

PROFITABILITY OF BANKING IN THE NEGATIVE INTEREST RATE ERA

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The relevance of ownership structure and loan portfolio quality

**Jyväskylä University
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ABSTRACT

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Title Profitability of banking in the negative interest rate era – The relevance of ownership structure and loan portfolio quality	
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<p>Negative money market interest rates have been a defining feature of European economy during the years 2015-2022, which can be called as a negative interest rate era. On top of the aggregate economy, this era has also influenced the banking sector and the banking business. The topic of this master's thesis is to find out the most significant variables that have influenced on the profitability of banking sector. Variables defining the profitability are especially researched through the perspective of bank's size, ownership structure and the locale of the bank meaning if it situates in the Euro area or outside of it. One key standpoint of this thesis is the effect of loan portfolio quality to the bank's profitability.</p> <p>This thesis was conducted as quantitative research using various panel econometric techniques. The data included over 560 banks from 35 different European countries. Three different variables were used to measure the profitability: return on average assets (ROAA), return on risk weighted assets (RoRWA) and net interest margin (NIM).</p> <p>The main result involving the effect of the loan portfolio quality indicate that for the shareholder owned banks in the Euro area and co-operative and savings banks outside the Euro area it could even be beneficial to increase the loan portfolio riskiness, as for these banks the increasing share of non-performing loans is recorded to have positive effect on ROAA. One explanation to this is that these banks can match the recognized risk with appropriate pricing. However, the increase in the riskiness of the loan portfolio could not be suggested for the shareholder owned banks outside the Euro area as for those banks the perceived profitability is worsened though increased share of non-performing loans.</p> <p>The results indicate that banks with different characteristics are affected by different independent variables. It is also recorded, that the same independent variable can cause an impact that is negative for some banks and positive to another. As an example for variation within the results, the faster growth speed of a shareholder owned bank is recorded to cause harm on NIM but benefit the broader profitability measure ROAA. Because of these notions it is important that each bank makes the practical decisions through their own perspective, rather than solely relying on theory or following the example set by the other banks.</p>	
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TIIVISTELMÄ

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<p>Negatiiviset rahamarkkinakorot ovat olleet merkittävä tekijä eurooppalaisessa taloudessa vuosina 2015–2022, jota voidaan kutsua negatiivisten korkojen aikakaudeksi. Aikakaudella on ollut vaikutuksia kokonaistalouden lisäksi myös pankkisektoriin ja pankkiliiketoimintaan. Tämän pro gradu -tutkielman tarkoituksena on selvittää kyseisen aikakauden merkittävimmät tekijät, jotka ovat vaikuttaneet pankkien kannattavuuteen. Kannattavuuteen vaikuttavia muuttujia tarkastellaan lisäksi pankin koon, omistusrakenteen ja sen perusteella sijaitseeko pankki Euro alueella vai muualla Euroopassa. Yhtenä merkittävänä näkökulmana tämä tutkielma tarkastelee pankin luottokannan laadun vaikutusta sen kannattavuuteen.</p> <p>Tutkielma toteutettiin määrällisenä tutkimuksena hyödyntäen useita paneeli ekonometrisia tutkimusmenetelmiä ja käytetty data sisälsi yli 560 pankkia yhteensä 35 Euroopan maasta. Kannattavuuden mittarina käytettiin kolmea eri muuttujaa: keskimääräisen kokonaispääoman tuotto (ROAA), riskipainotettu kokonaispääoman tuotto (RoRWA) ja nettokorkomarginaali (NIM).</p> <p>Lainakannan laatuun liittyen merkittävin tulos oli, että Euro alueen liikepankit ja Euro alueen ulkopuoliset osuus- ja säästöpankit näyttäsivät jopa hyötyvän lainakannan laadun heikentämisestä, sillä näille pankeille järjestämättömien luottojen osuuden kasvu näyttäisi vaikuttavan positiivisesti keskimääräisen kokonaispääoman tuottoon. Yksi selitys havaitulle vaikutukselle on se, että kyseiset pankit kykenevät hinnoittelemaan havaitsemansa riskit asianmukaisesti. Lainakannan laadun heikentämistä ei kuitenkaan voi suositella Euro alueen ulkopuolisille liikepankeille, sillä kyseisten pankkien kannattavuus näyttäisi heikentyvän lainakannan heikentymisen myötä.</p> <p>Tulokset osoittavat etenkin sen, että eri muuttujat vaikuttavat erilaisiin pankkeihin. Lisäksi huomattiin myös, että siinä missä yksittäinen muuttuja saattaa aiheuttaa negatiivisen vaikutuksen yhdelle pankille ja positiivisen toiselle. Esimerkki tulosten vaihtelevuudesta nähdään pankin nopean kasvuvauhdin vaikutuksista, sillä nopeampi kasvuvauhti näyttäisi heikentävän nettokorkomarginaalia, mutta toisaalta parantavan laajempaa kannattavuuden mittaria, eli kokonaispääoman tuottoa. Etenkin näiden huomioiden valossa on tärkeää, että pankin johto tekee käytännöntason ratkaisunsa kyseisen pankin lähtökohdista, eikä luota täysin teoriaan tai muiden pankkien asettamaan esimerkkiin.</p>	
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1 INTRODUCTION

The topic of this master's thesis stems from the abnormal situation in the economy caused by the negative money market interest rates. This situation lasted for almost seven years, but now for example the most commonly used housing loan reference rate, the 12-month Euribor has stayed positive from the 21st of April 2022. The current geopolitical crisis situation due to the war in Ukraine has induced strong inflation pressures globally, due to which central banks have already started their strongly tightening monetary policy actions widely. However, the era of negative interest rates started in the European financial markets in the summer of 2014. From there on the deposit facility rate, one of the main monetary policy rates of European Central Bank (ECB) has stayed negative until the most recent months. The negative quotations of steering rate were followed by corresponding course of action also in Euro Overnight Index Average (EONIA) rate and Euribor rate with three months maturity as also both of them dropped below zero lower bound in November of 2014 and in April of 2015 respectively.

The era of negative money market interest rates has had tremendous effects on banking industry. Money market interest rates are one of the key components driving bank's revenues and expenses, which are items in the income statement contributing to the profit or loss the bank has made. Revenues and expenses are created based on altering the positions of balance sheet items, i.e., assets and liabilities. Each asset and liability item has its own unique combination of liquidity, risk, size, and return, which all have effects on the valuation of these balance sheet items.

One of the key components of bank profitability is the net interest income (NIM), which is the return the bank is receiving as it executes its principal business functions of borrowing short (selling liabilities) and lending long (buying assets). From these transactions the bank collects the gains as the difference between the interest it is paying to the depositors and the interest it is receiving from the loans it has granted. To make it simple, bank's profit is largely derived from the difference between the interest of purchased assets (loans granted) and the interest of acquired liabilities (deposits received), i.e., the net interest income (NIM).

The direct effect of negative money market interest rates has been especially seen in lowering the profitability of banks through lowering the net interest margin (López-Penabad et al., 2022). As the interest rate for the bought assets (loans granted) consists of the reference rate, as which Euribor -rates are often used, topped up with the case-specific margin, the introduction of negative interest rates has caused melting down of the margins received from the assets, as the Euribor -rates have turned negative. At the same time, the banks have not been able to transmit these negative interest rates to the interests that are paid for the sold liabilities (deposits), because of the banks' concern to give an incentive for a possible bank run. This dilemma has resulted in narrowing NIM, which partly lowers the profitability of banks (Claessens et al., 2018; Jobst & Lin, 2016).

However, recent research argues, that the effects of negative money market interest rates on the profitability of banks might have been even positive in some time periods and cases (Junttila et al., 2021) or at least dependent on the business model the bank is operating on (Chen et al., 2018). To patch up the lost profits from narrowing NIM, banks have had an incentive to shift from deposit-funded business model towards more wholesale-based funding (WSF) model, as WSF provides the ability to obtain funding with negative interest rate costs. Accessing to the markets of WSF, however, is not possible for every bank. Especially the smallest banks are left outside, as they can't meet the requirements based on their sizes and other conditions. Based on this, there could be a gap in profitability for the smallest banks, as the gap couldn't have been patched with WSF.

On the other hand, it has also been found that even though the total NIM would have remained constant, there has been a change in its composition. When investigating the effects of the flattening yield curve and decreasing interest rates on the net interest margin (NIM) Chaudron et al. (2022) made a difference between the interest earned solely from the maturity transformation and the interest earned from the residual part of the interest income. The residual part of the interest income included the interest income from market power, risk-compensation, and other mark-ups. Their main result was that the interest income from maturity transformation has decreased, but simultaneously those losses have been covered with increased interest income from the residual part, especially from the market power. However, this thesis also accounts for the concern, that the ability to achieve market power and therefore to compensate for the decreasing part of interest income, is not necessarily the same for banks with different features.

Numerous studies have shown that the period of low and negative interest rates has led to banks taking more risks in general (Aramonte et al., 2019; Bottero et al., 2019; Delis & Kouretas, 2011; Heider et al., 2019; Nucera et al., 2017). To fill up the gap in profitability that banks relying highly on deposit funding have been facing, it sounds somewhat justified for them to increase their portfolio riskiness to charge higher margins, which would then mitigate the lost profits they are facing.

However, the increasing riskiness of the loan portfolio, could it lead the bank to also increase the loan loss provisions they are reserving for uncollected loans and loan payments? When loan loss provisions are recorded as an income statement item, which acts as an expense, they have a lowering effect on operating profits. Furthermore, the increasing riskiness of the loan portfolio can also be seen to cause increasing the share of non-performing loans. This can then be interpreted as a higher probability to default causing for example increasing expenses on WSF and bank supervision. These issues raise a question on whether the increases to portfolio riskiness are advantageous for banks, or if they are only acting as a double-edged sword, which lowers the profitability with increased loan loss provisions and/or increased share of non-performing loans.

This brings us to the research questions of this master's thesis, which can be specified as:

- I. Have banks, that rely highly on deposit-based funding, increased their loan loss provisions and/or share of non-performing loans as they seek for more profits by increasing the portfolio riskiness?
- II. How has this affected on the profitability?
- III. Is there a difference in regards the ownership structure of banks or the size of the bank?

The data includes European level banking data from 567 different banks in 35 European countries. The data are retrieved from the Moody's Analytics BankFocus database, and the empirical analysis is based on various panel econometric techniques.

This master's thesis will contribute to the surprisingly limited literature on the effects of negative money market interest rates on bank profitability and riskiness. In practical sense, the aim is to find whether the increase in portfolio riskiness has been worth over its costs and that way give recommendations on whether the risk taking should be continued and even increased. This master's thesis aims to contribute to the new research direction Junttila and Nguyen (2022) pointed out in their recent study concerning the effect of sovereign risk premium on bank profitability. They found that as the sovereign risk premium has negative effects on profitability, measured both with and without risk-adjustment, it also has an increasing effect on the degree of wholesale funding and loan loss provisions the bank executes. Now the aim is to look more closely on the effects the loan loss provisions have had on the profitability of banks as they have increased their portfolio riskiness during the negative interest rates.

This master's thesis is structured as followed: first, the theoretical framework that is meaningful for this study is presented in chapter two, which is then followed by the review of the previous literature in chapter three. Chapter four will then present the data and methodology in more detail and chapter five reports the results of empirical analysis and interpretations on those. Finally, the main results, limitations of this study and suggestions for future research are concluded in chapter six.

2 THEORETICAL FRAMEWORK

2.1 Profitability of a bank

The general form of profit function of a simplified bank can be denoted as follows:

$$\pi = r_L L + r M - r_D D - C(D, L)$$

where $M = (1 - \alpha)D - L$. Here L denotes loans, M the net position in interbank reserves, D deposits, C the cost of managing volumes of D and L and α being a coefficient for compulsory reserves. Notations r_L , r , and r_D denote for different interest rates, which are collected or paid for loans, interbank reserves, and deposits, respectively. This function states the revenues of a bank to be dependent on the volume of the loans and reserves to which the bank obtains a certain amount of interest and from which the expenses, i.e., the interest paid on deposits and other costs of managing the bank, are subtracted (Alessandri & Nelson, 2015).

In the perspective of the general form of the profit function of a simplified bank, the main characteristic of negative interest rate era has been that the banks have been unable to lower the interest paid on the deposits (r_D) below zero, and at the same time the interest rate for interbank reserves (r) has turned negative causing the net position in the interbank reserves to cause a lowering effect on the aggregate revenues. The interest rate for loans has always stayed positive, but as the interest for interbank reserves is no longer positive and banks are reluctant to lower the interest rate on deposits to the negative side, there is more pressure to maintain the level of the interest rates on loans to ensure the level of revenues to stay the same.

In practice the profitability of a bank can be measured with numerous different measures some of them being risk-adjusted and some not. For this study the return on average assets (ROAA) is used as the non-risk adjusted measure. ROAA is calculated based on dividing the net income with average total assets. To compare, the risk adjusted measure of profitability is the return on risk weighted assets (RoRWA), which is defined as the operating profit divided by the risk weighted assets.

The main component driving banks' profits is the net interest margin (NIM), which is defined as the average of the net value gained from the interest-earning assets:

$$NIM = \frac{\text{interest received} - \text{interest paid}}{\text{average interest earning assets}}$$

(Jobst & Lin, 2016). NIM has also been the main concept for discussion as the money market interest rates have fallen below zero. When the market conditions have been "normal" with positive reference rates, the NIM has operated somewhat normally. The interest paid for obtaining the funding has been flexible as banks are able to regulate over the interests they are paying for the depositors:

the cut in policy rates is mostly transmitted to deposit rates within 12 months of the reduction (Altavilla et al., 2021).

In the past there has not been a clear benefit in obtaining wholesale funding from the markets. Now as the money market interest rates have fallen below zero and the banks have been reluctant to transfer these negative interests to the deposit rates in the fear of a bank run, the NIM is melting as the lending rates for new loans have declined and existing loans with variable rates are re-priced to a lower interest rate level (Jobst & Lin, 2016). To improve the NIM, banks might shift their funding strategy to rely more on wholesale funding. This could allow the “interest paid” part of the NIM numerator to go negative and therefore increase the margin.

2.2 Risk management and loan loss provisions

Typically, the banks have low leverage ratios when compared to other industries, as the main source of funding for banks’ lending operations comes from the liabilities as compared to equities. Of course, liabilities have numerous items, but the main ones are the deposits from the customers and the wholesale funding the bank has obtained from the markets. Mainly with these two components, the bank executes its main purpose of asset transformation from these two into loans.

One notable difference between wholesale funding and deposit funding is that banks can regulate the interest paid on the deposits while interest paid on the wholesale funding is determined by the markets and can therefore be more volatile, making it riskier for the banks. Alessandri and Nelson (2015) point out that as the rotation of wholesale funding balance is faster than the one of the loan portfolios, the funding needs to be refinanced multiple times during the long lending periods. This highlights the risks on the maturity mismatches and repricing frictions, that could end up causing banks’ income margins to decrease if the interest rates were rising.

This applies to the deposit funded banks too: if the interest rates would rise, the banks could start to compete from the deposits by offering depositors higher interest rates for their deposits to obtain funding. If the interest paid for the deposits would be less than the cost for wholesale funding, also the banks that previously obtained the funding from the wholesale markets would now be interested in switching back to the more traditional deposit-based funding model.

Even though the debate on how to finance lending and mitigate the risks arising there is important and relevant for the period of negative interest rates, it is only one part of the risks that banks deal with. From time-to-time banks are unable to collect loans and/or loan payments resulting in losses in the lending operations. Banks prepare themselves for these events with loan loss provisions.

Beatty and Liao (2014) point out in their literature review that loan loss provisions are an important factor for estimating losses in assets (bank loans) that otherwise would seem to be solid. They also state that under current regulations, loan loss provisions are decreasing both earnings and capital of the bank. Laeven

and Majnoni (2003) describe loan loss provisions as costs, which the bank faces due to loan losses that are expected to materialize over time, but for which the exact time is yet unknown. They also state that on top of preparing for expected losses, banks should also prepare for unexpected events, that result in losses, with earnings that are left after taxes.

3 PREVIOUS LITERATURE

3.1 Profitability of Banks

3.1.1 Profitability during negative interest rates

Contrary to the purpose, the negative interest rate policies have been seen to have contracting effect on the economy as they have caused reductions to banks' profits and led banks to reduce their lending activities (Brunnermeier & Koby, 2019; Eggertsson et al., 2019). Especially regarding the aggregate profitability of a bank, there are also numerous studies claiming that during the negative interest rates, there hasn't been any changes or that the changes to the profitability have been positive. In this section these different findings are presented.

Using a cross-country dataset including also a large share of small banks, Lopez et al. (2020) found out that the negative rates have not had any substantial effect on overall net income of the banks. On the contrary, weak evidence suggest that the effect could even have been positive. However, when it comes specifically to earning net interest income, Lopez et al. (2020) and Heider et al. (2019) both agree on the fact that part of creating profit has lowered during negative policy rates and that the impact has not been that remarkable for banks that rely more on wholesale-based funding than it has for deposit-based banks.

Altavilla, Boucinha and Peydró (2018) found from analyzing the effects of unconventional monetary policy on bank profitability, that the decreases in short-term interest rates are not in association with lower bank profit even though they seem to have downsizing effect on interest rate margins. They state that the aggregate profitability of banks hasn't been lowering because monetary conditions have also asymmetrically affected positively on loan loss provisions and non-interest income, which both have offset the negative impact on net interest margin. They conclude that if the period of low interest rates would be prolonged, it could potentially cause negative effect on profits, but even then, the effect would be compensated with improving macroeconomic conditions.

When looking at changes in drivers of profitability during these negative interest rates, Turk (2016) found from using bank-level data from large Danish and Swedish banks, that the loan margins charged from the customers have remained relatively stable even though the reference rates have dropped below zero. This means that the borrowers have been able to enjoy from the lowering interest rates as the margins haven't gone up as reference rates have gone down, which had been the initial purpose of negative interest rates. She also found that the banks have been able to offset the reductions in interest income by reducing the costs of funding and by charging higher fees. However, one of the offsetting components that banks haven't been able to utilize, is the negative interest paid on the deposit, which would take action by decreasing the capital-value of the deposit at its maturity.

As the reduction in the profitability is claimed to be resulting from the narrowing NIM, a recent study by Altavilla et al. (2021) sheds light to the point that maybe this is not the case. They found that the banks considered in investment-grade and other sound banks have been able to pass-through the negative policy rates to the corporate deposits without experiencing additional outflows of deposits. They give the reasoning for this from the preference of the companies to deposit their high demand of liquidity and safe assets to the most highly rated banks, which also explains why in some cases the corporate deposits even increased despite of negative deposit rates. However, they do not find this pattern to hold with less healthy banks.

3.1.2 Profitability and the ownership structure of bank

It has been found that stakeholder and shareholder owned banks tend to have different aspects through which they both have been prioritizing profitability during low and negative interest rate era. De Menna (2021) makes a comparison between non-cooperative and cooperative banks and even further divides cooperative banks in two categories based on the degree of utilizing relationship lending (meaning that financial institution has close ties to the borrower, usually corporation) over more consolidated structure. First, he finds out that as cooperative banks rely more heavily on interest income, which has decreased during this negative rate era, those banks have started to seek savings in operational costs of local and regional branches. This causes cooperative banks to move more closer to consolidation, which has been seen to cause eroding in the strength of the relationship lending (Berger & Udell, 2002).

The second finding from De Menna (2021) was that the cooperative banks that rely strongly on relationship lending experienced more severe negative effects on profitability than weak relationship cooperative banks and non-cooperative banks. The third and probably the most interesting finding was that even though both, non-cooperative and cooperative banks do increase credit risk when interest rates fall, they do it via different channels. Non-cooperative banks tend to take on higher credit risks while prioritizing profitability while cooperative banks make sure to provide access to credit for their customers by increasing their capital buffers, which does not necessarily advocate for improving the profitability.

It is essential to note that De Mennas data consisted of 3.998 banks within the Euro area and out of 2.136 cooperative banks vast majority (1.985) were defined as strong relationship cooperative banks. This highlights that the findings on that category apply for most of the cooperative banks. Considering this research, it needs to be noted that due to many similar characteristics that cooperative banks have with savings banks, we can carefully assume that perhaps these findings are also applicable to savings banks that are analyzed in this research, too.

3.2 Riskiness of banking

3.2.1 Dependency on banks' business model

For a sample of 1.334 banks from 101 countries, Demirgüç-Kunt and Huizinga (2010) address the time before the great financial crisis of 2008. They argue that low levels of nondeposit (wholesale) funding can offer risk reductions for banks, even though they observed it to cause lower rate of return on assets (ROA). They also note that relying solely on wholesale funding is highly risky if the markets would suddenly become uncertain for some reason and the wholesale financiers would have an incentive to withdraw their funding. The research refers to the model provided by Huang and Ratnovski (2011) which states the incentive for withdrawal could be because of negative signals stemming from the bank asset quality, and which would eventually cause otherwise solvent bank to fail if the withdrawal couldn't be refinanced.

Demirgüç-Kunt and Huizinga (2010) measure the risk with Z-score, which they define to be the number of standard deviations the bank's ROA must fall before the bank becomes insolvent. The mean value for Z-score is found to be 30,740. When determining the estimates for Z-score determinants they find out the coefficient of nondeposit funding to be -41,0014. This means that mean value of Z-score is reduced to 10,238 in case the bank having the mean value of Z-score would increase the share of nondeposit funding from 0 % to 50 % ($30,740 + (0,5 \cdot (-41,004)) = 10,238$). The result was statistically significant at 5 % risk level. This describes their findings on how the increasing levels of wholesale funding lead to remarkable worsening risk position in terms of bank becoming insolvent.

As the research by Demirgüç-Kunt and Huizinga (2010) was conducted for the period before the GFC, the more recent study by Köhler (2015) also includes the crisis period as the sample includes both listed and unlisted banks from 15 countries in European Union from 2002 to 2011. Unlike Demirgüç-Kunt and Huizinga (2010), Köhler (2015) finds out that business model has an impact on the risk effects of the level of wholesale funding. Specifically for investment banks the stability is seen to be improving with larger shares of wholesale funding, while for the retail banks the effect is found to be reverse.

Extending the studies of Demirgüç-Kunt and Huizinga (2010) and Köhler (2015), Mergaerts and Vander Vennet (2016) find from studying a panel data of 505 banks from 30 European countries over the period of 1998 to 2013, that the improvements in performance of retail banks are mainly attributed by the strong reliance on customer deposits and larger capital ratio, which turns into a higher profitability and higher NIM. They also find that banks which are relying more on riskier lending have been compensated for that risk, which is shown in their pre-impairment ROA. However, the negative impact of the extra risk is revealed as the impact on total ROA is negative through the higher exposure on loan impairments.

Bank's riskiness has also been seen to be dependent on the income streams the bank is having. Mergaerts and Vander Vennet (2016) state that low stage of

income diversification, which is typical for largely retail-oriented banks, deteriorates banks profitability and resilience. Also, Nucera et al. (2017) concur with those results as they find that larger banks with more diversified income streams are found to be less risky than smaller and more conventional banks, that predominantly rely on deposit funding. According to Köhler (2015), the benefits of income diversification are also dependent on the banks business model. They found the income diversification to improve the performance of retail banks, but on the opposite hurt the stability of investment banks.

The risks stemming from the trade-off between wholesale based and deposit-based ways of financing is also the reason why for example Jobst and Lin (2016) demand for greater emphasis on modifying the supervision of bank liquidity to more appropriate direction to capture these concerns. This leads to think if pursuing the possibility to participate on financing the lending activities from the wholesale markets would even be beneficial for the small banks that have enough deposit-based finance to cover their needs. Also, a question is raised if the banks riskiness has risen during the negative interest rates regardless of the funding strategy they execute? However, it needs to be noted that the data selection of none of these studies mentioned above in this subsection include the negative interest rate era, which is the main describing feature of the selected time span of this thesis.

3.2.2 Riskiness during negative interest rates

When investigating the impact of changes in monetary policy rates have on risk perceptions, risk tolerance and on the degree of risk in the portfolios, pricing of assets and terms of funding, Borio and Zhu (2012) defined something they call “risk-taking channel”. They find that one set of effects impacts through interest rates. They justify that lower interest rates boost asset and collateral values and enhance incomes and profits, which can cause reductions in risk perceptions and/or increase risk tolerance. They state that one example of this is that as the volatility decreases during the rising markets, it releases risk budgets from these economic agents who might then make more daring positions in risk wise.

Despite the theoretical finding from Borio and Zhu (2012), López-Penabad et al. (2022) conclude that all in all European banks have not taken more risk over the period 2011-2019. However, they also state that the implementation of negative interest rate policy (NIRP) effects banks differently depending on their business model. Contributing to the hypothesis of this study, they find that banks whose main source of finance is retail deposits have been more negatively affected by the implementation of NIRP than other banks.

In Dell’Ariccia, Laeven and Marquez (2014), the authors develop a model for financial intermediation, and find that if the banks were able to adjust their business models (e.g., their capital structures), they would obtain greater leverage and greater risk taking if there were reductions in real interest rates and if the demand function for loans would simultaneously be downward sloping. On the contrary, if the banks were not able to make any adjustments to their business models, as the capital structure would be exogenously fixed, the effect

of reducing real interest rates and downward sloping demand functions of loans was dependent on the degree of leverage the bank already had: If the bank was well capitalized, it was observed to increase the risk taking and if not, the risk taking could even be decreased especially if the demand curves for loans were linear or concave. Dell'Ariccia et al. (2014) also found out that a reduction in the risk-free interest rates (to which they contrast the reference rates) also leads banks to take more operational risks, especially by reducing monitoring. They state the incentive to reduce monitoring to be because the lowering reference rates reduce the interest rates on bank loans which further causes the banks gross return to reduce.

More recent empirical research by Heider, Saidi and Schepens (2019) contributes to the findings of Dell'Ariccia et al. (2014), as they find the banks having a high reliance on deposit funding, to take more risks and lend less after the introduction of negative interest rates. They explain their findings through the perspective on how negative money market interest rates have affected on the banks net worth. They state that before the negative era, when policy rates were lowered, but still maintained on the positive side, the reduction in interest rates lower the banks' cost of funding and increase the bank net worth regardless whether the granted loans were financed with deposits or with market-based debt. Now as the policy rates have lowered on the negative side, it has led to the situation where lowering policy rates even more causes the banks net worth to lower if the bank relies highly on deposits.

To describe the increased risk taking and constricted lending, the findings of Heider et al. (2019) can be specified with increase of one standard deviation in banks' deposit ratio (deposits over total assets), which results in financing firms with 16 % higher volatility on return on assets (ROA) and also in reducing lending with 13 %.

Using large cross-country dataset including 5200 banks from 27 developed Asian and European countries during 2010-2017, Lopez et al. (2020) find opposite results to the ones by Heider et al. (2019) in regards of lending activity. Especially in regards of small banks Lopez et al. (2020) suggest that the reduction resulting to negative interest rates has induced the small and highly deposit-based banks to shift their assets away from the cash reserves and more towards increasing lending, which obviously has been the main intent of the negative interest rates. They also found out that negative interest rates seem to be insignificant in regards of liability variables, which indicates that the banks haven't been adjusting their business models in terms of funding strategy in response to the negative interest rates. Combining this finding to the one presented earlier by Dell'Ariccia et al. (2014), the steadiness of business model could mean increasing risk taking at least for well capitalized banks.

Another defining feature of negative interest rate era is the large expansion of the central banks' balance sheets as they have executed the asset purchase programs aiming to stabilize the economy. Using Germany as an example, Lewis and Roth (2019) find the asset purchase programs to have restoring effect on bank lending, but also that the borrowing does not become cheaper. They even find

the excess bond premiums to be risen significantly and therefore suggest that lending might have become riskier.

3.2.3 Loan Loss Provisions

In this study, loan loss provisions are one of the measures used to describe the quality of the bank's loan portfolio. The quality can be described with other measures too, as for example Guerrieri and Harkrader (2021) did as they investigated the drivers for bank revenues and loan charge-offs with data from 2002 to 2020. They found out that the changes in macroeconomic factors explain most of the variation in loan charge-offs, which are the debt that the bank believes to be unlikely entirely collected as the borrower has become delinquent on payments. This reveals the sensibility of the quality of the loan portfolio to the macroeconomic factors. However, Guerrieri and Harkrader (2021) also found out that the explanatory relationship of macroeconomic factors wasn't that large for revenue, that was measured with pre-provision net revenue. This finding contributes to the assumption that the changes in macroeconomic environment affect the profitability through the quality of the loan portfolio.

Laeven and Majnoni (2003) found out when using bank level data on large commercial banks in various geographical regions during 1988 to 1999, that loan loss provision had undesired negative relation to loan growth. This meant that as they observed the bank to have rapid growth in lending, the bank didn't put aside more loan loss provisions, even though the rapid growth of loan portfolio is generally associated to increase bank risk with lower monitoring measures and lower quality of loan portfolio. Another main finding in their research was that banks typically delay with increasing loan loss provisions until the economic cycle turns into a downturn. This causes the increase in provisioning to become too late, which magnifies the impacts of the downturn on banks' income and capital.

In a more recent study, with data period from 1998 to 2013, Mergaerts and Vander Vennet (2016) stated that at least in a short run, asset growth in total results to relatively more loan loss provisions per asset. They suggested this to imply that asset growth would mean either higher concentration of loans or a lower quality of loans, for which these increased loan loss provisions are executed for. This finding is in line with the hypothesis of this study: if the bank has increased risk-taking it should also increase the loan loss provisions.

However, since Laeven and Majnoni (2003) and Mergaerts and Vander Vennet (2016) made their findings, new regulatory framework has been implemented in the banking industry. Under IFRS 9 banks are obligated to implement expected credit loss (ECL) framework, which recognizes impairments and which was set to be effective starting from the beginning of 2018 (Bank for International Settlements, 2017). The previous standard was more backwards looking, as it only required banks to recognize such credit losses for which there was apparent evidence of a loss. However, under the current ECL impairment banks are required to be more forward looking as the signs for ECL need to be

continuously recognized regarding the past events, current conditions and information on future forecasts.

Concerning policy uncertainties that have described the recent years, Ng et al. (2020) documented that in times of higher policy uncertainty banks have put aside more loan loss provisions, which is noted to be consistent with the signals banks have been giving on rising numbers of expected loan losses. Unfortunately, the current research is lacking the overall analysis on the effects of IFRS 9 on the loan loss provisions as the new regulatory framework is still relatively new. Also, the era of IFRS 9 starting from the beginning of 2018 is somewhat affected by the features caused by the COVID-19 pandemic, which already itself can be believed to have a remarkable impact on loan loss provisioning.

4 DATA AND METHODOLOGY

4.1 Data and regression model

In this section, I present the data and the methodology that was used for the estimations. First, the data obtained from the Moody's Analytics BankFocus database includes yearly bank-level data from European region from 2010 to 2019. The period selection intentionally excludes the ongoing COVID-19 pandemic. The reason for the exclusion is that it is presumed that including the year of 2020 wouldn't bring any extra value for the purpose of this study, but rather it could even twist the results as the pandemic and its mitigating actions are still ongoing.

The panel regression is estimated to be the following:

$$\Delta Y_{ijt} = \alpha + \beta X_{ijt-1} + \gamma \Delta Z_{ijt} + \delta \Delta M_{jt} + \varepsilon_{ijt}, \quad (1)$$

which is an adjusted version from the one presented by Detragiache, Tressel and Turk-Ariss (2018) in their working paper. The regression includes subscripts i , j and t which are set to denote banks, countries, and time periods. On the left side as dependent variable of the regression there is ΔY_{ijt} , which refers to the change in banks profitability over the previous period, meaning from $t - 1$ to t . The right side, the explanatory variables consist of three vectors and the error term ε_{ijt} . The first vector X_{ijt-1} describes bank initial characteristics that are averaged over the previous period $t - 1$. The second one ΔZ_{ijt} is the vector of bank variables that explain bank initial variables and the third one ΔM_{jt} is the vector of changes in country-specific (specifically defined as Euro Area and other European regions) macroeconomic variables. Vectors that describe estimated coefficients are denoted as α , β , γ and δ .

Inspired by Junttila and Nguyen (2022), this study also uses a common profitability measure and in addition a measure which functions as risk-weighted profitability measure. The profitability is measured with the return on average assets (ROAA) and with the return on risk weighted assets (RoRWA), of which the latter is measured by the operating profit relative to risk weighted assets, to examine whether there is a difference in the results regarding on if the profitability measure is risk adjusted or not.

Due to data availability issues faced with the macroeconomic variables, it was first decided to rule out the countries with less than five banks in the dataset. This decision ruled out the countries of Albania, Andorra, Bosnia and Herzegovina, Moldova, Montenegro, North Macedonia and San Marino. However, it was decided to not rule out Iceland even though the data included only three Icelandic banks, but because of the remarkable international characteristics of Icelandic banking sector and the extensive bailout package it received after the Great Financial Crisis. In total this decision ruled out 19 individual banks from the data. Later, also Ukraine was ruled out from the

dataset, as the data from Ukrainian banks included extensive amount of missing observations especially on the second dependent variable RoRWA.

The original dataset acquired from Moody's Analytics BankFocus database included 979 banks. As the original dataset included high number of missing observations, it was decided that the bank in question is sampled out if the bank level explanatory variables are missing more than 40 % of the observations. To further improve the quality and to exclude minor errors in the data, percentiles below 1 and above 99 are sampled out from each of the bank level and macroeconomic variables to ensure robustness of the estimations. With these actions it could be ensured that errors stemming for example from reporting errors are ruled out from the dataset.

Table 1 summarizes the final dataset, which includes 567 banks in 35 countries within the European region. Out of total number of banks 386 are commercial banks, which are noted as shareholder banks in this study. Stakeholder banks include 112 cooperative banks and 69 savings banks.

Table 1: List of countries within the dataset

	Banks	Observations	Frequency	Cum.	EURO area
Austria (AT)	22	220	3,88	3,88	Yes
Belarus (BY)	6	60	1,06	4,94	No
Belgium (BE)	12	120	2,12	7,05	Yes
Bulgaria (BG)	10	100	1,76	8,82	No
Croatia (HR)	7	70	1,23	10,05	No
Cyprus (CY)	6	60	1,06	11,11	Yes
Czechia (CZ)	9	90	1,59	12,70	No
Denmark (DK)	19	190	3,35	16,05	No
Estonia (EE)	6	60	1,06	17,11	Yes
Finland (FI)	9	90	1,59	18,69	Yes
France (FR)	96	960	16,93	35,63	Yes
Germany (DE)	17	170	3,00	38,62	Yes
Greece (GR)	4	40	0,71	39,33	Yes
Hungary (HU)	12	120	2,12	41,45	No
Iceland (IS)	3	30	0,53	41,98	No
Ireland (IE)	5	50	0,88	42,86	Yes
Italy (IT)	37	370	6,53	49,38	Yes
Latvia (LV)	10	100	1,76	51,15	Yes
Lithuania (LT)	5	50	0,88	52,03	Yes
Luxembourg (LU)	8	80	1,41	53,44	Yes
Malta (MT)	4	40	0,71	54,14	Yes
Netherlands (NL)	17	170	3,00	57,14	Yes
Norway (NO)	35	350	6,17	63,32	No
Poland (PL)	16	160	2,82	66,14	No
Portugal (PT)	9	90	1,59	67,72	Yes
Romania (RO)	6	60	1,06	68,78	No
Russian Federation (RU)	61	610	10,76	79,54	No
Serbia (RS)	3	30	0,53	80,07	No
Slovakia (SK)	6	60	1,06	81,13	Yes
Slovenia (SI)	6	60	1,06	82,19	Yes
Spain (ES)	31	310	5,47	87,65	Yes
Sweden (SE)	7	70	1,23	88,89	No
Switzerland (CH)	13	130	2,29	91,18	No
Turkey (TR)	21	210	3,70	94,89	No
United Kingdom (GB)	29	290	5,11	100,00	No
Total	567	5670	100,00		54,7 % Yes 45,3 % No

This thesis performs four sets of regressions, each with dependent variable being first ROAA, then RoRWA and finally NIM, specified as follows:

1. Stakeholder owned banks in Euro region
2. Shareholder owned banks in Euro region
3. Stakeholder owned banks in rest of the Europe (excl. Euro region)
4. Shareholder owned banks in rest of the Europe (excl. Euro region).

This classification allows for the comparison of the results in terms of the variation stemming from the Euro as compared to the other currencies in Europe and considers the effects of different ownership structures.

In addition to analysis based on the ownership structure of the banks, the analysis is also made for different size classes based on the log of assets. First the full sample is divided into two groups based on natural logarithm of assets being below-median and above-median describing small and large banks respectively. After that the analysis is made with even smaller groups using quartiles of the log of assets, which creates four size classes.

Next, the explanatory variables are presented and discussed. Variables were chosen based on previous research, especially by Detragiache et al. (2018), Chaudron et al. (2022) and Junttila and Nguyen (2022). All the variables are summarized in Appendix 1, which presents definitions, labels and citations used in process of choosing the variables.

Explanatory variables - bank level variables

The vector of bank level variables includes the following. The first one is the bank size, which is measured by the log of total assets, and it is used to divide banks into groups of large and small banks. Typically, large banks differ from the smaller ones with more advanced risk management systems and the ability to utilize wholesale funding to a larger extent than smaller banks. Also, as Chaudron et al. (2022) points out, the size of the banks also accounts for scale economies, which could be either positive or negative. Total assets are also incorporated in previous growth rate of the bank, as this variable is computed from the change in log of assets compared to the previous period.

As Junttila and Nguyen (2022) suggest in their recent study, changes in bank profitability should be investigated through the shifts that have happened in wholesale-based funding and loan loss provisions. To point out to what extent the bank is using wholesale funding and whether the share of it changes over the data period, the data includes the share of wholesale funding in total funding excluding derivatives. As discussed in previous literature, this kind of variable describing the bank's funding model has previously been used by Detragiache et al. (2018). Usage of wholesale funding potentially has given banks the ability to boost up their NIM as during the negative interest rates the wholesale funding has been more inexpensive form of financing the lending activities. Through a positive effect on NIM during the negative interest rate era, share of wholesale funding could also have a positive effect on overall profitability measures.

For highlighting the quality of the banks' assets, the data includes the share of non-performing loans in gross loans, which has been previously used by Detragiache et al. (2018). This variable tells the true quality of the banks' lending portfolio and reveals if there is a connection between smaller banks boosting their lending with riskier loans and what is the effect of it on the profitability. Intentionally, it was decided to choose a variable that describes the amount of loans of which the risk has already realized to some extent. Non-performing loans are defined as such in which the borrowers haven't made any scheduled payments on principal or interest in past 90 days. This measure accounts for the realized risks, but also allows the loan to recover if the borrower is able to return to the original schedule of payments.

To account for whether a bank has increased the anticipation for loan losses in case the quality of assets has declined, the variable selection includes loan loss provisions, which is included as Junttila and Nguyen (2022) suggested. Loan loss provisions are expected to influence negatively on banks' earnings and capital and eventually through these factors the effect on profitability would also be negative. This measure of loan quality has been previously used by Mergaerts and Vander Vennet (2016) as they also studied the effects of bank business models on performance through risks. In the data the loan loss provisions are reported as a balance sheet item, but for the estimations the variable is measured relative to the total assets as the amount of loan loss provisions is divided by the total assets and multiplied by 100.

As non-performing loans and loan loss provisions are both a measure for the quality of the loan portfolio but with different perspectives, the empirical analysis focuses here separately for both of these to find out which one of these variables better describes the effect of the loan quality on the performance of the bank.

An important factor for this specific time of low and negative interest rates in terms of bank performance is the amount of which they have been able to patch up the assumed lost profits in net interest income by other income items. López-Penabad et al. (2022) utilize the share of non-interest income in their study to illustrate the diversity of the banks income. In this study, the corresponding variable is the share of net interest income in operating revenues.

Initial bank leverage is measured in this study by the ratio of tangible equity over total assets as again Detragiache et al. (2018) also did in their study. They also pointed out the importance of this ratio, as the banks with stronger and better-quality capital buffers potentially were not forced to make expensive deleveraging decisions during the Great Financial Crisis. Considering this study, stronger capital position also potentially leaves the bank with more room to make decisions and negotiate on funding.

As the purpose is also to see if there are differences between the larger and smaller banks it is also important to look at the efficiency of the bank. This is because it would be too unjustified to define the future of the bank to be limited only due to the size if the bank itself is efficient in what it does. The variable of efficiency is defined as the cost to income ratio, which is reported as total

operating expenses as a percent of operating revenues. This same variable has been previously used by Junttila and Nguyen (2022).

Finally, the set of explanatory variables describing the bank initial characteristics includes one period lagged value of the dependent variable, i.e., the profitability measure.

In addition to variables on bank initial characteristics, the data includes one additional instrumental variable, that describes those initial characteristics. The variable is the share of wholesale funding in total funding multiplied by the dummy variable on macroeconomic variable of interest rate level, with positive values being noted as zero and negative values noted as one. This variable allows to recognize the changes that possibly have occurred in usage of wholesale funding due to entering the negative era of interest rates.

Explanatory variables - macroeconomic variables

To describe macroeconomic conditions, this study includes five macroeconomic variables: interest rate level, inflation, growth of the GDP, growth of the central bank balance sheet and Herfindahl-Hirschman index (HHI). Out of these macroeconomic variables, the inflation, growth of the GDP, and HHI have been previously used in research by Chaudron et al. (2022) as they studied the effects on the net interest margin.

For country specific interest rates, this study uses the short-term interest to characterize the interest rate environment as it was suggested in recent study by López-Penabad et al. (2022). As in many cases the short-term interest rates are used as a reference rate for lending, those rates are in strong connection with the interest income that the bank can generate. These interest rates are retrieved from the OECD database (2022c) and are defined as “rates at which short-term borrowings are effected between financial institutions or the rate at which short-term government paper is issued or traded in the market”. The short-term interest rate data provides compiling area total rate for Euro area (including 19 countries in the Euro area) and country specific rate for each country outside the Euro area.

The second macroeconomic variable is the country-level inflation rate, measured as year-on-year annual change in consumer price index (CPI). Although at least in the Euro area the inflation has been remarkably low and stable during the research period, it is an important indicator to illustrate the differences between the Euro area and non-Euro area. This variable is also retrieved from the OECD database (2022b).

As the increased demand for loans can be associated with stronger economic growth, the growth of the GDP is included in the macroeconomic variables to control for the shifts in the demand for loans. The OECD database (2022a) notes indicator to be based on nominal GDP values.

One distinctive feature for this era of negative interest rates has also been the remarkable expansion of central bank balance sheets, which is the fourth macroeconomic variable. The increase in central bank balance sheets has been previously used by Gambacorta et al. (2014), as they find the increase to lead to a

short-term rise in economic activity and consumer prices. For countries in the Euro area, the growth of the central bank balance sheet is measured from the European Central Bank (ECB) balance sheet and for non-euro-countries the variable is measured from the country's national central banks' balance sheet. The data for this variable is retrieved from the website or annual reporting of each of the central banks

The last macroeconomic variable is the Herfindahl-Hirschman index (HHI), which describes the competitive environment of the banking sector in the country in question. HHI is calculated as a sum of squared annual market shares, which means that first banks total assets are divided by the sum of total assets of every bank within the country and the result is then squared and summed for each country-year pair. The index varies between zero and one, with values closer to zero meaning that the market is highly competitive and values exactly one describing the market to have no competition, so only one bank covers the whole market.

Descriptive statistics of the final full dataset are presented below in Table 2. During the sample period, the overall average of bank profitability has been 0,57 % based on ROAA and 1,41 % based on RoRWA. The sample seems to include a high variety of banks in terms of their share of wholesale funding in total funding as the values range from 0,08 % to 100 % with average of 32,64 %. None of the values in descriptive statistics alert that the sample would include significant outliers, which could influence the results. This also confirms that the decision of sampling out the percentiles below one and above 99 has improved the quality of the data.

Table 3 presents the pairwise correlation matrix. As expected, all the profitability measures are in statistically significant positive correlation with each other. Between ROAA and RoRWA the correlation is remarkably higher than it is between those and NIM, which is expected as NIM does not involve items beside interest income point of view. In terms of correlation, the share of wholesale funding in total funding is noted to have statistically significant negative relation to all three profitability measures. Considering the overall profitability measured with ROAA and RoRWA, the correlation between those and share of non-performing loans is quite obviously negative, but with NIM the correlation is positive and statistically significant and the same applies also with the share of loan loss provisions to assets but with even higher values. Somewhat surprisingly the efficiency variable has relatively strong and statistically significant negative relation to all the profitability measures.

Variables from 11 to 15 listed in table 3 are the macroeconomic variables. The interest rate level seems to have a highly statistically significant correlation with every other variable besides the RoRWA whereas inflation and growth of the GDP are also statistically significantly correlated to some variables but with milder correlation value. Not surprisingly, the growth of central bank balance sheet has mild positive correlation with log of assets and share of whole sale funding in total funding but also positive correlation with interest rate level and negative correlation with inflation, for which the statistical significance is also

higher. However, the variable measuring the growth of central bank balance sheets does not seem to have highly statistically significant correlation to any other variable than to the interest rate level and inflation.

Table 2: Descriptive statistics - full sample

	N	Mean	SD	Min	p25	Median	p75	Max
roaa	4888	.569	1.138	-7.159	.241	.56	1.028	4.697
rorwa	3638	1.412	2.070	-11.209	.627	1.536	2.335	8.791
nim	4898	2.646	1.894	-.01	1.44	1.99	3.28	12.97
lassets	5123	16.047	1.868	11.051	14.776	16.028	17.144	20.89
wstf	5134	32.643	23.486	.079	14.014	28.489	46.457	100
npl	4766	8.141	9.720	.079	2.221	4.459	10.212	67.352
llptoassets	4909	.586	0.998	-.846	.06	.223	.708	7.723
intincoprev	5111	58.725	19.194	-1.502	49.261	59.726	71.258	110.054
leverage	5124	9.749	4.896	1.132	6.372	9.011	12.325	58.292
efficiency	5112	64.922	19.600	22.862	52.76	62.666	73.229	206.772
interestraterlevel	5555	1.841	3.399	-.731	-.019	.573	1.491	19.34
inflation	5589	1.985	2.296	-1.125	.629	1.528	2.446	15.534
cbassetsgrowth	4702	14.042	14.625	-17.69	1.139	10.329	28.721	45.807
gdpgrowth	5548	1.749	1.700	-2.981	.926	1.822	2.535	8.427
hhindex	5515	.21	0.111	.089	.138	.18	.252	.714

Notes: ROAA - return on average assets; RORWA - return on risk weighted assets; NIM - net interest margin (on average interest earning assets); LASSETS - log of total assets; WSTF - wholesale funding in total funding; NPL - nonperforming loans in gross loans; LLPTOASSETS - loan loss provisions to total assets; INTINCOPREV - interest income to operating revenues; LEVERAGE - bank leverage by tangible equity to total assets; EFFICIENCY - cost to income ratio; INTERESTRATELEVEL - the level of short term interest rate; INFLATION - inflation; CBASSETSGROW - growth of the central bank assets; GDPGROWTH - growth of the GDP; HHINDEX - Herfindahl-Hirschman index.

Table 3: Pairwise correlation matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(1) roaa	1.000														
(2) rorwa	0.821***	1.000													
(3) nim	0.279***	0.140***	1.000												
(4) lassets	-0.057***	-0.003	-0.330***	1.000											
(5) wstf	-0.079***	-0.100***	-0.250***	0.260***	1.000										
(6) npl	-0.274***	-0.383***	0.242***	-0.199***	-0.164***	1.000									
(7) llptoassets	-0.379***	-0.464***	0.411***	-0.139***	-0.088***	0.535***	1.000								
(8) intincoprev	0.028*	-0.013	0.349***	-0.004	-0.109***	-0.029**	0.125***	1.000							
(9) leverage	0.262***	0.145***	0.344***	-0.417***	-0.027*	0.185***	0.089***	-0.003	1.000						
(10) efficiency	-0.485***	-0.535***	-0.184***	-0.107***	-0.076***	0.157***	-0.075***	-0.255***	-0.109***	1.000					
(11) interstratelevel	0.083***	-0.026	0.577***	-0.180***	-0.076***	0.113***	0.369***	0.222***	0.202***	-0.132***	1.000				
(12) inflation	-0.051***	0.012	0.012	-0.092***	0.053***	0.016	0.030**	-0.002	0.008	0.042***	0.051***	1.000			
(13) cbassets	-0.019	-0.011	-0.011	0.026*	0.026*	0.003	0.015	0.006	-0.017	-0.023	0.032***	-0.036**	1.000		
(14) gdpgrowth	0.053***	0.059***	0.010	-0.002	-0.014	-0.014	-0.043***	-0.028**	0.027*	0.025*	-0.013	-0.033**	0.098***	1.000	
(15) hhindex	0.030***	0.034**	0.072***	-0.164***	-0.172***	0.089***	0.031**	0.049***	-0.004	-0.002	-0.109***	0.027**	0.032**	0.047***	1.000

Notes: Variable notations presented with table 2.

Standard errors in parentheses

* p<0.10, ** p<0.05, *** p<0.010

4.2 Methodology

To determine suitable methods for standard panel regression analysis, a few pretests were performed. First, with Breusch and Pagan (1980) Lagrange multiplier test for random effects it was determined that pooled ordinary least squares (OLS) regression is the correct method for estimations for ROAA, as the null hypothesis for the validity of the pooled OLS approach couldn't be rejected. For RoRWA and NIM as the null hypothesis was rejected, the generalized least squares is the most appropriate method. Furthermore, the Hausman (1978) test was performed for RoRWA and NIM regressions, and as the statistics proved to be significant, they guided to use the fixed effects estimator for the RoRWA and NIM models. Test statistics of these tests are presented in Appendix 2.

To gain more understanding, the generalized method of moments (GMM) estimators was applied after the standard panel regression analysis. The usage of GMM allows to control over the endogeneity of the lagged dependent variable in a dynamic panel model. To determine whether to use difference or system GMM, the estimate of lagged dependent variable from difference GMM (DGMM) was compared to the estimates from pooled OLS and fixed effects approach, as it is suggested by Bond (2002). The estimates from pooled OLS and fixed effects approach should be used as upper-bound and lower-bound estimates, respectively, which means that if the estimate from DGMM falls below or is close to the one from fixed effects approach, system GMM should be used over DGMM.

This pretesting was done for six different regressions: two for each of the different dependent variables, ROAA, RoRWA and NIM, including first the non-performing loans and then the loan loss provisions as the key independent variable describing the quality of the banks' loan portfolio. Based on the pretests for ROAA and RoRWA, with non-performing loans as a variable describing the quality of banks' loan portfolio, difference GMM is used as an estimator and as for loan loss provisions the two-step DGMM estimates fell below the lower-bound fixed effects estimates, system GMM was exercised. For the NIM regressions with both loan portfolio quality measures, system GMM was proved to be the correct method. Detailed estimates are presented in Appendix 2.

To explain the method more in detail it is first assumed that the (linear) regression model including endogenous independent variable is

$$y = X'\beta + u, \tag{1}$$

where y describing the variables and u as an error term are $N \times 1$ vectors; β is a $K \times 1$ vector of unknown parameters; X is a $N \times K$ matrix of explanatory variables.

Difference GMM

The estimation approach of difference GMM estimator was first proposed by Arellano and Bond (1991) as they used the estimation technique to estimate within effects in their model. The original model can be specified as

$$y_{it} = \beta_0 + \beta_1 x_{it-1} + \beta_2 y_{it-1} + a_i + u_{it}, \quad (2)$$

where the a_i is the unobserved fixed effect. By applying the first differencing, and subtracting the lagged values of y and x , the unobserved effects are eliminated:

$$y_{it} - y_{it-1} = \beta_0 + \beta_1(x_{it-1} - x_{it-2}) + \beta_2(y_{it-1} - y_{it-2}) + (u_{it} - u_{it-1}). \quad (3)$$

However, this brings out the endogeneity problem, as u_{it-1} is a part of y_{it-1} . To control for this endogeneity, instrumental variables, as the lagged values of y , are needed as it is assumed, that past values of the dependent variable are not correlated with the future error terms (sequential exogeneity). Values of y_{it-2} and earlier lags are also relevant because of the autoregressive path to later lags and as they are part of the first difference by the definition presented in equation (3).

System GMM

The estimation approach of system GMM estimator was introduced by Arellano and Bover (1995) and Blundell and Bond (1998). System GMM gets its idea from using additional assumptions and by those also additional equations, which results in estimating system of equations. The system consists of two equations, which are the same as presented earlier: first-level difference equation (3) and level equation (2). Because the former of those again faces the issue of endogeneity between y_{it-1} and a_i , instrumental variables in the form of difference $y_{it-1} - y_{it-2}$ or earlier, are applied.

The relevance of dealing the endogeneity issue with difference $y_{it-1} - y_{it-2}$ or earlier is because they are correlated by their definition but also because of autoregression. The assumption of sequential exogeneity applies also now, as the differencing removes the unobserved effects in a_i .

The assumptions of difference and system GMM are the sequential exogeneity and that there is no autocorrelated error, as in the y terms are not autocorrelated. To test for these assumptions, Hansen-Sargan test for exclusion is used for testing the sequential exogeneity and if the exclusion is not satisfied, the estimation can be done with more distant lag to find more satisfying result in terms of exclusion. To test for autocorrelation, Arellano-Bond test is applied.

After finding the statistically significant parameter estimates from the GMM results the next step was to analyze if those results were also significant in the long-run and if the impact was different to the impact observed from the short-run. The long-run coefficient for the k^{th} parameter estimate is computed as

$$\beta_k \div [1 - \phi], \quad (4)$$

where ϕ is the parameter estimate on the lagged dependent variable.

5 RESULTS AND ANALYSIS

This section will present the main results with analysis on various perspectives. Note, that only the most relevant findings are presented and discussed here in this part of the thesis and the full results are presented in Appendix 3. All in all, it seems that the usage of loan loss provisions better captures the effect of loan portfolios quality to the profitability at least in full sample GMM estimations. With ownership- and region-based subsample comparison both the non-performing loans and loan loss provisions return significant coefficients affecting the profitability measures ROAA and RoRWA.

Preliminary analysis started with figures describing the development of key variables in the four main subgroups divided by the ownership structure and use of Euro as a currency. When comparing Figures 1-4, it seems that there haven't been any remarkable differences between the profitability measures in different subgroups. Rather it seems that both subgroups, stakeholder and shareholder owned banks, especially the banks in the Euro-area did suffer from lower profitability during 2011-2012, which roughly sits in time of Eurozone debt crisis. Somewhat same kind of movement can be seen with shareholder owned banks in non-Euro-area, but not so much with stakeholder owned banks in non-Euro-area.

The observation on the changes in profitability, which was made for shareholder owned banks outside the Euro-area could be because those banks are typically larger ones with more remarkable international ties and access to the capital markets in Euro-area. This way those banks may be more vulnerable to the changes affecting the banks in Euro-area and the entire Europe as a whole.

Through all the subgroups it seems that ROAA has experienced quite mild improvements over the years if any. However, especially in Euro-area it seems that after the years of 2011-2012 with lower profitability, the risk adjusted measure of profitability, RoRWA, has improved remarkably and stabilized its values close to 1,5 % since 2015. This could be because of two reasons, first of which being that the risk weight in assets has lowered or that there has been changes in the reporting of risk weights.

Again, it seems that in all subgroups loan loss provisions to assets and share of interest income in operating revenue have remained somewhat stable or have been only slightly downward sloping, during the research period. On the contrary to prior expectations, it seems that in all subgroup's banks have not increased their share of loan loss provisions in total assets. The same declining trend for loan loss provisions can also be observed even though the banks are divided into size quartiles based on the log of assets (Figure 7).

Also, the share of interest income in operating revenue has not been decreasing remarkably at least for shareholder owned banks, but rather it seems that stakeholder owned banks had been experiencing these reductions. The reduction in the share of interest income is incorporated with decreasing short-term interest rate levels, but it could be also suggested that the reduction occurs because banks have been able to exploit other income items when at the same

time the amount of interest income has remained stable. The latter explanation is also supported as it was noticed earlier that the profitability measures have not suffered during the research period.

Figure 1: Average LLP relative to total assets, ROAA and interest rate level on left scale and interest income in relation to operating income and share of wholesale funding in total funding on right scale. Data for the stakeholder banks in euro area.

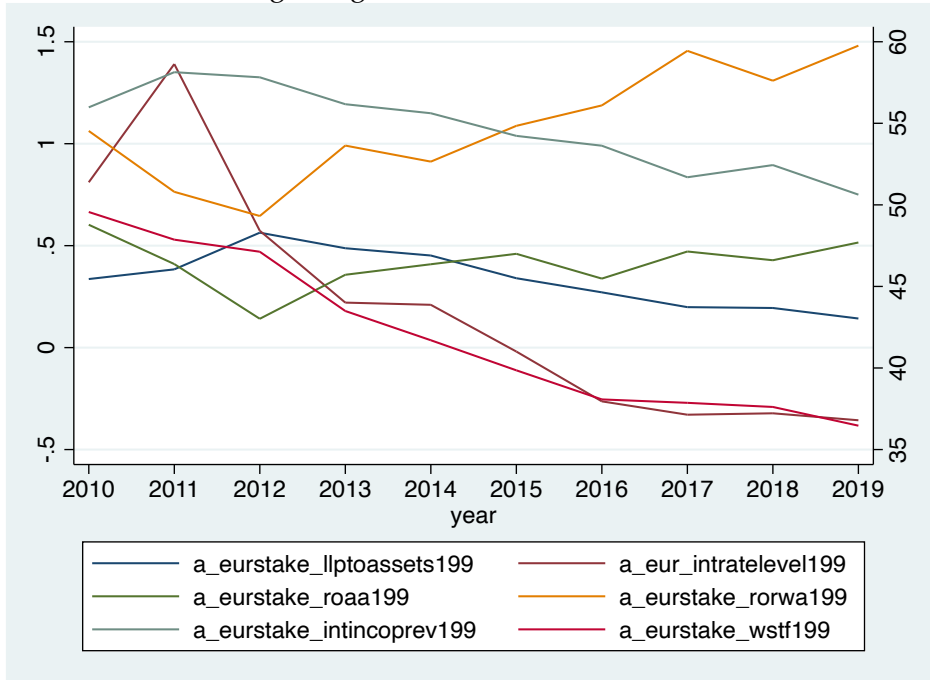


Figure 2: Average LLP relative to total assets, ROAA and interest rate level on left scale and interest income in relation to operating income and share of wholesale funding in total funding on right scale. Data for the shareholder banks in euro area.

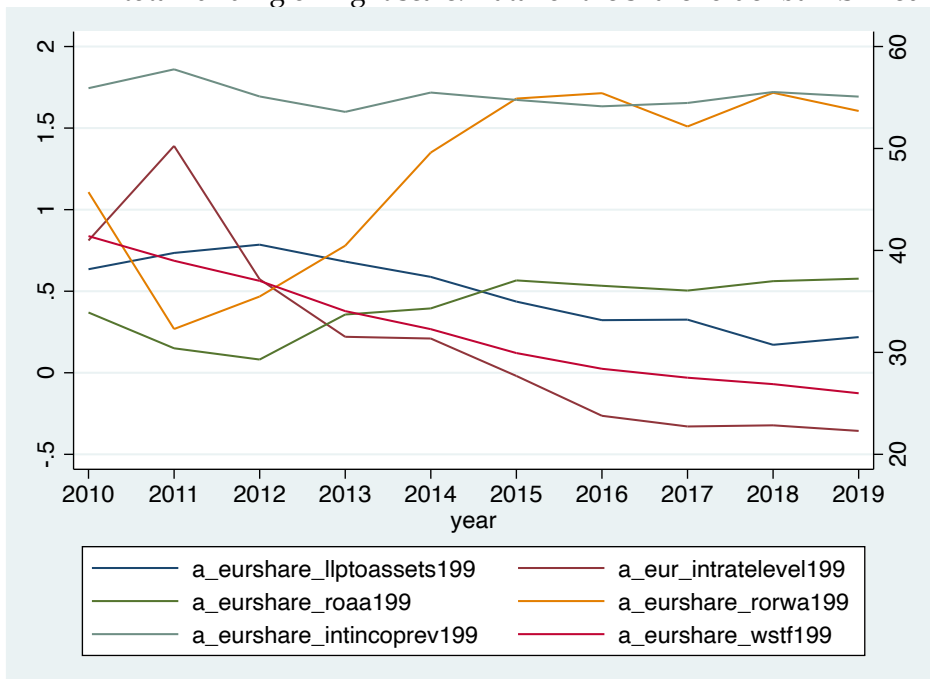


Figure 3: Average LLP relative to total assets, ROAA and interest rate level on left scale and interest income in relation to operating income and share of wholesale funding in total funding on right scale. Data for the stakeholder banks in non-euro-area.

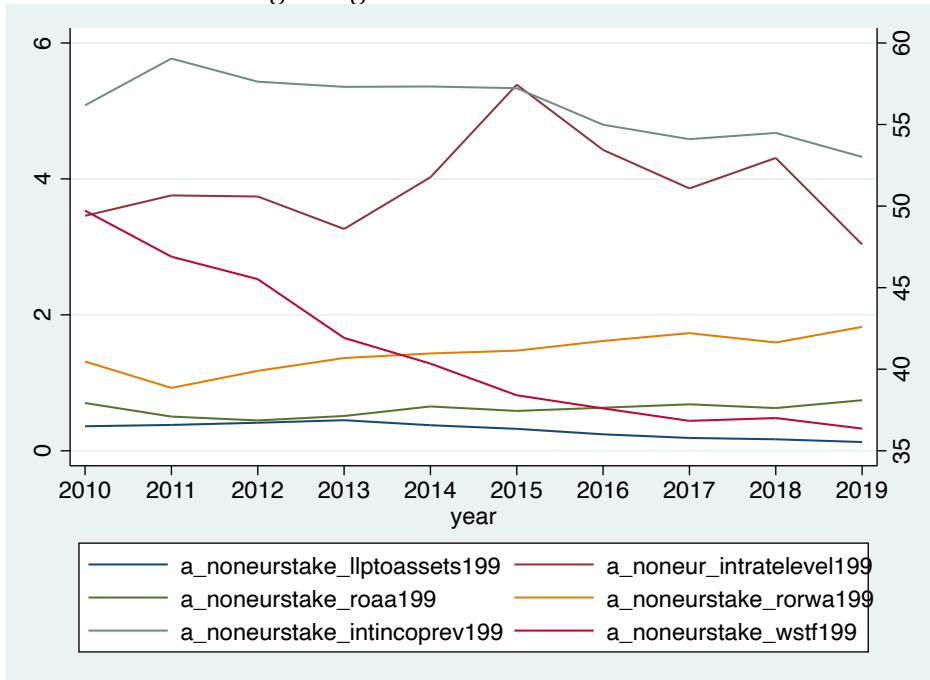
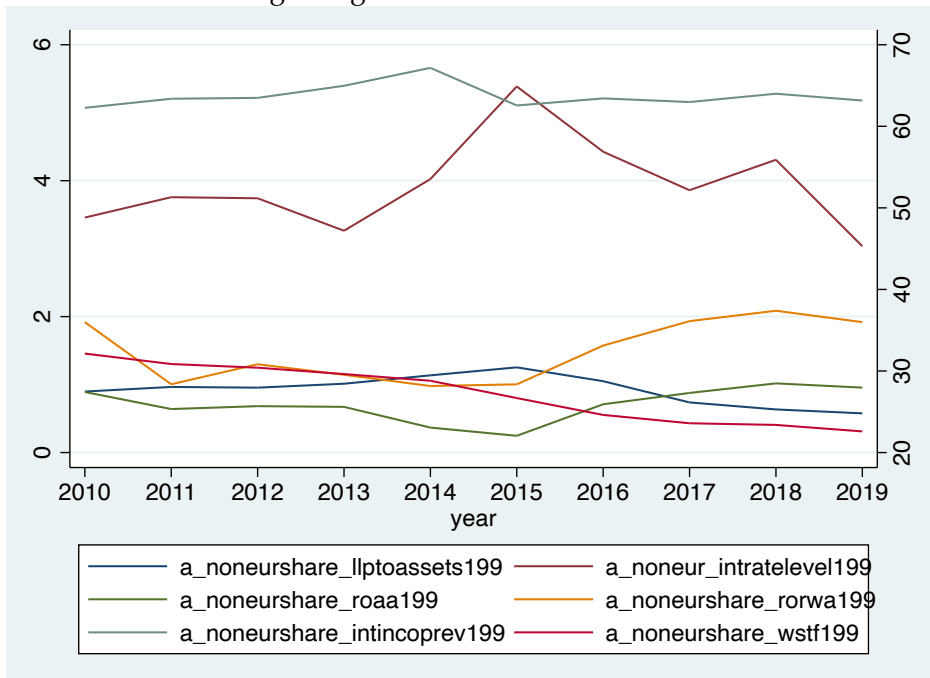


Figure 4: Average LLP relative to total assets, ROAA and interest rate level on left scale and interest income in relation to operating income and share of wholesale funding in total funding on right scale. Data for the shareholder banks in non-euro-area.



Nevertheless, the interest rate level in Euro-area has been lowering ever since the peak year of 2011, with the most recent values being quite deep on the

negative side. At the same time this trend is not seen for non-Euro-area as there the short-term interest rates have varied, but without any continuous trend.

Finally, and again against the preliminary expectations it seems that the trend for the share of wholesale-based funding as a part of total funding has been downward sloping in each subgroup. The same trend seems to apply also for each subgroup sorted by the size of the bank by quartiles in terms of log of assets meaning that banks have used less wholesale-based funding. Notable is that when observing Figures 1-4, it seems that stakeholder owned banks have higher share of wholesale funding than shareholder owned banks.

Figure 5 shows the differences between the size quartiles based on the average share of wholesale-based funding in total funding in each quartile. It seems that the first two quartiles of smaller banks have not utilized wholesale-based funding to the same extent that the bigger banks in the third and fourth quartiles, for which the share of wholesale funding seems to be about 10-15 percentage points higher. This confirms the prior expectations that bigger banks are more able to exploit wholesale-based funding leaving the smaller banks to be more dependent on deposit-based funding, but also raises a question on why banks have decreased the share of wholesale funding over the research period.

The reasoning for this might be rooted to the asset purchase programs ran by the central banks. These programs are a part of the non-standard monetary policy measures that central banks have been using since mid-2014 to support the monetary policy transmission mechanism. Through these programs central banks have been providing liquidity at least to the larger banks, which might have caused less demand for interbank finding causing the share of wholesale funding in total funding to decrease. If this is the case, the asset purchase programs could be the reason for the decreased share of wholesale funding that can be observed throughout each of the bank size quartiles and over the research period.

To describe the development of the other measure for the quality of banks' loan portfolio besides the loan loss provisions, Figure 6 shows the changes in non-performing loans. For each subgroup, the share of non-performing loans has declined from the peak years, which were between the start of the financial crisis and 2015, which was about when the interest rates fell below zero. For both loan portfolio quality measures, it can be noted that smaller banks in the 1st and 2nd quartiles seem to suffer from lower quality, which causes them to put aside more loan loss provisions. Further analysis will reveal if this has an effect on the profitability of the smaller banks in comparison to the bigger ones in quartiles 3 and 4.

As already these figures show, it does not seem to be the case that the banks have taken on more risk during the negative interest rate era or at least those risks have not yet realized. Even though the current standard for putting aside loan loss provisions is more forward looking than the previous one, as briefly explained in the end of Chapter 3, majority of the observations presented here have been collected from the time before the current standard, i.e., before 2018.

If the banks have taken on more risk during the negative interest rate era, the effect in the measures considered here could be observed only later with this

more forward looking standard for loan loss provisions. In this case there might have increased risk taking during the negative interest rate era, but as those risks have not yet realized and/or cannot be predicted, it would mean that there are no demands on recording for loan loss provisions or noting the loan as NPL at this stage. Later if the economy faces another shock or the interest rates turn back on the positive side, the event can cause distress on the debtors' ability to make payments, which would cause the realization of the risks taken during the negative interest rate era. However, at this stage it is not possible to predict this kind of future events with the data used in this study.

Summing up the results for the first research question it first of all seems that in addition to the banks in the first two quartiles, also shareholder banks have had lower share of wholesale funding than other banks. It also seems, that banks in any of the categories have not increased their share of loan loss provisions in total assets, which means that if there has been an increase in portfolio riskiness, it has not yet realized. However, it can be noted that the banks that have used less wholesale funding tend to make more loan loss provisions, but it cannot be stated yet that these two things would be in relation to one another.

Figure 5: Share of wholesale funding over total funding for each size quartile based on log of assets.

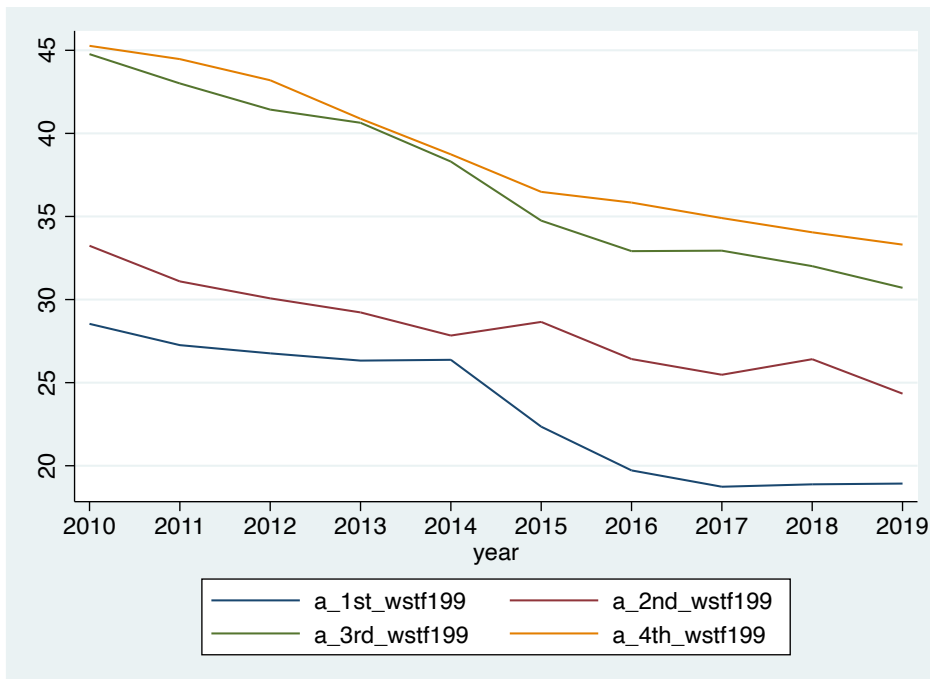


Figure 6: Share of non-performing loans over gross loans for each size quartile based on log of assets.

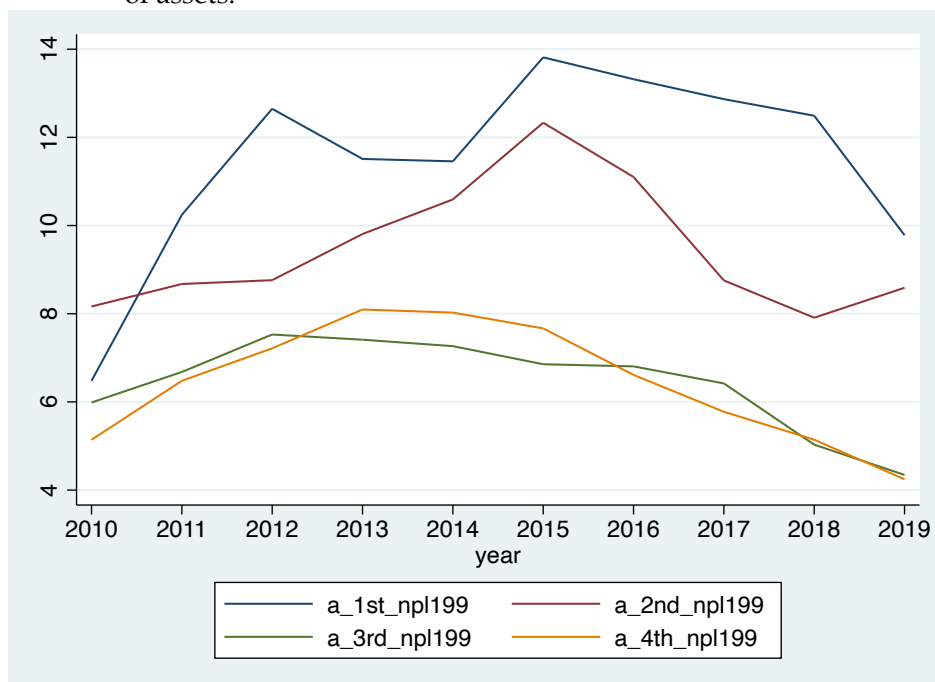
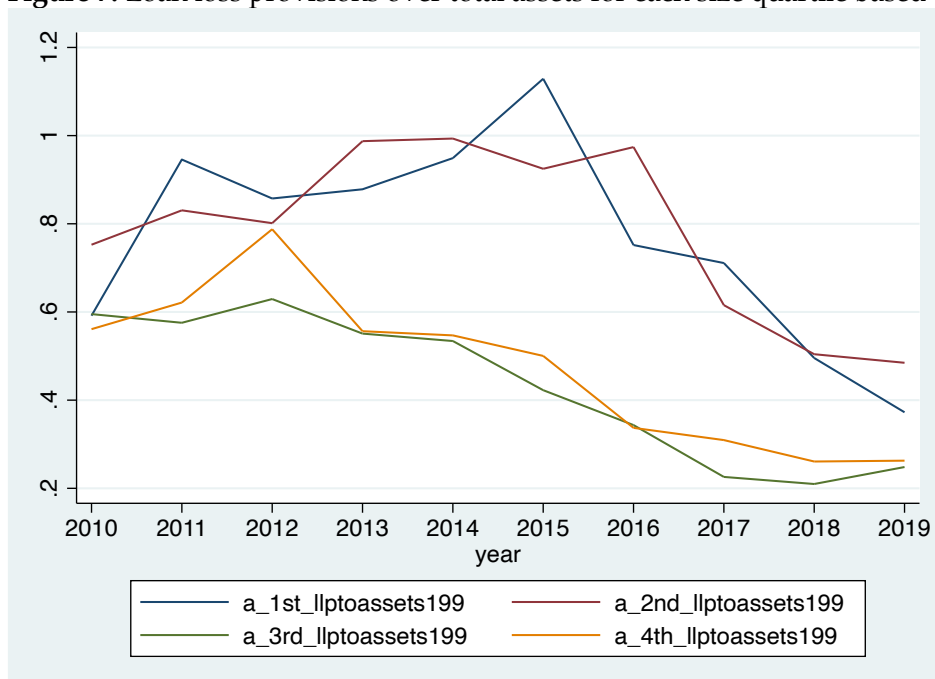


Figure 7: Loan loss provisions over total assets for each size quartile based on log of assets.



5.1 Full sample results for ROAA and RoRWA

Full sample results are presented in Table 4, which is divided into four sections reporting the results for four different sets of regressions:

1. Model with ROAA and non-performing loans
2. Model with RoRWA and non-performing loans
3. Model with ROAA and loan loss provisions to assets
4. Model with RoRWA and loan loss provisions to assets

Each section includes three columns: the first column presents the results from pooled ordinary least squares or fixed effects estimations, the second from difference or system GMM estimations and the third column reports the long-run coefficients estimated for the statistically significant parameter estimates.

Models 1 and 2, which include the non-performing loans as a variable describing the quality of the loan portfolio, do not provide statistically significant results that would be relevant in perspective of the research questions of this thesis. Model 2 shows, that in full sample as the one period lagged value of risk weighted profitability measure RoRWA increases by 1 % it boosts up the current value by 0.333 % and even by 0.498 % in long-run with these findings being highly statistically significant at 1 %. This means that the past good performance on risk weighted profitability tends to have positive effect on future profitability. Model 2 also reveals that the impact of 1 % higher share of interest income in operating revenue only leads to mild improvements in RoRWA.

Main findings in full sample results are with model 3 and 4, which first of all reveal why banks have started to use less and less wholesale funding, even though theory suggests that using more wholesale funding could be altogether beneficial during negative interest rate era. Regardless of the profitability measure, increasing the share of wholesale funding in total funding has led to decreasing values of ROAA and RoRWA. Even though the effect is only minor, as 1 % increase in share of wholesale funding leads to 0.006 or 0.02 % decrease in ROAA and RoRWA, respectively, it should be enough of a reason to a bank to even decrease the share of wholesale funding to optimize the business model for the best possible outcome. More of a reason is given as those effects are greater and statistically significant in the long run.

These results are pointing to the same direction as Junttila et al. (2021) pointed when they analyzed Finnish Cooperative banks. They found out that those banks have not been able to improve their risk-adjusted profitability measure anymore since 2017 and this effect is now observed to be even greater in negative sense. However, notable reductions in the amount of wholesale funding would end up causing melting down of the banks' balance sheet and therefore also cause decrease in profits and revenue. This leads the banks to use careful consideration when choosing their business model.

Full sample results also reveal the cruel consequences that taking on more risk causes on the profitability if the risks would come to realize to the point where bank would have to put aside loan loss provisions. If the amount of loan loss provisions in total assets increased by 1 % on the previous period, it would mean negative 0.209 % impact on ROAA by the next period. In the long run the effect is about twice as severe with negative impact of 0.413 % and even with higher statistical significance.

For risk-adjusted profitability measure RoRWA the impact of loan loss provisions is more severe than compared to ROAA, which is perceivable as

RoRWA accounts for the risks in assets. The results show that 1 % increase in the share of loan loss provisions results in almost three times larger negative impact on RoRWA (-0.610 %) than in ROAA (-0.209 %), but also that the impact is not more severe in the long run. This would suggest that unlike with ROAA, with RoRWA the banks are more able to limit the duration of the unwanted effects of portfolio risks.

Highly significant effects of macroeconomic variables are recorded with model 3, where interest rate level and HH-index both have positive effect on ROAA. Agreeing to the findings from López-Penabad et al. (2022), this study also indicates that lowering interest rate level has had negative effect on ROAA. However, model 1 suggests that lowering interest rates could have had positive impact on ROAA, but the result is statistically significant only at 10 %. Notable is, that as the data used in this study included commercial banks, savings banks and cooperative banks, the data used in the study by López-Penabad et al. (2022) also included real estate and mortgage banks, bank holdings and holding companies, which may have an effect on the results especially when comparing the results from model 1.

The HH-index is observed to have positive effect on ROAA, which indicates that if the competitive environment measured by HH-index becomes more concentrated, the effect on ROAA is positive (model 3). This means that the banks that operate on areas and economies where the banking sector is less concentrated, meaning that there is more competition, suffer reductions in their ROAA.

Last notable result from the full sample analysis is with the size of the bank, which is noted by the log of assets. Size of the bank does not seem to have impact in any other model besides the model 4, where the impact is significant at 5 % and also large when compared to other variables. It seems that in perspective of RoRWA it hasn't been beneficial for a bank to be large, as 1 % increase in log of assets would lead to 1.285 % decrease in RoRWA. Of course, these are only full sample results, and more detailed analysis will be given in the next two subchapters involving differences in size categories and in ownership and region based divisioning.

Concluding the result for the second research question, it seems that turning back to use more deposit based funding would have positive effect on profitability as the benefits from using wholesale based funding seems now to be turned against on the preliminary purpose of using them. Although the preliminary analysis showed that the quality of loan portfolio has not been suffering during the negative interest rate era, the results show that especially the risk-adjusted profitability is strongly dependent on decreasing quality of loan portfolio.

Table 4: Full sample results

	Model 1			Model 2			Model 3			Model 4		
	Pooled OLS: ROAA	Two-step DGMM: ROAA	Long-run coefficients : ROAA	Fixed effects: RoRWA	Two-step DGMM: RoRWA	Long-run coefficients : RoRWA	Pooled OLS: ROAA	Two-step SYS-GMM: ROAA	Long-run coefficients : ROAA	Fixed effects: RoRWA	Two-step DGMM: RoRWA	Long-run coefficients : RoRWA
L.roaa	0.505*** (0.0452)	0.225* (0.131)	0.290 (0.218)				0.575*** (0.0458)	0.493*** (0.0937)	0.972*** (0.364)			
L.rorwa				0.204*** (0.0659)	0.333*** (0.0746)	0.498*** (0.167)				0.170*** (0.0598)	0.0990 (0.120)	
L.lassets	-0.00975 (0.00885)	-0.0866 (0.413)		-0.846*** (0.236)	-1.015 (0.666)		-0.00273 (0.00819)	0.0270 (0.0307)		-0.761*** (0.253)	-1.285** (0.653)	-1.426** (0.715)
L.difflassets	0.153 (0.166)	0.0413 (0.478)		1.112*** (0.408)	0.705* (0.424)	1.0570 (0.663)	0.284* (0.160)	0.440 (0.347)		1.008*** (0.382)	0.795 (1.283)	
L.wstf	-0.00404*** (0.000933)	-0.0137 (0.0104)		-0.0295*** (0.00692)	-0.00924 (0.0132)		-0.00286*** (0.000825)	-0.00586*** (0.00215)	-0.0115*** (0.00388)	-0.0298*** (0.00718)	-0.0296* (0.0166)	-0.0328* (0.0190)
L.wstf x negativerate	0.00140* (0.000771)	-0.00704* (0.00396)		0.0126*** (0.00239)	0.00183 (0.00577)		0.000649 (0.000716)	-0.00128 (0.00108)		0.0122*** (0.00224)	0.00561 (0.00643)	
L.npl	-0.0079*** (0.00268)	-0.00179 (0.0143)		-0.0222* (0.0124)	-0.0171 (0.0165)							
L.llptoassets							0.0303 (0.0371)	-0.209** (0.0841)	-0.413*** (0.113)	-0.130 (0.135)	-0.610** (0.241)	-0.677*** (0.223)
L.intincoprev	0.000677 (0.00102)	-0.00968 (0.00699)		0.0151** (0.00723)	0.0308*** (0.00888)	0.0462*** (0.0149)	0.000556 (0.000938)	-0.00299 (0.00262)		0.0127 (0.00776)	0.0110 (0.0134)	
L.leverage	0.0185*** (0.00693)	-0.00240 (0.0361)		-0.0483 (0.0355)	-0.0397 (0.0481)		0.0147*** (0.00557)	0.0349*** (0.0132)	0.0689*** (0.0234)	-0.0731* (0.0415)	-0.141** (0.0647)	-0.157** (0.0748)
L. efficiency	-0.00470** (0.00192)	0.000476 (0.00794)		-0.000599 (0.00487)	0.00356 (0.00593)		-0.00341** (0.00156)	-0.00480 (0.00374)		-0.00167 (0.00475)	-0.00977 (0.0109)	
L.gdpgrowth	0.00468 (0.00739)	-0.0114 (0.0159)		-0.0223 (0.0279)	-0.0475 (0.0300)		0.00571 (0.00724)	0.000784 (0.00651)		-0.0190 (0.0274)	-0.0258 (0.0338)	
L.inflation	-0.00781 (0.00544)	-0.00778 (0.00970)		-0.00929 (0.0192)	0.00248 (0.0194)		-0.00857* (0.00496)	-0.00230 (0.00511)		-0.0133 (0.0200)	0.0122 (0.0245)	
L.interestrategylevel	0.0106* (0.00560)	-0.0406* (0.0223)	-0.0524* (0.0272)	-0.0564* (0.0316)	-0.0455 (0.0343)		0.00146 (0.00652)	0.0295*** (0.0107)	0.00122 (0.00217)	-0.0489 (0.0301)	-0.000238 (0.0359)	
L.cbassetsgrowth	0.00128 (0.00106)	-0.000274 (0.00126)		0.00123 (0.00200)	0.000804 (0.00196)		0.000860 (0.00102)	0.000617 (0.00108)		0.00122 (0.00203)	0.00167 (0.00216)	
L.hhindex	0.385*** (0.107)	-0.159 (0.518)		-1.376* (0.791)	-1.174 (0.978)		0.264** (0.109)	0.337*** (0.129)	0.00155 (0.0129)	-1.359* (0.785)	-1.137 (0.962)	
year 2012		-0.141 (0.185)			-0.521 (0.350)			-0.100 (0.0694)			-0.487 (0.340)	
year 2013		-0.153 (0.161)			-0.342 (0.292)			0.0126 (0.0533)			-0.225 (0.262)	
year 2014		-0.272			-0.703*			-0.0377			-0.365*	

		(0.166)		(0.426)		(0.0717)		(0.193)
year 2015		-0.00692		-0.239*		0.0540		-0.133
		(0.0967)		(0.144)		(0.0471)		(0.164)
year 2016		0.0358		-0.0840		0.0179		-0.0321
		(0.0682)		(0.120)		(0.0425)		(0.122)
year 2017		0.0446		0.0402		-0.0150		0.0805
		(0.0513)		(0.0871)		(0.0442)		(0.0905)
year 2018		0.0219		0.0644		-0.0152		0.0803
		(0.0373)		(0.0877)		(0.0365)		(0.0865)
Constant	0.628**		15.95***		0.365	0.226	14.93***	
	(0.289)		(4.071)		(0.238)	(0.688)	(4.581)	
Observations	2903	2365	2097	1629	2974	2974	2111	1642
R-squared	0.424		0.145		0.442		0.130	
No. of instruments		106		212		219		119
No. of groups		521		399		547		397
AR1 (p-value)		0.000159		0.000819		0.00000047		0.00172
AR2 (p-value)		0.855		0.849		0.129		0.506
Hansen-J (p-value)		0.145		0.109		0.110		0.195

Standard errors in parentheses

* p<0.10, ** p<0.05, *** p<0.010

Long-run coefficient for the kth parameter estimate is computed as $\beta_k \div [1 - \phi]$, where ϕ is the parameter estimate on the lagged dependent variable.

5.2 Results based on bank size

When the banks are divided into groups based on their size, in groups of smaller banks also the number of cooperative and savings banks tends to be overrepresented as generally these banks are smaller than shareholder owned commercial banks. Analysis on differences between different size groups is executed based on using dummy variables.

First, the dummy variables were used to divide the full sample to two size groups based on the whole-sample median value of log of assets. Results from this analysis are presented in appendix 3 in table 7. The only statistically significant result was with model 1 in pooled OLS regression. The result indicated that the below median banks would have 0.0569 % higher ROAA than the above median banks. However, it needs to be noted that the result is only significant at 10 % confidence level and that the result is not supported by any statistically significant result from GMM analysis.

The second set of dummy variables was used to control for the size quartiles based on the log of assets. The smallest banks were included in the first quartile and the biggest banks in the fourth quartile which was also set as a control group. The results are presented below in table 5. The value of R-squared reveals that the chosen independent variables better describe the changes in ROAA than in RoRWA, which was also the case with full sample results. However, due to the endogeneity issues the most robust results are with GMM analysis for which the test diagnostics from Hansen J -test and test for autocorrelation of error term seem to be well behaving.

Model 3 with ROAA as the dependent variable and the share of loan loss provisions in total assets describing the quality of the loan portfolio gives out statistically significant results with differences in profitability between the size groups. However, the result is somewhat inconsistent, as it suggests that banks in the first and third quartiles would be the ones that would suffer from 0.269 % and 0.200 %, respectively, lower ROAA given the chosen variables and the research period. It needs to be noted that the result for the banks in the third quartile is only significant at 10 % confidence level, which leaves room for guessing, as for the smallest banks the result is significant at 5 % and is therefore more reliable.

Table 5: Full sample with bank size divided into quartiles

	Model 1			Model 2			Model 3			Model 4		
	Pooled OLS: ROAA	Two-step DGMM: ROAA	Long-run coefficient s ROAA	Pooled OLS: RoRWA	Two-step DGMM: RoRWA	Long-run coefficient s RoRWA	Pooled OLS: ROAA	Two-step SYS-GMM: ROAA	Long-run coefficient s: ROAA	Fixed effects: RoRWA	Two-step DGMM: RoRWA	Long-run coefficient s RoRWA
L.roaa	0.504*** (0.0451)	0.347*** (0.0736)	0.530*** (0.172)				0.572*** (0.0462)	0.545*** (0.123)	1.200** (0.598)			
L.rorwa				0.208*** (0.0674)	0.361*** (0.125)	0.566* (0.305)				0.182*** (0.0617)	0.262*** (0.0710)	0.354*** (0.130)
L.diffassets	0.143 (0.165)	0.438 (0.429)		0.876** (0.402)	0.849 (0.770)		0.267* (0.158)	-0.0683 (0.421)		0.816** (0.385)	0.619 (0.471)	
L.wstf	-0.00423*** (0.000955)	-0.0249*** (0.00686)	-0.0380*** (0.0111)	-0.0332*** (0.00721)	-0.0345*** (0.0114)	-0.0540** (0.0210)	-0.00303*** (0.000831)	-0.00461 (0.00426)		-0.0325*** (0.00749)	-0.0330** (0.0130)	-0.0446** (0.0175)
L.wstf x negativerate	0.00156** (0.000763)	-0.00247 (0.00186)		0.0114*** (0.00236)	0.00409 (0.00669)		0.000763 (0.000709)	-0.00180 (0.00224)		0.0114*** (0.00219)	0.00718 (0.00528)	
L.npl	-0.00797*** (0.00268)	0.00278 (0.00752)		-0.0178 (0.0122)	0.0164 (0.0218)							
L.llptoassets							0.0277 (0.0376)	0.00645 (0.0883)		-0.0991 (0.134)	-0.176 (0.173)	
L.intincoprev	0.000703 (0.00101)	0.00126 (0.00536)		0.0152** (0.00724)	0.0185* (0.00966)	0.0290* (0.0166)	0.000552 (0.000929)	-0.00147 (0.00251)		0.0128* (0.00777)	0.0138 (0.0109)	
L.leverage	0.0195*** (0.00686)	0.0252 (0.0188)		-0.0305 (0.0332)	-0.0450 (0.0446)		0.0151*** (0.00552)	0.0324*** (0.0110)	0.0712** (0.0301)	-0.0533 (0.0382)	-0.0385 (0.0416)	
L. efficiency	-0.00451** (0.00188)	0.00198 (0.00487)		0.000466 (0.00493)	-0.00307 (0.00744)		-0.00331** (0.00156)	-0.00221 (0.00416)		-0.000228 (0.00480)	0.00214 (0.00640)	
L.gdpgrowth	0.00488 (0.00733)	-0.0206** (0.0102)	-0.0315* (0.0162)	-0.0417 (0.0272)	-0.0517 (0.0337)		0.00591 (0.00720)	-0.00169 (0.00766)		-0.0349 (0.0269)	-0.0593* (0.0323)	-0.0804* (0.0435)
L.inflation	-0.00647 (0.00538)	-0.00627 (0.00835)		-0.0125 (0.0192)	-0.00827 (0.0203)		-0.00712 (0.00493)	-0.00304 (0.00592)		-0.0158 (0.0200)	-0.0179 (0.0202)	
L.interestrateratelevel	0.0112** (0.00572)	-0.00822 (0.0161)		-0.0431 (0.0309)	-0.0367 (0.0322)		0.00267 (0.00656)	0.00345 (0.0141)		-0.0387 (0.0303)	-0.00691 (0.0345)	
L.cbassetsgrowth	0.00138 (0.00104)	0.00106 (0.00101)		0.00184 (0.00197)	0.00110 (0.00245)		0.000911 (0.00101)	0.00118 (0.00101)		0.00175 (0.00198)	-0.000186 (0.00234)	
L.hhindex	0.368*** (0.109)	-0.620 (0.391)		-1.068 (0.796)	-0.859 (0.849)		0.271** (0.111)	0.185 (0.153)		-1.168 (0.773)	-1.332 (0.883)	
1 st quartile	-0.00828 (0.0544)	0.0549 (0.467)		0.659 (0.572)	0.547 (1.067)		-0.0269 (0.0542)	-0.269** (0.129)		0.899* (0.509)	0.861 (0.968)	
2 nd quartile	0.113** (0.0442)	0.319 (0.387)		0.167 (0.486)	0.453 (0.950)		0.0717* (0.0420)	0.00976 (0.114)		0.443 (0.408)	0.755 (0.901)	
3 rd quartile	0.0348 (0.0361)	0.0171 (0.291)		0.368 (0.310)	0.924 (0.626)		0.0399 (0.0323)	-0.200* (0.115)		0.567** (0.281)	1.233* (0.636)	

year 2012		-0.0565 (0.0840)		0.0342 (0.259)		-0.111 (0.0926)		0.0188 (0.250)
year 2013		0.0142 (0.0730)		0.0565 (0.225)		0.00522 (0.0818)		0.0628 (0.223)
year 2014		-0.150 (0.0948)		-0.422 (0.335)		-0.0615 (0.0979)		-0.319 (0.332)
year 2016		0.0334 (0.0415)		0.0968 (0.114)		0.0556 (0.0465)		0.0828 (0.108)
year 2017		-0.00499 (0.0438)		0.128 (0.121)		0.0349 (0.0356)		0.135 (0.113)
year 2018		0.0260 (0.0521)		0.165 (0.128)		0.0193 (0.0421)		0.191* (0.113)
year 2019		-0.0197 (0.0482)		0.0857 (0.129)		-0.00597 (0.0342)		0.0496 (0.114)
Constant	0.412** (0.195)		1.649** (0.734)		0.285* (0.161)	0.451 (0.508)		1.819** (0.910)
Observations	2943	2401	2128	1655	3018	3018	2144	1669
R-squared	0.427		0.138		0.445		0.125	
No. of instruments		275		272		194		271
No. of groups		527		405		552		404
AR1 (p-value)		0.00000499		0.00152		0.00000219		0.00103
AR2 (p-value)		0.684		0.835		0.157		0.661
Hansen-J (p-value)		0.133		0.114		0.114		0.176

Standard errors in parentheses

* p<0.10, ** p<0.05, *** p<0.010

5.3 Results based on the ownership structure

This part reports the results based on the ownership structure and whether the bank is domiciled in the Euro area or not. The results are divided into four tables depending on the model that is used for the estimations. The models are the same as the ones used in the full sample and size category-based results. The most valid and interesting results in comparison between the ownership structure and Euro area seem to be with model 1 in table 6 as the rest of the interesting and significant results are with models from 2 to 4, from which the results are presented in appendix 3 in tables 10-13.

Model 1 includes ROAA as a dependent variable and non-performing loans as a variable describing the loan portfolio riskiness. The first finding for stakeholder owned banks in Euro area is somewhat questionable as it seems that one period lagged profitability measured with ROAA would have negative impact on current profitability. Although the result is significant at 5 %, it is not supported with results from other models.

At the same time also the size of the bank measured with the log of assets has had notably large negative effect on profitability. The effect is statistically significant for stakeholder owned banks in Euro area and shareholder owned banks outside the Euro area meaning that in those subgroups if the bank has 1 % increase in log of assets the profitability measure ROAA goes down by 1.594 % and 0.768 %, respectively. This result is also supported by the results from other models, which also indicate that the effect would apply to all subgroups depending on the model that is used and also for both profitability measures with and without risk adjustment. At its worst, the effect of log of assets was as much as -4.028 % (Model 4, Shareholder owned banks outside the Euro area). In none of the models, the significant effect of log of assets to profitability was positive indicating that increasing the size of the bank is not necessarily a good thing in profitability wise. This also indicates that it would be profitable for these banks to stay small rather than to seek growth.

Although the bank size does not seem to have affected positively on the profitability, the results indicate that for the profitability of shareholder owned banks in the Euro area it has been beneficial to grow fast during the research period. This result is supported by models 1 and 2, which both use the ROAA as the dependent variable and that the effect is only significant for shareholder owned banks in the Euro area. Somehow other banks have not been able to harness their rapid growth into growing profitability, which gives an advantage to shareholder owned banks in the Euro area as the impact of 1 % increase the change of log of assets leads to 2.680 % increase in ROAA. In the long run, the effect remains high being 2.479 % and still statistically significant.

As already discussed in the full sample results, the business model variable wholesale funding over total funding does indicate only minor effects on profitability. However, the results indicate that increasing the share of wholesale

funding would have slight positive impact on profitability for stakeholder owned banks in Euro area, but negative impact on shareholder owned banks outside the Euro area. This would mean that increasing the share of wholesale funding would still benefit cooperative and savings banks in Euro area, but only slightly, which was also noted by Junttila et al. (2021). The choice of the business model during the negative interest rate era has not had an impact on profitability for any of the subgroups.

Model 1 delivers statistically significant results for the effect of non-performing loans for each of the subgroups excluding the stakeholder owned banks in the Euro area. Based on the results, it could be even beneficial for shareholder banks in the Euro area and stakeholder banks outside the Euro area to take on more risky loans as the 1 % increase in non-performing loans is noted to improve the ROAA by 0.0800 and 0.0251 %, respectively. This result is not supported nor disproved with results from the other models as they do not provide statistically significant results. For banks in these two subgroups the result could also mean that although the banks include risky projects into their portfolios, they are also able to adjust the pricing to match the risk taking to be profitable.

For shareholder banks outside the Euro area the result is more rational as the impact of increasing share of non-performing loans harms the profitability. This result is supported also with other models also using the loan loss provision as the measure for the quality of the loan portfolio. It also seems that the impact on risk-weighted profitability measure is even greater than just for the basic ROAA and that the impact of loan loss provisions is greater than non-performing loans.

However, the most remarkable finding marking the effects of loan portfolio quality is with the model 4, which reveals that the impact of loan loss provisions on risk-adjusted profitability of stakeholder owned banks outside the Euro area is extremely high (-1.087 %) compared to the other subgroups. The finding becomes more worrying as the Figure 8 shows that banks in that subgroup also suffer from very high share of loan loss provisions compared to the others. For stakeholder owned banks in Euro area the basic profitability measure ROAA suffers remarkably, if the share of loan loss provisions increases (model 3), while for the other subgroups the effect is not significant. However, Figure 8 highlights that stakeholder owned banks in Euro area are not suffering from high share of loan loss provisions as the shareholder owned banks outside the Euro area are.

Figure 8: Share of loan loss provisions in total assets in each subgroup.

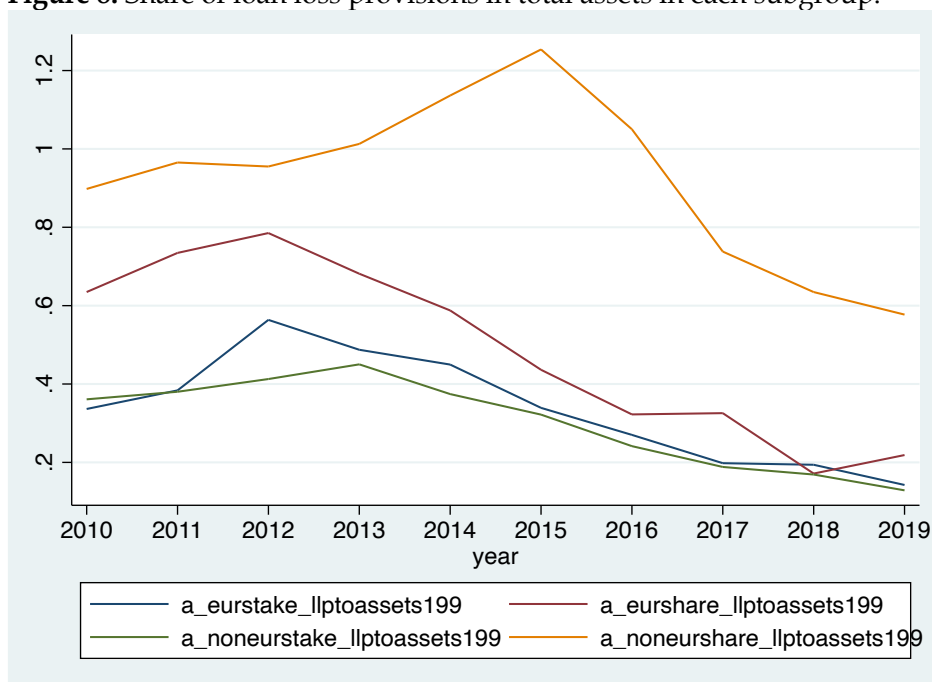
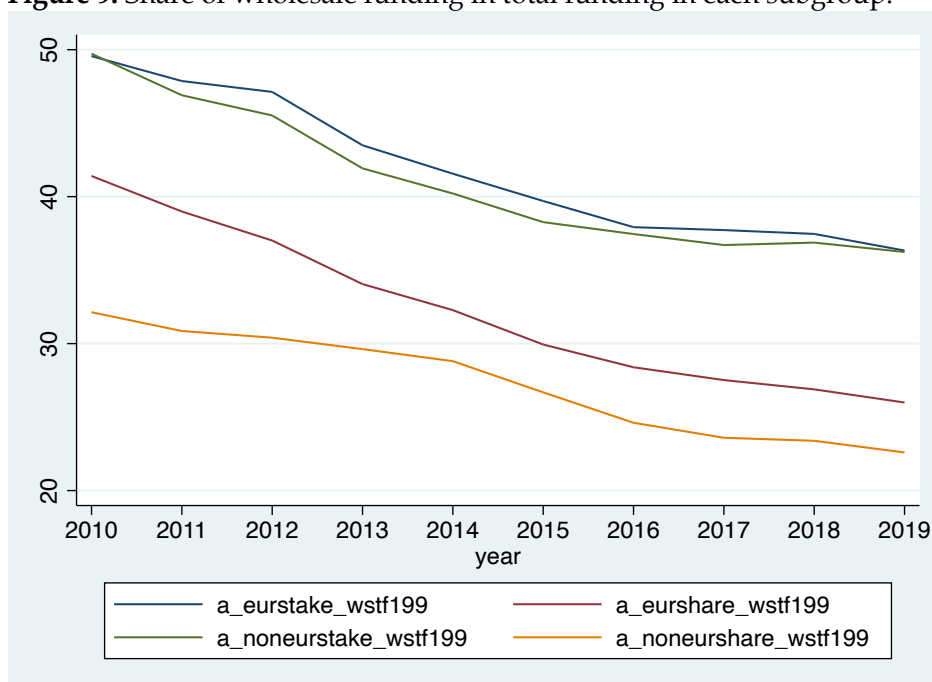


Figure 9: Share of wholesale funding in total funding in each subgroup.



From the macroeconomic variables again only the interest rate level and the HH-index deliver statistically significant results. Highly consistent result is that regardless of the ownership structure, the overall profitability has been negatively affected by the increase in interest rate level for the banks in the Euro area. This means that as the trend for the interest rate can be observed to be downward sloping (Figures 1 and 2), the effect on profitability of Euro area banks has been positive during the research period. However, it is not possible to

compare the results between stakeholder and shareholder owned banks in the Euro area, without making any precautions. None of the models delivered significant results for both ownership structures in the Euro area as models 1, 2 and 4 dropped out the entire variable from GMM regressions due to the collinearity issues for stakeholder owned banks in the Euro area.

Outside the Euro area the results are also consistent as each of the models giving statistically significant coefficients suggest that for the stakeholder owned banks the effect of rising interest rate level has been positive (the effect of decreasing interest rate level is then negative) for the profitability. As for the shareholder owned banks, the effect of rising interest rates has been negative, which is only shown in the model 2 measuring the impact on risk-adjusted profitability measure RoRWA.

The effect of competitive situation in the banking sector seems to only address the banks outside the Euro area. However, the effect is noted only with models 2 and 3, and only at 10 % risk level, which implies a low level of significance. Nevertheless, from this it can be carefully interpreted, that banks outside the Euro area tend to effloresce with risk adjusted profitability, if they operate in local and less competitive region or area.

Concluding the results for the third research question, it seems that the results vary greatly depending on both the ownership structure but also on the regional positioning in or outside the Euro area. Looking at the figures 8 and 9, the banks in the Euro area banks have been utilizing more wholesale funding and making less loan loss provisions as opposed to the banks outside the Euro area. Other than that, the results for the third research question are rather scattered suggesting that there are unique characteristics that define the profitability for each subgroup.

Table 6: Subsample results from the subsample analysis on ownership and Euro area with model 1

	Stakeholder owned in Euro area			Shareholder owned in Euro area			Stakeholder owned outside Euro area			Shareholder owned outside Euro area		
	Pooled OLS	Two-step DGMM	Long-run coefficients	Pooled OLS	Two-step DGMM	Long-run coefficients	Pooled OLS	Two-step DGMM	Long-run coefficients	Pooled OLS	Two-step DGMM	Long-run coefficients
L.roaa	0.201*** (0.0719)	-0.159** (0.0719)	-0.138** (0.0535)	0.483*** (0.0814)	-0.0809 (0.252)		0.459** (0.181)	0.0366 (0.102)		0.479*** (0.0667)	0.324** (0.146)	0.479 (0.319)
L.lassets	0.000142 (0.0161)	-1.594*** (0.291)	-1.374*** (0.255)	-0.0288* (0.0151)	-0.946 (0.663)		-0.0303 (0.0365)	-0.0795 (0.378)		-0.000091 (0.0168)	-0.768* (0.449)	-1.136* (0.665)
L.difflassets	-0.124 (0.374)	-0.0937 (0.348)		0.184 (0.253)	2.680** (1.354)	2.479** (1.193)	0.543 (0.386)	0.301 (0.340)		0.0412 (0.252)	0.718 (0.615)	
L.wstf	0.00201 (0.00186)	0.0156* (0.00805)	0.0134** (0.00681)	-0.00333 (0.00224)	-0.0143 (0.0195)		0.00472 (0.00381)	-0.0216 (0.0232)		-0.0086*** (0.00209)	-0.0221 (0.0161)	
L.wstf x negativerate	0.00118 (0.00128)	-0.000536 (0.00223)		0.000707 (0.00213)	-0.00896 (0.00695)		0.00141 (0.00453)	-0.00661 (0.0313)		0.00320* (0.00189)	-0.0175 (0.0174)	
L.npl	-0.0193*** (0.00479)	0.0202 (0.0180)		-0.00921** (0.00433)	0.0800*** (0.0278)	0.0740** (0.0293)	0.0121*** (0.00309)	0.0251*** (0.00551)	0.0261*** (0.00601)	-0.0141** (0.00618)	-0.0358* (0.0195)	-0.0530** (0.0237)
L.intincoprev	0.00263* (0.00134)	0.00277 (0.00599)		0.00263* (0.00136)	0.0318** (0.0135)	0.0294** (0.0126)	-0.000103 (0.00732)	0.00975** (0.00468)	0.0101** (0.00487)	-0.00164 (0.00213)	-0.00390 (0.0131)	
L.leverage	0.0301** (0.0144)	-0.0667** (0.0261)	-0.0575** (0.0239)	0.0167 (0.0102)	0.0354 (0.0887)		0.0581*** (0.0200)	-0.00114 (0.0445)		0.0145 (0.0129)	-0.0217 (0.0483)	
L. efficiency	0.00545 (0.00504)	0.0101* (0.00550)	0.00872* (0.00477)	-0.00550* (0.00285)	-0.00609 (0.0117)		-0.0112 (0.00795)	0.00817 (0.00744)		-0.0072*** (0.00275)	-0.00981 (0.00647)	
L.gdpgrowth	-0.0114 (0.00849)	-0.0195 (0.0164)		-0.0165 (0.0137)	-0.0648 (0.0452)		0.0112 (0.0168)	-0.0271 (0.0415)		0.0393** (0.0163)	0.0348 (0.0292)	
L.inflation	-0.00141 (0.00585)	-0.00432 (0.00929)		0.00519 (0.00830)	0.00110 (0.0224)		-0.00216 (0.00847)	-0.0137 (0.0202)		-0.0152 (0.0132)	0.00172 (0.0251)	
L.interestrategylevel	-0.0717 (0.0665)			-0.103 (0.0851)	-0.485** (0.223)	-0.448** (0.197)	0.0194 (0.0269)	0.267** (0.102)	0.277*** (0.0985)	0.00864 (0.00705)	-0.0176 (0.0218)	
L.cbassetsgrowth	-0.000056 (0.00106)	-0.000200 (0.00132)		0.000945 (0.00161)	0.00130 (0.00197)		0.00371* (0.00194)	0.000377 (0.00133)		0.00230 (0.00241)	-0.00231 (0.00373)	
L.hhindex	0.123 (0.310)	-1.985 (1.899)		-0.610** (0.285)	-0.207 (1.710)		0.0121 (0.284)	1.208 (0.754)		0.421** (0.208)	-0.188 (0.491)	
year 2012		-1.354*** (0.325)						-0.908* (0.497)			-0.0551 (0.229)	
year 2013		-1.160*** (0.285)			-0.416** (0.193)			-0.716** (0.300)			-0.0159 (0.192)	
year 2014		-1.130*** (0.340)			-0.346 (0.212)			-0.361 (0.303)			-0.324* (0.192)	
year 2015		-0.498** (0.206)			-0.0546 (0.143)			-0.462*** (0.166)			-0.209 (0.154)	
year 2016		-0.328** (0.163)			-0.0813 (0.112)			-0.0995 (0.0965)			0.257* (0.134)	
year 2017		-0.246**			-0.136						0.125	

year 2018		(0.111)		(0.106)				(0.117)
		0.00873		-0.0145				0.118
year 2019		(0.102)		(0.0797)				(0.0836)
Constant	-0.422		1.109**		0.741		0.990**	
	(0.667)		(0.436)		(0.965)		(0.493)	
Observations	721	591	898	737	249	206	1035	831
R-squared	0.266		0.447		0.603		0.429	
No. of instruments		117		67		29		70
No. of groups		128		158		43		192
AR1 (p-value)		0.077		0.0507		0.946		0.00328
AR2 (p-value)		0.218		0.784		0.504		0.805
Hansen-J (p-value)		0.180		0.132		0.140		0.192

Standard errors in parentheses

* p<0.10, ** p<0.05, *** p<0.010

5.4 Results for NIM as the dependent variable

The results from ROAA and RoRWA regressions were scattered in nature indicating that those profitability measures are under the influence of various elements. To get deeper into the effects of negative money market interest rates on the profitability, the previous results still left room for further analysis to be made on the profitability measure of net interest margin. By the definition, NIM has been the part of the profitability that is more directly related with the negative money market interest rates than the broader profitability measures ROAA and RoRWA.

Full sample results from the NIM regressions are presented in table 7 with model 5 using the non-performing loans as a measure for quality of banks loan portfolio and model 6 using loan loss provisions to assets. As it shows, in both models the lagged values of NIM have the greatest impact on the dependent variable NIM. Again, also with NIM regressions, the business model variable of wholesale funding in total funding is shown to have only small but significant (model 5) negative impact on NIM as it also did on ROAA and RoRWA regressions. It can also be said, that in full picture neither of the loan portfolio variable quality measures have effect on NIM.

Regarding the macroeconomic variables, as expected the interest rate level shows exceedingly significant effect at 1 % confidence level: if the interest rates were to rise by 1 %, it would cause NIM to rise by 0,07 % in short term and even by 0,25 % in the long run (model 6). With model 5 these effects are only slightly smaller. During the research period the interest rates have been downward sloping in the Euro area, but more varying outside the Euro area, as shown in the figures 1-4. Already pointing out from the full sample results, downward sloping interest rates cause lowering effect to the NIM.

The other macroeconomic variable having a statistically significant effect on NIM is the HH-index in model 6. If the HHI, meaning the competitive environment in the country in question, were to be higher meaning less competitive, it would cause positive effect on the NIM in short term. The effect gets greater and statistically even more significant in the long run, as the rise in the HHI would end up with more than three times higher positive impact on the NIM in the longer period. This effect could not be seen with ROAA and RoRWA regressions indicating that the positive effect of low competitive situation in the banking sector is especially associated with the traditional way of a banks to make profit through NIM, not necessarily so remarkably with the broader perspective of ROAA and RoRWA. This result is also supported by Chaudron et al. (2022) as they found out the total NIM to be highly related to the market power of the bank.

In regards of the profitability depending on the size of the bank, the same regressions were also performed for NIM using size dummies. The dummies divided the full sample into two categories being below and above median and

into quartiles using the log of assets. As with ROAA and RoRWA regressions, NIM regressions did not reveal statistically significant results. This indicates that the size of the bank does not seem to be a variable defining the profitability of the bank. Results with these size dummies are presented in the appendix 3 table 11.

Table 7: Full sample results using NIM as a dependent variable

	Model 5			Model 6		
	Fixed effects: NIM	Two-step SYS-GMM: NIM	Long-run coefficients NIM	Fixed effects: NIM	Two-step SYS-GMM: NIM	Long-run coefficients NIM
L.nim	0.521*** (0.0337)	0.764*** (0.0540)	3.230*** (0.966)	0.516*** (0.0386)	0.710*** (0.0621)	2.446*** (0.737)
L.lassets	-0.267*** (0.0803)	0.0200 (0.0408)		-0.294*** (0.0826)	-0.0145 (0.0375)	
L.difflassets	0.295** (0.140)	-0.123 (0.341)		0.354** (0.147)	0.190 (0.298)	
L.wstf	-0.00653*** (0.00175)	-0.00600** (0.00273)	-0.0254** (0.0100)	-0.00560*** (0.00186)	-0.00445 (0.00272)	
L.wstf x negativerate	-0.00127*** (0.000439)	-0.000216 (0.00123)		-0.000736 (0.000468)	0.000194 (0.00150)	
L.npl	0.00568* (0.00313)	0.00427 (0.00393)				
L.llptoassets				0.0387 (0.0295)	0.0285 (0.0424)	
L.intincoprev	-0.000268 (0.00186)	0.00380* (0.00227)	0.0161* (0.00944)	0.000123 (0.00161)	0.00266 (0.00225)	
L.leverage	0.00685 (0.00964)	0.0131 (0.0108)		0.00612 (0.0101)	0.0202 (0.0134)	
L. efficiency	-0.000645 (0.000919)	0.000521 (0.00244)		-0.000342 (0.000861)	0.00370 (0.00281)	
L.gdpgrowth	-0.0193** (0.00772)	-0.00402 (0.00685)		-0.0193** (0.00753)	0.000284 (0.00659)	
L.inflation	-0.00539 (0.00618)	0.00340 (0.00478)		-0.00661 (0.00595)	-0.00149 (0.00466)	
L.interestrateratelevel	0.0457*** (0.0136)	0.0554*** (0.0126)	0.235*** (0.0341)	0.0482*** (0.0129)	0.0712*** (0.0153)	0.245*** (0.0364)
L.cbassetsgrowth	0.000891 (0.000687)	-0.000833 (0.000813)		0.000959 (0.000671)	-0.000583 (0.000792)	
L.hhindex	-0.169 (0.288)	0.234 (0.148)		-0.329 (0.268)	0.442** (0.175)	1.523*** (0.535)
year 2012		0.0568 (0.0580)			0.0229 (0.0653)	
year 2013		0.103** (0.0507)			0.0690 (0.0569)	
year 2014		0.127** (0.0606)			0.121* (0.0646)	
year 2016		0.0478 (0.0336)			0.00705 (0.0266)	
year 2017		0.0635** (0.0320)			0.0387 (0.0284)	
year 2018		0.0679* (0.0369)			0.0246 (0.0314)	
year 2019		-0.00193 (0.0344)			-0.0358 (0.0318)	
Constant	5.676*** (1.374)	-0.178 (0.684)		6.100*** (1.409)	0.213 (0.711)	
Observations	2873	2873		2944	2944	
R-squared	0.359			0.373		
No. of instruments		94			148	
No. of groups		530			539	
AR1 (p-value)		0.00000053			0.00000696	
AR2 (p-value)		0.489			0.373	
Hansen-J (p-value)		0.117			0.114	

Standard errors in parentheses

* p<0.10, ** p<0.05, *** p<0.010

Finally, the subsample results with models 5 and 6 are presented in tables 8 and 9. Analyzing the results from the final regressions with four sub-categories between stakeholder and shareholder owned banks in and outside the Euro area the first observation is, that neither of the loan portfolio quality measures delivered statistically significant results. By this it can be concluded that the loan portfolio quality measures do not have statistically significant influence on NIM, even though there was a positive effect recorded on ROAA with shareholder banks in the Euro area and stakeholder banks outside the Euro area. This also suggests that the banks in those two subcategories have not necessarily been able to charge higher interests on the riskier loans, but rather that the profit has been made through other income items.

Models 5 and 6 return mostly similar results, with variables having statistically significant effects being the one period lagged value of NIM, log of assets, difference in log of assets and wholesale funding in total funding. For all banks in both models, the higher value of lagged NIM has positive effect on the development of future NIM. With shareholder owned banks, the effect of past NIM is even larger in the long run with banks both outside and inside the Euro area. With stakeholder owned banks the effect is statistically significant only in short run, suggesting that stakeholder owned banks are only able to generate short term benefit from the past high values of the NIM.

Results with log of assets show that both models agree that greater size of the bank effects negatively on NIM with shareholder owned banks in the Euro area. Also model 1 with ROAA as a dependent variable showed negative impact on stakeholder owned banks in the Euro area and for all shareholder owned banks in the Europe leaving only stakeholder owned banks outside the Euro are not to be suffering from their size.

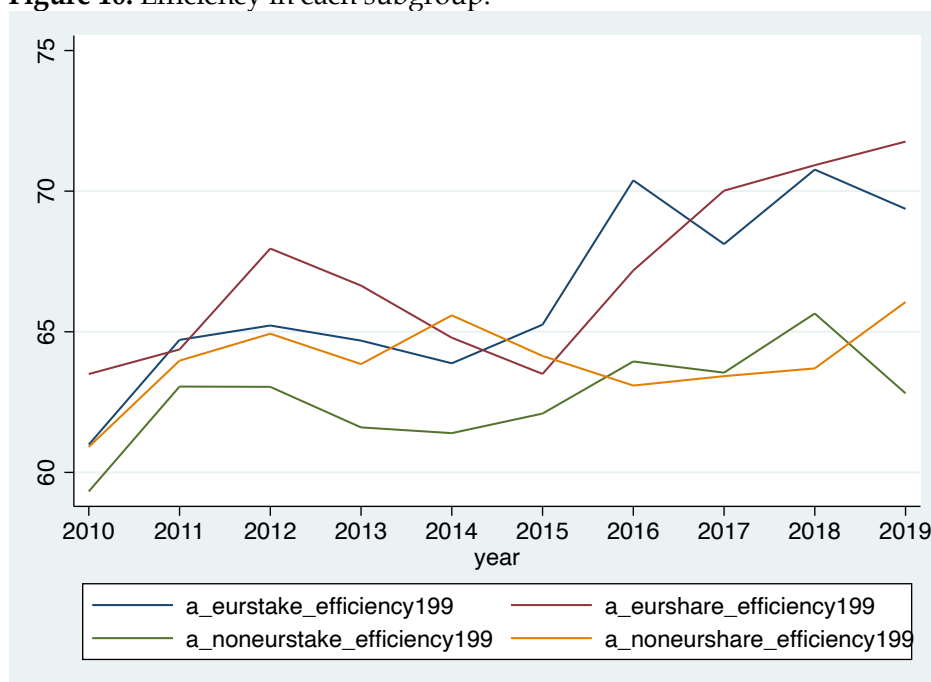
Even though the growth speed of the bank had remarkably high positive impact on ROAA in model 1 with shareholder owned banks in the Euro area, it seems that on NIM the effect has been negative as the results from model 6 show for all banks inside the Euro area. This finding again proves, that the banks have not been able to generate profits through NIM, but rather through broader profit measures that consider also other income items. The higher the growth speed of the bank in the Euro area has had, more its NIM has suffered. However, the shareholder owned banks have been able to overcome that suffering with other income items making the effect on ROAA to be highly positive. Nevertheless, the impact of growth speed has been positive for the NIM of shareholder owned banks outside the Euro area, but as model 1 showed, the impact is not seen with broader profitability measure ROAA.

As all the previously presented results already showed for business model variable wholesale funding in total funding, also NIM regressions continue the same trend. The effect of wholesale funding in total funding to NIM seems to be negative but only mild and applicable only for banks outside the Euro area. Even though the negative effect is mild, the long run impact is 2-4 times more as the same effect in short term. These findings again explain, why banks across the subcategories have reduced their share of using wholesale funding as part of their total funding. During the negative interest rate era, model 5 shows that

shareholder owned banks outside the Euro area have experienced positive effect to the NIM from the business model variable. However, previous results show that this, again mild effect, is not carried all the way to the ROAA and RoRWA measures.

From the bank level variables, efficiency is the last one that shows statistically significant results for the impact on NIM. Results from model 5 indicate moderate positive effect for stakeholder owned banks inside the Euro area. This result is also supported with the results from the model 1 with ROAA, which strengthens the interpretation that savings banks and cooperative banks inside the Euro area are better able to use their efficiency to ensure greater profitability. Figure 10 below also shows that these banks are well positioned with their efficiency average compared to the other subgroups.

Figure 10: Efficiency in each subgroup.



Regarding the macroeconomic variables, the only independent variable indicating statistically significant effect, is the interest rate level. Although for ROAA in model 1 the statistically significant effect was recorded for shareholder owned banks inside the Euro area and stakeholder owned banks outside the Euro area, in NIM regression the effect is only with shareholder owned banks outside the Euro area.

With both NIM models, the positive effect of 1 % rise in interest rate level to NIM is recorded to be approximately 0.06 % in short run and exceedingly greater, over 0,2 %, in long run. Worth of reminding is that the positive effect of rising interest rates also means that the effect of lowering interest rates is negative. As figures 3 and 4 show, the interest rates outside the Euro area have been seemingly unsteady during the data period causing variation to the NIM. However, this variation is not seen with models 1-4, which means that the other

profitability drivers stabilize the variation caused by the interest rates to the NIM as broader profitability measures are investigated.

Notable is also that the HH-index does not have statistically significant impact on NIM as observed from the GMM results, even though the competitiveness of market environment was one of the key variables effecting the overall profitability. This would also suggest that the positive impact of easy competitive environment does not benefit the profitability through NIM but rather through other income items.

Table 8: Results from the subsample analysis based on ownership and Euro area with model 5

	Stakeholder owned in Euro area			Shareholder owned in Euro area			Stakeholder owned outside Euro area			Shareholder owned outside Euro area		
	Fixed effects: NIM	Two-step SYS-GMM: NIM	Long-run coefficients NIM	Fixed effects: NIM	Two-step SYS-GMM: NIM	Long-run coefficients NIM	Fixed effects: NIM	Two-step SYS-GMM: NIM	Long-run coefficients NIM	Fixed effects: NIM	Two-step SYS-GMM: NIM	Long-run coefficients NIM
L.nim	0.507*** (0.0881)	0.934*** (0.0470)	14.238 (10.913)	0.488*** (0.0562)	0.581*** (0.129)	1.387* (0.735)	0.499*** (0.0964)	0.543*** (0.170)	1.190 (0.817)	0.519*** (0.0419)	0.734*** (0.0563)	2.764*** (0.798)
L.lassets	-0.454*** (0.106)	-0.00337 (0.0141)		-0.128 (0.0795)	-0.0808** (0.0341)	-0.193** (0.0910)	-0.393** (0.194)	0.229** (0.111)	0.501* (0.284)	-0.261* (0.144)	-0.0144 (0.0472)	
L.difflassets	-0.233 (0.163)	-0.382* (0.206)	-5-828 (5.405)	0.0116 (0.123)	-0.247 (0.167)		0.0501 (0.207)	-1.426 (1.0432)		0.531** (0.229)	0.482 (0.371)	
L.wstf	-0.00181 (0.00230)	0.000708 (0.00121)		-0.00386* (0.00215)	0.00474 (0.00385)		0.00602 (0.00618)	-0.0206*** (0.00647)	-0.0450** (0.0176)	-0.0107*** (0.00320)	-0.00592* (0.00341)	-0.0223* (0.0122)
L.wstf x negativerate	-0.000777** (0.000367)	-0.000910 (0.00109)		0.0000879 (0.000671)	0.00204 (0.00142)		-0.00134 (0.00224)	-0.0215 (0.0253)		-0.000271 (0.00151)	0.00775** (0.00360)	
L.npl	0.000373 (0.00394)	0.00108 (0.00225)		0.00120 (0.00275)	0.00625 (0.00492)		0.0148*** (0.00350)	0.0137 (0.0162)		0.00756 (0.00621)	0.00918 (0.00633)	
L.intincoprev	-0.000962 (0.00126)	-0.000226 (0.00148)		0.00299** (0.00150)	0.00415 (0.00357)		0.00349 (0.00348)	0.00218 (0.0124)		-0.00361 (0.00380)	-0.000648 (0.00361)	
L.leverage	-0.0206** (0.00813)	0.000479 (0.00524)		0.00378 (0.00780)	0.00393 (0.0111)		0.0244 (0.0237)	0.0208 (0.104)		0.0137 (0.0200)	0.0322 (0.0200)	
L.efficiency	0.00229** (0.00109)	0.00465*** (0.00122)	0.0708 (0.0590)	-0.00110 (0.000839)	-0.00150 (0.00203)		0.0000652 (0.00336)	0.0150 (0.00983)		-0.000309 (0.00191)	0.00390 (0.00245)	
L.gdpgrowth	-0.0148** (0.00605)	-0.00242 (0.00479)		-0.0137 (0.00959)	-0.000807 (0.0150)		0.00775 (0.0125)	0.00848 (0.0347)		-0.0328 (0.0200)	-0.0164 (0.0179)	
L.inflation	-0.00489 (0.00439)	0.00411* (0.00220)	0.0626 (0.0538)	-0.000500 (0.00599)	-0.00946 (0.00848)		0.00236 (0.00726)	-0.00254 (0.0186)		-0.0129 (0.0151)	-0.00920 (0.0128)	
L.interestrategylevel	0.0871*** (0.0295)			0.0551 (0.0379)			0.0121 (0.0503)	0.0464 (0.0831)		0.0493*** (0.0150)	0.0628*** (0.0120)	0.236*** (0.0341)
L.cbassetsgrowth	-0.00108*** (0.000383)	-0.000519 (0.000579)		-0.000238 (0.000704)	-0.000115 (0.00105)		-0.00210** (0.000959)	-0.00101 (0.00180)		0.00372** (0.00175)	-0.00135 (0.00247)	
L.hhindex	-0.789* (0.408)	-0.408 (0.264)		-1.232*** (0.382)	0.0777 (0.461)		0.124 (0.421)	0.965 (0.690)		0.102 (0.481)	-0.240 (0.315)	
year 2012		0.106* (0.0629)			0.0238 (0.0995)			-0.0450 (0.231)			0.0681 (0.110)	
year 2013		0.0831 (0.0654)			0.0662 (0.0997)			-0.0501 (0.230)			-0.128 (0.109)	
year 2014		0.103* (0.0605)			0.0837 (0.103)			0.154 (0.234)			0.0808 (0.128)	
year 2015		0.0866*** (0.0247)			-0.0229 (0.0431)						-0.292*** (0.104)	
year 2016					-0.0353			-0.0916			-0.0168	

year 2017		0.0433** (0.0185)		(0.0393) -0.0266 (0.0404)		(0.137) 0.0637 (0.179)		(0.0720) -0.0481 (0.0658)	
year 2018		0.152*** (0.0477)		0.0189 (0.0345)		-0.147 (0.229)			
year 2019		0.0294 (0.0266)				0.0553 (0.243)		-0.215*** (0.0745)	
Constant	8.587*** (1.884)	-0.203 (0.329)		3.376** (1.328)	1.750** (0.728)	6.480** (3.137)	-3.187 (2.401)	6.039** (2.402)	0.574 (1.058)
Observations	697	697		895	895	241	241	1040	1040
R-squared	0.645			0.416		0.654		0.342	
No. of instruments		123			125		29		112
No. of groups		128			159		41		202
AR1 (p-value)		0.00461			0.0143		0.042		0.0000624
AR2 (p-value)		0.979			0.0690		0.564		0.342
Hansen-J (p-value)		0.171			0.170		0.309		0.249

Standard errors in parentheses

* p<0.10, ** p<0.05, *** p<0.010

Table 9: Results from the subsample analysis based on ownership and Euro area with model 6

	Stakeholder owned in Euro area			Shareholder owned in Euro area			Stakeholder owned outside Euro area			Shareholder owned outside Euro area		
	Fixed effects: NIM	Two-step SYS-GMM: NIM	Long-run coefficients NIM	Fixed effects: NIM	Two-step SYS-GMM: NIM	Long-run coefficients NIM	Fixed effects: NIM	Two-step SYS-GMM: NIM	Long-run coefficients NIM	Fixed effects: NIM	Two-step SYS-GMM: NIM	Long-run coefficients NIM
L.nim	0.522*** (0.0843)	0.903*** (0.0613)	9.262 (6.453)	0.526*** (0.0527)	0.579*** (0.136)	1.374* (0.768)	0.569*** (0.0701)	0.831*** (0.145)	4.911 (5.081)	0.507*** (0.0473)	0.759*** (0.0505)	3.149*** (0.869)
L.lassets	-0.429*** (0.119)	-0.0109 (0.0183)		-0.186** (0.0760)	-0.0915** (0.0425)	-0.217** (0.108)	-0.368 (0.232)	0.0675 (0.0936)		-0.272* (0.148)	0.00669 (0.0452)	
L.difflassets	-0.390** (0.177)	-0.813*** (0.242)	-8.347 (5.889)	-0.0785 (0.130)	-0.417** (0.191)	-0.991* (0.561)	-0.00788 (0.218)	-0.400 (0.342)		0.754*** (0.241)	0.905*** (0.311)	3.755*** (1.403)
L.wstf	-0.000149 (0.00246)	0.000599 (0.00229)		-0.00332 (0.00210)	0.00310 (0.00367)		0.00498 (0.00648)	-0.00249 (0.00729)		-0.00992*** (0.00331)	-0.00802** (0.00359)	-0.0333** (0.0152)
L.wstf x negativerate	-0.000577* (0.000332)	0.000337 (0.00174)		0.000385 (0.000714)	0.00203 (0.00139)		-0.000137 (0.00238)	0.00351 (0.00873)		0.00339 (0.00259)	0.000450 (0.00498)	
L.llptoassets	-0.0640*** (0.0234)	0.0263 (0.0419)		0.0115 (0.0326)	0.0353 (0.0449)		0.113*** (0.0277)	0.0556 (0.0554)		0.0605 (0.0417)	0.0734 (0.0588)	
L.intincoprev	-0.00165 (0.00138)	0.00284 (0.00214)		0.00199 (0.00133)	0.00305 (0.00296)		0.00356 (0.00379)	0.0108*** (0.00315)	0.0639 (0.0625)	-0.00259 (0.00338)	-0.00223 (0.00376)	
L.leverage	-0.0297*** (0.00968)	-0.00551 (0.00777)		0.00417 (0.00859)	0.0110 (0.0115)		0.0365 (0.0220)	0.0220 (0.0555)		0.0104 (0.0194)	0.0184 (0.0224)	
L. efficiency	0.00174 (0.00134)	0.00265 (0.00225)		-0.000518 (0.000923)	-0.00177 (0.00206)		0.00277 (0.00280)	0.00672 (0.00491)		-0.000222 (0.00170)	0.00397 (0.00314)	
L.gdpgrowth	-0.0123**	0.0000157		-0.0112	0.00217		0.0106	0.0155		-0.0319*	-0.00980	

	(0.00591)	(0.00633)	(0.0101)	(0.0113)	(0.0136)	(0.0188)	(0.0193)	(0.0185)	
L.inflation	-0.00457	0.00292	-0.0000972	-0.00683	0.00515	0.000510	-0.0142	-0.00437	
	(0.00412)	(0.00352)	(0.00695)	(0.00950)	(0.00997)	(0.0118)	(0.0142)	(0.0119)	
L.interestraterlevel	0.0869***		0.0561		0.0178	0.0642	0.0507***	0.0588***	0.244***
	(0.0263)		(0.0356)		(0.0554)	(0.0423)	(0.0141)	(0.0114)	(0.0431)
L.cbassetsgrowth	-0.00118***	-0.000652	-0.000353	-0.000142	-0.00211*	-0.00211	0.00375**	-0.00154	
	(0.000385)	(0.000641)	(0.000704)	(0.000891)	(0.00111)	(0.00236)	(0.00169)	(0.00242)	
L.hhindex	-0.624	-0.338	-1.395***	-0.119	0.570	0.414	0.00101	0.358	
	(0.433)	(0.329)	(0.449)	(0.396)	(0.461)	(0.763)	(0.440)	(0.305)	
year 2012		0.0832		0.0833		0.0366		0.0213	
		(0.0971)		(0.0899)		(0.234)		(0.1000)	
year 2013		0.0433		0.0930		0.184		-0.128	
		(0.0937)		(0.0851)		(0.154)		(0.0989)	
year 2014		0.0527		0.0857		0.267		0.0758	
		(0.0986)		(0.0830)		(0.200)		(0.105)	
year 2015								-0.250**	
								(0.102)	
year 2016		-0.0845***		-0.0126		-0.0475		0.0363	
		(0.0287)		(0.0397)		(0.131)		(0.0761)	
year 2017		-0.0242		0.00441		0.108			
		(0.0374)		(0.0382)		(0.114)			
year 2018		0.0751*		0.0264		0.0875		-0.00870	
		(0.0420)		(0.0385)		(0.0975)		(0.0709)	
year 2019		-0.0344		-0.000700		0.128		-0.182**	
		(0.0467)		(0.0363)		(0.0912)		(0.0829)	
Constant	8.226***	0.0268	4.265***	2.041**	5.625	-2.110	6.206**	0.352	
	(2.101)	(0.442)	(1.261)	(0.825)	(3.762)	(2.088)	(2.478)	(1.018)	
Observations	735	735	936	936	212	212	1061	1061	
R-squared	0.636		0.431		0.678		0.359		
No. of instruments		121		125		31		152	
No. of groups		131		164		40		204	
AR1 (p-value)		0.00340		0.0188		0.0110		0.0000527	
AR2 (p-value)		0.850		0.107		0.0420		0.340	
Hansen-J (p-value)		0.143		0.180		0.164		0.153	

Standard errors in parentheses

* p<0.10, ** p<0.05, *** p<0.010

6 CONCLUSIONS

The focus of the master's thesis was to examine the changes in profitability that the banks in Europe have experienced during the low and negative interest rate regime. The overall characteristic of the findings is that the variables influencing banks profitability are especially dependent on the ownership structure and whether the bank is in the Euro area or not, rather than the size of the bank. Also, banks with different characteristics have different drivers for the profitability and the impact of one variable is not the same for every subgroup.

As for the shareholder owned banks in the Euro area and co-operative and savings banks outside the Euro area it could even be beneficial to increase the loan portfolio riskiness, this could not be suggested for the shareholder owned banks outside the Euro area. This suggestion for increasing the portfolio riskiness is justified, as the results from increasing share of non-performing loans showed positive effect for ROAA if the bank was shareholder owned bank in the Euro area or co-operative or savings bank outside the Euro area. For future studies, it would be interesting to see how the new ECL framework effects the results as in the future banks are obligated to predict credit losses through which the right level of loan loss provisions is set.

The same kind of subcategory-depending pattern is seen with the interest rate level variable, even though it seems that overall, the lowering of the interest rate levels cause a negative impact on profitability. With closer observation it seems that in the Euro area the profitability of banks has been improved by lowering interest rates whereas for the banks outside the Euro area, the impact of lowering interest rates has been hurting the profitability. Here it needs to be reminded, that banks outside the Euro area have not been experiencing the negative interest rate era as fiercely as banks inside the Euro area. This may have left the banks outside the Euro area to be more able to execute the basic banking business of buying assets and selling liabilities rather than forcing them to experiment different drivers for finding profitability.

Clear benefit for the profitability of co-operative and savings banks in the Euro area, measured with both ROAA and NIM, is the efficiency. At the same time, there still seems to be benefits to utilize more wholesale funding in total funding. However, greater size of the bank and faster growth speed are recorded to have negative impact on profitability of these banks measured again with both ROAA and NIM.

Besides the share of non-performing loans, the main defining factor for enhancing stronger profitability with shareholder owned banks in the Euro area is the growth speed. This is noticed to be on the contrary to the co-operative and savings banks in the Euro area, which highlights the differences in the profitability factors the banks in different subgroups experience. As one factor can be the key variable of ensuring greater profitability to some bank, the same variable could be the one causing the opposite effect to some other bank with different defining features.

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APPENDIX 1

Original	Definition	Label	Citation
Return on average assets (ROAA)	(%)	roaa	Dependent variable
Return on risk weighted assets (RoRWA)	Operating profit / RWAs (%)	rorwa	Dependent variable
Size	Difference over year in natural log of assets	lassets	(Chaudron et al., 2022)
Wholesale funding in total funding	Wholesale funding / Total funding excluding derivatives (%)	wstf	(Detragiache et al., 2018; Junttila & Nguyen, 2022)
Non-Performing loans in total loans	Non-Performing loans / Gross loans (%)	npl	(Detragiache et al., 2018)
Loan loss provisions in total assets	Loan loss provisions / Total assets (%)	llptoassets	(Junttila & Nguyen, 2022; Mergaerts & Vander Vennet, 2016)
Net interest income in operating revenue	Net interest income / Operating revenues (%)	intincoprev	(López-Penabad et al., 2022)
Leverage	Tangible assets / Total assets (%)	leverage	(Detragiache et al., 2018)
Efficiency (cost to income ratio)	Total operating expenses / Operating revenues (%)	efficiency	(Junttila & Nguyen, 2022)
Level of short-term interest rate		interestratelevel	(López-Penabad et al., 2022)
Inflation	Year-on-year annual change in consumer price index (CPI) (%)	inflation	(Chaudron et al., 2022)
Central Bank assets	Year-on-year annual change calculated using end of the year values. ECB for countries in Euro-area and national central bank for each country outside the Euro-area. (%)	cbassetsgrowth	(Gambacorta et al., 2014)
GDP growth	(%)	gdpgrowth	(Chaudron et al., 2022)
Herfindahl-Hirschman index	Index calculated based on total assets	hhindex	(Chaudron et al., 2022)

APPENDIX 2

Breusch-Pagan-test	ROAA		RoRWA		NIM	
	NPL	LLP	NPL	LLP	NPL	LLP
χ^2 -test statistics	0.48	0.00	160.23	180.15	2477.18	1517.36
P-value	0.2453	1.0000	0.0000	0.0000	0.0000	0.0000
Hausman specification test						
χ^2 -test statistics			317.70	342.52	327.12	603.85
P-value			0.0000	0.0000	0.0000	0.0000
Test for deciding GMM estimator						
Pooled OLS	0.5052456	0.5747861	0.5750791	0.6656593	0.8795525	0.8718877
Fixed effects	0.1918	0.147238	0.2037491	0.1703294	0.5211014	0.5163387
Two-step DGMM	0.2249378	-0.1989452	0.3325514	0.2858898	0.3983439	0.4777977

APPENDIX 3

Table 10: Full sample results with bank size divided into below and above median banks and with ROAA and RoRWA as dependent variables

	Model 1			Model 2			Model 3			Model 4		
	Pooled OLS: ROAA	Two-step DGMM: ROAA	Long-run coefficients ROAA	Fixed effects: RoRWA	Two-step DGMM: RoRWA	Long-run coefficients RoRWA	Pooled OLS: ROAA	Two-step SYS-GMM: ROAA	Long-run coefficients : ROAA	Fixed effects: RoRWA	Two-step DGMM: RoRWA	Long-run coefficients RoRWA
L.roaa	0.504*** (0.0452)	0.146 (0.121)					0.574*** (0.0460)	0.585*** (0.141)	1.408* (0.818)			
L.rorwa				0.208*** (0.0675)	0.356*** (0.0874)	0.552*** (0.210)				0.186*** (0.0622)	0.292*** (0.0728)	0.412*** (0.145)
L.diffassets	0.157 (0.164)	-0.265 (0.498)		0.846** (0.401)	0.668 (0.416)		0.284* (0.157)	-0.264 (0.631)		0.787** (0.384)	0.672 (0.412)	
L.wstf	-0.00401*** (0.000938)	-0.0156 (0.0111)		-0.0340*** (0.00720)	-0.0324*** (0.0111)	-0.0503*** (0.0190)	-0.00285*** (0.000820)	-0.0110* (0.00657)	-0.0266 (0.0170)	-0.0330*** (0.00750)	-0.0372*** (0.0114)	-0.0525*** (0.0160)
L.wstf x negativerate	0.00141* (0.000756)	-0.00355 (0.00321)		0.0110*** (0.00237)	0.00798 (0.00549)		0.000649 (0.000700)	0.00472 (0.00517)		0.0111*** (0.00222)	0.00721 (0.00441)	
L.npl	-0.00819*** (0.00269)	-0.00134 (0.0122)		-0.0164 (0.0123)	-0.00526 (0.0185)							
L.llptoassets							0.0294 (0.0374)	0.129 (0.128)		-0.0859 (0.135)	-0.135 (0.184)	
L.intincoprev	0.000672 (0.00102)	-0.00970 (0.00738)		0.0150** (0.00727)	0.0254*** (0.00854)	0.0394*** (0.0152)	0.000553 (0.000932)	-0.00352 (0.00382)		0.0129* (0.00776)	0.0161 (0.00987)	
L.leverage	0.0190*** (0.00623)	0.000398 (0.0320)		-0.0238 (0.0330)	-0.0129 (0.0429)		0.0148*** (0.00510)	0.0109 (0.0214)		-0.0453 (0.0377)	-0.0199 (0.0416)	
L. efficiency	-0.00479** (0.00189)	0.00149 (0.00691)		0.00101 (0.00493)	0.00674 (0.00625)		-0.00347** (0.00156)	0.00753 (0.00673)		0.000743 (0.00479)	0.00547 (0.00645)	
L.gdpgrowth	0.00391 (0.00737)	-0.0177 (0.0138)		-0.0449 (0.0273)	-0.0782** (0.0321)	-0.121** (0.0543)	0.00521 (0.00722)	-0.00319 (0.00901)		-0.0388 (0.0269)	-0.0681** (0.0283)	-0.0962** (0.0406)
L.inflation	-0.00809 (0.00544)	-0.00424 (0.00938)		-0.0136 (0.0193)	-0.0154 (0.0190)		-0.00859* (0.00497)	-0.00544 (0.00717)		-0.0173 (0.0200)	-0.0101 (0.0182)	
L.interestrateratelevel	0.00999* (0.00558)	-0.0469** (0.0202)	-0.0114 (0.00918)	-0.0408 (0.0310)	-0.0148 (0.0307)		0.00130 (0.00647)	0.0155 (0.0190)		-0.0360 (0.0304)	-0.00281 (0.0373)	
L.cbassetsgrowth	0.00136 (0.00105)	0.000939 (0.00118)		0.00197 (0.00197)	0.000533 (0.00224)		0.000895 (0.00101)	-0.000124 (0.00131)		0.00192 (0.00197)	0.000298 (0.00208)	
L.hhindex	0.352*** (0.108)	-0.701 (0.476)		-1.066 (0.804)	-0.940 (0.862)		0.251** (0.109)	0.130 (0.192)		-1.131 (0.797)	-1.310 (0.837)	
Below median	0.0569* (0.0332)	0.0872 (0.346)		-0.212 (0.327)	-1.018 (0.626)		0.0181 (0.0328)	-0.0539 (0.108)		-0.140 (0.306)	-0.386 (0.511)	
year 2012		-0.0678			0.126			0.116			0.0989	

		(0.127)		(0.201)		(0.170)		(0.221)
year 2013		-0.0727		0.111		0.163		0.0913
		(0.116)		(0.173)		(0.160)		(0.180)
year 2014		-0.179		-0.292		0.0523		-0.232
		(0.138)		(0.312)		(0.163)		(0.268)
year 2016		0.0314		0.111		0.0786		0.0878
		(0.0485)		(0.106)		(0.0499)		(0.105)
year 2017		0.0142		0.146		0.0965*		0.137
		(0.0631)		(0.110)		(0.0507)		(0.104)
year 2018		0.0314		0.165		0.0694		0.149
		(0.0649)		(0.108)		(0.0568)		(0.0995)
year 2019		0.00325		0.0256		0.0238		0.0101
		(0.0695)		(0.107)		(0.0602)		(0.0940)
Constant	0.459**		1.881***		0.320**	0.0426	2.106**	
	(0.200)		(0.684)		(0.161)	(0.630)	(0.895)	
Observations	2943	2401	2128	1655	3018	3018	2144	1669
R-squared	0.425		0.135		0.444		0.121	
No. of instruments		125		252		78		220
No. of groups		527		405		552		404
AR1 (p-value)		0.000480		0.00104		0.00000300		0.000944
AR2 (p-value)		0.849		0.855		0.188		0.629
Hansen-J (p-value)		0.233		0.183		0.323		0.144

Standard errors in parentheses

* p<0.10, ** p<0.05, *** p<0.010

Table 11: Results from the subsample analysis on ownership and Euro area with model 2

	Stakeholder owned in Euro area			Shareholder owned in Euro area			Stakeholder owned outside Euro area			Shareholder owned outside Euro area		
	Fixed effects	Two-step DGMM	Long-run coefficients	Fixed effects	Two-step DGMM	Long-run coefficients	Fixed effects	Two-step DGMM	Long-run coefficients	Fixed effects	Two-step DGMM	Long-run coefficients
L.rorwa	0.0742 (0.0602)	0.198 (0.194)		0.145** (0.0693)	0.139 (0.183)		0.115 (0.0898)	0.0192 (0.0719)		0.191* (0.104)	0.0495 (0.104)	
L.lassets	-1.341** (0.640)	-1.869 (1.433)		-1.196** (0.491)	-2.227*** (0.837)	-2.586*** (0.825)	0.686 (0.415)	-0.236 (0.720)		-1.202*** (0.390)	-2.212*** (0.627)	-2.327*** (0.732)
L.diffassets	0.677 (0.517)	1.546 (2.001)		0.920* (0.525)	3.087 (2.224)		0.793* (0.465)	0.897 (1.025)		1.311* (0.778)	1.205 (0.754)	
L.wstf	0.00590 (0.0159)	0.0395 (0.0471)		-0.0256** (0.0111)	0.0263 (0.0253)		-0.0162 (0.0267)	-0.0202 (0.0351)		-0.0357*** (0.0122)	-0.0273** (0.0126)	-0.0288** (0.0135)
L.wstf x negativerate	0.00461 (0.00668)	0.000816 (0.0166)		0.0123*** (0.00397)	-0.00213 (0.00960)		0.00665 (0.00519)	-0.00007 (0.0239)		0.0176** (0.00881)	0.00605 (0.0108)	
L.npl	-0.0302 (0.0327)	0.0261 (0.0689)		0.00554 (0.0137)	0.0228 (0.0411)		0.0538* (0.0303)	0.0419 (0.0336)		-0.0639*** (0.0234)	-0.0593*** (0.0224)	-0.0624*** (0.0235)
L.intincoprev	0.00408 (0.0117)	0.0600*** (0.0184)	0.0748*** (0.0270)	0.0349*** (0.00838)	0.0618*** (0.0223)	0.0717** (0.0329)	0.00163 (0.0106)	0.00449 (0.0101)		0.00318 (0.0132)	0.00442 (0.0143)	

L.leverage	-0.174** (0.0802)	-0.311** (0.134)	-0.387* (0.212)	-0.0297 (0.0548)	0.0528 (0.118)	0.0739 (0.0558)	-0.0975 (0.0626)		-0.0884 (0.0582)	-0.168** (0.0690)	-0.177** (0.0803)	
L.inefficiency	-0.00203 (0.00629)	-0.00581 (0.0197)		-0.00536 (0.00571)	0.0146 (0.0230)	0.00509 (0.00881)	0.0182* (0.0100)	0.0186* (0.00991)	-0.00168 (0.00844)	-0.000249 (0.00793)		
L.gdpgrowth	-0.0229 (0.0381)	0.0373 (0.0722)		-0.0877 (0.0551)	-0.0781 (0.0950)	-0.00599 (0.0449)	0.00573 (0.0531)		0.0716 (0.0476)	0.0267 (0.0643)		
L.inflation	-0.0169 (0.0279)	0.0137 (0.0317)		0.0288 (0.0336)	0.0247 (0.0571)	-0.000417 (0.0301)	-0.0108 (0.0324)		-0.00690 (0.0370)	-0.0119 (0.0442)		
L.interestrateratelevel	-0.441 (0.335)			-0.331* (0.182)	-1.051*** (0.354)	-1.220*** (0.390)	-0.126 (0.126)	0.368* (0.221)	0.375* (0.221)	-0.0424 (0.0353)	-0.113** (0.0446)	-0.119** (0.0467)
L.cbassetsgrowth	-0.000805 (0.00306)	0.000517 (0.00437)		0.00317 (0.00255)	0.00259 (0.00416)	0.00630** (0.00288)	0.00163 (0.00312)		0.000596 (0.00443)	-0.00530 (0.00600)		
L.hhindex	0.434 (2.625)	-3.363 (3.731)		-1.896 (2.208)	-1.216 (2.750)	1.481 (1.291)	3.061* (1.652)	3.121* (1.631)	-0.961 (0.944)	0.0666 (1.487)		
year 2012		-1.619 (1.337)					-1.915*** (0.571)			-0.627 (0.454)		
year 2013		-0.616 (1.027)			-0.543* (0.318)		-1.106** (0.513)			-0.476 (0.369)		
year 2014		-0.722 (1.031)			-0.688* (0.384)		-0.810 (0.681)			-1.260** (0.605)		
year 2015		-0.238 (0.258)			-0.0369 (0.221)		-0.933*** (0.327)			-0.754*** (0.256)		
year 2016					-0.0926 (0.223)		-0.107 (0.275)			-0.0651 (0.220)		
year 2017		0.0927 (0.211)			-0.207 (0.204)		0.148 (0.167)			0.351* (0.192)		
year 2018		0.292 (0.308)			-0.0411 (0.148)					0.151 (0.162)		
year 2019		0.383 (0.308)						0.291* (0.152)				
Constant	24.76** (10.43)			20.98** (8.144)		-10.04 (6.731)			23.26*** (6.572)			
Observations	392	279		694	558	202	161		809	631		
R-squared	0.104			0.233		0.229			0.173			
No. of instruments		67			67		37			129		
No. of groups		72			132		37			158		
AR1 (p-value)		0.141			0.0423		0.270			0.0726		
AR2 (p-value)		0.126			0.860		0.825			0.437		
Hansen-J (p-value)		0.164			0.181		0.166			0.176		

Standard errors in parentheses

* p<0.10, ** p<0.05, *** p<0.010

Table 12: Results from the subsample analysis on ownership and Euro area with model 3

	Stakeholder owned in Euro area			Shareholder owned in Euro area			Stakeholder owned outside Euro area			Shareholder owned outside Euro area		
	Pooled OLS	Two-step SYS-GMM	Long-run coefficients	Pooled OLS	Two-step SYS-GMM	Long-run coefficients	Pooled OLS	Two-step SYS-GMM	Long-run coefficients	Pooled OLS	Two-step SYS-GMM	Long-run coefficients
L.roaa	0.288*** (0.0742)	0.219** (0.108)	0.281 (0.177)	0.510*** (0.0845)	0.190 (0.146)		0.610*** (0.0908)	0.678* (0.339)	2.107* (3.272)	0.576*** (0.0690)	0.463*** (0.112)	0.864** (0.388)
L.lassets	0.00326 (0.0126)	-0.0149 (0.0326)		-0.0228 (0.0147)	-0.0876* (0.0449)	-0.108* (0.0565)	-0.0110 (0.0189)	-0.0235 (0.141)		0.0195 (0.0164)	0.0446 (0.0397)	
L.difflassets	0.0391 (0.245)	0.180 (0.767)		0.310 (0.246)	0.661** (0.310)	0.816** (0.371)	0.278 (0.279)	0.246 (0.394)		0.223 (0.259)	0.278 (0.256)	
L.wstf	0.00283** (0.00134)	0.00197 (0.00205)		-0.00200 (0.00194)	-0.00377 (0.00394)		0.00500* (0.00280)	0.00330 (0.00523)		-0.0064*** (0.00192)	-0.00902** (0.00436)	-0.0168* (0.00914)
L.wstf x negativerate	-0.000226 (0.000937)	0.000337 (0.00174)		0.0000155 (0.00197)	-0.00177 (0.00274)		-0.00248 (0.00216)	0.00145 (0.00597)		0.00216 (0.00176)	-0.000922 (0.00322)	
L.llptoassets	-0.0831 (0.0629)	-0.276*** (0.100)	-0.354*** (0.0981)	-0.0620 (0.0697)	-0.123 (0.142)		0.307*** (0.0674)	0.292 (0.210)		0.0326 (0.0508)	-0.0273 (0.101)	
L.intincoprev	0.00306** (0.00131)	0.00543 (0.00426)		0.00188 (0.00131)	0.00835* (0.00426)	0.0103* (0.00525)	-0.00288 (0.00354)	0.00518 (0.00701)		-0.000214 (0.00205)	0.00435 (0.00571)	
L.leverage	0.0128*** (0.00398)	0.00754 (0.0120)		0.0137 (0.00945)	0.0101 (0.0196)		0.0322** (0.0144)	-0.0301 (0.0369)		0.0120 (0.0124)	0.0157 (0.0262)	
L. efficiency	-0.00129 (0.00220)	-0.00492 (0.00401)		-0.00533* (0.00287)	0.000794 (0.00507)		-0.00517 (0.00478)	0.00193 (0.00783)		-0.00346 (0.00255)	-0.00229 (0.00619)	
L.gdpgrowth	-0.0153* (0.00816)	-0.0115 (0.00876)		-0.0175 (0.0130)	-0.0201 (0.0201)		0.00591 (0.0131)	-0.00724 (0.0170)		0.0442*** (0.0161)	0.0351 (0.0232)	
L.inflation	-0.00262 (0.00554)	0.00183 (0.00785)		0.000221 (0.00820)	-0.0138 (0.0138)		0.00628 (0.00841)	-0.00612 (0.0155)		-0.0145 (0.0118)	-0.0215 (0.0174)	
L.interestrateratelevel	-0.111** (0.0540)	-0.129* (0.0755)	-0.166 (0.104)	-0.108 (0.0789)			-0.0366 (0.0305)	0.00663 (0.0603)		0.000231 (0.00782)	0.0112 (0.0129)	
L.cbassetsgrowth	-0.000546 (0.000896)	0.00134 (0.00120)		0.000740 (0.00158)	0.000977 (0.00157)		0.00394** (0.00186)	0.00130 (0.00213)		0.00195 (0.00236)	-0.00140 (0.00298)	
L.hindex	-0.263 (0.239)	-0.0793 (0.481)		-0.542** (0.269)	-1.074 (0.657)		-0.198 (0.243)	0.598 (0.607)		0.373* (0.206)	0.477* (0.281)	0.889 (0.581)
year 2012					-0.254 (0.158)			0.0315 (0.157)			0.292 (0.184)	
year 2013		0.124** (0.0565)			-0.0766 (0.122)			0.255* (0.143)			0.218 (0.140)	
year 2014		0.107 (0.0873)			-0.0327 (0.176)			0.599** (0.282)			-0.194 (0.211)	
year 2015		0.117* (0.0685)			0.0589 (0.0633)							
year 2016		-0.0189 (0.0430)			0.0319 (0.0751)			0.353*** (0.125)			0.419*** (0.142)	
year 2017					-0.0330			0.267**			0.283**	

year 2018		-0.0304 (0.0790)		(0.0737) 0.0313 (0.0559)		(0.103) 0.275*** (0.101)		(0.127) 0.257** (0.125)
year 2019		0.0131 (0.0462)				0.406*** (0.127)		0.192* (0.113)
Constant	0.0650 (0.343)	0.516 (0.793)	0.971** (0.434)	1.735* (0.917)	0.535 (0.567)	-0.0132 (2.005)	0.123 (0.480)	-0.683 (0.934)
Observations	758	758	942	942	219	219	1055	1055
R-squared	0.293		0.446		0.717		0.437	
No. of instruments		123		125		31		141
No. of groups		133		166		42		206
AR1 (p-value)		0.0129		0.00250		0.0972		0.00136
AR2 (p-value)		0.905		0.375		0.236		0.364
Hansen-J (p-value)		0.148		0.165		0.188		0.187

Standard errors in parentheses

* p<0.10, ** p<0.05, *** p<0.010

Table 13: Results from the subsample analysis on ownership and Euro area with model 4

	Stakeholder owned in Euro area			Shareholder owned in Euro area			Stakeholder owned outside Euro area			Shareholder owned outside Euro area		
	Fixed effects	Two-step DGMM	Long-run coefficients	Fixed effects	Two-step DGMM	Long-run coefficients	Fixed effects	Two-step DGMM	Long-run coefficients	Fixed effects	Two-step DGMM	Long-run coefficients
L.rorwa	0.143 (0.147)	0.323 (0.302)		0.151** (0.0706)	0.248* (0.148)	0.330 (0.261)	0.340* (0.188)	0.814 (0.612)		0.149 (0.113)	-0.0344 (0.464)	
L.lassets	-1.594*** (0.603)	0.645 (3.864)		-0.764 (0.515)	-1.841* (0.975)	-2.449* (1.356)	1.147** (0.503)	-0.0634 (0.597)		-1.122*** (0.410)	-4.028*** (1.138)	-3.894** (1.965)
L.difflassets	1.002** (0.449)	0.742 (0.725)		0.738 (0.504)	1.966 (1.998)		0.539 (0.521)	1.171 (0.942)		1.237 (0.764)	1.314 (2.127)	
L.wstf	0.00481 (0.0149)	-0.0237 (0.0371)		-0.0234* (0.0124)	0.0282 (0.0253)		-0.0396* (0.0225)	-0.0190 (0.0402)		-0.0377*** (0.0123)	-0.0645* (0.0378)	-0.0624 (0.0461)
L.wstf x negativerate	0.00104 (0.00529)	0.00170 (0.0208)		0.0122*** (0.00395)	0.00338 (0.00792)		-0.00339 (0.00902)	-0.0791 (0.0726)		0.0209** (0.00916)	0.0109 (0.0117)	
L.llptoassets	0.0811 (0.297)	0.421 (0.614)		-0.0729 (0.193)	-0.263 (0.267)		0.421* (0.215)	0.969 (0.662)		-0.210 (0.195)	-1.087* (0.610)	-1.0511** (0.433)
L.intincprev	0.00866 (0.00984)	0.0110 (0.0305)		0.0307*** (0.00810)	0.0634*** (0.0208)	0.0843** (0.0331)	0.00949 (0.0113)	0.0346 (0.0230)		0.000203 (0.0158)	0.0280 (0.0291)	
L.leverage	-0.187** (0.0736)	-0.185 (0.259)		-0.00284 (0.0597)	0.0554 (0.143)		0.0527 (0.0614)	-0.114 (0.120)		-0.157** (0.0690)	-0.911*** (0.233)	-0.880* (0.530)
L. efficiency	0.00468 (0.0129)	0.00332 (0.0269)		-0.00319 (0.00436)	0.0160 (0.0186)		0.0193 (0.0118)	0.0643* (0.0346)	0.346 (1.307)	-0.00592 (0.00992)	0.00423 (0.0495)	
L.gdpgrowth	-0.0195 (0.0421)	-0.0513 (0.0766)		-0.0908* (0.0519)	-0.0249 (0.0736)		-0.0411 (0.0381)	-0.0984 (0.0831)		0.0797* (0.0473)	-0.0148 (0.0895)	
L.inflation	-0.0194	0.0335		0.00507	0.0317		-0.0219	-0.0467		0.000874	0.0851	

L.interstratelevel	(0.0253) -0.512* (0.306)	(0.0635)	(0.0357) -0.239 (0.181)	(0.0506) -0.798** (0.361)	-1.0618** (0.512)	(0.0286) -0.0282 (0.138)	(0.0469) 0.360** (0.147)	1.935 (6.0264)	(0.0366) -0.0468 (0.0333)	(0.0636) -0.0535 (0.0733)
L.cbassetsgrowth	-0.00158 (0.00261)	0.000408 (0.00477)	0.00167 (0.00250)	0.000563 (0.00356)		0.00662** (0.00275)	-0.000388 (0.00321)		0.00162 (0.00447)	-0.000339 (0.00935)
L.hhindex	-0.108 (2.335)	-0.0163 (3.917)	-2.073 (2.235)	0.301 (2.358)		1.141 (1.272)	2.125 (2.337)		-0.592 (0.994)	1.776 (1.812)
year 2012		-0.690 (1.328)					-2.098*** (0.674)			-2.213*** (0.741)
year 2013		-0.232 (1.351)		-0.236 (0.258)			-1.485** (0.640)			-1.091** (0.547)
year 2014		0.142 (1.571)		-0.212 (0.418)			-0.984 (0.813)			-1.611*** (0.522)
year 2015		0.00126 (0.686)		0.200 (0.198)			-0.914** (0.371)			-1.235** (0.487)
year 2016		-0.0704 (0.421)		0.101 (0.181)			-0.378* (0.216)			-0.573** (0.280)
year 2017		0.0718 (0.369)		-0.00229 (0.170)						
year 2018				0.111 (0.139)			0.0787 (0.198)			-0.120 (0.255)
year 2019		-0.0925 (0.152)					0.269** (0.127)			-0.734* (0.383)
Constant	28.29*** (9.836)		13.60 (8.503)			-17.73** (8.021)			22.79*** (7.655)	
Observations	395	283	722	582		182	143		812	634
R-squared	0.112		0.211			0.282			0.142	
No. of instruments		37		67			29			73
No. of groups		71		134			33			159
AR1 (p-value)		0.0586		0.0277			0.203			0.0675
AR2 (p-value)		0.144		0.551			0.334			0.616
Hansen-J (p-value)		0.149		0.190			0.115			0.148

Standard errors in parentheses

* p<0.10, ** p<0.05, *** p<0.010

Table 14: Full sample results with size dummies and with NIM as dependent variable

	Model 5			Model 6			Model 5			Model 6		
	Fixed effects: NIM	Two-step SYS-GMM: NIM	Long-run coefficients NIM	Fixed effects: NIM	Two-step SYS-GMM: NIM	Long-run coefficients NIM	Fixed effects: NIM	Two-step SYS-GMM: NIM	Long-run coefficients NIM	Fixed effects: NIM	Two-step SYS-GMM: NIM	Long-run coefficients NIM
L.nim	0.518*** (0.0328)	0.779*** (0.0485)	3.517*** (0.990)	0.513*** (0.0380)	0.772*** (0.0402)	3.379*** (0.770)	0.536*** (0.0326)	0.732*** (0.0764)	2.731** (1.0633)	0.533*** (0.0364)	0.780*** (0.0446)	3.552*** (0.925)
L.lassets	-0.229***	0.0162		-0.253***	-0.0299							

	(0.0863)	(0.0514)		(0.0880)	(0.0407)							
L.diffassets	0.298**	-0.0286		0.357**	0.499*	2.186*	0.243*	0.134		0.289**	0.612*	2.784*
	(0.139)	(0.308)		(0.146)	(0.267)	(1.183)	(0.138)	(0.513)		(0.142)	(0.352)	(1.559)
L.wstf	-0.00652***	-0.00435*	-0.0197*	-0.00557***	-0.00394**	-0.0172**	-0.00708***	-0.00419		-0.00621***	-0.00450**	-0.0205**
	(0.00179)	(0.00239)	(0.0101)	(0.00190)	(0.00176)	(0.00697)	(0.00168)	(0.00542)		(0.00180)	(0.00212)	(0.00867)
L.wstf x negativerate	-0.00128***	-0.000876		-0.000763	0.00108		-0.00140***	0.00115		-0.00100**	0.00112	
	(0.000441)	(0.00121)		(0.000469)	(0.00103)		(0.000438)	(0.00409)		(0.000471)	(0.00116)	
L.npl	0.00537*	0.00421					0.00581*	0.00100				
	(0.00308)	(0.00333)					(0.00305)	(0.00535)				
L.lptoassets				0.0372	0.0925**	0.405**				0.0389	0.108**	0.491**
				(0.0293)	(0.0447)	(0.192)				(0.0293)	(0.0521)	(0.226)
L.intincoprev	-0.000243	0.00184		0.000129	0.00370*	0.0162*	-0.00106	0.00683**	0.0255**	-0.000852	0.00424*	0.0193*
	(0.00184)	(0.00236)		(0.00159)	(0.00197)	(0.00865)	(0.00184)	(0.00287)	(0.0111)	(0.00160)	(0.00254)	(0.0106)
L.leverage	0.00759	0.0104		0.00696	0.00658		0.0127	0.0115		0.0146	0.00937	
	(0.00954)	(0.00843)		(0.00999)	(0.0114)		(0.00903)	(0.0167)		(0.00982)	(0.0129)	
L. efficiency	-0.000755	0.00113		-0.000427	0.00578***	0.0253***	-0.000157	0.00625*	0.0233*	0.000341	0.00660***	0.0301***
	(0.000916)	(0.00208)		(0.000863)	(0.00163)	(0.00796)	(0.000922)	(0.00325)	(0.0135)	(0.000844)	(0.00218)	(0.0110)
L.gdpgrowth	-0.0186**	-0.00642		-0.0184**	-0.000723		-0.0213***	-0.00757		-0.0219***	-0.00132	
	(0.00777)	(0.00677)		(0.00762)	(0.00626)		(0.00793)	(0.00784)		(0.00774)	(0.00635)	
L.inflation	-0.00508	0.000137		-0.00631	-0.00255		-0.00514	-0.00261		-0.00657	-0.00201	
	(0.00616)	(0.00417)		(0.00597)	(0.00370)		(0.00610)	(0.00544)		(0.00591)	(0.00436)	
L.interestrategy	0.0456***	0.0526***	0.237***	0.0478***	0.0623***	0.273***	0.0509***	0.0698***	0.260***	0.0541***	0.0576***	0.262***
	(0.0136)	(0.0114)	(0.0337)	(0.0130)	(0.0119)	(0.0385)	(0.0133)	(0.0180)	(0.0460)	(0.0129)	(0.0120)	(0.0466)
L.cbassetsgrowth	0.000938	-0.000381		0.000984	-0.000919		0.00114*	-0.000627		0.00122*	-0.00105	
	(0.000685)	(0.000832)		(0.000667)	(0.000774)		(0.000670)	(0.000913)		(0.000660)	(0.000747)	
L.hhindex	-0.248	0.176		-0.397	0.396***	1.734***	-0.188	0.326		-0.357	0.341**	1.553**
	(0.293)	(0.142)		(0.272)	(0.134)	(0.559)	(0.291)	(0.211)		(0.270)	(0.146)	(0.622)
Below median	0.177*	0.0619		0.186**	-0.0980							
	(0.0982)	(0.189)		(0.0916)	(0.132)							
1 st quartile							0.411***	0.0305		0.337**	-0.0186	
							(0.157)	(0.166)		(0.165)	(0.0890)	
2 nd quartile							0.363***	-0.0511		0.397***	-0.0390	
							(0.111)	(0.146)		(0.0997)	(0.0834)	
3 rd quartile							0.127*	-0.00276		0.150***	0.0723	
							(0.0656)	(0.209)		(0.0580)	(0.0765)	
year 2012		0.0321			0.0564			0.0529			0.0445	
		(0.0535)			(0.0504)			(0.129)			(0.0537)	
year 2013		0.0671			0.0727			0.0775			0.0645	
		(0.0520)			(0.0456)			(0.130)			(0.0484)	
year 2014		0.0995*			0.177***			0.157			0.194***	
		(0.0594)			(0.0512)			(0.133)			(0.0562)	
year 2015		-0.00949										
		(0.0288)										
year 2016		0.0397*			0.0486*			0.0286			0.0557*	

		(0.0233)		(0.0280)		(0.0339)		(0.0319)
year 2017		0.0458**		0.0625**		0.0299		0.0618*
		(0.0232)		(0.0283)		(0.0335)		(0.0316)
year 2018		0.0708***		0.0659**		0.0713*		0.0762**
		(0.0211)		(0.0307)		(0.0400)		(0.0346)
year 2019				0.00440		-0.0235		0.00729
				(0.0241)		(0.0361)		(0.0293)
Constant	5.013***	-0.0863	5.382***	0.220	1.112***	-0.367	1.068***	-0.413
	(1.482)	(0.902)	(1.509)	(0.754)	(0.174)	(0.325)	(0.175)	(0.295)
Observations	2873	2873	2944	2944	2913	2913	2986	2986
R-squared	0.361		0.376		0.357		0.370	
No. of instruments		106		208		98		195
No. of groups		530		539		534		544
AR1 (p-value)		0.00000076		0.00000140		0.00000750		0.00000089
AR2 (p-value)		0.480		0.442		0.565		0.454
Hansen-J (p-value)		0.180		0.144		0.165		0.102

Standard errors in parentheses

* p<0.10, ** p<0.05, *** p<0.010