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Does low banking profitability contribute to Financial Instability in the Euro Zone?

Paulo Miguel Bernardino Rodrigues

Master in Economics

Supervisor:

Ph.D. Diptes Chandrakante Prabhudas Bhimjee, Invited
Assistant Professor, ISCTE Business School, ISCTE-IUL

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Resumo

Este estudo explora a hipótese de que baixos níveis de rentabilidade bancária constituem um fator de risco para a estabilidade financeira. Adotando um modelo que pretende detetar os principais determinantes da rentabilidade dos bancos sobre 4 quartis de rentabilidade bancária, pertencentes a uma amostra que agrega informação sobre 735 bancos. Os bancos da amostra detêm ativos totais superiores a 1.000\$ milhões e estão localizados em 12 países da área euro. A janela temporal de estudo vai desde 2006 até 2015. O propósito deste modelo de dados em painel é tentar entender a relevância da variável “crescimento do PIB” para explicar a rentabilidade dos bancos menos rentáveis durante o período de crise e comparar a significância desta variável com o caso dos bancos mais rentáveis, tentando encontrar diferenças, nomeadamente, se o impacto da variação do PIB na rentabilidade dos bancos é mais sentido nos bancos menos rentáveis do que nos mais rentáveis. Os resultados sugerem que não há relação entre menores níveis de rentabilidade e efeitos superiores da variação do PIB sobre a rentabilidade dos bancos durante a crise. Os resultados base estão sujeitos a verificações de robustez, sendo estes globalmente estáveis. A nossa análise sugere que outros fatores de risco da gestão bancária deverão ser abordados adequadamente pelos decisores políticos.

Palavras-chave: Estabilidade Financeira; Supervisão Bancária; Determinantes da Rentabilidade Bancária; Crise Financeira; Crise Económica.

Classificação JEL: E32; G01

Abstract

The present research explores the hypothesis that lower levels of banking profitability constitutes a risk factor for financial stability by adopting a model which intends to find the main banking profitability determinants over 4 bank profitability quartiles of a sample of 735 banks. The sampled banks have total assets over \$1 Billion and are located in 12 Euro Area countries. The adopted time window ranges from 2006 to 2015. This panel data model's purpose is to find the relevance of the 'GDP growth' variable on explaining profitability of the lower profitable banks in the in-crisis period and compare this variable's significance with the case of the higher profitable banks by looking for differences, mainly, whether it is a more relevant factor for lower profit banks than higher ones. The findings suggest that there is no relationship between lower profitability levels and higher impacts of GDP growth on banks profitability during the crisis. The baseline results are subject to robustness checks and are globally stable. Our analysis suggests that other risk factors on banks' management should be adequately addressed by policymakers.

Keywords: Financial Stability; Banking Supervision; Banking Profitability Determinants; Financial Crisis; Economic Crisis.

JEL Classifications: E32; G01

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Acronyms

CI: Credit Institution

ECB: European Central Bank

EU-27: 27 member states of the European Union

FED: Federal Reserve System

G.D.P.: Gross Domestic Product

HIPC: Harmonized Indices of Consumer Prices

ROAA: Returns on Average Assets

ROAE: Returns on Average Equity

SDW: Statistical Data Warehouse

Introduction

The 2007-2008 ‘Subprime’ Crisis and its consequential sovereign debt crisis in 2011 was an immensely relevant event that completely changed the political, economic, and social landscape, leading to massive levels of unemployment and emigration, stagnation over salaries for a long period of time, and the decrease of financial sustainability for government intervention due to big increments of public debt.

The benefits of the existence of a financial system are considered to be relevant by increasing efficiency on the allocation of financial needs from the excess liquidity of some, promoting savings and its transmission into investment which leads to higher long-term growth for any given country.

It therefore becomes important to understand in which way it is possible to promote the normal activity of the contemporary financial system within the economy without having the associated risk of these activities compromising the real economy at a large scale once a given systemic episode sets in.

The European Central Bank on the Financial Stability Review, published in May 2015, argued that the registered low profitability levels on banking activity in the previous years of the review were considered a key risk for financial stability in the euro area. This statement is based on the presumption that low bank profitability is in general a risk factor for the financial stability due to reduction of robustness to deal with a crisis or because it promotes a riskier approach by banks to increase profitability.

The adopted empirical methodology consists of a sample encompassing the period starting from 2006 until 2015 of aggregated bank specific and country specific variables of 735 Euro Area banks from 12 countries with assets over \$1 billion. The dataset period starts in 2006 to include a pre-crisis moment and goes to 2015 because that is the first moment when the output-gap in the euro area becomes positive after the sovereign debt crisis. The whole sample has been divided into 4 quartiles depending on their profitability levels (ROAA and ROAE) on the pre-crisis period. Several regression models with the same model specification are estimated with the goal to detect whether there has been a higher impact from the economic activity variable (GDP growth) on the in-crisis banking profitability in the weaker profitable banks than on the higher ones. That is, the present Dissertation aims to address the heterogeneity with the

adopted sample regarding the impact of G.D.P. in the Euro Area banking profitability during the crisis.

Accordingly, the present Dissertation adopts the research design advanced by (Elekdag et al., 2020), in this case using 2016, a post-crisis period, as the reference period to divide the banks into different profitability quartiles while in this latter study the referenced period was the pre-crisis period by applying an average between 2006 and 2007 of banks' ROAA registered values. The dataset is extracted from BankFocus, AMECO, SDW and Eurostat and the data is annual.

The findings advanced by the present Dissertation suggest that there was no higher profitability impact from the crisis on lower profitable banks than on higher profitable ones. This main result is verified in a consistent manner both by having ROAA and ROAE as the dependent variable and in other sub time-intervals (within 2006-2015). These results are interesting because it contrasts with the ECB claim described above which can promote further discussion on this topic. By having the results suggesting lower profitable banks do not contributed more to the higher financial instability during the crisis than higher profitable banks, it differentiates from the claims and arguments appointed by the ECB.

The study is structured as follows. Section 2 presents some of the main literature over research topics surrounding banking profitability determinants and the behavior of post crisis bank performance in Europe. Section 3 describes the dataset and the chosen econometric approach. Section 4 presents the results of the econometric models (including robustness checks) and section 5 concludes.

Chapter 1. Literature Review

In this literature review I will review (i) the standard determinants of banking profitability, which will include the choice of the variables most commonly used; (ii) the major debate in the literature and its schools of thought; (iii) European banks' profit determinants and their comparison with those of US banks; (iv) the crisis and its effects on European banks; and, finally, (v) the importance of banking profitability on the robustness of banks during crisis periods.

Taking a look at the literature of empirical studies on banking profitability determinants it is noticeable that they usually follow a standard approach through econometric analysis on a variety of plausible variables that might be relevant to determine different levels of profitability between banks over the years. These analyses might encompass one economy (e.g. Curak et al., 2012), or multiple (e.g. Petria et al., 2015).

The chosen variables are within three groups of factors that are always present: (i) cyclical, (ii) structural or industry-specific, and (iii) bank-specific factors. Following Curak et al. (2012), as an example, for bank-specific factors the following variables are typically used: bank size (total assets); solvency risk (ratio of equity to total assets); liquidity risk (ratio of loans to deposits); credit risk (ratio of loans to total assets); fees income (income from fees and commissions over total assets ratio) and operating expenses management (operational costs to total assets). For structural factors, the variables concentration (Herfindahl Hirschman Index) and the EBRD index (EBRD index of banking sector reform) are typically chosen; and for cyclical factors, the author typically relies on economic growth (GDP growth rate) and the unemployment rate. In addition, variables such as the real interest rate (Vong & Chan, 2009), inflation (Jara-Bertin et al., 2014) or NPL's (Non-Performing Loans) ratio (Anastasiou et al., 2019) are also commonly used.

In the academic literature there is a major debate concerning which group of determinants are more relevant in terms of explanation power. Two schools of thought have been upheld were created surrounding this fundamental debate. Short (1979) argues structural factors as more important than others. Subsequently, other authors arrive at a similar conclusion (Demirgüç-Kunt, A. & Huizinga, H., 1999; Detragiache et al., 2018; Dietrich & Wanzenried, 2011; IMF, 2018), although there is no consensus on whether higher or lower levels of market concentration are good or not for bank profits. The other school of thought argues that cyclical

factors play a bigger role in explaining banks' profits (Albertazzi & Gambacorta, 2009; ECB, 2015a).

Looking at the European Union banking framework, at both the EU-27 (Petria et al., 2015) and the euro area (ECB, 2015a) level, cyclical factors are deemed to be more relevant than structural factors, but in the bank-specific factors there seems to be no consensus.

It is also interesting to compare banking profitability differences and similarities on the two largest economies in the world, the European Union, and the United States of America. Feng & Wang (2018) tries to provide an answer on why US banks profited on average more during the crisis and post-crisis periods than their European counterparts, concluding that this is due to lower returns on earning assets, higher funding costs, and lower scale of efficiency. The first and second reasons are justified by the research as a consequence of the European Central Bank's less aggressive rate cuts when comparing to FED's. In a post-crisis period, there are also declines in relative technical efficiency by the European banks in relation to the US ones and the research presents two main reasons for that: higher costs for European banks in dealing with their higher levels of NPLs and the higher resources devoted to strengthening capitalization to meet the requirements of Basel III.

Additionally, when we look at the crisis and post-crisis period in the euro-area, these have clearly been a period of lower levels of banking performance. The major reasons pointed by the academic literature are the financial vulnerability and the macroeconomic situation which contributed to an overwhelming level of Non-Performing Loans (NPL's) (Angori et al., 2019).

The ECB (2015b) has required banks to be more conservative on their dividend distribution in order to prioritize the accomplishment of the recent and more demanding capital requirements, thus implying the need to reduce the riskiness of credit granted to customers. Rossi et al. (2018)'s findings have confirmed that the more rigorous behavior in granting credit to borrowers more recently adopted by banks has resulted in higher levels of bank profitability in the late post-crisis period.

One important theoretical point to notice is the relevance of bank profitability in financial market stability and robustness, which is an important argument underlying the present research since the goal is to test if this theoretical assumption can be empirically verified when studying the 2007-2008 financial crisis. The ECB (2015a) considers low bank profitability relevant for financial stability and it gives two main reasons for that. First, the higher capitalization of banks can increase their shock-absorption capacity, so the logic being those higher profits can and

might increase banking capital reserves levels meaning lower financial instability once a future macroeconomic or financial disturbance happens. Secondly, consistent periods of low profitability may incentivize banks to take a riskier approach in seeking higher profits, which will probably deteriorate the stability of the financial and banking system. The latter argument works both for preventing new financial crises and for decreasing its effects in the case such an event does happen.

This research seeks to compare the reaction of banks to the crisis depending on their levels of profit in the pre-crisis period by checking whether lower profitable banks were more affected by the crisis than the ones that had more profits, thus giving strength, or not, to the ECB's argument that lower banking profit levels is dangerous for financial stability. It is difficult to find in the literature researchers that analyze bank performance determinants separating banks by their level of profit, with the exception of Elekdag et al. (2020), which pursues such an approach. Correspondingly, this research runs quantile regressions on conditional bank profitability distributions given the levels of bank profitability on the post-crisis period and study how their profitability reacts during late crisis events. The main goal is to study how the different groups of banks, given their profit levels, are recovering from the crisis. It differs from the present study since the profitability distribution (through quartiles) is established given the pre-crisis period profitability level and it intends to study how the different bank groups react to the initial and middle shocks during crisis events.

Chapter 2. Data & Methodology

2.1. Data

This study’s dataset is quantitative, and it is from secondary sources.

Data on Euro Zone¹ Banks general information, balance sheets and income statements are from the BankFocus – Bureau Van Dijk Database, which is made available by Moody’s Analytics. Country level macroeconomic variable GDP growth is collected from AMECO Database’s² OVG D indicator (GDP, at constant prices) and the inflation rate is extracted from Eurostat’s HICP indicator. Market concentration by country is available at the Statistical Data Warehouse in the indicator “Herfindahl index for Credit institutions (CIs) total asset” provided by the European Central Bank.

Bank-specific indicators collected from the BankFocus Database include total assets, equity, loans, returns on average assets (ROAA), returns on average equity (ROAE), equity over total assets, cost to income ratio, total customer deposits, and country.

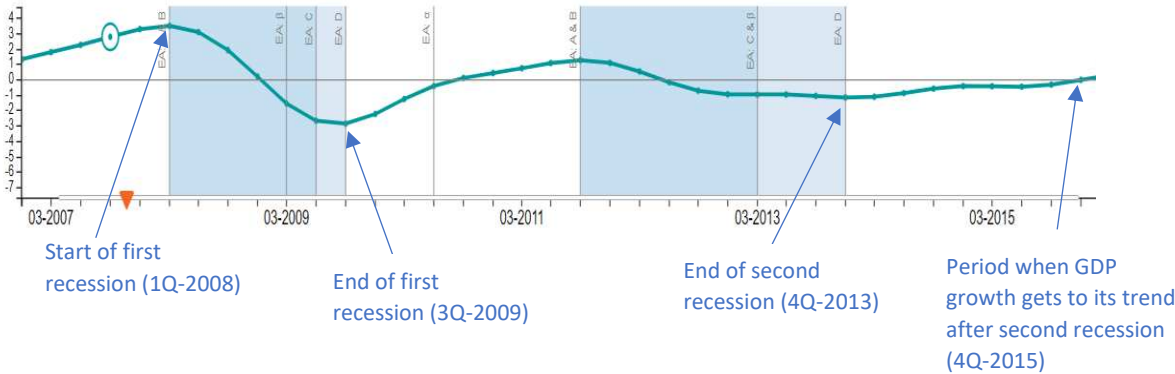


Figure 2.1. GDP growth cycle as percentage of deviation from the trend for the Euro Area. Source: Business cycle clock, Eurostat.

¹ This only encompasses the countries that were part of the Euro Zone since 2006 (EA-12): Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, and Spain.

² European Commission.

The data is annual and is collected in reference to the time interval 2006-2015. It starts in 2006 because that is the first year available with a reasonable amount of banks present in the database and 2015 is the last mainly because is the year that, according to the Eurostat³, GDP growth got back to its long-term trend after the Euro Area sovereign debt crisis of 2011 (Figure 2.1).

The sample includes 735 banks in 10 periods (2006-2015) taken from an original sample of 988 banks. Banks with Assets in 2015 smaller than one billion US dollars were excluded from the final sample due to their lower influence on the risk of the banking system as a whole and their potential to create biases. For those reasons, they were considered less relevant to be studied and, hence, excluded.

It is important to be aware of possible features of the data that might affect the results. Firstly, the dataset could suffer from survivorship bias since it only includes banks that have data available in every period and every indicator, excluding the ones that went bankrupt during that period. Secondly, some banks have international activities that affect their income and balance sheets, inside and outside of the selected Euro Zone countries, which means their indicators were affected by different macroeconomic realities and so the country's correspondent macroeconomic variables may not be as relevant as they are in banks that only operate nationally.

Five datasets are used in the economic analysis. The first being the full sample and the other four being sub-divisions of the latter. These sub-divisions consider the average value of bank profits (ROAA) between 2006 and 2007 (pre-crisis period), settling the division between the lower and the higher profitable banks within the sample, so each sub-division represents a profitability level quartile, so that Q1 is the most profitable while Q4 is the least profitable ones.

2.2. Descriptive statistics

³ Euro Area Business Cycle Clock (<https://ec.europa.eu/eurostat/cache/bcc/bcc.html>).

The table (2.1) presents some stylized facts about the sample, their median value, their mean and its standard deviation while Table 2.2 shows stylized facts of each profitability quartile banks on their bank-specific features.

Table 2.1’s description column also presents some of the data manipulation applied into scales to facilitate interpretation of model parameters.

Table 2.2 gives an insight on bank-specific variables means by quartile and it is already worth of some description and interpretation:

Table 2.1. Descriptive statistics of every variable.

2006-2015				
Variable	Description	Median	Mean	SD
Bank Size	Log (Total Assets)	15.59	16.00	1.58
Solvency Risk	Total Equity to Total Assets ratio (%)	6.68	7.70	5.49
Credit Risk	Loans to Total Assets ratio (%)	60.89	56.40	22.74
Liquidity Risk	Loans to Deposits ratio (%)	1.00	37.42	1270.20
Operational Efficiency	Cost to Income ratio (%)	67.22	66.30	204.73
ROAA	Returns on Average Assets (%) times 100	27	49.60	332.97
ROAE	Returns on Average Equity (%) times 10	43.6	56.34	470.48
GDP growth	Real GDP Growth Rate (%)	1.49	1.20	2.74
Inflation	Inflation Rate (%)	1.7	1.64	1.02
Market Concentration	Herfindahl Index for Credit Institutions (0-100)	3.17	4.97	4.85

Source: Performed by author in STATA.

Table 2.2. Mean of every bank-specific variable for each quartile.

Variables	Q4	Q3	Q2	Q1
ROAA	12.05	32.65	37.48	116.13
ROAE	17.84	50.99	58.29	98.26
Bank Size	15.69	15.71	16.45	16.17
Solvency Risk	6.04	6.52	7.38	10.87
Credit Risk	55.58	56.62	55.99	57.40
Liquidity Risk	76.06	4.31	12.29	56.90
Operational Efficiency	80.79	70.01	58.12	56.24

Source: Performed by author in STATA.

- i. Both profit measures, ROAA and ROAE, increase by each quartile, which shows that the quartiles set by the average of ROAA between 2006 and 2007 are still able consistent once the time interval raises, from 2006 to 2015, in both profit metrics.
- ii. It is also worth noticing the differences in magnitude between quartiles’ related profits average. Whilst Q2 is not significantly more profitable, on average, than Q3 (approximately 0,05% of Assets and 0,7% of Equity), Q1 is roughly 5 to 10 times more profitable, on average, than Q4.

iii. There is a small connection between bank size and profitability quartiles, although Q1 is, on average, a little smaller than Q2. But overall, the differences between quartiles are not considered significant.

iv. Solvency risk (equity to assets) decreases in more profitable quartiles which might indicate a riskier approach in this specific risk measure made by the least profitable banks.

v. Credit risk seems to increase with profitability quartiles although it is difficult to see a clear relationship.

vi. Liquidity risk shows an interesting insight, as in Q2 and Q3 values are relatively low, whilst in Q1 and Q4 values are significantly larger with the highlight of Q4 (size of loans is 76.06% of deposits).

vii. Higher profitable quartiles show higher levels of operational efficiency which goes along with market logic and, hence, this is something that was expected.

viii. Lastly, remembering the second reason why the ECB considered bank profitability crucial to financial stability '*persistently low profitability could incentivise banks to take on undue risks in order to generate higher returns, which can lead to increased financial fragility going forward*' (ECB, 2015a:p.134), it is important to take into account that in this research, due to data limitation, the period of 2006-2007 might be a limited proxy to determine which banks are persistently considered as more profitable because this pre crisis moment might have included a period of higher returns, in some cases, over riskier management strategies taken by typical lower profitable banks. Q1 high levels of credit and liquidity risk and Q4 high levels of solvency and liquidity risk might be a result of this ECB line of argumentation.

2.3. Econometric Framework

As previously explained, the econometric framework of this research follows the most typical line pursued in the literature related to the determinants of banking profitability, which groups the independent variables into three categories: (i) Bank-specific variables, (ii) Industry-specific variables, and (iii) Cyclical variables.

As a research strategy, the main idea is to maximize the explanatory power of the model so that the isolated impact of GDP growth can be detected. A higher positive correlation between

banking profitability and GDP growth suggests a higher reaction on profitability from the economic situation. Considering the crisis period as a worse economic situation period than a non-crisis period, higher levels of correlation between banking profitability and GDP growth during the crisis suggest a higher negative impact of GDP growth on the profitability of banks. Taking into account the goal of this research, the idea is to detect whether there are differences in the level and significance of the parameters of GDP growth between the lower and higher profitable banks.

Bank-specific variables include bank size, solvency risk, credit risk, liquidity risk, and operational efficiency. Bank size is measured by the logarithm of total assets of banks and might have a positive correlation with profits in case of economies of scale (Athanasoglou et al., 2008) or negative in case of diseconomies of scale (Kořak & Āok, 2008), as both scenarios are present in the academic literature and there is no consensus on which effect is stronger. Solvency risk is represented by a proxy, the ratio of equity to total assets, in percentage, and its expected value is uncertain according to the academic literature, although in an economic crisis period a riskier bank will probably not benefit from that strategy, so a negative correlation between the amount of risk⁴ and profits is expected. Credit risk is represented by the percentage of the ratio between loans and total assets, while liquidity risk is represented by the percentage of the ratio between loans and total customer deposits. In the context of both measures of risk, since they are intrinsically risk measures and the research addresses a crisis period, the expected sign is negative meaning a negative correlation between risk and profits. Operational efficiency is obtained by the percentage of the ratio of operational cost to operational income so the lower the value the bigger the efficiency. A negative correlation between that variable and profit is assumed (Detragiache et al., 2018).

The only Industry-specific variable present in this research is market concentration, which is represented by the Herfindahl index for credit institutions (CIs) using total assets and is scaled between 1-100. Banks in each country and year have a single correspondent Index value. As previously discussed, the effect of market concentration is not consensual in the literature, as bigger market concentration might increase profits due to the higher market power detained by banks, the higher average bank sizes can also create diseconomies of scale, reducing profitability; and on the other hand, bigger market competition, as according to microeconomics theory, reduces profitability since banks charge less interest on loans and pay higher on deposits

⁴ Positive correlation with the variable because the higher equity to assets ratio, the lower the risk of solvency.

but it also influences banks to be more efficient which can overcome the effect of lower banking margins (interest charged on loans minus interest paid on deposits) and promote profits. Both theoretically and empirically, it is not clear what to expect from the effect of this variable.

The cyclical variables (macro variables) used in this research are the real GDP growth rate and the inflation rate of each country that corresponds to its corresponding national banks. Real GDP growth represents the economic activity growth, and it is expected to produce positive and significant parameters since positive economic cycles usually lead to higher number of loans and investment while negative cycles lead to the opposite, plus a higher number of non-performing loans is also expected which decreases profits. The academic literature also detects a positive relationship between economic growth and financial sector profitability (Athanasoglou et al., 2008). The inflation rate is also expected to be positively correlated with banking profits due to its relationship with interest rates: if inflation is high, central bank interest rates tend to increase, a fact which widens the margins to banking interest rates (ECB, 2015a).

To measure profitability two variables were chosen, in order to increase robustness related to the results. These two variables are Returns on Average Assets (ROAA) and Returns on Average Equity (ROAE). According to Dietrich & Wanzenried (2011), both ROAA/ROA and ROAE/ROE are the most commonly used variables in the academic literature that measure bank profitability.

2.4. Econometric Analysis

For the panel data regression analysis, both linear panel data model estimators, random and fixed effects, were considered. Hausman tests were applied for every pair of regressions for different dependent variables and sub time-intervals, one with a fixed effects estimator and other, for the same time span and variables, with a random effects estimator. The results of the applied tests were not coherent for every pair of regressions and considering that there are not significant differences in parameters and variables significance levels between both estimators, it makes sense that every regression share the same model estimator. Out of the two options, the fixed effects estimator was chosen in order to ensure that covariates used are exogenous, and therefore, the estimator is consistent (Brüderl & Ludwig, 2015).

Linear panel data models with a fixed effects estimator were then applied to the five studied panel datasets (Full Sample; Q1; Q2; Q3 and Q4) for multiple time intervals. The baseline specification can be represented as follows:

$$y_{b,p,t} = \alpha X_{b,t} + \beta Z_{p,t} + \gamma W_{p,t} + c_b + \epsilon_{b,t} \quad (1)$$

Where $y_{b,p,t}$ refers to the predicted profitability (ROAA / ROAE) for bank b , in country p , at year t . Parameters α , β and γ correspond to variables X , Z and W . X includes bank-specific variables for a specific bank b and time t , Z the industry-specific variable for a specific country p and time t , and lastly, W for cyclical variables of a specific country p and time t as well. c_b represents bank fixed effects whereas $\epsilon_{b,t}$ the error term.

The robust standard error estimation version of the fixed effects panel model proposed by Kiefer (1980) was applied. Kezdi (2003) suggests that the robust estimator does not get biased, neither significantly more diverse, with higher time-series dimensions (with $T > 2$) and recommends its use for medium and large sized samples, as it is the case in this dissertation.

These econometric models were run in STATA statistical software.

Chapter 3. Results

This section presents multiple regressions for different time spans, addressing the entire time-interval, as well as some estimations on some sub-intervals, in order to have the most accurate interpretation possible related to the banking economic reality under analysis.

3.1. 2006 – 2015

Firstly, the regression models are applied to the whole sample time-interval (2006-2015). The estimations do not acknowledge expected structural breaks due to its inclusion of both pre and in-crisis moments, which will be addressed later on.

Table 3.3. 2006-2015 (ROAA)

Variables / Sample-sets	Q4	Q3	Q2	Q1	Full Sample
Bank Size	1.809 (8.65)	11.87 (8.922)	7.605 (5.907)	41.99* (24.31)	6.826 (10.01)
Solvency Risk	0.999** (0.495)	3.396** (1.428)	0.68 (0.789)	19.51*** (6.441)	7.739** (3.309)
Operational Efficiency	-0.016*** (0.003)	-0.185 (0.151)	-0.008 (0.005)	-0.077 (0.438)	-0.015** (0.007)
Credit Risk	0.0096 (0.295)	-0.754 (0.719)	-0.011 (0.399)	0.481 (0.493)	-0.239 (0.338)
Liquidity Risk	0.000002 (0.00003)	-0.238*** (0.089)	-0.078*** (0.029)	0.006 (0.005)	0.000007 (0.0002)
GDP Growth	0.677*** (0.242)	-0.8 (2.557)	4.356** (1.839)	12.28*** (2.298)	3.601*** (0.907)
Inflation	-2.443** (0.99)	18.73 (17.1)	-2.33* (1.194)	7.435* (4.485)	5.492 (3.918)
Market Concentration	1.878 (1.226)	-12.58* (6.646)	-1.842 (1.43)	-5.356*** (2.004)	-6.185*** (1.961)
Observations	1840	1840	1830	1840	7350
F test	65.42***	2.80***	3.62***	7.21***	8.26***

Notes: Bank fixed effects not shown. Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Source: Performed by author in STATA.

Highlighting conclusions from these first regressions (Tables 3.3 and 3.4) are that GDP growth is significant at 1% level in most quartiles and in the sample as whole, only exception being Q3. Q4 profitability does not show a stronger reaction from economic activity than Q1 and when scaling the coefficient values with the profitability average levels, it is possible to extrapolate the conclusion that Q1 shows a higher reaction on profitability from the economic

activity than Q4⁵. In Q1, a percentage point increase in GDP growth reflects an increase of profitability of 0.12% on assets and 2.56% on equity while in Q4 it reflects an increase of 0.007% and 0,25%, respectively. These differences are wider than the average ones in both ROAA and ROAE.

Table 3.4. 2006-2015 (ROAE)

Variables / Sample-sets	Q4	Q3	Q2	Q1	Full Sample
Bank Size	-22.55 (37.08)	-5.586 (18.13)	25.59** (12.48)	154.3 (95.65)	33.15 (23.46)
Solvency Risk	0.547 (1.184)	1.372 (1.319)	-0.561 (0.784)	19.51* (11.17)	5.842 (3.612)
Operational Efficiency	-0.037*** (0.007)	-0.700** (0.306)	-0.014** (0.006)	-0.425 (0.434)	-0.035*** (0.013)
Credit Risk	0.385 (0.982)	-1.328 (1.351)	0.442 (0.655)	1.141 (0.995)	0.018 (0.648)
Liquidity Risk	0.0005*** (0.0002)	-0.683** (0.267)	-0.113*** (0.042)	0.005 (0.004)	0.0002 (0.0002)
GDP Growth	2.501** (1.201)	-0.845 (4.375)	6.638*** (1.482)	25.62*** (9.892)	8.001*** (2.709)
Inflation	-9.211* (4.953)	29.05 (29.77)	-2.564 (3.729)	4.291 (7.920)	3.637 (6.965)
Market Concentration	3.033 (4.027)	-14.55 (9.504)	1.302 (6.466)	-0.690 (4.327)	-3.753 (3.595)
Observations	1840	1840	1830	1840	7350
F test	89.26***	4.47***	11.52***	2.17**	5.63***

Notes: Bank fixed effects not shown. Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1. Source: Performed by author in STATA.

In Table 3.3, Liquidity risk for Q3 and Q2 is significant at the 1% level; operational efficiency for Q4 is significant at the 1% level and for the full sample at 5%, and solvency risk for Q1, is considered significant at 1% level, while Q4, Q3 and the full sample, at the 5% level.

In Table 3.4, Liquidity risk for Q4 and Q2 is a significant variable at the 1% level and for Q3 at 5%; operational efficiency for Q4 and Sample at 1% and for Q3 and Q2 at 5% and solvency risk is only considered significant for Q1 at the 10% level.

As expected, maybe due to structural breaks in the sample, the explanatory power of the model is small. New time sub-intervals are addressed within the time interval 2006-2015 so that the trajectory of the business cycle might be properly accounted for.

3.2. 2008 – 2015

⁵ It is important to account for differences in profitability averages, remembering the 10 and 5 times higher average profitability over Assets and Equity, respectively, between Q1 and Q4. When looking to differences in the coefficients, the values, for comparison purposes, must be scaled according to the average level of profitability.

In order to acknowledge expected structural breaks and to focus on the most important time-period for this study, the in-crisis period, the years of 2006 and 2007 were not addressed in the following regressions.

The next pair of regressions will include a time-interval between 2008-2015, starting at the year the Eurostat⁶ considers as the beginning of the recession in the euro area and ending in the year where it considers the Output Gap to stop being negative after the second regression (2011-2013).

Looking at the estimation outputs (Tables 3.5 and 3.6) and starting with the ROAA regression, GDP growth is a significant variable in Q4, Q1 and in the sample as whole, all at 1% level. The parameters difference between GDP growth in Q4 and Q1 shrink (0.767 and 8.17 in Table 5 comparing to 0.677 and 12.28 in Table 3.3) but the values still do not necessarily prove a stronger reaction from economic growth in Q4 than in Q1. Further interesting analysis on these outputs show operational efficiency and solvency risk to be at a 1% level of significance, for Q4 bank profitability during 2008 to 2015, suggesting that higher solvency risk levels and lower operational efficiency also significantly punished profitability on these banks.

Moving to the ROAE regression (Table 3.6), GDP growth significantly loses its importance to explain profitability measured over equity. GDP growth on the full sample remains significant at the 1% level but over the quartiles, it is only significant, at a 5% level significance, on Q1 and at a 10% level on Q3, suggesting again that the crisis might have affected more negatively higher profitable banks than lower profitable ones. Operational efficiency seems to be positively correlated in a significant way (1% level) with profitability in Q4, Q3 and Q2 and when looking on the sample as a whole.

⁶ Business Cycle Clock (<https://ec.europa.eu/eurostat/cache/bcc/bcc.html>).

Table 3.5. 2008-2015 (ROAA)

Variables / Sample-sets	Q4	Q3	Q2	Q1	Full Sample
Bank Size	-16.297 (10.998)	11.35 (18.12)	8.494 (8.143)	59.41 (40)	0.131 (16.44)
Solvency Risk	1.173*** (0.432)	2.864 (3.373)	1.102 (1.280)	28.32 (22.14)	9.01 (7.45)
Operational Efficiency	-0.012*** (0.003)	-0.201 (0.171)	-0.008** (0.004)	-0.045 (0.367)	-0.015** (0.007)
Credit Risk	0.0685 (0.245)	-0.899 (1.033)	0.221 (0.565)	1.160 (0.800)	-0.073 (0.555)
Liquidity Risk	0.00006 (0.00004)	-0.365** (0.174)	-0.053 (0.035)	0.012 (0.010)	0.0001 (0.0003)
GDP Growth	0.767*** (0.286)	1.642 (1.027)	3.379 (2.296)	8.17*** (2.829)	2.350*** (0.903)
Inflation	-1.809* (1.04)	19.07 (17.8)	-3.219*** (1.212)	5.835 (8.925)	4.627 (4.802)
Market Concentration	0.651 (1.291)	-30.26 (20.65)	-4.172* (2.549)	-5.185** (2.453)	-9.636** (4.222)
Observations	1472	1472	1464	1472	5880
F test	201.71***	2.11**	2.64***	2.71***	6.20***

Notes: Bank fixed effects not shown. Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.
Source: Performed by author in STATA.

Table 3.6. 2008-2015 (ROAE)

Variables / Sample-sets	Q4	Q3	Q2	Q1	Full Sample
Bank Size	-85.99 (61.14)	-23.01 (39.12)	14.06 (16.09)	302.6* (182.7)	33.43 (40.15)
Solvency Risk	0.315 (1.318)	-0.651 (4.947)	0.878 (1.445)	37.21* (19.07)	8.770 (5.445)
Operational Efficiency	-0.030*** (0.007)	-0.860*** (0.308)	-0.020*** (0.005)	-0.261 (0.335)	-0.036*** (0.012)
Credit Risk	1.199 (1.476)	-0.939 (2.255)	1.646 (1.220)	1.221 (1.223)	0.279 (0.921)
Liquidity Risk	0.0006** (0.0003)	-1.000** (0.505)	-0.080 (0.055)	0.007 (0.005)	0.00005 (0.0003)
GDP Growth	1.525 (1.184)	2.569* (1.378)	2.440 (1.763)	16.49** (7.277)	4.741*** (1.586)
Inflation	-7.264 (5.912)	29.09 (30.95)	-4.119 (3.292)	4.294 (8.337)	1.916 (7.366)
Market Concentration	4.332 (5.912)	-42.98 (36.10)	-3.776 (7.676)	14.62 (10.78)	-2.027 (9.677)
Observations	1472	1472	1464	1472	5880
F test	15.24***	5.80***	9.70***	1.68*	4.75***

Notes: Bank fixed effects not shown. Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.
Source: Performed by author in STATA.

3.3. 2008 – 2013

The final estimations consider the end of the crisis period as the end of the second recession in the eurozone which is stated by the European commission to be in 2013.

Table 3.7 shows for the first time, a stronger significance level from GDP growth on Q4's profitability over assets than the one of Q1.

Table 3.8 on the other hand, continues to point out Q1's profitability over equity to be more significantly influenced by GDP growth than Q4 banks profitability over equity

Table 3.7. 2008 – 2013 (ROAA)

Variables / Sample-sets	Q4	Q3	Q2	Q1	Full Sample
Bank Size	-12.71 (13.909)	19.24 (16.41)	10.94 (12.17)	0.187 (77.81)	-33.99 (50.63)
Solvency Risk	2.298** (1.07)	2.55 (6.35)	-0.481 (0.888)	37.13 (26.61)	11.83 (9.796)
Operational Efficiency	-0.011*** (0.002)	-0.652* (0.353)	-0.008** (0.004)	0.295 (0.300)	-0.014** (0.006)
Credit Risk	-0.088 (0.258)	-2.167 (1.905)	0.579 (0.465)	2.769* (1.455)	0.555 (0.594)
Liquidity Risk	0.001 (0.001)	-0.172 (0.144)	0.058 (0.084)	0.021** (0.01)	0.014** (0.006)
GDP Growth	1.021*** (0.376)	0.393 (1.223)	0.504 (1.213)	13.66** (6.312)	2.488*** (0.884)
Inflation	-2.732* (1.54)	25.46 (25.43)	-0.781 (2.201)	-4.746 (8.72)	1.538 (5.843)
Market Concentration	0.111 (1.775)	-30.19 (27.95)	-2.834 (2.536)	0.424 (6.496)	-9.721 (6.308)
Observations	1104	1104	1098	1104	4410
F test	5.87***	2.19**	1.46	6.29***	5.10***

Notes: Bank fixed effects not shown. Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1. Source: Performed by author in STATA.

Table 3.8. 2008 – 2013 (ROAE)

Variables / Sample-sets	Q4	Q3	Q2	Q1	Full Sample
Bank Size	-107.6 (88.54)	8.962 (31.08)	45.21 (35.13)	394.9 (258.7)	57.1 (54.66)
Solvency Risk	4.543 (3.001)	10.28*** (3.455)	0.629 (1.288)	49.95* (26.29)	12.54* (7.46)
Operational Efficiency	-0.025*** (0.007)	-0.138 (0.571)	-0.015* (0.009)	-0.115 (0.256)	-0.027*** (0.007)
Credit Risk	0.867 (1.868)	0.576 (1.980)	2.842 (1.937)	0.596 (1.320)	-0.004 (1.128)
Liquidity Risk	0.004 (0.0003)	-0.968 (1.149)	0.001 (0.140)	0.013** (0.006)	0.011*** (0.004)
GDP Growth	2.337 (1.703)	2.503* (1.418)	0.663 (1.626)	21.94* (11.40)	5.063** (2.500)
Inflation	-10.85 (7.755)	-8.566 (10.24)	-4.003 (4.764)	0.492 (19.74)	2.498 (11.63)
Market Concentration	1.383 (7.764)	-11.05 (10.54)	3.789 (13.92)	-1.117 (17.45)	-13.01 (14.44)
Observations	1104	1104	1098	1104	4410
F test	4.22***	1.65	24.37***	3.24***	5.02***

Notes: Bank fixed effects not shown. Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1. Source: Performed by author in STATA.

Table 3.7 serves as the reference regressions of this research and Table 3.8 as its robustness check. In order to understand the impact of GDP growth on profitability of the different quartiles, the coefficients produced on each quartile model must be scaled from the average profitability level they presented during that period. Table 3.9 serves as a reference for the

difference in values of GDP growth variable parameters between the quartiles, and mainly, between Q4 and Q1.

Table 3.9 demonstrates a significantly higher average ROAA in Q1 banks than in the other quartiles (1.04% comparing to 0.30%, 0.39% and 0.12% of assets), including an about 9 times higher value than Q4 average ROAA. It also demonstrates a higher, but not as high, average level of ROAE in Q1 in relation to the other quartiles (7.43% comparing to 4.42%, 5.64 % and 4.42% of equity), with Q1 having an approximately 5 times higher average ROAE than Q4.

Table 3.9. Mean of profitability measures ROAA and ROAE from 2008 until 2013

ROAA	Q4	Q3	Q2	Q1	Full Sample
2008 – 2013	12.06	38.75	29.57	104.39	46.22

ROAE	Q4	Q3	Q2	Q1	Full Sample
2008 – 2013	15.18	56.42	44.23	74.31	47.54

Source: Performed by author in STATA.

3.4. Discussion on the Main Results

Table 3.7 indicates GDP growth to be significant at the 1% level in Q4 and the Full Sample and it is significant at the 5% level in Q1. This variable is always positively correlated with ROAA. Positive correlation between GDP growth and banking profitability shows higher reaction from changes in GDP growth on profitability, meaning during the crisis where GDP growth was lower than usual, a higher negative impact from its decrease on banking profitability.

Analyzing other independent variables’ impact on ROAA (Table 3.7) from 2008 until 2013, it is possible to state several interesting results:

- i. Bank size is not a significant variable for any sub-sample in this period.
- ii. Solvency risk is significant in Q4 at a 5% level. This risk measure is negatively correlated with ROAA, meaning a decrease of 1 percentage point in the equity over assets rate, is related to a decrease of 0.02 percentage points in ROAA on Q4.
- iii. Another variable considered significant to influence profitability in most sample-sets, except for Q1, is operational efficiency and, in all these cases, efficiency

is positively correlated⁷ with profitability, as expected. For Q4, operational efficiency is significant at the 1% level, for Q2 and the full sample, at the 5% level and for Q3, at the 10% level. The parameters suggest a decrease in 10 percentage points of the cost-to-income ratio leads to an increase of 0.001, 0.065, 0.001 and 0.001 percentage points in ROAA for Q4, Q3, Q2 and Sample, respectively.

iv. Credit risk proves only to be significant, at the 10% level, to explain Q1 banks profitability and this suggests that this relationship is positive, so that an increase of this risk measure in 10 percentage points translates into an increase of 0.27 percentage points in ROAA.

v. Liquidity risk is significant at the 5% level for both Q1 and Sample sample-sets. On all these situations the relationship between risk levels and profitability is positive which is surprising since it happens during an in-crisis period. Interpreting these results, an increase of 10 percentage points of loans to deposits ratio is related to an increase of 0.002 and 0.001 percentage points in ROAA for Q1 and Sample, respectively.

vi. Regarding inflation, the latter seems to not have a relationship with banking profitability during the crisis throughout the banking profitability distribution, except for Q4. Unexpectedly, this relationship is negative, suggesting a negative impact of inflation on banking profitability during the crisis. If inflation goes up 1% level, the predicted ROOA decreases by 0.27 on Q4.

vii. Market concentration does not exhibit statistical significance of at least 10%, on any sample-set, during this crisis period.

viii. Returning to the GDP growth variable analysis, if there is a 1 percentage point increase in GDP growth, the model predicts an increase of 0.01, 0.14 and 0.02 percentage points in ROAA for Q4, Q1 and Full Sample banks, respectively.

It should be observed that there is a difference between average ROAA on Q4 and Q1 of about 9 times. The GDP growth parameter in Q1 regression is of about 14 times higher than the one in Q4. Interestingly, the fact that GDP growth proves to be more significant in Q4 and Q1 than in the other two quartiles, Q3 and Q2, and that in these quartiles (Q1 and Q4) solvency risk, for Q4, liquidity risk and credit risk, for Q1, are significant variables as well (while in Q3 and Q2 that is not the case) might show an interesting pattern of riskier or higher risk exposure banks to be more present in extreme parts of the profitability distribution.

⁷ Negative parameters stand for a positive correlation between operational efficiency and ROAA.

In order to provide robustness checks on the previous baseline results, we move on to Table 3.8, having now ROAE as the dependent variable instead of ROAA.

Table 3.8 significantly reduces the importance of GDP growth as a variable capable of explaining profitability during the crisis when comparing to Table 3.7. In the four quartiles, it only proves to be significant, and only at the 10% level, in Q3 and Q1 whilst in the whole Sample, it considers economic activity as a significant variable at 5% level.

Looking individually to each variable impact on the five sample-sets:

i. Bank size is not a significant variable, at least at the 10% level, for any sample-set. In Table 3.7 the same happened.

ii. Solvency risk is considered significant at 1% level for Q3 banking profitability and at 10% level for Q1 and the Full Sample. In all these cases, solvency risk is negatively correlated⁸ with ROAE, so higher risk translates into lower profitability. An increase of 1 percentage point of the equity over assets ratio is related to an increase of 1, 5 and 1.2 percentage points in ROAE for Q3, Q1 and the Full Sample, respectively. In Table 3.7 it is significant for Q4 at 5%.

iii. For Q4, Q2 and Sample sample-sets, operational efficiency is considered significant at 1%, 10% and 1% level, respectively. When interpreting these findings, it is possible to say that the model predicts a positive correlation between efficiency and profitability, as expected. The results indicate that an increase of 10 percentage points in the cost-to-income ratio causes an expected decrease in ROAE of 0.03, 0.02 and 0.03 percentage points in Q4, Q2 and the Full Sample banks, respectively. In Table 3.7 operational efficiency is significant for Q4, Q3, Q2, and Full Sample sample-sets (1%, 10%, 5% and 5% level, respectively).

iv. In Table 3.7 credit risk is only a significant variable for Q1 sample-set, at 10% level, but in Table 3.8 it is not significant at all for any sample-set.

v. Liquidity risk is significant at 5% and 1% level for Q1 and Full Sample sample-sets. In both situations the parameter shows a positive sign, suggesting that higher levels of liquidity, so lower liquidity risk, is correlated with higher profitability on equity. A 10 percentage points increase of the loans to deposits ratio is related to an increase of 0.013 and 0.011 percentage points in ROAE for Q1 and Full Sample sample-sets,

⁸ Lower levels of the Solvency risk ratio, means riskier levels of solvency. So, positive parameters mean a negative correlation between solvency risk and ROAE.

respectively. In Table 3.7 this variable is significant for Q1 and the whole Sample too (5% level, for both cases) and it is positively correlated as well.

vi. Inflation is not proving to be a relevant variable as it was in Table 3.7, where it is only significant at 10% for Q4. In Table 3.8 it is not significant, at least at 10% level, for any sample-set.

vii. Market concentration is not a significant variable for any of the sample-sets, confirming the previous results shown in Table 3.7.

An important point to take from Table 3.8 is that GDP growth proves to have affected more the higher profitable banks than lower ones and even the sample as whole was more affected than Q4 and Q3.

In Table 3.8, Q1 profitability shows a higher exposure to risk when compared to other quartiles, by showing two of the three risk measures, solvency risk and liquidity risk, to be significant variables on explaining ROAE levels, being the only quartile sample to do so.

This robustness analysis shows that GDP growth is a significant variable to explain profitability on both returns on assets (Table 3.7 and Table 3.8) and equity for Q1 banks, which does not happen with any other quartile sample (Q4, Q3 and Q2).

Operational efficiency is on both regressions significant at the 1% level for Q4 banks. This means that on lower profitable banks, the least efficient ones on their operational activity registered higher losses or smaller profits during the crisis but it is hard to extrapolate the idea that this situation is more evident during crisis periods because this was not compared to models applied during non-crisis periods.

Another robust result is the significance of the liquidity risk variable on profitability, showing higher levels of this risk measure to be correlated with lower levels of profitability, maybe suggesting a higher risk exposure on Q1 banks when compared with the other quartile sample banks.

Conclusion

This research tests the hypothesis advanced by the European Central Bank in its Financial Stability Review (ECB, 2015a), that low banking profitability could potentially increase financial risk in the Euro Area. This hypothesis suggests that lower levels of bank profits could decrease their ability to survive against economic and financial crisis by incentivizing banks to increase their risk attitude and reduce their capital base, reducing their robustness to deal with crisis periods.

This research proposes an approach similar to the ones used to find the main determinants of banking profitability with the goal to determine the effect of negative and low GDP growth rates (as it was the case in the addressed time-periods that included two consecutive regressions dealing with this relevant research question) on banking profitability in 4 different samples, each one representing a profitability quartile of the whole sample. Ultimately, the goal is to find whether the GDP growth variable affected more intensively lower profitable banks than higher profitable ones. The Dissertation employs panel data analysis, and the dataset is comprised of multiple variables such as the bank-specific variables of bank size, solvency risk, credit risk, liquidity risk operational efficiency, returns on average assets and returns on average equity; the cyclical variables of GDP growth and inflation; and the only industry-specific variable of market concentration. The baseline results are then robustified by robustness checks.

The empirical results suggest that there is no relationship between low banking profitability and higher negative effects from economic and financial crisis. This result is consistent in most regression models reported in this research, which is also confirmed by the conducted robustness check. Additionally, the bank group of higher profitable banks show a higher exposure to risk during this crisis period, relative to the three other groups of banks in the median and lower levels of profitability.

Policy makers, mainly in banking supervision institutions such as Central Banks, are interested in promoting the stability of the financial system, especially, after the previous financial crisis in 2007-2008, mostly felt in the US and Euro Area. Given this goal, it is important to understand what requirements are crucial for banks to respect in order to promote financial stability and avoid severe repercussions on the real economy and worsen government budgets relative to future financial crisis or to promote crisis mitigation.

As a policy recommendation for these authorities, the present research suggests a higher supervision focus over riskier banking strategies than over the recent recorded lower banking profitability, since low profitability does not seem to be correlated with financial instability. An attempt to find which types of risk strategies are more associated with higher financial instability could be a focus shared both by banking supervision institutions and academia.

As a suggestion for future research, it is important to extend this analysis addressing the ECB hypothesis by either including banks from other geographical regions or applying other validating methodological procedures, using for example smaller quantile groups. Another suggestion involves the attempt to divide banks between risk level quartiles instead of profitability quartiles and run the same econometric model to detect whether economic and financial crisis affect more banks with higher levels of risk and also, what type of risk is more likely to increase financial instability.

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