sample)

Source: own calculation.

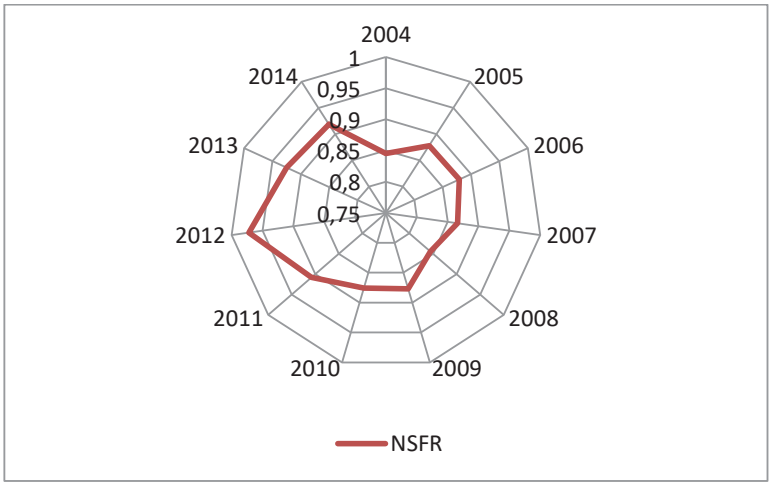

Chart 33: Value of the NSFR in Spain from 2004 to 2014 (for banks in the research sample)

Source: own calculation.

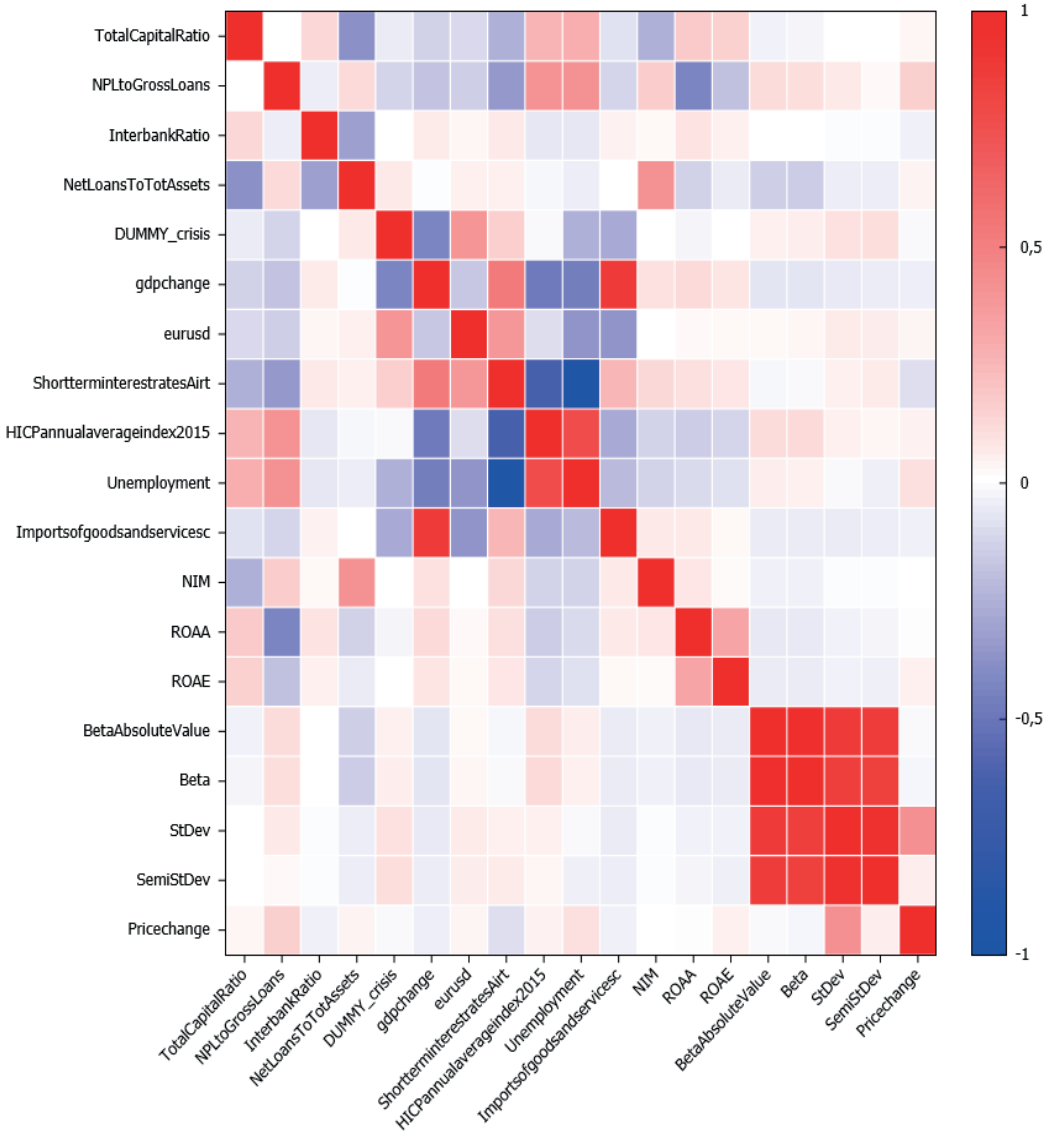

Chart 34: Correlation matrix of variables - model B

Source: own study.

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