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Bank Profitability and Efficiency in Portugal and Spain: A Non-Linearity Approach

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Abstract: This paper aims to analyze the determinants of profitability and bank efficiency in the Iberian Peninsula. To achieve the proposed objective, a sample of 66 Portuguese and Spanish banks was analyzed. To test the hypotheses formulated according to the proposed literature review, the panel data methodology was used; specifically, the Generalized Method of Moments (GMM) system model proposed by and the Tobit model. The results point out that the banking performance, measured in terms of profitability and efficiency, in the Iberian Peninsula, is influenced by internal management variables, but also by the macroeconomic environment. More interestingly, and new in the Iberian banking sector literature, the results prove a positive and negative non-linear relationship between bank size and their levels of profitability and efficiency, respectively.

Keywords: performance determinants; bank size; Iberian Peninsula; GMM system; DEA

1. Introduction

Banks establish contacts between economic agents with liquidity and economic agents with a shortage of it, capturing the savings of the first agents to invest in the second agent (Sharma et al. 2013). Therefore, if these transactions are carried out efficiently, they will make the economy in which the sector operates a healthy and profitable one, as well as contributing to the stability and performance of the entire financial and economic system of the country (Athanasoglou et al. 2008).

Due to the great importance of the banking sector in the global economy, some authors seek to research which banking policies are being well implemented and create value, and which need to be restructured to contribute more and better to the economic health of institutions, as well as to the economic development of these countries.

According to the financial literature (e.g., Athanasoglou et al. 2008; Dietrich and Wanzenried 2011; Defung et al. 2016), banking performance, measured through profitability and/or efficiency, is affected by both internal determinants and bank external factors. In fact, according to Trujillo-Ponce (2013); Ding et al. (2017) or Sufian and Kamarudin (2015), the determinants of the bank's performance can be divided. First, there is a group of bank-specific determinants directly resulting from management decisions, such as asset composition, bank capitalization, operational efficiency, or bank size, among others. The second group of determinants includes the macroeconomic environment or the sector specificity, such as state participation, economic growth, and public debt, among others

Thus, while the internal factors result from internal management policies, external determinants are exogenous to the institution and are not available to the bank manager. However, despite being external to the organization, these factors can be predicted and, hence, the importance they have on performance models as they can help decision-makers to prevent unfavorable situations.

Thus, this study aims to distinguish the factors that determine the performance of banks operating in Portugal and Spain, as a global Iberian market, in the period from 2011 to 2016, with the performance being analyzed by profitability and efficiency. The importance of studying this market globally is because at an international and sometimes European level, given the geographical proximity, commercial and cultural relations, these markets are understood as one. Besides, with the intervention of the Troika in Portugal in May 2011, it was necessary to recapitalize Portuguese banking, which found its main source in Spanish capitals. Indeed, in the period under study, the two countries' GDP together represents 10.44% of the European Union GDP. Therefore, the need to study the performance of this market together seems evident. The sample of our empirical study is composed of 66 banks in the Iberian Peninsula, of which 13 are Portuguese, and 53 are Spanish. These numbers also reveal the impossibility of studying Portuguese banks individually given the small number of observations that would make it impossible to use the proposed methodologies. The results show specifically that banking performance is positively affected by depositors' demand, revenue diversification, and GDP. The relationship between the bank's size and profitability is positive non-linear. However, when considering efficiency, it appears that the growth of deposits has a positive impact on economic efficiency, while the size has a non-linear negative effect. These outcomes suggest that a larger banking dimension may not translate into more efficiency, but into greater profitability.

In this way, in our view, the present study may present relevant contributions to the academic community, managers, investors, or regulators. In fact, the first great novelty of this work for the banking sector is the fact that we propose a modeling framework that combines the use of the generalized method of moments (GMM) estimation method with data envelopment analysis (DEA). Then, as far as we know, this study is the first to examine the non-linear relationship between size and performance in the Iberian banking sector. We conclude that this non-linear effect exists, so regulatory policies must take this finding into account. Having policies differentiated by the size of banks may not be the best differentiation. Moreover, for the managers and investors, our results are important to understand which are the main determinants of profitability and efficiency and which are the ones that most contribute to the best efficiency in the management of resources.

This paper is organized as follows. The next section presents the literature review where the main theories and hypotheses are identified. The third section describes the sample data, the variables used in the study, and the methodology used to estimate the models. Section 4 presents the main results, and, finally, Section 5 presents the conclusions, limitations, and lines of future research.

2. Literature Review

Since profitability and efficiency are traditional measures of performance, several authors (e.g., Aiello and Bonanno 2016; Athanasoglou et al. 2008; Defung et al. 2016; Dietrich and Wanzenried 2011; Ding et al. 2017; Djalilov and Piesse 2016; García-Herrero et al. 2009; Guru et al. 2002; Knezevic and Dobromirov 2016; Sufian and Kamarudin 2015) concluded that the performance determinants of Banking institutions can be divided into two categories—internal and external—and can be subdivided into industry-specific factors and macroeconomic factors.

The first category concerns factors that are specific to banks; that is, they are variables that are controlled by their management, which reflect the different management policies and decisions and, consequently, dictate their performance (Djalilov and Piesse 2016; Guru et al. 2002). External determinants are factors that derive from the country's economic and legal environment and, therefore, nothing related to how the bank is being managed (Dietrich and Wanzenried 2011; Ding et al. 2017; Djalilov and Piesse 2016). Thus, internal factors are part of, among others, bank asset structure, bank asset quality, bank capital, bank operational efficiency, bank revenue diversification, bank annual deposit growth, and bank size. In the same way, among the external factors, we can highlight the property, the fact that the banks are quoted or not, inflation, or economic growth. These variables are those used in our estimation model, and to that extent, it is precisely on these that the literature review will focus.

We emphasize that our study differs from the others, which we quote below, for the following reasons. First of all, we studied two countries as a global market, given their geographical, commercial, and cultural proximity, as well as the high share of the Spanish capital in Portuguese banking. Second, we considered the performance, measured through profitability and efficiency, of the Iberian banking sector, which in our best knowledge of the literature has not been studied, proposing a modeling framework that combines the use of the GMM system estimation method with DEA. Finally, and for this sector, the possible non-linear relationship between bank size and performance was also not considered in the literature.

2.1. Bank Specific Factors

2.1.1. Asset Structure

Banks tend to diversify their loan portfolio and increase liquidity to reduce risks, particularly in times of crisis (Djalilov and Piesse 2016). Therefore, in general, loans positively influence profitability because, as a bank's core business, they are a significant generator of interest income (Bikker and Hu 2002). Based on this premise, authors like Bourke (1989); García-Herrero et al. (2009); Saona (2016); Tan et al. (2017); Trujillo-Ponce (2013) refer to a positive relationship between the relative percentage of loans on a bank's assets and its profitability. It is noteworthy that Dell'Atti et al. (2015) verify that banks' specialization in traditional activity (loans) lead to higher cost efficiency, given that by specializing they can optimize costs.

However, the increase in the loan portfolio is associated with high liquidity risk if the bank's management does not know how to efficiently reduce liabilities or finance the increase in assets on the balance sheet (Knezevic and Dobromirov 2016; Trujillo-Ponce 2013). Tan et al. (2017) confirmed that liquidity risk has a positive influence when considering ROAA as a measure of bank profitability in Chinese banks. However, there is a negative relationship if ROAE is considered. Trabelsi and Trad (2017) found a negative relationship between the structure of assets and ROAA and a positive one with ROAE.

Guru et al. (2002) and Rumler and Waschiczek (2014) found a negative relationship between the asset structure and the profitability of banks in their studies. Also, Aiello and Bonanno (2016), Sufian and Kamarudin (2015) found a negative relationship between the structure of assets and efficiency, indicating that there is a low quality of assets that implies the non-payment of loans by borrowers, conditioning thus liquidity and efficiency. As it turns out, the relationship of this variable with performance is far from being consensual, since on the one hand more volume of loans may imply more business and more specialization, and, therefore, more profit and efficiency for the bank, while on the other hand, a large set of loans implies higher operating costs with the possibility that the premium applied to the long-term interest rate is insufficient to cover processing costs, credit losses and the cost of maintaining required capital reserves.

Based on the arguments described above, we propose that the first hypothesis be tested, with no definite sign as there is no consensus between the authors:

Hypothesis 1 (H1). *There is a significant relationship between the composition of banks' assets and their performance.*

2.1.2. Operational Efficiency

According to some studies (Athanasoglou et al. 2008; Ding et al. 2017), operational efficiency is one of the indicators that most influence bank profitability.

Traditionally, operational efficiency for the banking sector is measured using the cost-benefit ratio (CIR), and the higher the CIR, the more inefficient the bank is. To increase the performance measured through profitability, it is necessary to increase the efficiency of the financial institution's management (Athanasoglou et al. 2008; Dietrich and Wanzenried 2011); that is, the reduction of

operating costs (administrative expenses, employees' salaries, among others) and, at the same time, increase revenues, which can lead to a high level of bank profitability Knezevic and Dobromirov (2016) or Neves et al. (2020).

Some authors who obtained a negative relationship between CIR and profitability, are, among others, Dietrich and Wanzenried (2011); Garcia and Guerreiro (2016); Guru et al. (2002); Knezevic and Dobromirov (2016), or Trujillo-Ponce (2013).

It should be noted that as it is intended to analyze performance from efficiency, it cannot be used as an explanatory variable since it already represents an operational efficiency variable in itself, an efficiency measure. Thus, CIR is only used for profitability determinants.

Based on the literature cited, the second hypothesis is presented:

Hypothesis 2 (H2). *There is a positive relationship between a bank's operational efficiency and its level of profitability.*

2.1.3. Revenue Diversification

Bank activities can be divided into traditional activities and non-traditional activities, both of which are important to increase the levels of bank performance. According to Trujillo-Ponce (2013), non-traditional activities arise with the purpose of diversification, trying, in this way, to generate new sources of income complementing traditional activities. In this sense, Stiroh (2004, 2006) and Stiroh and Rumble (2006) show that financial institutions need to increase non-traditional activities to survive the increasingly strong competition.

On the other hand, DeYoung and Rice (2004) argue that basing profitability on non-traditional activities can mortgage the future of institutions, calling into question the strategies and initial objectives.

Thus, while Saona (2016) demonstrated that there is a negative relationship between diversification and bank profitability, Narwal and Pathneja (2016) show a positive relationship. Likewise, Tan et al. (2017) showed a positive relationship between non-traditional activities and ROAA, but negative with ROAE, which means that there are doubts about how it affects revenue diversification in banking performance.

Concerning efficiency, Sufian (2009) and Aiello and Bonanno (2016) document a positive effect, which indicates that banks benefit from business diversification, not only focusing on their intermediation function; also Gulati and Kumar (2017) conclude that the greater exposure of banks to non-traditional activities contributes positively to efficiency. However, Phan et al. (2018) find a negative relationship, that is, more diversification leads to less efficiency. Finally, some authors have not found statistical significance in this relationship, such as, for example, Elsas et al. (2010); Stiroh and Rumble (2006); and Trujillo-Ponce (2013), among others. Accordingly, the following hypothesis is posed, with no definite sign:

Hypothesis 3 (H3). *There is a significant relationship between the diversity of a bank's revenues and its level of performance.*

2.1.4. Annual Deposits Growth

Bank deposits represent a more stable and cheaper financial resource than other financing and should contribute to an increase in the sector's performance (García-Herrero et al. 2009).

However, with the recent economic crisis, the "war on deposits" may very well have caused banking institutions to have engaged in aggressive policies and, consequently, to have reduced their profit margins. That is, for banks to be more attractive to depositors, they chose to pay higher rates, causing the reduction of their financial margin to negatively affect the institution's profitability (Trujillo-Ponce 2013). In fact, as Dietrich and Wanzenried (2011) argue, high deposit growth rates also entice additional competitors, affecting the profitability of these institutions.

For example, Trujillo-Ponce (2013) found no relationship between the growth rate of bank deposits and Spanish bank profitability. However, Garcia and Guerreiro (2016) found that the growth of deposits has a positive impact on ROAA, but that it has no statistical significance on ROAE. In contrast, Dietrich and Wanzenried (2011) face a negative influence on ROAA and a positive influence on ROAE.

Concerning efficiency, Sufian and Kamarudin (2015) do not find a statistically significant relationship between deposits and efficiency. Sufian (2009), on the other hand, verified a negative effect of the natural logarithm of deposits on efficiency, which indicates that the most efficient banks are associated with lower deposit growth since by not expanding their market share they will not be involved in increasing costs In harmony with the exposed literature, the following hypothesis is posed, with no definite sign:

Hypothesis 4 (H4). *There is a significant relationship between the growth rate of a bank's deposits and its level of performance.*

2.1.5. Size

There is a wide range of studies that associate the size of financial institutions with their profitability. The larger a bank is, the more easily it can achieve economies of scale (Djalilov and Piesse 2016; Iannotta et al. 2007). In other words, having a larger size, the bank can increase its services by having the same fixed expenses, thus enabling a reduction in expenses (García-Herrero et al. 2009).

Saona (2016) adds that a large bank will incur large operations; therefore, it will be associated with a higher risk that, consequently, will cause the institution to charge higher margins, positively influencing profitability through increased results.

However, a bank that is too large may incur diseconomies of scale since it will have an increase in variable costs, such as, for example, operational, bureaucratic, and marketing expenses, negatively affecting bank profitability (Athanasoglou et al. 2008; Dietrich and Wanzenried 2011).

Besides, a larger size can hamper efficient bank management due to the occurrence of aggressive competitive strategies, García-Herrero et al. (2009).

Dietrich and Wanzenried (2011) concluded that, before the crisis, large and small banks were more profitable than medium-sized banks, but during the crisis, those that proved to be less profitable in Switzerland were large banks. Similarly, Berger and Mester (1997) found evidence that smaller banks have a higher rate of return.

The study by Ding et al. (2017) showed that, after the crisis, the US banking sector managed to restructure itself and present a positive relationship between size and profitability. Since the authors had obtained a negative relationship during the crisis. Also, Elsas et al. (2010) and Knezevic and Dobromirov (2016) demonstrated a negative and significant relationship between size and profitability. Other investigations have found no significant relationship between profitability and bank size (Alshatti 2016; Athanasoglou et al. 2008; Lee and Kim 2013; Rumler and Waschiczek 2014; Trujillo-Ponce (2013). This duality of results may also indicate a non-linear relationship, as verified by Nguyen (2018).

The size of the banks is also the subject of study regarding the determinants of efficiency. From the analyzed literature, it appears that Defung et al. (2016), Dell'Atti et al. (2015) and Goswami et al. (2019), and Phan et al. (2018) find a positive relationship, justifying that larger banks are more efficient, as they manage to achieve economies of scale. It should be noted that Aiello and Bonanno (2016) also document a positive relationship, also exploring a possible non-linear relationship, which they do not find for Italian cooperative banks. However, Gulati and Kumar (2017) state that the relationship between bank size and efficiency is ambiguous, and smaller banks may have better efficiencies.

Under the exposed literature, the following hypothesis is presented, with no definite sign:

Hypothesis 5 (H5). *There is a significant relationship between bank size and their level of performance.*

Moreover, as the size is important to differentiate banks and there are mixed findings (e.g., Alshatti 2016; Athanasoglou et al. 2008; Ding et al. 2017; Goswami et al. 2019; Gulati and Kumar 2017) of size on banking profitability and efficiency, this study seeks to answer the following research question: is there a non-linear relationship between bank size and performance?

2.2. Macroeconomic Factors

Economic Growth

A country's economic growth is traditionally measured by its Gross Domestic Product (GDP) and can be conditioned by different economic cycles. If economic conditions are unfavorable, asset quality may be compromised, leading to credit losses and increases in provisions held by banks, and, consequently, a decrease in results and profitability. On the other hand, if economic conditions are favorable, the demand for credit by households and companies will increase, as the solvency and financial flexibility of borrowers will improve (Athanasoglou et al. 2008; Dietrich and Wanzenried 2011; Lee and Kim 2013; Rumler and Waschiczek 2014; Trabelsi and Trad 2017, or Trujillo-Ponce 2013), causing an increase in banking results and therefore in its performance level.

However, Saona (2016) and Shehzad et al. (2013) showed that in periods of significant economic growth, this variable may not have the expected relationship with the profit of the institutions, as the economic situation is favorable, banks tend to adjust their interest margins (reducing them), and may negatively affect their profitability.

Other authors such as Djalilov and Piesse (2016); García-Herrero et al. (2009), or Knezevic and Dobromirov (2016) found no relationship between economic growth and bank profitability.

Finally, Garcia and Guerreiro (2016) concluded that GDP negatively affects the banking sector if it is analyzed using the ROAE performance indicator, but without meaning, if the most operational performance measure, ROAA, is used.

Concerning efficiency, Defung et al. (2016); Sufian and Kamarudin (2015) find a positive relationship between GDP and efficiency, justifying this relationship because the growth of the economy increases deposits and cash flows, which will increase efficiency.

Aiello and Bonanno (2016); Dell'Atti et al. (2015), and Goswami et al. (2019) document a negative relationship between GDP per capita and efficiency, since the greater the development of the greater the operational and financial costs that banks will incur.

Accordingly, we propose the following hypothesis to be tested, with no definite sign:

Hypothesis 6 (H6). *There is a significant relationship between the country's GDP and banking performance.*

3. Research Design: Data, Variables, and Methodology

3.1. Data

The data constituting the sample are for 66 Iberian banks, of which 13 are Portuguese and 53 Spanish, for the period from 2011 to 2016. The analysis includes all banks with complete data for at least four years, a necessary condition for the second-order correlation estimation (Arellano and Bond 1991). As the second-order correlation is an assumption of GMM, and this will be the estimation method used, this correlation must be tested (Neves 2018, or Vieira et al. 2019). The data to calculate bank and industry-specific variables come from Orbis Bank Focus, Bureau van Dijk's database. While the macroeconomic variables come from The World Bank.

The fact that we study Iberian Banking as a global market is related, on the one hand, to the fact that Spanish banking has a large presence in Portugal and, on the other hand, because internationally the specialized press describes the sector as unique, with the same problems and challenges, fundamentally after the contagion witnessed by the global financial crisis. Moreover, following Silva et al. (2018) or Cancela et al. (2020), the two countries have similar economic and social characteristics, whereby the

joint analysis of the banks operating in Portugal and Spain allows us to have a better perception of the performance in this sector.

In fact, these two cross-border countries have been widely considered by the players in the global economy and the press as an Iberian market and not as markets considered individually. They have some very similar business characteristics, and there is a cultural tradition in Spanish banks intervening in Portuguese banking capital. This happened even more with the sovereign debt crisis that in Portugal ended up leading to an adjustment program by the troika and that forced a greater bank capitalization. Besides, these two countries after the crisis appear with a good global reputation with new amounts of foreign capital in the face of the rapid economic recovery after the financial crisis. Likewise, at the macro level, the GDP of both countries in the period covered by our sample is growing above the European average (Cancela et al. 2020).

3.2. Variables

3.2.1. Dependent Variables

Profitability

Much of the literature uses ROAA and ROAE as a measure of performance evaluation, and for this reason, it will also be the performance indices used in this work. The average return on total assets (ROAA) is the relationship between average profit and assets (Athanasoglou et al. 2008). Trujillo-Ponce (2013) (European Central Bank 2010) argues that this is perhaps the most important measure for comparing the efficiency and performance of banking institutions for not accounting for financial leverage. Garcia and Guerreiro (2016) state that ROAA portrays the efficiency of management because they obtain results through the assets that banks hold. The average return on equity (ROAE) is the relationship between net income and equity (Athanasoglou et al. 2008). This indicator shows the return on capital invested by shareholders. For this reason, Rumler and Waschiczek (2014) argue that ROAE is the most popular performance measure for financial analysts. However, they warn that we need to be careful when interpreting this index, since a high ROAE value may indicate low levels of equity. That is, a high value of the return on equity may be the result of an increase in the external debt, so there will be greater financial leverage.

It is important to note that as ROAE is based, above all, on a perspective of return to the shareholder, there may be pressure for the distribution of results, thus jeopardizing the capitalization of banking institutions. However, this ratio estimates the contribution of all equity and off-balance sheet facts, while ROAA ignores off-balance sheet activities (Athanasoglou et al. 2008; Rumler and Waschiczek 2014), as liabilities assumed by banks that generate income, which, accounting, are not included in the assets of banks. It should also be noted that, in part, the asset is valued at acquisition cost, which can lead to the underestimation or overestimation of the elements that compose it, thus influencing the ROAA ratio.

Efficiency

Banking performance has also been analyzed through efficiency. Efficiency compares banks' ability to transform inputs into financial products and services (Tecles and Tabak 2010).

Efficiency has been calculated through Data envelopment analysis (DEA) (e.g., Defung et al. 2016; Sufian and Kamarudin 2015). This is a non-parametric performance evaluation method, which sees banks as Decision-making units (DMU), evaluation units, calculating efficiency through inputs (resources used) and outputs (goods and services obtained) (Ebrahimnejad et al. 2014). Using mathematical programming, the DEA optimally assigns the weightings of the inputs and outputs, the objective function of each DMU being given by the quotient of the weighted outputs and the weighted inputs; maximum efficiency is one, that is, a DMU is considered efficient when the result of the optimization function is one (Palečková 2017) and the

minimum efficiency is zero (Yang 2014; Sufian and Kamarudin 2015). This method has the weaknesses of not measuring absolute efficiency (Ebrahimnejad et al. 2014) and not allowing the presence of a random error term (Niţoi and Spulbăr 2016); that is, it is not able to separate the effect of random shocks estimated efficiencies (Huang et al. 2015); and as strengths, there is the lack of a pre-conceived structure concerning inputs and outputs (Huang et al. 2015), allowing the variables from bank to bank to be adapted, since they operate in a different from country to country (Du and Sim 2016).

Having exposed the main points in the calculation of efficiency, it must be taken into account that the most important task in measuring efficiency is to identify inputs and outputs (Kao and Liu 2014). There are four methodologies for this—production, intermediation, profit, and assets.

On the one hand, the production methodology regards the bank as a production system, in which it produces loans and provides services to account holders (Bassem 2014). In this methodology, the inputs to be considered are, for example, employees, equipment, workspace and as outputs, the bank produces two services—deposits and loans (Kao and Liu 2014; Mäkinen and Jones 2015). It should be noted that An et al. (2015) show that efficiency improves the better the performance in the deposit utilization phase, that is, banks should improve their capacity to absorb more deposits, applying more attractive policies.

On the other hand, the intermediation methodology considers the bank as a mediator of funds between savers and investors (Bassem 2014). In this analysis, inputs are, for example, labor, physical capital, purchased funds, deposits, and outputs, short, medium, and long-term loans (Kao and Liu 2014), bonds, and off-balance sheet assets (Tsionas et al. 2015), revenue-generating assets (Mamatzakis et al. 2015), income (Desta 2016; Abdul-Wahab and Haron 2017). Investment in technology can also be considered as input, and the number of ATMs can be used as a proxy (Wang and Lu 2015).

The profit methodology presents the financial institution as a generator of income, having in this form, as inputs supported interest and other expenses supported and as outputs unproductive loans (NPL), interest income, and other income (Zhu et al. 2014; Defung et al. 2016; Davutyan and Yildirim 2017). It should be noted that NPLs cause technological setbacks (Fujii et al. 2014), which is one of the factors that most contribute to bank inefficiency (Zhu et al. 2014). With the increase in NPL, banks must diversify their income and increase it in sources other than interest (Aggelopoulos and Georgopoulos 2017), such as, for example, bank fees.

Finally, under the asset approach, it is assumed that the basic function of any financial institution is the creation of credit, so the value of their assets (credit) is an output (Bassem 2014).

In the case under study, as followed by Neves et al. (2020), the profit approach is considered, accepting as inputs the total loans over total assets, the cost-to-income ratio, and the Personnel expenses; while as outputs, bank capitalization, asset return ratios and return on equity were considered. Efficiency is then calculated using the DEA method as followed by Phan et al. (2018) and Banna et al. (2019).

3.2.2. Independents Variables

Understanding the intrinsic and exogenous factors that influence the profitability of Portuguese and Spanish banks is one of the main focuses of this study. Therefore, the variables in Table 1 will be analyzed.

Table 1. Bank-specific and macroeconomic factors.

Variables	Formula
Asset Structure—EA	The ratio between Total Loans and Total Assets[1]
Operational Efficiency—CIR	The ratio between Total Expense and Total Revenue[2]
Revenue Diversification—DIVR	The ratio between Non-Interest Income and Gross Income
Annual Deposit Growth—CAD	Total deposi$_t$ minus Total Deposits$_{-1}$ over Total Deposits$_{-1}$
SIZE	Total Asset Logarithm[3]
Economic growth—GDP	Real Gross Domestic Product Growth[4]

3.3. Methodology

3.3.1. Profitability

Considering ROAE and ROAA as the dependent variables and the independent variables as defined in Table 1, we obtain the following models:

$$ROAE_{i,t} = \beta_0 + \beta_1 ROAE_{i,t-1} + \beta_2 EA_{i,t} + \beta_3 CIR_{i,t} + \beta_4 DIVR_{i,t} + \beta_5 CAD_{i,t} + \beta_6 SIZE_{i,t} + \beta_7 SIZE^2_{i,t} + \beta_8 GDP_{i,t} + \varepsilon_{i,t} \quad (1)$$

$$ROAA_{i,t} = \beta_0 + \beta_1 ROAA_{i,t-1} + \beta_2 EA_{i,t} + \beta_3 CIR_{i,t} + \beta_4 DIVR_{i,t} + \beta_5 CAD_{i,t} + \beta_6 SIZE_{i,t} + \beta_7 SIZE^2_{i,t} + \beta_8 GDP_{i,t} + \varepsilon_{i,t} \quad (2)$$

The specification of these models follows Proença et al. (2020). To estimate these models, the dynamic GMM model was used, initially proposed by Arellano and Bond (1991) and improved by Blundell and Bond (1998). By using the GMM method, we solve two fundamental problems such as endogeneity and unobserved heterogeneity (Djalilov and Piesse 2016; García-Herrero et al. 2009; Neves et al. 2019 or Vieira et al. 2019).

3.3.2. Cost or Economic Efficiency

As followed by Defung et al. (2016), to calculate efficiency, we used the constant returns to scale—BCC model by Banker et al. (1984), with inputs orientation, that is, there is the minimization of inputs, keeping outputs constant. This approach is considered as it is easier for banks to change inputs (change in personnel expenses) than to change outputs (capitalization or change in profitability), as these depend on third party decisions (Goswami et al. 2019).

Thus, it is intended to minimize the following relationship as done by Banna et al. (2019):

$$\text{Minimize } EFF_k, \ \sum_{k=1}^{N} \varphi_k x_{ik} \leq x_{i0} EFF, \ \sum_{k=1}^{N} \varphi_k y_{jk} \leq y_{i0}, \ \sum_{k=1}^{N} \varphi_k = 1, \quad (3)$$

where $k = 1, 2, \dots, N$; $i = 1, 2, \dots, I$; $j = 1, 2, \dots, J$; EFF_k is the cost efficiency of DMU k; y_{jk} is the output j of the DMU k: x_{ik} is the input j of the DMU k; φ_k is a constant vector denoting the intensity levels at which the N observations are conducted (Delis and Papanikolaou 2009). It is assumed that the inputs and outputs are not negative; the total inputs are given hi i and outputs by J.

The economic efficiency varies between zero and one. If the score is 1, it means that banks used the minimum possible amount of inputs to produce the outputs, and the proportion of inputs guarantee the minimum possible costs.

To analyze the determinants of efficiency, the Tobit methodology is used, since efficiency is a scale from zero to one, this being the most appropriate methodology, following Defung et al. (2016) and Wang and Lu (2015). Thus, according to these authors, the model is as follows:

$$EFF_{i,t} = \beta_0 + \beta_1 EA_{i,t} + \beta_2 DIVR_{i,t} + \beta_3 CAD_{i,t} + \beta_4 SIZE_{i,t} + \beta_5 SIZE^2_{i,t} + \beta_6 GDP_{i,t} + \varepsilon_{i,t} \quad (4)$$

It should be noted that the panel was calculated from 2013 to 2016, as data were absent from 2011 to 2012 in some banks.

4. Results

4.1. Descriptive Statistics

This section describes the descriptive statistics (mean, minimum, maximum, and standard deviation) for the variables used in the sample. From what can be seen from Table 2, the study shows a

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[1]   Alshatti (2016); García-Herrero et al. (2009); Sharma et al. (2013) and Trujillo-Ponce (2013)Trujillo-Ponce
[2]   Dietrich and Wanzenried (2011), Knezevic and Dobromirov (2016) and Saona (2016).
[3]   Alshatti (2016); Djalilov and Piesse (2016); Knezevic and Dobromirov (2016); Tan et al. (2017) and Trujillo-Ponce (2013).
[4]   Athanasoglou et al. (2008); Dietrich and Wanzenried (2011); Garcia and Guerreiro (2016) and Rumler and Waschiczek (2014).

positive average of ROAA and negative of ROAE for all years under observation. It is also observed that the means of the independent variables are all positive. Regarding the standard deviation, it can be seen that the annual growth of deposits is the variable with the highest value.

Table 2. Descriptive Statistics.

Variable	Mean	Std. Dev.	Min	Max
ROAA	0.379719	1.701478	−12.008	9.952
ROAE	−0.46703	43.87163	−596.314	45.98
EFF	0.4566023	0.3653675	0	1
EA	0.510006	0.235952	0	0.942856
CIR	66.87424	27.38884	13.891	296.87
DIVR	43.7394	28.1506	−99.6403	179.604
CAD	1154.213	14457.01	−61.1799	184025.5
SIZE	16.21646	2.201946	11.7182	21.01613
GDP	0.238848	2.406531	−4.02826	3.432253

4.2. Efficiency

Table 3 show the estimates of economic/cost efficiency per bank in the 4 years under analysis. As can be seen, the average economic efficiency increased from 2013 (0.4519) to 2016 (0.5355), registering a global average for all banks and the entire period of 0.4223. The number of efficient banks grew in 2014 and 2015 compared to 2013, and then decreased in 2016 compared to 2015. There were 12 banks if in the period under review they always remain efficient.

As the efficiency score is smaller than 1, on average, the 66 Iberian banks did not use the minimum amount of inputs to produce the outputs, and the proportion of inputs did not guarantee the minimum possible costs. Moreover, at the end of the analyzed period, the average cost efficiency was 53.5%, indicating a potential cost savings of 46.5%, i.e., for banks to be efficient (cost efficiency scores equal to 1) they have to reduce 46.5% of their costs.

4.3. Results Discussion

Tables 4 and 5 show the results of the regression model. Table 4 presents the results for banks in the Iberian Peninsula considering a linear relationship between size and performance measured through the two profitability and efficiency indicators, and Table 5 a non-linear analysis between bank size and performance. Table 4 shows that the variables that influence profitability are all except the size of the banks if we consider ROAA as a measure of performance evaluation. In case we take into account the ROAE, in addition to the size, the asset structure is also not relevant in explaining the levels of bank performance. When analyzing efficiency, autonomous (constant) efficiency, and the growth of deposits have a positive impact on economic efficiency.

Considering the non-linear relationship between the size of the banks and the profitability, there is an interesting result, which is the fact that the size of the bank has a positive non-linear relationship (predominantly positive, concave downward curve—part of the U inverted to the point maximum), that is, profitability grows when the size of the bank increases, but after determining a point this growth is marginally lower. However, with efficiency the opposite occurs, the size of the asset has a negative non-linear impact on efficiency (predominantly negative, concave upward curve—part of the U to the minimum point), but after a certain point, the decrease is marginally inferior. Smaller banks are more efficient as they will have smaller cost structures.

Table 3. Efficiency scores.

DMU	2013–2016	2013	2014	2015	2016
1	0.262	0.262	0.262	1	0.815
2	0.305	0.305	0.335	1	0.505
3	0.305	0.305	0.323	1	0.49
4	0.268	0.268	0.29	0.021	0.427
5	0.198	0.198	0.227	0.133	0.505
6	0.104	0.104	0.178	0.202	0.324
7	0.12	0.569	0.16	0.096	0.398
8	0.019	0.248	0.036	0.141	0.206
9	0.116	0.128	0.436	0.409	0.312
10	0.039	0.081	0.095	0.169	0.192
11	0.021	0.082	0.028	0.183	0.846
12	1	1	0.109	0.105	0.84
13	0.09	0.101	0.179	0.152	0.122
14	0.518	0.518	1	0.152	0.647
15	0.077	0.077	0.139	0.128	0.84
16	0.057	0.068	0.152	0.114	0.841
17	0.056	0.066	0.152	0.096	0.087
18	0.079	0.079	0.068	0.132	1
19	0.386	0.386	0.102	0.075	0.852
20	0.358	0.358	0.017	0.037	0.875
21	0.495	0.495	0.292	0.837	0.08
22	0.171	0.189	1	0.059	0.883
23	1	1	1	0.059	0.883
24	0.432	0.432	0.23	0.022	1
25	0.37	0.37	0.167	0.022	0.909
26	0.424	0.424	0.134	0.022	0.085
27	0.361	0.361	0.038	0.022	1
28	0.366	0.366	0.188	0.022	1
29	0.019	0.019	0.123	0.022	0.092
30	0.357	0.357	0.025	0.022	0.126
31	0.787	0.787	1	1	1
32	1	1	1	1	0.034
33	0.461	0.461	0.584	0.022	0.034
34	0.416	0.416	0.167	0.022	0.456
35	0.358	0.358	0.191	0.022	0.456
36	0.327	0.327	0.674	0.022	0.456
37	0.495	0.495	0.635	0.022	0.456
38	0.521	0.521	0.543	0.022	0.456
39	0.146	0.146	0.011	0.605	0.318
40	0.674	0.674	0	0.605	0.318
41	0.514	0.514	0.031	0.495	0.318
42	0.361	0.361	0.366	0.495	0.318
43	0.602	0.602	0.371	0.495	0.002
44	1	1	0.052	0.495	0.318
45	0.173	0.173	1	0.121	0.563
DMU	**2013-2016**	**2013**	**2014**	**2015**	**2016**
46	1	1	1	1	1
47	1	1	1	0.121	0.563
48	0.207	0.207	0.08	0.293	0.563
49	0.895	0.895	0.451	0.581	0.563
50	1	1	1	1	1
51	1	1	1	1	1
52	1	1	1	0.451	0.563
53	1	1	1	1	1
54	0.32	0.32	0.867	1	0.062
55	0.029	0.029	1	1	0.782
56	0.247	0.247	0.291	1	0.277
57	0.155	0.155	1	1	0.545
58	0.02	0.02	1	1	0.221
59	1	1	0.346	1	0.299
60	0.029	0.029	0.083	1	1
61	0.064	0.636	0.117	1	1
62	0.671	0.671	1	0.141	1
63	1	1	1	1	0.085
64	0.087	0.622	0.069	0.086	0.114
65	0.564	0.564	0.452	0.194	0.026
66	0.382	0.382	0.695	0.042	1
Number of efficient banks	12	12	17	18	13
Mean	0.422	0.451	0.432	0.406	0.535
Standard deviation	0.336	0.323	0.380	0.405	0.341

As we can see by reading Table 4, all independent variables are significant in explaining the ROAA except the size of the banks. In this way, we can corroborate the hypotheses presented in the previous section (Hypotheses 1–4, and 6) according to the literature referred to above. When we use the variable ROAE to measure the performance of banks, in addition to size, the structure of assets also does not show any statistically significant result. From the provisions, it is clear that it is not possible to corroborate hypothesis 1, which means that it is not possible to identify whether the banking sector can efficiently manage an increase in the loan portfolio during the period under analysis. This period is characterized by strong competition and banking competitiveness, as banks have been under great pressure to attract customers. We are not ignoring the fact that this measure is particularly interesting for investors/shareholders.

Particularly, among the significant variables of the models, the negative relationship of CIR with performance is highlighted. The negative and significant coefficient of the cost-to-income ratio shows that poor management of expenses is one of the main factors influencing poor banking performance. That is, to achieve higher performance, there must be a decrease in expenses and/or an increase in revenues (Knezevic and Dobromirov 2016). The result obtained is in line with those obtained by Dietrich and Wanzenried (2011) and Shehzad et al. (2013). The higher the CIR, the lower the efficiency and, therefore, the profitability, thus corroborating Hypothesis 2.

Concerning non-traditional revenues, our results emphasize that these are fundamental in increasing bank performance, corroborating Hypothesis 3, and according to the results of Tan et al. (2017).

Table 4 shows a positive and significant relationship between the annual growth rate of deposits and both performance variables. Indeed, we corroborate hypothesis 4, according to Dietrich and Wanzenried (2011) and Garcia and Guerreiro (2016). The increase in demand for deposits increases bank profitability in the Iberian Peninsula. At a time when banks were experiencing the effects of a complex financial crisis, in an attempt to slow recovery, these banks may be benefiting from increased depositors' purchasing power and consequent deposits. There is no need to engage in aggressive policies (which could adversely affect performance) to attract depositors. Regarding the macroeconomic variable used, GDP, the positive and significant relationship verified, corroborates hypothesis 6 showing that the external environment is decisive to influence decisions that increase banking performance (Dietrich and Wanzenried 2011; Lee and Kim 2013; Rumler and Waschiczek 2014; Trabelsi and Trad 2017 or Trujillo-Ponce 2013).

Regarding efficiency and analyzing Table 4, it appears that only hypothesis 4 is corroborated, verifying that the growth of deposits implies an increase in economic efficiency, and indicating that the most efficient banks are associated with greater deposit growth, achieving gain economies of scale, as noted by Sufian and Kamarudin (2015). The degree of explanation of the model also reveals a low degree of explanation of the explanatory variables, so more variables should be taken into account to explain efficiency and/or a more extended period. In Table 5, in addition to the previous explanatory variables, the quadratic variable of the banking size was introduced to understand if there is a non-linear relationship between bank size and performance. The results obtained are very similar, in terms of sign and significance, to those obtained in the previous table, the big difference being in the non-linear relationship between bank size and performance. This result is in itself revealing of the importance of the theme and the originality of this work.

Table 4. Results of the Models formulated in Equations (1), (2) and (4): Estimation for the Banks in the Iberian Peninsula Sample considering a linear relationship between bank size and performance.

Variables & Tests	ROAE				ROAA				EFF			
	Coefficient	Standard Error	Z	*p*-Value	Coefficient	Standard Error	Z	*p*-Value	Coefficient	Standard Error	Z	*p*-Value
Constant	−5.6765	7.0277	−0.81	0.419	2.6811	0.54404	4.93	0.000 ***	0.71194	0.31041	2.29	0.023 **
L1.	0.1231	0.034	3.59	0.000 ***	−0.14877	0.03773	−3.94	0.000 ***				
EA	9.6403	6.292	1.53	0.126	−1.9280	0.5621	−3.43	0.001 ***	−0.24448	0.18625	−1.31	0.192
CIR	−0.176	0.0137	−12.88	0.000 ***	−0.0219	0.00197	−11.11	0.000 ***				
DIVR	0.0581	0.0100	5.80	0.000 ***	0.00533	0.00128	4.15	0.000 ***	0.00126	0.00121	1.04	0.302
CAD	0.0002	1.14×10^{-5}	14.6	0.000 ***	0.00004	1.07×10^{-6}	39.25	0.000 ***	0.00324	0.00126	2.58	0.011 **
SIZE	0.6045	0.4291	1.41	0.159	−0.0257	0.03625	−0.71	0.478	−0.0116	0.01935	−0.60	0.549
GDP	2.0833	0.1910	1091	0.000 ***	0.2241144	0.081724	2.74	0.006 ***	−0.00789	0.02825	−0.28	0.780
Sargan			16,215 (13)	0.2377			16.126 (13)	0.24				
Wald			1068 (7)	0.0000			10,656 (7)	0.0000				
AR (1)			−1.165	0.2441			−1.097	0.2727				
AR (2)			−1.6306	0.1030			−1.36	0.1739				
Pseudo R^2											0.0749	

The variables in the Table are those defined in the previous section and the rest of the information required to read the Table is as follows: (i) the values in parentheses represent the asymptotic standard errors consistent with heteroscedasticity; (ii) **, *** represent the coefficients that are statistically significant at the level of 5% and 1%, respectively; (iii) The Sargan test has a p-value greater than 5% showing that the instruments are valid and the values between relatives represent degrees of freedom; (iv) Wald's test has a p-value of less than 5% indicating that the set of coefficients is asymptotically distributed as χ2 under the null hypothesis without significance, the degrees of freedom are represented in parentheses; (v) The Arellano-Bond test is distributed asymptotically as N (0.1) under the null hypothesis of no serial correlation. The AR (2) test indicates that there are no serial correlation problems.

Table 5. Results of the Models formulated in Equations (1), (2) and (4): Estimation for the Banks in the Iberian Peninsula Sample considering the quadratic variable of the banks' size.

Variables & Tests	ROAE				ROAA				EFF			
	Coefficient	Standard Error	Z	*p*-Value	Coefficient	Standard Error	Z	*p*-Value	Coefficient	Standard Error	Z	*p*-Value
Constant	−637.294	218.322	−2.92	0.004 ***	−83.482	26.511	−3.15	0.002 ***	4.5418	2.1732	2.09	0.038 **
L1.	0.0988	0.0834	1.19	0.236	−0.2449	0.0774	−3.17	0.002 ***				
EA	10.562	18.344	0.58	0.565	−1.1933	2.0409	−0.58	0.559	−0.1285	0.1944	−0.66	0.510
CIR	−0.1525	0.0367	−4.15	0.00 ***	−0.0218	0.0052	−4.21	0.000 ***				
DIVR	0.0633	0.0353	1.79	0.073 *	0.0075	0.00421	1.79	0.073 *	0.0011	0.0012	0.99	0.325
CAD	0.0002	4.91E× 10^{-5}	3.51	0.00 ***	0.00004	5.8E× 10^{-6}	6.75	0.000 ***	0.0032	0.0012	2.62	0.010 **
SIZE	78.833	26.966	2.92	0.003 ***	10.828	3.3134	3.27	0.001 ***	−0.4896	0.2690	−1.82	0.071 *
SIZE^2	−2.3764	0.81288	−2.92	0.003 ***	−0.3357	0.10151	−3.31	0.001 ***	0.0143	0.0080	1.78	0.077 *
GDP	1.9117	0.6062	3.15	0.002 ***	0.1914	0.07326	2.61	0.009 ***	−0.0022	0.0280	−0.08	0.936
Sargan			7.036 (13)	0.9003			20.168 (13)	0.0911				
Wald			52.60 (8)	0.000			124.27 (8)	0.000				
Pseudo R^2										0.0897		

The variables in the Table are those defined in the previous section and the rest of the information required to read the Table is as follows: (i) the values in parentheses represent the asymptotic standard errors consistent with heteroscedasticity; (ii) *, **, *** represent the coefficients that are statistically significant at the level of 10%, 5% and 1%, respectively; (iii) The Sargan test has a p-value greater than 5% showing that the instruments are valid and the values between relatives represent degrees of freedom; (iv) The Wald test has a p-value of less than 5% indicating that the set of coefficients is asymptotically distributed as χ2 under the null hypothesis without significance, the degrees of freedom are represented in parentheses.

As seen in Table 5 for profitability, the size parameter is positive, and the square size parameter is negative, which indicates that the relationship between the bank's size and profitability is inverted U-shape until to the maximum point (predominantly positive, concave downward curve). This means that from a given size of the bank, the profitability increases but at a much lower rate than when the size of the banks is smaller. The positive effect indicates that the larger a bank is, the more easily it can achieve economies of scale (Djalilov and Piesse 2016; Iannotta et al. 2007), reducing costs and increasing profitability (García-Herrero et al. 2009). However, a bank that is too large may incur diseconomies of scale since it will have an increase in variable costs, such as, for example, operating, bureaucratic and marketing expenses, negatively affecting bank profitability (Athanasoglou et al. 2008; Dietrich and Wanzenried 2011). In this sense, the positive non-linear relationship indicates the transition from economies of scale to diseconomies of scale, i.e., our results demonstrate that as the size of the bank increases, it fails to take full advantage of economies of scale, since increases in profitability are lower when compared to smaller banks.

Besides, these results may also indicate that a large bank will incur large operations; therefore, it will be associated with a greater risk that, consequently, will cause the institution to charge higher margins, positively influencing profitability, via increased results (Saona 2016). However, if defaults start to occur, the results of banks are adversely affected by the constitution of loan loss provisions.

It should also be noted that Dietrich and Wanzenried (2011) also concluded that, before the crisis, large and small banks were more profitable than medium-sized banks, but during the crisis, those that proved to be less profitable in Switzerland were the biggest banks. Similarly, Berger and Mester (1997) found evidence that smaller banks have a higher rate of return.

Regarding efficiency, observing Table 5, the size parameter is negative and the size square parameter is positive, which indicates that the relationship between the bank's size and profitability is U-shaped up to the minimum point (predominantly negative, concave upward curve). This negative relationship suggests that smaller cost structures will allow greater efficiencies, as verified by Berger et al. (2010). As the size of the banks increases, efficiency has decreased, but at an increasingly lower rate of decline, indicating a stabilization of "economic inefficiency" with the increase in the bank's size.

In this way, our results extend the literature on the banking sector, because, to our best knowledge, this is the first study to analyze the nonlinear effect of bank size on profitability and efficiency measures combining two differents methodologies, GMM and DEA. It is concluded that this non-linear effect exists, whereby regulatory policies have to take this finding into account. Having policies differentiated by the size of banks may not be the best differentiation.

5. Conclusions

The global financial crisis 2007–2008 showed that a strong and financially sustainable banking system is essential for the growth of any economy, due to its role as a financial intermediary. Hence the importance of studying this sector. This study had a main objective to analyze the factors that influence the performance of Portuguese and Spanish banking, using two profitability indicators, ROAA and ROAE, and an efficiency indicator, during a period from 2011 to 2016 and 2013 to 2016, respectively. To achieve this goal, we proposed a modeling framework that combines the use of the generalized method of moments (GMM) estimation method with data envelopment analysis (DEA).

Our results show that the profitability of Iberian banking is influenced by internal and external variables. In particular, it appears that the banks' performance is positively influenced by depositors' demand, diversification of revenues, and GDP. At a time that includes the Troika's intervention period in Portugal and given the geographical proximity of Spain as well as the legal requirements established, the banks needed to reinvent their traditional sources of revenue.

Note also the relationship between the size of the bank and the profitability which is positive non-linear (predominantly positive, concave downward curve—part of the U inverted to the maximum point); that is, the profitability grows when the size of the bank increases, but after determining this point this growth is marginally lower. However, with efficiency, the opposite occurs, the size of

the asset has a negative non-linear impact on efficiency (predominantly negative, concave upward curve—part of the U to the minimum point), but after a certain point, the decrease is marginally inferior. Smaller banks have higher efficiencies, as they will have smaller cost structures. That result was further reinforced when it was found that Iberian banks did not manage their expenses and costs efficiently and that they incurred a poorly applied operational policy, negatively influencing efficiency. of these institutions, and the decline in profitability.

Our results could be interesting to academics, managers, regulators, and civil society. Indeed, we extend the literature on the banking system in the Iberian peninsula. Moreover, our results can be used by regulators and managers in your planning, because we show the determinants of efficiency and profitability, and in particular, we found that large banks are more profitable and less efficient. Civil society realizes that the banking sector is important for your economic well-being, and so this sector has to improve its efficiency.

The small sample size is our main limitation, especially for efficiency. For future work, it would be interesting to introduce new variables to capture the differences in corporate governance between banks from different institutional environments, common law vs civil law. Besides, it would be desirable to see if public banks have performance levels similar to private ones as well as levels of efficiency. Moreover, in future studies, it would be interesting to subdivide economic efficiency into technological and allocative efficiencies.

Author Contributions: All authors contributed to the definition of the problem to be studied, to the research question; The database was treated by M.E.N.; The text was written by A.D.; The methodology was developed by E.N. and C.P.; The literature review was prepared by the three authors. All authors have read and agreed to the published version of the manuscript.

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