LSE 'Europe in Question' Discussion Paper Series

Bank profitability in the Euro area: The asymmetric effects of common supervision

Ioanna Avgeri, Yiannis Dendramis and Helen Louri

LEQS Paper No. 170/2020

June 2021

Bank profitability in the Euro area: The asymmetric effects of common supervision

Ioanna Avgeri*, Yiannis Dendramis** and Helen Louri***

Abstract

In the years after the financial crisis low bank profitability has been a major issue. The increased regulation imposed in the wake of the crisis has often been accused of overburdening banks and contributing to low profitability. The euro area, consisting of 19 different economies, made a big step in 2014 when it adopted a common supervisory mechanism introducing a heavy regulatory framework. The scope of this paper is to examine the effect that the establishment of the Single Supervisory Mechanism (SSM) in 2014 has had throughout the profitability distribution of 78 directly supervised euro area banks. We employ unconditional quantile regression analysis with panel data covering the period 2011-2017. Our main findings indicate a robust positive effect of the SSM in the lower quantiles of the bank profitability distribution, while the effect in the upper quantiles depends on the profitability index examined. The introduction of the SSM was also found to reduce the probability of bank insolvency, the effect being stronger for weaker banks. Such positive consequences for profitability, stability and convergence should be taken into account by policy makers as we move towards the next reforms of the European Banking Union.

Keywords: European Banking Union, SSM, Bank profitability, quantile regression

---

*** Department of Economics, Athens University of Economics and Business**
Email: iavgeri@aueb.gr
**** Department of Economics, Athens University of Economics and Business**
Email: ydendramis@aueb.gr
***** Department of Economics, Athens University of Economics and Business**
Email: elouri@aueb.gr

Table of Contents

Acknowledgments

Research support from the Research Centre of the Athens University of Economics is gratefully acknowledged.

Bank profitability in the Euro area: the asymmetric effects of common bank supervision

1. Introduction

The eruption of the financial and sovereign debt crises in Europe, in 2008 and 2010 respectively, revealed the deficiencies of the supervisory and regulatory structure of the European financial sector. To prevent a similar crisis from reoccurring, the EU introduced a set of institutional reforms. These reforms are part of the European Banking Union (EBU), which is based on three pillars: a Single Supervisory Mechanism (SSM), a Single Resolution Mechanism (SRM) and a common European Deposit Guarantee Scheme (EDIS). The supervisory role of the first pillar officially started in November 2014 after assessing banks with the help of asset quality reviews and stress testing. Within the framework of the SSM all systemic banks in the EU are supervised according to the same standards. Thus, significant banks in the euro area are centrally supervised by the European Central Bank (ECB) with the National Competent Authorities (NCAs) providing assistance to the ECB (EC, 2013). The less significant financial institutions are indirectly supervised by the ECB, which oversees the consistency of NCAs' supervisory tasks.[1]

[1] For more on the direct and indirect supervisory role of the ECB and its decision-making governance see Petit (2019)

This institutional innovation was known and anticipated by the banking industry as the development and implementation of the SSM covered a considerable time period before its introduction in 2014. Recent literature suggests that during the preparatory phase the European banks adjusted their behavior and modified their activities in anticipation of the SSM. KPMG (2016) criticizes the new framework and argues that the price of greater resilience "achieved through these reforms is a large deadweight impact on banks' return on regulatory capital". On the other hand, Fiordelisi et al. (2017) provide evidence that banks which expected to fall within the remit of the SSM adjusted their lending activity, which subsequently affected positively their equity capital ratios. Finally, as presented in Avgeri et al. (2020) the SSM had an (unanticipated) positive effect on the profitability of the directly supervised banks in comparison to the indirectly supervised banks during the year of its launch.

In this study we attempt a more profound analysis of the effect that the introduction of the SSM has had on the profitability of the directly supervised banks. The reason why we analyze bank profitability so thoroughly is because it displayed a rapid decrease due to the financial crisis and rebuilding sustainable profitability levels is a significant step towards a resilient financial sector (Detragiache et al., 2018; Enria, 2021). Figure 1 illustrates how the return on assets (ROA) and the return on equity (ROE) of the SSM supervised banks of our sample evolved during the period 2011-2017. Profitability remained weak after the crisis and, for the banks that lie within the lower quantiles of ROA and ROE, it even displayed negative values. Before 2014 the profitability indices of the more profitable banks follow a different trajectory in comparison to the less profitable ones. After 2014, however, the profitability indices started to converge, displaying reduced inequality between the more profitable and less profitable banks.

In what follows we examine whether the observed profit improvement and profit convergence could be partly attributed to the introduction of the SSM. Focusing on the pool of European banks that are directly supervised by the ECB, we examine the effect of the SSM throughout the distribution of the banks' profitability indices, and in particular, ROA and ROE and their risk adjusted values as well as the corresponding Z-score. Our interest is on the role (unintentionally) played by the SSM among other important profitability determinants related to the macro and structural environment and bank-specific characteristics.

To gain a complete overview of the effect of the SSM we first perform our analysis using both ROA and ROE as alternative profitability indicators. In the case of ROA our results indicate that the more profitable banks benefited the most by the SSM. In the case of ROE the positive effect that the SSM has had on the profitability of the directly supervised banks was more pronounced for the less profitable banks. Second, we extend our examination replacing the dependent variable by the Z-score, which represents the number of standard deviations that a bank's rate of ROA has to fall for the bank to face insolvency. The role of the Z-score can be twofold. On the one hand it can be used as a robustness check, an approach also used by Elekdag et al. (2020). On the other hand it can be considered as a measure of bank riskiness, as a higher Z-score reflects a lower probability of insolvency.[2] Even though, as illustrated in Figure 2, it does not display intense fluctuations, examining it will provide indications regarding the effect of the SSM on the overall financial stability. Third, we used as dependent variables two alternative measures of performance, namely the risk-adjusted ROA and risk-adjusted ROE, given by ROA and ROE divided by the respective standard

[2] Studies using the Z-score as a risk indicator are, among others, the ones of Leroy and Lucotte (2017), Vasquez and Federico (2015), Delis et al. (2014), Kick and Prieto (2014), Demirguc-Kunt and Huizinga (2010).

deviation.[3] Finally, we use two different model specifications where we gradually add explanatory variables.

Our analysis will contribute first, to the Banking Union related literature, as it examines a topic of great significance for the EU financial sector, through a detailed and more individual-centered way for the banks involved in comparison to prior studies. We focus specifically on the asymmetric effect that the SSM has had on the profitability of the supervised banks applying unconditional quantile regression analysis, an approach which, to the best of our knowledge, has not been considered enough by the ongoing research pertaining to the implications of the recent EU institutional reforms. Second, our conclusions could be of use for other economies pondering about how to introduce new regulatory measures for bank supervision. As argued by many researchers of emerging economies (Mehta and Bhavani, 2017: Kohlscheen, et al., 2018; Fernandes et al., 2021) a credible and efficient regulatory framework is key for overall financial stability and bank performance.

The rest of this paper is structured in the following way: Section 2 presents a review of the relevant literature. Section 3 describes the data, the variables and the methodology used. Section 4 provides the results of the econometric analysis and section 5 concludes.

2. Literature Review

A significant amount of academic research in finance has been dedicated to understanding bank performance. A foundational theory of a profit maximizing bank in an oligopolistic setting is provided by the Klein-Monti model.[4] The empirical literature related to the determinants of bank profitability is rich and expanding as

[3] A similar approach has been used in Le Tu et al. 2019, Le Tu and Nguyen Dat 2020, Elekdag et al. 2020.

[4] Freixas and Rochet (2008) provide an elegant and exhaustive exposition of the model.

macroeconomic and structural conditions change and new developments are introduced in the overall institutional framework as well as in the way in which banks operate as financial entities. The selection of studies presented below is grouped according to the focus of their analysis.

2.1 Studies assessing external conditions and internal characteristics of banks

Among the earlier empirical studies seeking to understand what determines bank profitability are those of Molyneux and Thornton (1992) and Bourke (1989), that focus on European banks during 1986-1989 and on banks located in Europe, North America and Australia during 1972-1981 respectively. These studies, using linear models, analyze the influence of internal and external determinants on bank profitability. The results in Molyneux and Thornton (1992) suggest that the variables that exert a positive effect on profitability are capital ratios, nominal interest rates and government ownership, while they find evidence of an inverse relationship between profitability and liquidity. In addition, they find a positive relationship between staff expenses and before-tax return on assets. Bourke (1989) finds indications that capital ratios, liquidity ratios and interests rates have a positive effect on profitability, while staff expenses have an inverse relationship with pre-tax return on assets. His findings pertaining to the effect of concentration depend on the dependent variable used. In a broader context, Demirguc-Kunt and Huizinga (1999) study the relationship between a comprehensive set of determinants and interest margins and profits of banks located in 80 countries during 1988-1995. They include bank characteristics, macroeconomic variables, as well as different legal and institutional indices. In addition to the standard findings, they provide evidence that in developing countries foreign banks have higher margins and profits than domestic banks, while the opposite is observed in industrialized countries.

Focusing on Europe, Pasiouras and Kosmidou (2007) explore how financial characteristics and the overall banking environment affect bank profitability. Their sample consists of 584 domestic and foreign banks operating in 15 European countries over the years 1995-2001. Employing fixed effects estimation, they find indications that both domestic and foreign banks are affected by banks' specific characteristics and by the financial market structure and macroeconomic conditions, even though the profits of domestic and foreign banks are not affected in the same way and to the same extent by these determinants.

The question of low profitability related to European banks in comparison to their U.S. counterparts is investigated by Feng and Wang (2018). Their sample consists of 220 European banks and 301 U.S. banks over the years 2004–2014 and they use the O'Donnell (2012) decomposition approach. According to their findings the lower profitability of European banks can be attributed to their lower returns on earnings assets, higher funding costs, and lower scale efficiency. In addition, the observed deterioration of the relative profitability of European banks in the post-crisis period can be attributed to the decreased relative returns on earnings assets, the increased relative funding costs, and the declines in relative technical efficiency, scale efficiency, and residual mix efficiency. Furthermore, Elekdag et al. (2020) examine the determinants of bank profitability in 2007-2016 focusing on the significant banking institutions, which fall within the remit of the SSM. They employ ordinary least squares (OLS) and conditional quantile regression analysis. Their baseline results (OLS regression) indicate that the most reliable determinants of bank profitability are real gross domestic product (GDP) growth and the non-performing loans (NPL) ratio. The results from the quantile regression analysis indicate that the positive effect of an increase in real GDP growth and a decrease in NPL ratios will be larger for the less profitable banks. In a recent study Agoraki et al. (2021) analyze how the performance of banks operating in the core and periphery Eurozone countries is affected by internal and external determinants along with the Basel II agreement regulatory framework.

Conducting a generalized method of moments (GMM) dynamic panel estimation analysis over the period 2007-2016, they provide evidence that the regulatory framework plays a significant role. More restrictive regulations on bank activities exert a positive effect on bank performance. In addition, their findings suggest that among the most significant bank-specific determinants of bank performance are equity capital and bank size. Furthermore, their results indicate that banks which turn to short-run capital market funding are more fragile.

Several studies focus on how aspects related to bank management influence bank performance. Based on a sample of 98 banks with international presence and headquartered in 27 countries over the years 1994–2012, Gambacorta et al. (2014) analyze the way income diversification affects bank profitability. They find evidence of a positive correlation between diversification and profitability, once the diversification ratio is up to 30%. For the global systemically important banks (GSIBs) the positive effect of diversification is less significant compared to other banks. The role of market power is examined by Carbó Valverde and Rodríguez Fernández (2007) using a representative sample of banks from seven European countries over the years 1994-2001 and applying the seminal Ho–Saunders model (1981) to a multi-output framework. According to their findings there is evidence that the relationship between market power and profitability varies across specializations. Both market power and risk parameters affect bank margins with the introduction of financial innovations. In the same vein, Neves et al. (2020) analyze the determinants of performance and efficiency using a sample of 94 banks from Euro zone countries. Applying the generalized method of moments (GMM) and data envelopment analysis (DEA), they find evidence that the effects of the bank-specific determinants on efficiency depend on the macroeconomic environment.

Finally, few studies examine bank profitability in a single country context. Athanasoglou et al. (2008) examine the bank-specific, industry-specific and macroeconomic determinants of the profitability of the Greek banking sector over the period 1985-2001, incorporating in their empirical analysis the structure-conduct-performance (SCP) hypothesis and applying the generalized method of moments (GMM). They analyze the effects of these determinants on bank profitability and attempt to identify how the business cycle affects profitability, finding evidence of a positive effect, which is significant at the upper phase of the cycle. The determinants of bank profitability in Vietnam are explored by Batten and Vo (2019). Using a sample of 35 domestic Vietnamese commercial banks over the years 2006-2014 and applying fixed effects and GMM estimation methods, they find evidence that bank size, capital adequacy, risk, operating expenses and productivity exert a strong influence on profitability. Bringing the empirical analysis up to 2019, Le Tu and Nguyen Dat (2020) analyze the relationship between capital structure and bank profitability. They use a sample of 30 Vietnamese banks from 2007 to 2019 and apply a quantile regression approach. Their findings suggest an inverted U-shaped relationship between profitability and capital adequacy, which is only significant at the 90th quantile of the profitability distribution.

2.2 Studies with emphasis on structural characteristics

Another stream of literature focuses on how structural changes in markets and policies affect bank profitability. The relationship between profitability and market structure is the focal point in the study of Mirzaei et al. (2013). They analyze the effects of market structure on profitability and stability by incorporating the traditional structure-conduct-performance (SCP) and relative-market-power (RMP) hypotheses. Their sample consists of 1929 banks both from advanced and emerging economies during the period 1999-2008. Their results indicate that, as far as the advanced economies are concerned, greater market share leads to higher bank profit rates, but it has no significant impact on bank profitability in emerging markets. In addition, they

estimate a negative effect of concentration on profits in the emerging economies and an insignificant effect on bank profitability in advanced markets. Regarding the stability of banks, there is evidence of a negative relationship between concentration and bank soundness in advanced economies.

The role of financial structure in bank performance, measured by bank profitability and bank interest margins, is also analyzed by Demirguc-Kunt and Huizinga (2000). Applying simple means tests and regression analysis on a dataset that includes bank observations from 44 countries, during the period 1990-1997, they reveal that the degree of development of the national financial systems affects bank performance. Berger et al. (2000) develop a methodology to explore the sources of persistence of profits in the US banking sector. They use annual Call Report data over the period 1969-1997 for all domestically chartered US commercial banks. Their findings suggest that market power in output markets derived from impediments to product market competition generated persistence at the low end of the performance distribution. On the other hand, market power in input markets derived from informational opacity generated persistence at the high end of the distribution. In addition, according to their results, sources of persistence can be considered the local, state, and regional/macroeconomic shocks both for the high and low ends of the distribution. Regulatory geographic restrictions appear to have contributed little to the persistence of profits.

The way in which monetary policy affects bank profitability is explored by Borio et al. (2017). Using a sample of 109 large international banks over the period 1995–2012 and employing the dynamic System Generalized Method of Moments (S-GMM) panel methodology, they find indications of a positive relationship between interest rate structure and bank profitability. In addition, they allow for non-linearities in the relationship between interest rates and bank profitability and their findings indicate

that the effect of interest rates on profitability is particularly large when rates are low. Another study about how conventional and unconventional monetary policy in the euro area affects bank profitability was conducted by Altavilla et al. (2019). According to their main conclusion, monetary policy easing is related to lower bank profits only in the case where there are no appropriate controls for the endogeneity of the policy measures to expected macroeconomic and financial conditions. The effect of the financial crisis combined with the type of ownership is examined by Dietrich and Wanzenried (2011). They study the determinants of bank profitability using GMM estimation techniques and focusing on 372 banks in Switzerland over the years 1999-2009 including in their analysis the impact of the financial crisis. According to their findings, important factors that affect bank profitability are operational efficiency, growth of total loans, funding costs, the business model and the effective tax rate. Furthermore, they find evidence that during the crisis state-owned banks performed better than privately owned banks. In addition, credit quality indicators did not have a significant effect on profitability before the crisis, while during the crisis they had a negative effect on profitability. Similarly, they find evidence that the yearly growth of deposits had a significant negative effect on profitability during the crisis years.

2.3 The role of changes in regulation and the implications of the SSM

Another important stream of literature explores the way in which regulation and supervision affect bank performance and overall efficiency. Barth et al. (2013), examine banks from 72 countries during 1999-2007. According to their main results there is evidence that regulatory restrictions on bank activities decrease efficiency, while stricter capital requirements increase it. In addition, their findings suggest that strengthening supervisory power has positive effects on efficiency in countries where supervisory authorities are more independent. They also find evidence of a positive relationship between market monitoring and bank efficiency. Regulatory changes are also scrutinized by Ongena et al. (2013). They examine the relation between home-country regulation and supervision and bank lending standards abroad. They analyze

business lending by 155 banks to 9613 firms across 16 countries. Their findings indicate that lower entry barriers, tighter restrictions on bank activities and higher minimum capital requirements in domestic markets are associated with lower bank lending standards abroad. Focusing on the cost of financial intermediation, Demirguc-Kunt et al. (2004) examine how financial regulation, banking sector concentration and institutional development affect bank efficiency. They use generalized least-squares estimation and their dataset comprises banks from 72 countries over the period 1995-1999. Their results indicate that, among other determinants, regulatory restrictions increase the cost of financial intermediation, while they find mixed evidence on the relation between concentration and efficiency.

A more recent and growing stream of literature focuses specifically on the institutional changes introduced by the Banking Union and especially the SSM and their implications for the banks involved. Fiordelisi et al. (2017) study how the lending behavior and capitalization of the European banks have been affected during the period of the SSM launch. Their sample is composed of 336 banks over the period 2011-2014 and they use difference-in-differences estimation. Their findings disclose that the SSM supervised banks reduced their lending activities more than the group of banks supervised by the NCAs. Splitting total loans into reserves for loan losses and net loans, their results indicate that the SSM supervised banks reduced both these variables in anticipation of the SSM launch. Regarding banks' capitalization, their findings reveal a positive effect on equity capital ratios without a similar statistically significant effect on equity capital levels.

The effect of the introduction of the SSM on stock prices provides an alternative way to examine performance changes. In this vein, Carboni et al. (2017) explore whether the Comprehensive Assessment (CA) before the introduction of the SSM managed to produce valuable information for the market and whether it had a positive effect on

the stock price of the banks involved. Conducting treatment effect analysis on a sample of 158 listed institutions of which 50 were involved in the CA, they find evidence that the CA increased transparency but their findings also suggest that there was a negative market reaction for the directly supervised banks. Furthermore, Abad et al. (2020) analyze how stock market returns were affected by the main steps during the SSM development and implementation. They also explore its impact on systemic risk, overall risk of the EU market and the interdependence across countries. Their data refer to the daily stock price indices from 27 European countries over the period 2008-2014 on which apply a regulatory event study by estimating a dummy-extended seemingly unrelated regression (SUR) model. Their results disclose negative return responses and increased risk, reactions that differ among the different steps of the process of the SSM development and establishment. Additionally, these reactions were heterogeneous across EU countries.

The effect of the SSM on the market power of banks using the Lerner index and the Boone indicator was examined by Okolelova and Bikker (2019). Their analysis covers the years 2013-2016. The results when the Lerner index is employed provide evidence of a decrease in the market power of the directly supervised banks in the 2 years after the introduction of the SSM, in Austria, France, Germany and Spain. Using the Boone indicator, they find evidence of an increase in competition among the directly supervised institutions in Austria, France, Germany, Italy and Spain.

Finally, in a recent and differently focused study, Tziogkidis et al. (2020) examine the productivity and convergence behavior of the banks that fall within the remit of the SSM. They use a sample of directly supervised banks over the years 2011-2017 and they introduce a novel approach for testing for β-convergence in productivity, efficiency and technology. Their findings provide evidence of absolute convergence, which subsequently indicates the enhancement of integration.

In a nutshell, the existing empirical literature indicates that bank profitability is affected by regulatory changes and that the institutional restructuring due to the introduction of the SSM has had implications for European banks affecting their performance. It also indicates that factors that affect profitability may not have the same effect throughout the profitability distribution.

3. Data, econometric model and empirical methodology

3.1 Data

We use bank-specific and macroeconomic annual data for the period 2011-2017 from 18 member countries of the euro area. [5] Our dataset includes bank specific characteristics for 78 banks, which belong to the group of banks that in 2014 were classified as significant and their supervision was directly transferred to the ECB. For a bank to be categorized as significant it needs to fulfill one of the following criteria:[6]

1. The total value of its assets exceeds €30 billion.
2. The ratio of the bank's total assets to GDP of the member state, in which it is located, exceeds 20%, unless the total value of its assets is below €5billion.
3. The bank is one of the three most significant financial institutions of the member state in which it is located.

Table 1 presents all the variables included in our analysis and the sources from which they have been collected. To be included in our dataset a bank had to have non-missing

[5] We examine banks from Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Malta, Netherlands, Portugal, Slovakia, Slovenia and Spain. We excluded banks from Luxembourg because they have a different business model.

[6] ECB (2014).

values for all our variables of interest. Tables 2 and 3 present the summary statistics and the correlation matrix respectively.

3. 1 Econometric model

For our empirical analysis we estimate two alternative baseline specifications based on the following equation:

$$Y_{i,c,t}=\beta_0+\beta_1 ssm_t + \beta_2 X_{i,c,t-1} + \beta_3 M_{c,t-1} + Other_{i,c,t} \quad (1)$$

We define by $Y_{i,c,t}$ the profitability indicator for bank i, in country c, in period t. The main dependent variable is ROA and alternatively, as a robustness check ROE is used. Additionally, we examine the Z-score, which represents the number of standard deviations that a bank's rate of ROA has to fall for the bank to face insolvency. Therefore, a higher Z-score indicates a lower probability of insolvency. It is constructed as the sum of the mean rates of ROA (μ_{ROA_i}) and the equity to total assets ratio($eqta_{i,t}$) divided by the standard deviation of ROA (SD_{ROA_i}):[7]

$$Z\text{-}score_{i,t} = \frac{\mu_{ROA_i}+eqta_{i,t}}{SD_{ROA_i}} \quad (2)$$

As an additional robustness test, we replace the dependent variable by the alternative performance measures $ROA/SD_{i,t}$ and $ROE/SD_{i,t}$ given by ROA and ROE divided by the respective standard deviation:

$$ROA/SD_{i,t} = \frac{ROA_{i,t}}{SD_{ROA_i}} \quad \text{and} \quad ROE/SD_{i,t} = \frac{ROE_{i,t}}{SD_{ROE_i}} \quad (3)$$

[7] For more on the approaches related to the construction of the Z-score see Lepetite and Strobel (2013), Lepetite et al. (2021).

The dummy variable ssm_t indicates the years after the introduction of the SSM. It takes the value 1 from 2014 onward, and 0 otherwise.

The vector of bank-specific variables, $X_{i,c,t-1}$, comprises the natural logarithm of total assets as an indicator of bank size, the ratio of equity to total assets as a proxy for bank's capital, the ratio of loan loss reserves to gross loans as an indicator of bank's assumed risk and asset quality, and the cost to income ratio as an indicator of operational efficiency.

The vector of macroeconomic variables, $M_{c,t-1}$, includes the growth rate of each country's real Gross Domestic Product (GDP), the profit tax ratio (corporate taxes paid as a percentage of corporate profits), the Herfindahl-Hirschman Index[8] of market concentration and the Government Effectiveness Index as an institutional quality indicator.[9]As a way of statistical assessment of our results, first we set β_3 equal to zero and estimate equation (1) without accounting for the macroeconomic variables. Then, we repeat the estimation controlling for both bank-specific and macroeconomic variables.

Finally, $Other_{i,c,t}$ includes bank fixed effects and a residual term. The baseline regressions regarding profitability have also been conducted including time fixed effects. However, performing the F-test for their statistical significance has shown that they do not statistically differ from zero when we estimate the full specification of our

[8] We use the annual HHI of each country's credit institutions as provided by the ECB.

[9] According to the definition of Kaufmann et al. (2010), it represents the quality of public services, the quality of civil service and its level of independence from political pressure. It also indicates the government's credibility since it shows the quality of policy formulation and the commitment to implementing such policies.

model.[10] Therefore, in what follows, we focus on the specifications that include individual fixed effects.

3.3 Empirical Methodology

We conduct the empirical analysis by employing panel data estimation methods. First we examine the relationship between the institutional changes introduced by the SSM and the profitability indices using OLS estimation with individual fixed effects to derive our baseline results. This method, however, does not capture the effect throughout the profitability distribution. In addition, as depicted in the summary statistics of Table 2 and in Figure 3, the distributions of ROA and ROE are skewed in comparison to the normal distribution. Similarly, we observe a skewed distribution, in comparison to the normal, for the Z-score. For a more formal examination we conducted the test proposed by Alejo et al. (2015), which can be considered as an alternative to the Jarque-Bera normality test when analyzing panel data. The normality assumption is rejected at p=0.00 for ROA and ROE in the case of profitability, as well as for the Z-score in the case of the probability of insolvency. [11] The unconditional non-normality of the dependent variables might be seen as an indication of the asymmetry in the unconditional distributions of profitability. This suggests a more intricate econometric technique to deal with such distributional characteristics, rendering the quantile regression appropriate for the current study.

[10]The p-values according to which we fail to reject the null hypothesis that the statistical significance of the time fixed effects is equal to zero, are equal to 0.97 for the case of ROA and 0.31 for the case of ROE. In the interest of brevity, the related tables have been suppressed but are available upon request.

[11]To preserve space, the results of the tests are not presented in the tables but can be provided upon request.

Since we are interested in the effect of the SSM introduction on the different quantiles of the directly supervised banks' overall profitability distribution, we used the unconditional quantile regression method proposed by Firpo et al. (2009), a well-suited approach when we are interested in the distributional impact related to a newly introduced policy. The reason why this method suits our analysis better than the other popular approach, the conditional quantile regression, is because we attempt to examine whether the effect of the SSM was different among banks with different levels of profitability throughout the unconditional profitability distribution of our sample. We are interested in exploring whether the SSM affected the inequality of profits among the directly supervised banks. Since conditional quantile regression estimates cannot be used to assess the impact of the SSM on the corresponding unconditional quantile of the profitability distribution, we employed the unconditional quantile regression method.[12]

The foundational concept of this approach is the Influence Function (IF) which represents the effect of an individual observation on a distributional statistic of interest, $v(F_Y)$, where F_Y is the cumulative distribution function (CDF) of the dependent variable. In our case the distributional statistic of interest is the τ-th quantile of the unconditional distribution of the outcome variable $Y_{i,c,t}$. The unconditional quantile operator is defined as:

$$Q_\tau[.] = inf_{\mathrm{q}}\ Pr\,[\cdot \leq q] \geq \tau \qquad (5)$$

The population τ-th quantile of the unconditional distribution of $Y_{i,c,t}$ is:

[12] Empirical applications of this method can be found, among others, in the studies of Firpo et al. (2011), Ma et al. (2019), Dong et al. (2020), Seya et al. (2020), Qiaoling Kang et al. (2021).

$$q_\tau = Q_\tau[Y_{i,c,t}] \quad (6)$$

The IF for the τ-*th* quantile is given by:

$$IF(Y_{i,c,t}, q_\tau) = \left(\tau - \mathbb{I}\{Y_{i,c,t} \leq q_\tau\}\right)/f_Y(q_\tau) \quad (7)$$

where $\mathbb{I}\{.\}$ is an indicator function and $f_Y(.)$ is the density of the marginal distribution of $Y_{i,c,t}$. For the unconditional regression analysis we replace the outcome variable by the Recentered Influence Function (RIF), which is a transformation of the outcome variable. For the recentering we need to add the distributional statistic to the IF and for the population τ-*th* quantile the RIF is:

$$RIF(Y_{i,c,t}; q_\tau) = q_\tau + IF(Y_{i,c,t}, q_\tau) \quad (8)$$

Using the RIF we can compute the effect on a distributional statistic v, when the distribution of the outcome variable $Y_{i,c,t}$, changes after a change in the distribution of the covariates $X_{i,c,t}$. For the case of quantiles, by applying a regression of $RIF(Y_{i,c,t}; q_\tau)$ on $X_{i,c,t}$, we can consistently estimate the effect of $X_{i,c,t}$ on the unconditional τ-*th* quantile of $Y_{i,c,t}$. The conditional expectation of the $RIF(Y_{i,c,t}; q_\tau)$ modeled as a function of the explanatory variables, $E[RIF(Y_{i,c,t}; q_\tau)|\ X_{i,c,t}]$, is the RIF-regression model, which in the case of quantiles is considered the unconditional quantile regression. Unlike the case of the estimates obtained by a conditional quantile regression, which cannot be used to estimate the effect of a covariate on the corresponding unconditional quantile, the τ -*th* quantile RIF-regression aggregates to the corresponding unconditional quantile of interest.

4. Empirical Results

4.1 Baseline OLS Regression Analysis

As already shown by Avgeri et al. (2020), there is evidence that the establishment of the SSM in 2014 had a positive effect on the profitability of the directly supervised banks in comparison to banks supervised by national supervisors that year. In this section we conduct a more in-depth analysis on the sample of the directly supervised banks starting with the baseline OLS estimation.[13] As reported in Table 4, the institutional reforms introduced by the SSM appear to be among the statistically significant variables that affect profitability even when we examine a more extended period of time before and after their introduction. Our findings suggest a positive and statistically significant effect of the SSM on profitability for both specifications.

When we control for the set of bank-specific variables (Column 1), we observe a positive and statistically significant effect on ROA at the 1% level. It indicates that the expected mean effect of the SSM was a 0.32 increase of the profitability of the directly supervised banks. The effect of the SSM remains positive and statistically significant as we add the macroeconomic variables (Column 2), providing evidence of a 0.38 increase in ROA. Regarding ROE, a positive and statistically significant effect at the 1% level for the two specifications is estimated. As presented in Column 3, there is evidence of a 0.55 increase in the ROE of the directly supervised banks when we control for the bank-specific variables, and a 0.63 increase when the macroeconomic variables are included. As far as the other determinants of profitability are concerned,

[13] All regressions include bank fixed effects, the estimates of which, in the interest of brevity, are not reported in the tables, but can be provided upon request. In addition, for the OLS estimations, in order to avoid distortions of outliers, we winsorize all variables at the 1% level. The positive effect of the SSM is robust even without winsorization and the related results are available upon request.

size is the only one that appears to exert a statistically significant effect on both profitability indices. Its effect is found to be negative, something that could be attributed to the fact that the SSM supervised sample is composed of banks that are relatively large, therefore size may cause rigidity and managerial inefficiency.

Replacing the dependent variable with the risk-adjusted profitability metrics reinforces our results, as reported in Table 5. Columns 1 and 2 depict the results for the Z-score. As it is negatively related to the probability of insolvency, it provides indications about the effect of the SSM on the level of bank risk as well as on the overall stability. In Table 5 there is evidence of a positive and statistically significant effect of the SSM on the Z-score at the 1% level for the two specifications estimated. The results in Column 1 indicate a 3.16 increase in the Z-score of the directly supervised banks. Adding the macroeconomic variables our results indicate a 3.25 increase in the Z-score of the SSM supervised banks. Since a higher Z-score reflects a lower probability of insolvency, these findings suggest that the stability of the euro area banking sector has increased after the introduction of the SSM. In addition, since the Z-score is considered a risk-adjusted variant of ROA, this estimation can be seen as a validity assessment of the results presented in Table 4. Similarly, regarding the risk-adjusted ROA and ROE (ROA/SD and ROE/SD respectively), our findings indicate a positive and statistically significant effect after the introduction of the SSM, reinforcing the results related to bank profitability.

From this point on the focus of our analysis will be the second specification where we include the bank-specific and the macroeconomic variables as well as bank fixed effects. We focus on this specification as it is more inclusive and shows a better fit.

4.2 Unconditional Quantile Regression Analysis

Given the skewed distribution of our dependent variables we conduct a more detailed examination of the positive effect that the SSM has had on the profitability and stability of the directly supervised banks, using unconditional quantile regression analysis. At

this point we are interested in exploring which banks, among the directly supervised ones, were more affected by the new institutional regime in the years that followed its establishment. We examine ROA and ROE as alternative profitability indicators and the Z-score as an alternative but also as a stability indicator and we report the results for the 25th, 50th and 75th quantiles. To facilitate comparison, the first column of each table reports the baseline results. Table 6 reports the results for the three quantiles of interest of the distribution of ROA, which indicate a positive and statistically significant effect across all quantiles. The absolute value of the coefficients on SSM increases monotonically, suggesting that banks with higher ROA benefited the most.

Examining ROE as a robustness test (Table 7), we observe a positive and statistically significant effect of the SSM across the 25th to the 50th quantiles. As far as the 75th quantile regression of the profitability distribution is concerned, we observe a positive but not statistically significant effect of the SSM on the most profitable directly supervised banks. Moreover, the magnitude of the estimated coefficient of the effect of the SSM decreases as we move towards the upper quantile of the profitability distribution, implying a stronger response by banks with lower ROE. It may be the case that less profitable banks have benefited more from improved regulation and possibly from improved credibility extended to them by the common supervision. Credibility leads to easier market access and reduced financing costs, thus increasing profits.

Regarding the Z-score (Table 8) our results indicate a similar pattern. While the SSM is found to exert a positive effect on the Z-score of the banks within the 25th quantile, thereby reducing the probability of insolvency, this effect is positive but not statistically significant as we move towards the upper quantiles of the distribution. The interpretation here could be that weaker banks (in terms of solvency) benefited the most by the introduction of the SSM.

The estimated coefficients of the other profitability determinants, when statistically different from zero, are in accordance with the findings of the related literature. In particular, size, one of the most significant determinants of profitability, in most cases is found to be negatively related to profitability. As supervised banks are already of relatively large size, it is possible that larger size may cause inefficiencies (Feng and Wang 2018, Berger et al. 1987). The effect of the cost to income ratio, when significant, varies inversely to bank profitability in agreement with Koutsomanoli-Filippaki and Mamatzakis (2011). Equity to total assets is positively related to the Z-score as it is expected to reduce the probability of insolvency. In addition, it is negatively related to ROE hinting at the cost of keeping higher capital ratios. In general, the expected net effect of this ratio on the profitability indices can be either positive or negative, as explained in Dietrich and Wanzenried (2011). The growth rate of real GDP exerts a positive effect on profitability, which is consistent with Elekdag et al. (2020) and Altavilla et al. (2018). Banking concentration (HHI) has a negative effect on ROA and ROE, probably because, as argued in Barth et al. (2013) and Karadima and Louri (2020), there are fewer incentives for managers to improve performance in a market with concentrated power.

To sum up, our main findings demonstrate that the establishment of the SSM had an asymmetric effect across the profitability distribution of supervised banks. Regarding ROA, there is evidence that there was a stronger positive effect for the banks in the upper quantiles. This result is not observed in the case of ROE, where our findings suggest that the less profitable banks have benefited the most by the introduction of the SSM. A reason behind this difference could be the possible adjustment pertaining to the financial leverage that the directly supervised banks had to adopt due to the changes introduced by the SSM. Leverage was among the key indices, along with funding and risks related to liquidity, which were examined by the supervisory assessment during the preparatory steps before the SSM implementation. In addition, the powers of the supervisory role of the ECB include enforcing compliance with

prudential requirements such as, among others, exposure limits, liquidity requirements and leverage (Tressel 2014). Pagratis et al. (2020), using a sample of both European and US banks, which covered the years 2001-2013, provide evidence that banks use leverage to reach ROE targets, a common strategy in the banking industry. Since ROE = ROA × Leverage, banks with low ROA have the incentive to employ leverage adjustments towards their ROE targets. This result was particularly apparent among the larger banks and especially before the crisis. Given that leverage is generally negatively related to ROA and positively related to ROE (Athanasoglou et al. 2008, Sundararajan et al. 2002) and its monitoring falls within the powers of the ECB, our findings could indicate that the banks within the upper quantile of the profitability distribution reduced leverage the most, which subsequently exerted a negative effect on ROE of the more profitable banks. This indirect effect could have been captured by our policy variable (ssm_t).

In both cases however the positive and statistically significant effect remains robust for the banks within the lower and middle quantiles. This may suggest that the less profitable banks were not managing their resources and activities in the most efficient way and the adjustments they had to make within the SSM framework formed the conditions for increased efficiency and hence increased profitability. Furthermore, improved supervision and efficiency may have brought higher credibility in the market, thus lowering financing costs and causing a second round of increased profits.

Similarly, examining the Z-score, we find evidence that the stability of the weaker banks was enhanced the most, while the effect diminishes towards the upper quantiles. This result could also be the outcome of the improved supervision and efficiency, which in turn, may have increased credibility and improved solvency. The more pronounced effect in the case of the least profitable banks can be thought of as a

step towards financial integration, reinforcing the stability of the European financial sector.

5. Concluding remarks

Starting with the problem of low bank profitability and the often discussed accusations of an overburdening regulatory framework, in this study we attempt to dissect the effect that the implementation of a new demanding framework imposed by the SSM in 2014 has had on the profitability of the euro area directly supervised banks. Using unconditional quantile regression analysis on panel data, we found that different segments of the profitability distribution were affected in a positive but asymmetric way by the SSM.

Focusing on ROA, the positive effect of the SSM increases as we move towards more profitable banks. In the case of ROE the positive effect of the SSM was more apparent at the lower tail and the center of the profitability distribution, while the most profitable banks appear to have benefited less (if at all) by the uniform supervisory regime. Even though in both cases our findings suggest that banks within the 25th and 50th quantiles benefited from the introduction of the SSM, they are mixed regarding the banks at the upper quantile. Finally, there were also indications that the existence of the SSM reduced the probability of insolvency and more so for the least profitable banks.

It may be the case that the banks with lower profitability have benefited more from improved regulation and possibly from improved credibility extended to them by the common supervision. Credibility leads to easier market access and reduced financing costs, thus increasing profits and supporting solvency. Still, a more profound analysis of the observed profit convergence remains an interesting topic for further research.

The SSM is, thus, found to have enhanced bank profitability and financial stability in the years following its launch. Such positive effects should be taken under consideration by the policy makers as we move towards the next reforms of the European Banking Union.

References

Abad P., García-Olalla M. and Robles M.D. (2020). Does the Single Supervisory Mechanism Reduce Overall Risk in the European Stock Market? *Global Policy*, 11: 39-51.

Agoraki M-EK, Kouretas GP, Tsamis A. (2021). The determinants of performance in the Eurozone banking sector: Core versus periphery Eurozone economies. *International Journal of Finance and Economics*, 26: 416– 429.

Alejo J., Galvao A., Montes-Rojas G., Sosa-Escudero W. (2015). Tests for Normality in Linear Panel Data Models. *Stata Journal*, 15(3): 822-832.

Altavilla C., Boucinha M., Peydro J-L. (2018). Monetary policy and bank profitability in a low interestrate environment. *Economic Policy*, 33: 531-586

Athanasoglou P., BrissimisS. and Delis M. (2008). Bank-Specific, Industry-Specific and Macroeconomic Determinants of Bank Profitability. *Journal of International Financial Markets, Institutions and Money*, 18(2): 121-136.

Avgeri I., Dendramis Y. and Louri H. (2020). The Single Supervisory Mechanism and its implications for the profitability of European banks. *Bank of Greece Working* Papers no. 284.

Barth J., Lin C., Ma Y., SeadeJ. and Song F. (2013). Do bank regulation, supervision and monitoring enhance or impede bank efficiency? *Journal of Banking and Finance*, 37(8): 2879-2892.

Batten J., Vo X.V. (2019). Determinants of bank profitability – Evidence from Vietnam. *Emerging Markets Finance and Trade*, 55: 1417-1428.

Berger A. N., Bonime S.D., Covitz D.M., Hancock D. (2000). Why are bank profits so persistent? The roles ofproduct market competition, informational opacity, and regional/macroeconomic shocks. *Journal of Banking and Finance*, 24:1203-1235.

Berger, A.N., Hanweck, G.A., Humphrey, D.B., 1987. Competitive viability in banking: Scale, scope and product mix economies. *Journal of Monetary Economics*. 20: 501-520.

Borio C., Gambacorta L., Hofmann B. (2017).The influence of monetary policy on bank profitability. *International Finance*, 20(1): 48-63.

Bourke P. (1989). Concentration and other determinants of bank profitability in Europe, North America and Australia. *Journal of Banking and Finance*, 13: 65-79.

Carbó Valverde, S., Rodríguez Fernández, F. (2007). The determinants of bank margins in European banking. *Journal of Banking and Finance*, 31: 2043–2063.

Carboni M., Fiordelisi F., Ricci O., Stentella Lopes F.S. (2017). Surprised or Not Surprised? The Investors' Reaction to the Comprehensive Assessment Preceding the Launch of the Banking Union. *Journal of Banking and Finance*, 74: 122–132.

Delis M.D., Hasan I., Tsionas E.G. (2014). The Risk of Financial Intermediaries. *Journal of Banking and Finance*, 44: l–l2.

Demirguc-Kunt, A. and Huizinga, H. (1999). Determinants of commercial bank interest margins and profitability: some international evidence. *The World Bank Economic Review*, 13(2): 379-408.

Demirguc-Kunt, A., Huizinga, H. (2000). Financial Structure and Bank Profitability, *World Bank Policy Research Working Paper* no. 2430.

Demirguc-Kunt A., Laeven L., Ross Levine R.(2004) Regulations, market structure, institutions, and the cost of financial intermediation. *Journal of Money, Credit and Banking*, 36 (3): 593-622.

Demirguc-Kunt, A., Huizinga, H. (2010). Bank activity and funding strategies: the impact on risk and returns. *Journal of Financial Economics*, 98(3): 626-650

Detragiache E., Tressel T., Turk-Ariss R. (2018). Where have all the profits gone? European bank profitability over the financial cycle. *International Monetary Fund Working Paper* no. 18/99.

Dietrich A., Wanzenried G. (2011). Determinants of bank profitability before and during the crisis: Evidence from Switzerland. *Journal of International Financial Market, Institutions and Money*, 21: 307-327.

Dong X., Li C., Yoon S.M. (2020). Asymmetric dependence structures for regional stock markets: An unconditional quantile regression approach. The North American *Journal of Economics and Finance*, 52: 101-111.

Elekdag S., Malik S., Mitra S. (2020). Breaking the Bank? A probabilistic Assessment of Euro Area Bank Profitability. *Journal of Banking and Finance*, 20: 105-949.

Enria, A. (2021). Introductory statement. Hearing at the European Parliament Economic and Monetary Affairs Committee, 23 March 2021.

European Central Bank (2014). Aggregate report on the comprehensive assessment.

European Council (2013). Council approves single supervisory mechanism for banking union. PRESSE 389.

Feng G., Wang C. (2018). Why European banks are less profitable than U.S. banks: A decomposition approach. *Journal of Banking and Finance*, 90: 1-16.

Fernandes, G., dos Santos Mendes, L., de Oliveira Leite, R., (2021). Cash holding and profitability of banks in developed and emerging markets. *International Review of Economics and Finance*, 71: 880-895.

Fiordelisi F., Ricci O., Stentella Lopes F. S. (2017). The Unintended Consequences of the Launch of the Single Supervisory Mechanism in Europe. *Journal of Financial and Quantitative Analysis*, 52 (6): 2809-2836.

Firpo S., Fortin N., Lemieux T. (2009). Unconditional Quantile Regressions. *Econometrica*, 77(3): 953-973.

Firpo S., Fortin N., Lemieux T. (2011). Occupational tasks and changes in the wage structure. Institute for the Study of Labor (IZA) Discussion Paper no. 5542.

Freixas, X., Rochet, J. C. (2008). Microeconomics of banking, Second Edition. MIT Press: Cambridge, Massachusetts.

Gambacorta L., Scatigna M., Yang J.(2014). Diversification and bank profitability: a nonlinear approach. *Applied Economics Letters*, 21(6): 438-441.

Karadima, M.and Louri, H. (2020). Non-performing loans in the euro area: Does bank market power matter? *International Review of Financial Analysis*, 72: 101593.

Kaufmann D., Kraay A., Mastruzzi M. (2010). The Worldwide Governance Indicators: Methodology and Analytical Issues. *The World Bank Policy Research Working Paper* no. 5430.

Kick T., Prieto E. (2015). Bank Risk and Competition: Evidence from Regional Banking Markets. *Review of Finance*, 19 (3): 1185–1222.

Kohlscheen, E., Murcia, A., Contreras, J. (2018). Determinants of bank profitability in emerging markets. *BIS Working Paper* 686.

Koutsomanoli-Filippaki A.I. and Mamatzakis E.C. (2011). Efficiency under quantile regression: What is the relationship with risk in the EU banking industry? *Review of Financial Economics,* 20: 84-95.

KPMG (2016). The profitability of EU banks.

Lepetit L., Strobel F. (2013). Bank insolvency risk and time-varying Z-score measures. Journal of International Financial Markets, *Institutions and Money*, 25: 73-87.

Lepetit L., Strobel F., Thu Ha Tran (2021). An alternative Z-score measure for downside bank insolvency risk. *Applied Economics Letters*, 28(2): 137-142.

Leroy A., Lucotte Y. (2017). Is there a competition-stability trade-off in European banking? *Journal of International Financial Markets, Institutions and Money*, 46: 199-215.

Le Tu D., Tran S. H., Nguyen L. T. (2019). The impact of multimarket contacts on bank stability inVietnam. Pacific *Accounting Review*, 31: 336–57.

Le Tu D., Nguyen Dat T. (2020). Capital structure and bank profitability in Vietnam: A quantile regression approach. *Journal of Risk and Financial Management*, 13(8): 1-17.

Ma W., Renwick A., Greig B. (2019). Modelling the heterogeneous effects of stocking rate on dairy production: an application of unconditional quantile regression withfixed effects. *Applied Economics*, 51(43): 4769-4780.

Mehta, A. and Bhavani, G. (2017), What determines bank profitability? Evidence from emerging markets – The case of the UAE banking sector. *Accounting and Finance Research*, 6(1): 77-88.

Mirzaei A., Moore T., Liu G. (2013). Does market structure matter on banks' profitability and stability? Emerging vs. advanced economies. *Journal of Banking and Finance*, 37: 2920-2937.

Molyneux P. and Thornton J. (1992). Determinants of European bank profitability: A note. *Journal of Banking and Finance,* 16: 1173- 1178.

Neves M.E.D, Gouveia M.D.C., Proença C.A.N. (2020). European Bank's Performance and Efficiency. *Journal of Risk and Financial Management*, 13(4), 67.

Okolelova I., Bikker J. (2020). The single supervisory mechanism: Competitive implications for the banking sectors in the euro area. *International Journal of Finance and Economics,* 1-18.

Ongena S., Popov A.,Udell G. (2013). 'When the cat's away the mice will play': Does regulation at home affect bank risk-taking abroad? *Journal of Financial Economics*, 108 (3): 727-750.

Pagratis S., Karakatsani E., Louri H. (2020), Are Banks Using Leverage to Target Return on Equity? Evidence from the US and the EU. *Oxford Economic Papers,* 72 (3): 863-892.

Pasiouras F., Kosmidou K. (2007). Factors influencing the profitability of domestic and foreign commercial banks in the European Union. *Research in International Business and Finance*, 21: 222-237.

Petit C.A. (2019). The SSM and the ECB decision-making governance. In Gianni LO SCHIAVO (ed.), The European banking union and the role of law, Cheltenham: Edward Elgar Publishing, pp. 108-129.

Qiaoling Kang, Ji Wu, Minghua Chen, Bang Nam Jeon. (2021). Do macroprudential policies affect the bank financing of firms in China? Evidence from a quantile regression approach. Journal of International Money and Finance,102391. In press.

Seya H., Axhausen K.W., Chikaraishi M. (2020). Spatial unconditional quantile regression: application to Japanese parking price data. *The Annals of Regional Science*, 65(2): 351-402

Sundararajan V., Enoch C., San José A., Hilbers P., Krueger R., Moretti M., Slack G. (2002). Financial Soundness Indicators: Analytical Aspects and Country Practices. *International Monetary Fund Occasional Paper* no. 212.

Tressel T. (2014). The Single Supervisory Mechanism. In: From Fragmentation to Financial Integration in Europe. International Monetary Fund–Washington, D.C., Chapter 11.

Tziogkidis P, Philippas D., Tsionas M. (2020). Multidirectional conditional convergence in European banking. *Journal of Economic Behavior and Organization*, 173: 88-106.

Vazquez F., Federico P. (2015). Bank Funding Structures and Risk: Evidence from the Global Financial Crisis. *Journal of Banking & Finance*, 6l: l–l4.

Annex

Table 1. Variables and sources of data

Variable	Definition	Source
ROA	Return on assets	BankFocus
ROE	Return on equity	BankFocus
ta	Total assets (ln)	BankFocus
eqta	Equity to total assets	BankFocus
llrgl	Loan loss reserves to gross loans	BankFocus
cinc	Cost to income ratio	BankFocus
growth	Growth rate of real GDP	AMECO
prft	Profit tax	World Development Indicators of the World Bank
hhi	Herfindahl-Hirscheman Index	ECB Statistical Data Warehouse
ge	Government effectiveness	Worldwide Governance Indicators of the World Bank

Table 2. Summary statistics

Variable	N	median	mean	SD	skewness
ROA	542	0.255	0.0554	1.5523	-4.5927
ROE	539	5.15	1.6638	32.9504	1.8021
ta(ln)	542	18.145	18.0922	1.8317	-0.5949
eqta	542	6.35	6.9150	3.5696	0.85858
llrgl	531	3.28	5.4206	5.9238	1.9810
cinc	536	63.415	64.8903	28.627	11.656
growth	126	1.57	1.4566	2.8242	1.6117
prft	126	15.2	14.9644	7.6367	-0.1908
hhi	126	0.072	0.0989	0.0708	0.9837
ge	126	85.58	84.2637	9.6445	-0.5746

Table 3. Correlation matrix

	ta	eqta	llrgl	cinc	growth	prft	hhi	ge
ta	1.000							
eqta	-0.298	1.000						
llrgl	-0.182	0.277	1.000					
cinc	0.069	-0.097	0.114	1.000				
growth	-0.054	0.335	-0.110	-0.065	1.000			
prft	-0.116	-0.196	-0.045	-0.001	0.015	1.000		
hhi	-0.185	0.384	0.192	-0.135	0.065	-0.179	1.000	
ge	0.194	-0.265	-0.522	0.023	0.221	0.058	-0.119	1.000

Table 4. Baseline regression (ROA, ROE)

VARIABLES	(1) ROA	(2) ROA	(3) ROE	(4) ROE
ssm	0.319***	0.381***	0.549***	0.630***
	(0.104)	(0.124)	(0.186)	(0.219)
ta	-1.232***	-1.078*	-1.969**	-1.662*
	(0.466)	(0.550)	(0.827)	(0.947)
eqta	0.052	0.059	0.087	0.110
	(0.086)	(0.107)	(0.167)	(0.183)
llrgl	0.128	0.055	0.478	0.406
	(0.217)	(0.271)	(0.341)	(0.372)
cinc	0.328	0.428	0.615	0.785
	(0.532)	(0.564)	(0.903)	(0.932)
growth		0.0391		0.064
		(0.048)		(0.084)
hhi		-0.059		-0.124
		(0.122)		(0.247)
prft		-0.057		-0.015
		(0.148)		(0.296)
ge		-0.037		-0.051
		(0.033)		(0.059)
Constant	21.61**	22.42*	34.15**	33.78*
	(8.558)	(11.54)	(15.47)	(19.34)
Observations	448	448	448	448
R-squared	0.117	0.135	0.105	0.118

Note: Standard errors clustered at the bank level in parentheses. Statistical significance: *, ** and *** at the 10%, 5% and 1% level respectively.

Table 5. Baseline regression (risk-adjusted profitability metrics)

VARIABLES	(1) Z-score	(2) Z-score	(3) ROA/SD	(4) ROA/SD	(5) ROE/SD	(6) ROE/SD
ssm	3.163***	3.246***	0.613***	0.536***	0.517***	0.406***
	(0.854)	(0.835)	(0.122)	(0.131)	(0.129)	(0.137)
ta	-5.025**	-2.413	-0.679*	-0.792*	-0.663	-0.827*
	(2.211)	(2.202)	(0.403)	(0.400)	(0.415)	(0.423)
eqta	0.407**	0.859***	-0.022	-0.047	-0.083**	-0.117**
	(0.197)	(0.288)	(0.036)	(0.049)	(0.041)	(0.054)
llrgl	-1.292	-0.114	-0.041	-0.083	0.140	0.102
	(0.974)	(0.897)	(0.158)	(0.187)	(0.162)	(0.181)
cinc	-2.355	-1.877	-0.163	-0.153	-0.065	-0.067
	(1.892)	(1.817)	(0.324)	(0.355)	(0.299)	(0.326)
growth		-0.240*		0.068**		0.089***
		(0.126)		(0.031)		(0.033)
hhi		-0.832**		-0.021		-0.024
		(0.317)		(0.062)		(0.082)
prft		0.770		0.201*		0.259**
		(0.611)		(0.120)		(0.129)
ge		0.0643		0.008		0.0172
		(0.089)		(0.027)		(0.027)
Constant	126.7***	77.14**	14.09*	15.55*	14.25*	15.86*
	(40.09)	(38.57)	(7.336)	(7.863)	(7.535)	(8.143)
Observations	448	448	448	448	448	448
R-squared	0.159	0.189	0.114	0.136	0.075	0.111

note: Standard errors clustered at the bank level in parentheses. Statistical significance: *, ** *** at the 10%, 5% and 1% level respectively

Table 6. Unconditional quantile regression (ROA)

VARIABLES	(1) Baseline results	(2) QR 25th	(3) QR 50th	(4) QR 75th
ssm	0.381***	0.156***	0.183***	0.254**
	(0.124)	(0.058)	(0.043)	(0.0997)
ta	-1.078*	-0.495***	-0.352***	-0.290
	(0.550)	(0.177)	(0.131)	(0.291)
eqta	0.059	-0.038*	-0.021	-0.042
	(0.107)	(0.022)	(0.016)	(0.029)
llrgl	0.055	0.138	0.0004	-0.020
	(0.271)	(0.123)	(0.090)	(0.130)
cinc	0.428	0.043	0.007	-0.218***
	(0.564)	(0.048)	(0.053)	(0.054)
growth	0.0391	0.027***	0.022***	0.034**
	(0.048)	(0.007)	(0.007)	(0.013)
hhi	-0.059	-0.014	-0.021	-0.056*
	(0.122)	(0.019)	(0.018)	(0.029)
prft	-0.057	0.005	0.012	-0.002
	(0.148)	(0.077)	(0.056)	(0.076)
ge	-0.037	-0.004	-0.012	0.002
	(0.033)	(0.009)	(0.008)	(0.020)
Constant	22.42*	9.551***	7.869***	6.475
	(11.54)	(3.289)	(2.541)	(5.937)
Observations	448	448	448	448

Note: Standard errors clustered at the bank level in parentheses.
Statistical significance: *, ** and *** at the 10%, 5% and 1% level respectively.

Table 7. Unconditional quantile regression (ROE)

VARIABLES	(1) Baseline results	(2) QR 25th	(3) QR 50th	(4) QR 75th
ssm	0.630***	0.261***	0.222***	0.138
	(0.219)	(0.098)	(0.079)	(0.087)
ta	-1.662*	-0.749**	-0.387*	-0.425
	(0.947)	(0.371)	(0.209)	(0.268)
eqta	0.110	-0.089*	-0.073***	-0.082***
	(0.183)	(0.045)	(0.021)	(0.024)
llrgl	0.406	0.255	-0.080	-0.095
	(0.372)	(0.205)	(0.101)	(0.121)
cinc	0.785	0.038	-0.167***	-0.089
	(0.932)	(0.118)	(0.044)	(0.059)
growth	0.064	0.046***	0.030***	0.019
	(0.084)	(0.013)	(0.009)	(0.020)
hhi	-0.124	-0.062	-0.029	-0.019
	(0.247)	(0.046)	(0.025)	(0.032)
prft	-0.015	0.124	0.020	0.081
	(0.296)	(0.125)	(0.088)	(0.074)
ge	-0.051	-0.001	-0.006	0.003
	(0.059)	(0.016)	(0.012)	(0.016)
Constant	33.78*	14.43**	8.721**	8.894
	(19.34)	(6.959)	(4.148)	(5.361)
Observations	448	448	448	448

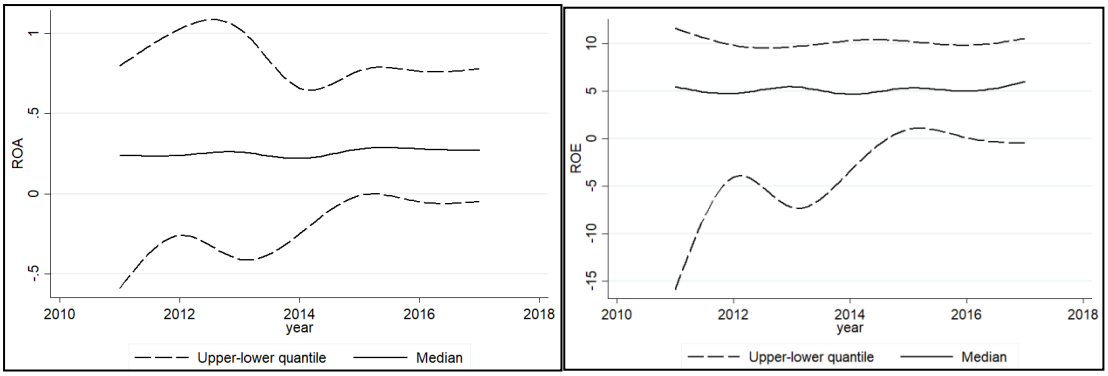
Note: Standard errors clustered at the bank level in parentheses.
Statistical significance: *, ** and *** at the 10%, 5% and 1% level respectively.

Table 8. Unconditional quantile regression (Z-score)

VARIABLES	(1) Baseline results	(2) QR 25th	(3) QR 50th	(4) QR 75th
ssm	3.246***	2.936**	1.208	4.421
	(0.835)	(1.392)	(1.685)	(3.223)
ta	-2.413	-1.647	1.421	-9.554
	(2.202)	(3.281)	(1.675)	(11.21)
eqta	0.859***	0.0315	0.344	0.840
	(0.288)	(0.424)	(0.269)	(0.669)
llrgl	-0.114	-0.953	-0.393	1.231
	(0.897)	(1.323)	(1.725)	(7.029)
cinc	-1.877	-0.0123	-0.521	-1.588
	(1.817)	(0.897)	(1.011)	(1.236)
growth	-0.240*	0.618*	-0.106	-0.675
	(0.126)	(0.315)	(0.225)	(0.569)
hhi	-0.832**	-0.694	-0.396	-0.851
	(0.317)	(0.593)	(0.360)	(0.970)
prft	0.770	0.254	0.513	2.840
	(0.611)	(1.394)	(1.057)	(4.714)
ge	0.0643	0.0255	-0.202	0.100
	(0.089)	(0.261)	(0.206)	(0.560)
Constant	77.14**	40.38	18.04	217.7
	(38.57)	(63.07)	(38.96)	(189.9)
Observations	448	448	448	448

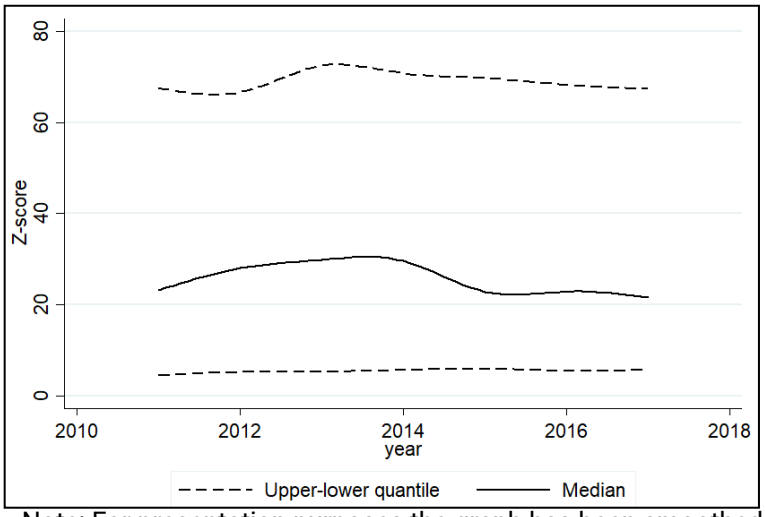
Note: Standard errors clustered at the bank level in parentheses.
Statistical significance: *, ** and *** at the 10%, 5% and 1% level respectively

Figure 1. Profitability of the directly supervised banks over 2011-2017 (in %)



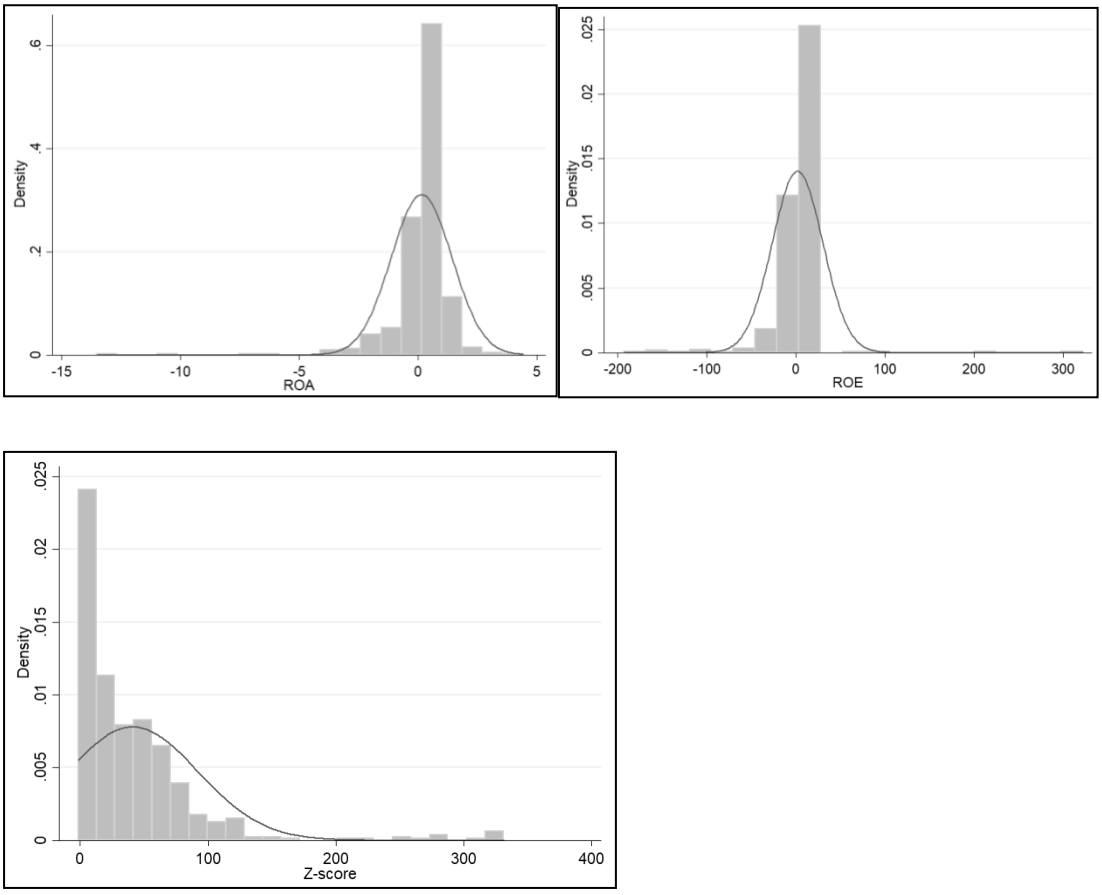
Note: For presentation purposes the graphs have been smoothed by a cubic spline in time.

Figure 2. Probability of insolvency of the directly supervised banks over 2011-2017 (in %)



Note: For presentation purposes the graph has been smoothed by a cubic spline in time.

Figure 3. Histogram and normal density for ROA, ROE and Z-score



Recent LEQS papers

Hasa, Taulant, 'The mirage of European governance: How to resolve the "puzzle" of EU Enlargement, LEQS Paper, No. 169, May 2021.

Monastiriotis, Vassilis and **Sakkas**, Stylianos, 'Employment mobility and labour market flexibility in the EU', LEQS Paper, No. 168, April 2021.

Diermeier, Matthias, **Frohwein**, Hannah and **Aljoscha,** Nau. 'One for one and none for all – The Radical Right in the European Union', LEQS Paper, No. 167, March 2021

Codogno, Lorenzo and **van den Noord**, Paul. 'Assessing Next Generation EU', LEQS Paper, No. 166, February 2021

Hancké, Bob, **Van Overbeke,** Toon and **Voss,** Dustin. ''Similar but different? Comparing economic policy responses to the corona crisis in the UK and Germany', LEQS Paper, No. 165, January 2021

Kochenov, Dimitry. 'Genuine Purity of Blood: The 2019 Report on Investor Citizenship and Residence in the European Union and its Litigious Progeny', LEQS Paper, No. 164, December 2020

Orenstein, Mitchell and **Bugaric,** Bojan. 'Work, Family and Fatherland: The Political Economy of Populism in Central and Eastern Europe', LEQS Paper, No. 163, December 2020

Cotaldo, Marco, **Monastiriotis,** Vassilis and **Rodrigues-Pose,** Andrés. 'How 'smart' are Smart Specialisation strategies?' LEQS Paper, No. 162, November 2020

Kenny, Michael and **Luca,** Davide. 'The urban-rural polarisation of political disenchantment: an investigation of social and political attitudes in 30 European' LEQS Paper, No. 161 November 2020

Kim, Do Won. 'Dimensionality, party competition and voter preference in the era of' LEQS Paper, No. 160, October 2020

Lopez Uroz, Nina. 'Populism Amidst Prosperity: Poland's Growth Model and its Socio-Political Outcomes',, LEQS Paper, No. 159, September 2020

Tesche, Tobias. 'The European Union's response to the coronavirus emergency: an early assessment' LEQS Paper, No. 157, June 2020

Delanty, Gerard. 'Six political philosophies in search of a virus: Critical perspectives on the coronavirus pandemic' LEQS Paper, No. 156, May 2020

Karadima, Maria and **Louri**, Helen. 'Bank competition and credit risk in the Euro area, 2005-2017: Is there evidence of convergence?' LEQS Paper, No. 155, April 2020

Campos, Nauro and **Macchiarelli**, Corrado. 'Brexit and the Euro' LEQS Paper, No. 154, March 2020

Corazza, Arthur. 'Power, interest and insecurity: A comparative analysis of workplace dualization and inclusion in Europe' LEQS Paper No. 153, February 2020.

Bronk, Richard and **Jacoby,** Wade. 'The epistemics of populism and the politics of uncertainty' LEQS Paper No. 152, February 2020

LSE THE LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE

LSE Europe in Question Discussion Paper Series

LEQS
European Institute
London School of Economics
Houghton Street
WC2A 2AE London
Email: euroinst.LEQS@lse.ac.uk

http://www.lse.ac.uk/european-institute/research/leqs-discussion-paper-series