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Risk-taking by banks: Evidence from European Union countries

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ABSTRACT

The aim of this paper is to study the relation between banks' ownership structure and their risk-taking behavior. Additionally, we examine the impact of banking regulation on banks' approach to taking risk. The empirical analysis considers a sample of listed banks from EU countries over the period of 2011 to 2016. We found that the structure of the board of directors can influence bank risk behavior but not the ownership concentration. No significant relation was found between the influence of the regulatory environment and bank risk, i.e., stricter regulation has no effect on risk taking by banks.

Keywords: Banks; Risk; Corporate governance; Regulation; EU countries.

JEL Codes: G21; G32; G34; G38.

1. INTRODUCTION

Banks play a crucial role in economic growth and are responsible for preserving financial stability. For instance, the bankruptcy of Lehman Brothers – one of the largest investment banks in the United States – triggered a financial crisis in 2008 that affected countries across the world. Consequently, governments and central banks refocused their attention on the financial sector, and, more particularly, on the banking system. Regulators began to deploy more strict regulation with the aim to create a robust banking system which would be capable of enduring the next financial crisis with increased resilience. Among the many causes of instability in the banking sector, risk-taking behaviour is one of the main sources of insolvency. In the case of European banks, greater exposure to systemic risk due to shadow banking activities caused worse performance (Acharya et al., 2013; Arteta et al., 2013). Additionally, according to Beltratti and Stulz (2012), the banks that performed worse during the 2008 crisis were those that had higher stock returns before the period of the crisis.

Going forward, recent studies show that risk-taking behavior is related with the corporate governance of the bank. As Beltratti and Stulz (2012) suggest, during financial crisis, the stronger the corporate governance is, the less risk the banks took, and consequently the better they performed. Corporate governance can be characterised in several ways according to ownership structure, i.e., is the financial institution owned by a large shareholder or by diffuse shareholders? Banks are considered to have a good ownership concentration when their shareholders are diffuse, because in cases where large shareholders are present, these shareholders tend to act in their own interest, which can include investing in more risky portfolios with the objective of gaining higher expected returns, even if such investment harms the performance of the bank – which are known as agency problems (Laeven and Levine, 2009; Esty, 1998; Galai and Masulis, 1976). The structure and the composition of the board of directors can also play a role in incentivising a bank to be riskier, or not. A smaller-sized board often performs better, as the risk of disagreements is diminished due to diversified points of views and the fact that the strategic decision-making process is more straightforward. On the other hand, if directors are not independent from the bank, then their behaviour can be skewed and more prone to conflicts of interest (de Andres and Vallelado, 2008).

In the context of a financial crisis, it is also important to understand the role of the regulators – is it true to say that more restrict regulation implies less risky behavior? According to Laeven and Levine (2009), the impact of regulation varies from bank to bank, according to the type of corporate governance. For instance, financial institutions with larger shareholders tend to choose riskier investment portfolios to compensate for the negative effect of stringent capital requirements.

Therefore, it is very important to analyze the role that corporate governance plays on banks' risk-taking behavior and how the regulatory framework affects it. This paper differs from previous studies in terms of the period under analysis, which is from 2011 to 2016, whereas the recent literature essentially only covers up until a few years after the financial crisis of 2008. Most of the empirical analysis uses a sample of countries across the world, or just the United States, whereas few studies focus on European countries. Furthermore, using a balanced panel dataset which includes observations of European banks, we regress a generalized least squares random effect model to determine whether corporate governance influences banks' risk-taking behavior, as well as the role of regulation in this relationship.

The paper is structured as follows: in Section 2 we briefly introduce the economic environment and describe the banking sector. In Section 3 we present a review of the literature regarding corporate governance, risk and regulation, and the relationship between them. In Section 4 we describe the data and the methodology used. In Section 5 we show the results of the empirical assessment and, finally in Section 6 we summarize the conclusions of this paper.

2. THE ECONOMIC ENVIRONMENT AND THE BANKING SECTOR

Going back to September 2008, the Lehman Brothers collapse was the catalyst which ignited the conditions that had been building up for several years and which ultimately resulted in the eruption of the latest global financial crisis. This shock deteriorated the economic environment in several ways in European Union countries, namely: GDP started to decrease, from 26,100 euros per capita in 2008 to 24,500 euros per capita in 2009, as showed in Figure 1. This decline was essentially driven by a contraction in exports and less private investment, especially in the manufacturing and industry (including energy) sectors, as showed in Table 1. Unemployment rate, as presented in in Figure 2, reached record numbers, which consequently also depressed private consumption (in Figure 3).

The collapse of the Lehman Brothers acted just like a trigger, as, in effect, the global macroeconomic environment was already showing worrying signs of imbalances and a weak financial system was slowly being installed. The lack of strong regulation and supervisory frameworks have progressively resulted in a higher level of risk-taking behavior by banks, with riskier investment portfolios being chosen to expectantly ensure better returns. According to Kosmidoua et al. (2017) and Cohen et al. (2014), higher opacity in a bank, i.e., less financial transparency and information asymmetry, is strongly associated with the risk of a stock market crash. During the pre-crisis period, the banking sector had precisely been accumulating this kind of opaque financial products and risky assets, the prime example being asset-backed securities. Furthermore, liquidity issues were also identified as being one of the origins of the vulnerability of the financial market (Longstaff, 2010), in the sense that toxic assets could not be either recovered or liquidated, and consequently banks were unable to raise funds in the market.

Nevertheless, the financial crisis forced significant structural changes in the macroeconomic environment and in the financial system, particularly with regards the regulatory and supervisory framework. Governments and central banks refocused their attention on the banking system and began to implement several reforms in this regard. For instance, the Basel Committee on Banking Supervision reformulated and upgraded the Basel Committee Standards, by announcing the Basel III framework in December 2010. The purpose of this enhanced global regulatory framework was to foster a more

resilient banking system by introducing both global liquidity risk standards and the overall leverage ratio, as well as strengthening the capital requirements that were already in place in the past decade (Basel Committee on Banking Supervision, 2010).

With regards Europe, reforms were brought about by the application of Basel III (which started in 2013), together with the implementation of the single supervisory mechanism (SSM), which was officially launched in 2014. The SSM composition mainly consisted of transferring the direct supervision of significant banks (evaluated in terms of dimension and systemic importance) from the national competent authorities to the European Central Bank (ECB). Additionally, on the monetary policy front, some extreme measures were taken to stimulate economic growth. The ECB progressively decreased the reference interest rate to unprecedented low figures – which even attained real negative levels – and embarked on unconventional measures, such as increasing its balance sheet through the purchasing of large amounts of government bonds with the aim of decreasing real interest rates and thus expand economic activity – known as ‘quantified easing’.

Accordingly, structural financial indicators started to reveal a certain recovery from the crisis in the banking sector. As illustrated in Figure 4, net interest income gradually and steadily increased when compared with the values before the crisis, as a repercussion of the low interest rates practiced by the European Central Bank.

Nevertheless, total revenue has declined (Figure 5), as a significant fall in trading income (Figure 6) and fees and commissions (Figure 7) has more than compensated the recovery of interest income (Schildbach, 2017).

The increase of the share of operating income in total assets (Figure 8), together with less expenditure (Figure 9) from 2008 to 2016, demonstrates that banks nowadays seek a safer asset allocation, with both an improvement in management strategy and rigorous supervision (European Central Bank, 2017).

More demanding capital requirements had the intended effect of increasing the capital ratio (Figure 10). In this context, regulators and policy makers have become more focused on the Common Equity Tier 1 definition, owing to not only the use of a more straightforward definition of capital, but also the strict criterion regarding risk-weighted assets (Schildbach, 2017).

Finally, in terms of market indicators, European financial stocks are still recovering from the aftermath of the financial crisis. Figure 11 shows that levels of shares prices continue to be lower than the pre-crisis period, which is the result of the legacy of toxic assets and non-performing loans (Basten and Serrano, 2018), from which it is proving to be quite hard to disassociate.

3. LITERATURE REVIEW

To maintain a sound and resilient economy, each agent needs to play its role in the best way they can. As a practical example, financial institutions, particularly banks, act as the bridge between lenders and borrowers, and thus playing a role as financial intermediaries, by channeling funds from one to another. Besides allocating savings and granting credit, these institutions also provide payments services such as credit transfers, direct debits, card payments, and mobile and online payments. In this perspective, banks are quite different from non-financial firms, as their business model is very distinct.

On one hand, banks are highly leveraged, where debt typically represents more than 90% of the balance sheet, comparing to 20% - 30% for non-financial firms (Gornall and Strebulaev, 2014). Due to this singularity, any increase in bank debt has a great effect on a bank's profitability, especially during a financial crisis (Konstantinos, 2012).

On the other hand, Levine (2004) suggests that large informational asymmetries exist in the banking system between internal and external parties, which leads to the existence of more opaque institutions. Insiders¹, tend to choose riskier portfolios to ensure larger returns, and conversely, debt holders (as outsiders) are more inclined to take less risk. Accordingly, the existence of opaqueness makes it more difficult for outsiders to control this risk-taking behavior. As part of their role to protect bank's outsiders, governments and supervisors are forced to implement stricter measures to regulate the banking sector, such as establishing minimum capital requirements.

Since the last financial crisis – which affected many countries worldwide – several studies have focused on analyzing in more depth the causes of the shock. Previous

¹ For example, controlling owners.

literatures suggest that a relationship between banks' performance and their risk-taking behavior exists (Acharya et al., 2013; Arteta et al., 2013). Considering the crucial role that banks play in economic growth and their responsibility in preserving the financial stability, an increase in their risk-taking behavior generates economic fragility (Bernanke, 1983; Calomiris and Mason, 2003a,b; Keeley, 1990). Additionally, the interaction between weak risk management and complex and opaque financial products only further deteriorates the financial system.

Accordingly, the board of directors represents one of the parties that can potentially be responsible for a bank being riskier, or not, as it is responsible for defining the bank's strategy and for advising managers on their decisions. On the one hand, the type of board of directors of a bank can determine the risk of insolvency (Battaglia and Gallo, 2017), while, on the other hand, managers also influence banks' risk-taking behaviour, as they are directly responsible for the day-to-day operational decisions. In this context, banks' corporate governance receives a reinforced attention from regulators, policy makers, and researchers, as does the relation between corporate governance and bank risk-taking. Kirkpatrick (2009) goes as far as to argue that the main cause of the 2007-2008 financial crisis was precisely the presence of a poor governance in the banking industry.

John et al. (2016) compiled the existent literature on corporate governance in banks, paying specific attention to corporate boards, ownership, and managerial incentives. These authors present the results of empirical analyses of various authors, and report divergent conclusions on the previously mentioned issues. Their findings also show that this topic has been strongly discussed among researchers in the past, with the objective to better understand the role of corporate governance in banks.

The Basel Committee on Banking Supervision also addressed this issue in its research works, by publishing guidelines and consultative documents on corporate governance. In particular, the most recent consultative document entitled "Principles for enhancing corporate governance" (Basel Committee on Banking Supervision, 2010) refers to a series of principles for a sound corporate governance in the banking industry. Furthermore, this subject was also included in the Pillar 2 requirements (supervisory review process) of

Basell II (Basel Committee on Banking Supervision, 2005, pp. 163–164²), reinforcing the importance of monitoring risk management and the need to establish principles for a good corporate governance.

Even though several papers reveal evidence linking governance structure with bank risk (Ellul and Yerramilli, 2013; Jensen and Meckling, 1976; John et al., 2008), there is no consensus regarding the sign of this relationship.

Laeven and Levine (2009), Esty (1998), and Galai and Masulis (1976) all agree that ownership which is characterised by large shareholders gives rise to an increase in bank risk. In comparison to managers, shareholders typically have a more diversified portfolio and the losses from choosing a riskier portfolio do not damage their personal wealth so much. In addition, for banks which have a very concentrated ownership, their shareholders tend to have greater power to control the strategic decisions, and thus suppress the opinion of minority shareholders.

A corporate structure which is divided between the board of directors and the managers creates certain agency problems (Berle and Means, 1932). For instance, banks with large shareholders tend to choose board directors for the purpose of protecting their own interest of taking more risk. On the contrary, managers have a less diversified investment portfolio, and as they often hold equity in the bank, they tend to make less risky choices (Saunders et al., 1990; Bouwens and Verriest, 2014). However, the outcome of the research of Iannotta et al. (2007) differs from the previous literature, as the authors argue that “higher ownership concentration is associated with better loan quality, lower asset risk and lower insolvency risk”.

The structure of the board of directors can also be characterised in terms of size and independence. Concerning the latter, independent members (someone with no relation with the institution) are expected to demonstrate a more uncompromised involvement with the financial institution when compared with shareholders and managers, and consequently they tend to take more reasonable decisions. In this regard, a negative association between bank risk-taking and independence is supported by various

² In July 2009, the Pillar 2 framework was revised due to the weakness encountered during the financial crisis of 2008 and published a new document with stricter principles (Basel Committee on Banking Supervision, 2009).

researchers (Beltratti and Stulz, 2012; Erkens et al., 2012; Wang and Hsu, 2013). Beltratti and Stulz (2012), conclude that banks with a shareholder-friendly board take more risks during crises, by analysing a sample of large banks across the world. Erkens et al. (2012) suggest that banks performed better during periods of crisis when a more independent board was present, since their decision-making was crucial for the decision of increasing capital and the consequent transfer of wealth from shareholders to debt holders. Wang and Hsu (2013) test the effect of board composition on the probability of a bank having an operational risk event and their results show that board independence is inversely related to the risk of financial institutions in this respect.

In terms of board size, Battaglia and Gallo (2017) found that banks with a larger number of board directors suffered greater losses during the crisis, which, in turn, affected financial stability by exposing the institutions to more systematic risk. This empirical evidence follows Wang and Hsu (2013), who also suggest that operational risk management performs worse when a larger board was present. The fact that board size negatively affects banks' performance is associated with the fact that a large number of directors leads to the board being more diversified in terms of culture and personalities. This diversity generates a wider range of opinions and strategies for the bank, albeit it is more difficult to coordinate and obtain a unanimous decision during board meetings in such cases.

Summing up, strong boards (i.e., with a small size in terms of members, with a larger proportion of them being independent directors, as defined by Pathan (2009) and Battaglia and Gallo (2017)) tend to take less risk and perform better when compared with larger-sized boards and less-independent directors.

In contrast, Adams (2012) shows that banks characterised as having strong boards, are associated with the TARP (Trouble Asset Relief Program) and demonstrate an inverted u-shape when analysing the effect of a bank board's structure on bank's performance (de Andres and Vallelado, 2008). These different perspectives prove that there is still a lack of consensus among economics researchers and that even more analysis is required. John et al. (2000, 2008) reveal mixed results, indicating that the impact of corporate governance on bank risk-taking also depends on capital regulation. Their findings suggest that regulators should take this issue into account when implementing

reforms, by administering different regulation to financial institutions in function of banks' characteristics, such as corporate governance.

One of the principal instruments used by regulators to control bank risk is through capital adequacy. This instrument has been enhanced over the past years, in particular after the last financial crisis. In relation to the more relaxed capital adequacy instruments which were previously in force, several banks still needed to be rescued or recapitalised, including those which were considered “too-big-to-fail” – which consequently led to a severe imbalance of the financial system. The presence of a larger percentage of capital adequacy suggests that the financial institution in question is more stable and has less credit exposures, which in turn contributes to preventing future insolvencies (Jeitschko and Jeung, 2005; Grossman, 1992). Central banks and supervisors commonly establish a minimum capital requirements and monitor them closely through periodic reports. The Basel Committee on Banking Supervision (2010) recently published Basel III, which imposes stricter standards principles for Pillar I, which incorporate the monitoring of capital, risk coverage, and leverage containment. The question is, does this type of regulation actually reduce the risk-taking behaviour of banks? In a certain sense, some authors suggest that an increase of the minimum capital requirements leads to higher risk, as banks tend to compensate the utility loss from stricter regulation (Buser et al., 1981; Koehn and Santomero, 1980; Laeven and Levine, 2009). In this perspective, when the capital adequacy ratio is established, banks are generally inclined to invest in risky assets up until the capital requirement is reached. As mentioned above, the relation between ownership structure and bank risk depends on capital regulation, although risk-taking incentives can also vary according to the ownership structure, even within the same regulation in one specific country (Laeven and Levine, 2009).

Overall, it is important to emphasise the role of corporate governance in the banking industry, since it is related with risk-taking behaviour. Furthermore, the aim of the authorities to create a robust banking system that is capable of surviving the next financial crisis through the recourse to stricter regulation might not have the expected effect for all banks alike.

4. DATA AND METHODOLOGY

4.1 DATA

The initial dataset used in this study considers all publicly listed active banks identified by Moody's Analytics BankFocus at the beginning of 2018. We focused on banks from European Union countries³ and collected data from income statement and balance sheet from the period of 2011 to 2016. This original sample was subsequently reduced to 140 banks due to problems of data availability, which ultimately resulted in the exclusion of some countries from the analyses, namely, Estonia, Ireland, and Luxembourg. We have also eliminated cooperative banks in France, specifically the Credit Agricole group, as, in effect, these regional banks will be included in the analyse of the ownership, risk, and regulation of Credit Agricole S.A. Additionally, we only consider banks who were part of the EURO STOXX 50 Index for more than three years during the period of 2011 to 2016. The final sample includes a balanced data of 726 observations, which represents 121 banks from 23 countries.

The source of financial information was Moody's Analytics BankFocus, whereas data concerning corporate governance were sourced by the Authors from the respective annual reports. The information regarding countries' variables was obtained from Eurostat and was complemented by the World Bank. Finally, the market information regarding mergers and acquisitions activities was derived from SNL – S&P Global Market Intelligence.

4.2 BANK RISK-TAKING

The scope of financial institutions includes diverse activities, and each subject is associated with specific risk, although these are all related with each other. Some of those risks are external and are not controlled by bank managers, an example being risk related with adverse market movements (e.g., variations in the interest rate, foreign exchange, equities, and commodities). However, banks need to always be prepared for such types of events. Other types of risk, such as credit risk and operational risk, can be supervised

³ Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom.

and moderated in function of the strategy of each bank. Previous studies argued that risk behaviour is related with bank's performance and consequently with the probability of bankruptcy (Bernanke, 1983; Calomiris and Mason, 2003a,b; Keeley, 1990).

A commonly used measure to proxy the variable of risk is the z-score, calculated as $(ROA+CAR)/\sigma(ROA)$, which is also used by several authors: Laeven and Levine (2009), Pathan (2009) and Beltratti and Stulz (2012). ROA correspond to Return on Assets, calculated as Net income plus Interest Expense divided by Total assets. The CAR (Capital Adequacy Ratio) is measured by the division of Tier 1 Capital by Risk-Weighted Assets and $\sigma(ROA)$ indicates the volatility of Return of Assets. A bank's z-score refers to the inverse probability of its insolvency (Roy, 1952), whereby a higher value in the distance of failure indicates less risk and greater stability. Like Laeven and Levine (2009) and Battaglia and Gallo (2017), we transform the z-score into a natural logarithm, which is normally distributed, as this measure is highly skewed.

We also examine a component of this measure separately as a measure of risk – the Capital Adequacy Ratio. The reason for integrating this variable in our model is that this ratio is closely monitored by regulators and supervisory bodies, where higher values mean a more stable bank. The data collected to calculate the two measures were obtained from Moody's Analytics BankFocus, for the period of 2011 - 2016.

4.3 CORPORATE GOVERNANCE

The analysis of corporate governance can be carried out in various ways. In this paper we mainly focus on ownership concentration and the structure of the board of directors. Information on bank ownership and board structures were hand-collected from the annual reports for 2016 of each bank. We assumed that this data remained unchanged for the entire period (2011 - 2016), as corporate governance structures changes little over time (Black et al., 2006; Cremers and Ferrell, 2010; La Porta et al, 1998, 1999). Additionally, if information was not present in the 2016 annual report, we then based our data on the current situation with respect to ownership and the bank's board of directors.

Regarding ownership concentration, we follow the references for ownership of La Porta et al. (1999) and Laeven and Levine (2009) and consider a bank to be owned by a wide range of shareholders if the largest hold less than 10% of the bank's voting rights.

In our model we distinguished ownership in two variables: i) a dummy variable which assumes the value of 1 when it is classified as large shareholder, and 0 otherwise; ii) and another calculated as a direct percentage of the voting rights of the largest shareholder.

Among other features, a strong board can be characterised as having a small size in terms of members, with a higher proportion of them being independent directors (Pathan, 2009; Battaglia and Gallo, 2017). To measure board size, we collected the number of directors on the board, and for independence we considered the share of total directors who are independent. Independence is defined as the following: an independent director is not an existing or former employee of the bank, and neither are their immediate family members and they have no significant business ties with the bank (Pathan, 2009, p. 1343).

4.4 REGULATION

Following previous studies (Beltratti and Stulz, 2012; Laeven and Levine, 2009), we use four variables as proxies of regulation: regulatory restrictions, capital stringency, power of official supervisor, and private monitoring. All those indicators are characterised by country and are based on the World Bank Banking Supervision Survey⁴, which was carried out in 2011 by Barth et al. (2012). The definition of the variables is as follows:

- Regulatory restrictions – is an index of regulatory restrictions on bank activities;
- Capital Stringency – is an index of regulatory oversight of bank capital;
- Power of official supervisor – is an index of the power of the bank supervisory agency;
- Private monitoring – is an index of the monitoring of the private sector part of the banking system.

All those indexes indicate the degree of regulation in a country, where greater values indicate that the bank industry is more highly regulated.

⁴ The survey provides information about banking regulation and supervision for 143 countries. It consists on a set of questions grouped by a specific issue, where each answer corresponds to a numeric value. We included the following: i) bank activity, ii) capital, iii) official supervision, and iv) private monitoring.

In our analysis we opt to exclude the indicator of capital requirements that is commonly used by researchers. In fact, most of the samples used in other studies cover countries across the world, where regulation varies from country to country. In the case of Europe, particularly in the countries which constitute our sample, the minimum of capital requirements is the same, which is set at 8% (which is identical to Basel III). We also decided not to consider the dummy variable used by Laeven and Levine (2009) regarding deposit insurance – because all European countries are covered by a deposit guarantee scheme (which is defined by each national authority).

4.5 CONTROL VARIABLES

In addition, we incorporate in our model certain bank-specific characteristics as control variables. According to Demsetz and Strahan (1997), when compared with smaller banks, major financial institutions tend to invest in more risky loan portfolios and operating with higher level of leverage ratios, as they are able to compensate from the benefits of having more diversified options to invest in. In this context, we account for the leverage ratio variable as a control variable, which corresponds to the division of Tier 1 capital by total assets, where a lower ratio indicates more leverage, and thus a higher level of risk for the bank.

The variable bank credit risk is calculated as the ratio of impaired loans to gross loans, with the objective to measure the total amount of impaired or doubtful loans. This variable can also be considered as a proxy of portfolio quality (Casu et al., 2011), where a lower ratio means a better quality of asset. A commonly used measure for asset quality is the loan loss provision divided by net interest revenue. This ratio indicates the proportion of interest income that is reserved to cover non-performing loans (NPL) as a contingency. The variable for liquidity risk is calculated by the ratio of liquid assets (cash and balances with central banks, plus net loans and advances to banks, plus level one assets) divided by deposits and short-term funding (customer deposits plus short term funding).

To control for bank business activity, we considered the ratio of loans divided by total assets, which corresponds to the percentage of total assets invested in the loan portfolio – which has the effect of controlling the differences in the banking business model across banks (de Andres and Vallelado, 2008).

We use the cost to income ratio to evaluate banks' operational efficiency, with this indicator being calculated as the ratio of total operating expenses divided by total operating income. A lower ratio indicates that the bank is more efficient. As mentioned above, the size of the bank also affects the risk behaviour, and for this reason we use the natural logarithm of the total asset variable.

Lastly, we include a dummy variable that assumes 1 when a bank was subject to a merger or a major acquisition over the sample period, and 0 otherwise. This kind of event can indeed be disruptive and there is a good chance that it could influence bank governance (Schranz, 1993; Berger et al., 1998).

With regards the country control variable, we use the logarithm of GDP per capita to account for economic environment changes. All bank-specific data were obtained from Moody's Analytics BankFocus, except for the data on variable mergers and acquisitions, which were derived from SNL – S&P Global Market Intelligence.

Table 2 presents the definitions for all the variables of our sample and the respective expected sign. Additionally, in Table 3 we describe the questions made in the survey for each index, as defined by the Authors.

4.6 SUMMARY STATISTICS

Table 4 displays the summary statistics for the risk, ownership, regulation, and control variables used in the empirical analysis. Additionally, in Table 5 we present the average value of each variable of our sample, clustered by country.

The average Capital Adequacy Ratio is higher than the minimum required (8%), presenting a percentage of 16.72%, which implies that most banks are complying with the regulation.

The country with the lowest percentage is Greece (12.300), mainly due to the economic and financial assistance programme that the country went through⁵. On the contrary, the highest percentage is seen in the Netherlands, with an average percentage of 24.90%. Continuing the analysis per country, the one with the highest risk of insolvency

⁵ Provopoulos (2014) describes the economic environment in Greece and the banking system during the financial crisis of 2008.

is Greece (5.99%), for the reasons mentioned before, whereas the country with the least probability of default is France (8.82%).

With respect the corporate governance variables, the mean of large shareholder is 0.80, which indicates that most banks in our sample have a shareholder which detains more than 10.00% of the shares. On the other hand, this percentage is not so high, when one considers that the mean of the voting rights is merely 31.57. Additionally, only four banks have a shareholder with more than 90% of the voting rights, with three of these being from Slovakia, and one from the Netherlands. We consider shareholders with less than 10% of voting rights to be a null value, following Laeven and Levine (2009). According to Kohler (2010), the mean of United Kingdom (UK) voting rights is lower when comparing with Continental Europe⁶, mainly due to the protection of shareholders' rights in UK, where large shareholders do not need to have much control of the bank to be able to control the management decisions.

Turning to the term for independent directors, the mean percentage is 61.67%, with a minimum of 14.28 and a maximum of 100.00. In this sample, 19 financial institutions have a full independent board, with the lowest percentage belonging to a Lithuanian bank – Siauliu Bankas. It is also found that, on average, the board of European Union countries has 10 members, with a minimum of 3 and a maximum of 20. The bank with the least board members is Prima Bank Slovensko A.S., although not being the smallest bank when considering the average of total assets. The smallest bank has 7 directors on the board, whilst three banks have 20 board members⁷, all of which belong to the top 15 largest banks of our sample.

Concerning the regulation variables, large differences exist between countries regarding the restrictions, where the range of this index is 3-12. In our sample, the minimum is 4, and the maximum is 11. Poland is the country which has the strictest restrictions for banking activities. Moving to capital stringency, the average is 6.59, which is slightly above the medium range (5.00) of this index. The official supervisory agencies in EU countries exercise greater regulatory power over the banking system, as the minimum is 9, with a maximum out of 13, from a range of 0-14. Finally, the minimum

⁶ The following countries are from Continental Europe: France, Germany, Italy and Spain.

⁷ HSBC Holdings PLC, Deutsche Bank AG, and Commerzbank AG.

value for private monitoring is 6.00, as is the case for Portugal, and the maximum value is 10.00, which corresponds to a mean of 8.24.

In Table 6 we present the correlation matrix by using Pearson's correlation coefficients. According to the findings of Barako and Tower (2007) and Gujarati (2003, p.359), the multicollinearity issue is not at stake in our model since none of the correlation coefficients⁸ is greater than 0.80. The highest correlation coefficient of 0.71 is between the leverage and liquidity variables.

Albeit with a weak relation, some statistically significance correlation between the z-score and all the governance variables was nevertheless found, with independence having the highest value (0.20). For the board size variable, it is shown that this variable has a positive effect on the z-score, which indicates that a larger board is associated with a more stable bank (a higher z-score), which differs from previous studies. In terms of the capital adequacy ratio variable, the relation is only significant for independence and board size at a significant level of 0.05, with a coefficient correlation of 0.20 and -0.15, respectively.

4.7 ECONOMETRIC MODEL

Although several studies have analysed the interaction between risk-taking by banks, corporate governance, and regulation, the signs of these relations are still ambiguous. Our empirical analysis consists of testing the following two hypotheses:

- H1: Stronger corporate governance (i.e., less concentrated ownership and a small and more independent board) has a negative influence on bank risk-taking behaviour;
- H2: Stricter regulation is negatively related to bank risk.

For this purpose, we use the generalized least squared (GLS) random effect (RE) method, following Baltagi and Wu (1999) and Pathan (2009). The most suitable method is GLS, bearing in mind that our sample is a balanced panel data. The results of the Breusch and Pagan Lagrangian multiplier test led us to exclude the pooled Ordinary Least Squared (OLS) method. We also opted not to use the fixed effect (FE) method for our

⁸ Between two independent variables.

model, as our key explanatory variables are constant over time (Wooldridge, 2015, p. 444).

Formally, we estimate the following equation for Hypothesis 1:

$$(1) Risk_{it} = \beta_1 + \beta_2 (LARGE)_{i2016} + \beta_3 (RIGHTS)_{i2016} + \beta_4 (IND)_{i2016} + \beta_5 (BS)_{i2016} + \beta_6 (CONTROL)_{it} + \varepsilon_{it}$$

The dependent variable RISK is a proxy for the alternatives measures of bank risk: the z-score and capital adequacy ratio, where subscripts i indicates individual bank ($i = 1, 2, \dots, 121$) and t year ($t = 2011, \dots, 2016$). The explanatory variables are *LARGE*, *RIGHTS*, *IND* and *BS* at ear 2016. *LARGE* is a dummy variable for a large shareholder, *RIGHTS* is the percentage held by the large shareholder, *IND* is the percentage of independent directors on the board, and *BS* indicates the number of members on the board. *CONTROL* considers the bank specific control variables, namely: leverage risk, liquidity risk, bank business activity, asset quality, credit risk, efficiency, bank size, and merges & acquisitions. β parameters are the estimated coefficient, and ε is the error term.

In addition, we also test the hypothesis of the impact of regulation on bank risk-taking (H2) by estimating the following regression equation:

$$(2) Risk_{it} = \beta_1 + \beta_2 (RESTRICT)_{j2011} + \beta_3 (CAPITAL)_{j2011} + \beta_4 (OFFICIAL)_{j2011} + \beta_5 (PRIVATE)_{j2011} + \beta_6 (CONTROL)_{it} + B_7 (GDP)_{jt} + \varepsilon_{it}$$

In this equation, RISK indicates the different variables of risk-taking (the z-score and capital adequacy ratio), where the subscript i indicates individual bank ($i = 1, 2, \dots, 121$) and t the year ($t = 2011, \dots, 2016$). The regulation index is represented by the explanatory variables for each country j , namely: *RESTRICT* is the index of regulatory restrictions on bank activities, *CAPITAL* is the index of regulatory oversight of bank capital, *OFFICIAL* is the index of the power of the bank supervisory agency, and *PRIVATE* is the index of the monitoring of the private sector part of the banking system. *CONTROL* considers the following bank specific control variables: leverage risk, liquidity risk, bank business activity, asset quality, credit risk, efficiency, bank size and merges & acquisitions. This

regression is clustered at country level, and thus we use *GDP* as a country control variable, which is represented as the Gross Domestic Product of country *j*, and year *t*.

5. EMPIRICAL RESULTS

5.1 BANK RISK-TAKING AND CORPORATE GOVERNANCE

Table 7 presents the results of the regression estimation for Equation (1). Firstly, we use the z-score as our bank risk measure and then we regress independently the corporate governance variables. We find that a large shareholder structure as well as a higher percentage of voting rights, are both negatively associated with inverse insolvency risk. This outcome supports the idea that a higher concentration of ownership leads to an increase in bank risk-taking (Laeven and Levine, 2009; Esty, 1998; Galai and Masulis, 1976). Furthermore, the result for independence is consistent with previous empirical studies (Beltratti and Stulz, 2012; Erkens et al., 2012; Wang and Hsu, 2013), where a greater percentage of independent members on the board indicates a more stable bank (a higher z-score).

Regarding board size, although an inverted association might be expected, a positive sign is displayed instead. This behaviour can be associated with the fact that owing to the diverse background of directors, deliberations at board meetings can benefit from additional knowledge, which ultimately results in agreeing to follow the ideal strategy, with less associated risk. Additionally, according to de Andres and Vallelado (2008), having a larger number of directors is beneficial, as this can result in better monitoring and advisory input.

When we consider all the corporate governance variables together, the results change for the large shareholder and the voting rights variables, as in these circumstances they present no significant association with bank risk. For the board structure variables, the results remain broadly the same, with a slightly increase in the coefficient estimator. Finally, the inclusion of the control variables also indicates that ownership structure does not have an impact on bank risk-taking. On the contrary, independence and board size are statistically significant for insolvency risk.

Next, we consider the capital adequacy ratio as the alternative variable for bank risk for Equation 1, with the results being presented in Table 8.

We follow the previous method, and the results are essentially the same. When we analyse ownership structure individually, no significant association is found. With regards independence, the positive relationship between capital adequacy ratio and the explanatory variables remains similar, emphasising the fact that a higher percentage of independent directors as board members contributes to a less risk-taking behaviour. By regressing the board size variable, we can say that board size affects positively bank risk-taking behaviour. This means that banks with larger boards increase their risk-taking behaviour, which supports the findings of Battaglia and Gallo (2017) and Wang and Hsu (2013). In addition, the introduction of the control variables does not change the results.

Since corporate governance variables are from the year of 2016, we also run a regression where all the variables are considered just for that given year. In this case, we use the OLS method, as we are no longer considering a panel data. The empirical analysis consists of choosing the insolvency risk as our risk measure and examines ownership and board structure individually. The results presented in Table 9 are in line with the previous model, apart from the considerable difference for the board size variable. By regressing this variable individually, board size affects bank stability (a higher z-score) negatively, which indicates that smaller board tends to take less risk, following the results of Battaglia and Gallo (2017) and Wang and Hsu (2013). Furthermore, large shareholders and their voting rights have no influence on bank risk, with the interaction coefficient between independence and the z-score being positive. In this context, it can be stated that more independent directors within a small board reduce the probability of bank default. For completeness sake, we also introduced the control variables, in which case the results remain consistent with previous models, except for the interaction between risk measure and board size, where the correlation was found not to be significant.

Overall, Hypothesis 1 is partially supported, where little or no evidence was found for ownership concentration and significant results were showed for board size. In terms of independence, we can affirm than having more independent directors is positively associated with less risk.

5.2 BANK RISK-TAKING AND REGULATION

Table 10 shows the estimation results of the relation between bank risk-taking and regulation, by using Equation (2).

First, we regress the regulations indexes individually, which are the restriction of banking activities (RESTRICT), capital stringency (CAPITAL), official power supervisory (OFFICIAL), and private monitoring (PRIVATE). We found no evidence that regulation has an impact on bank risk-taking behaviour. Additionally, when we introduce the control variables, they do not change the results of the association between regulations and bank risk-taking. Our results are not consistent with previous studies, where some interaction was found between corporate governance, bank risk, and regulation. Furthermore, the change of the dependent variable to capital adequacy ratio also displays the same unexpected results.

Following the empirical analysis of Laeven and Levine (2009), we also test the joint effect of corporate governance and regulation on bank risk-taking. However, our outcome is different from these authors. Given the results of our model, there is no evidence to support Hypothesis 2.

A possible explanation for our results could be related with the fact that, during the period covered in our model (2011-2016), European banks were already facing extremely strict regulation, due to the regulatory pressure implemented following the financial crisis. For this reason, whilst considering the stringent anti-risk requirements already in place, it could be the case that banks no longer had any margin to take further risks. From this perspective, small tweaks to the regulatory environment would have no impact on banks' risk-taking behaviour. Indeed, Bouwens and Verriest (2014) also found no direct evidence for a relation between regulation and bank risk-taking.

5.3 ROBUSTNESS TEST

Following the robustness tests of Laeven and Levine (2009), we carry out two more analyses to confirm our results. First, we exclude those banks considered to be owned by

a wide range of owners – banks where the largest shareholder owns less than 10% of the voting rights. The reason for excluding such banks is the consideration of a null percentage for shareholders with less than 10% of the voting rights, rather than considering the exact number. In addition, we consider a bank with a large shareholder structure when an owner holds more than 20% of voting rights, rather than the initial 10%.

Even after those adjustments to the sample, the results still hold, i.e.: i) there is no significant evidence for a relation between ownership structure and bank risk, ii) board structure has a certain influence on banks' behaviour, and iii) regulation does not affect banks' risk behaviour.

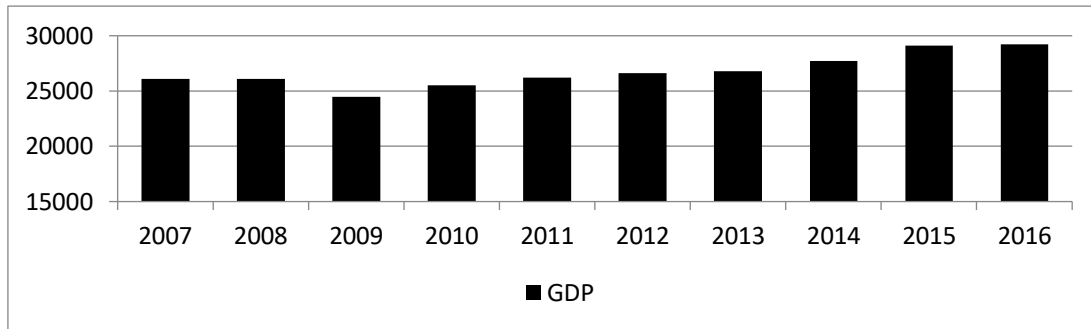
6. CONCLUSIONS

The financial crisis forced the implementation of significant structural changes in both the macroeconomic environment and the financial system, particularly for the regulatory and supervisory framework. In this context, risk measures and corporate governance have been a trend topic among governments and supervisors. Furthermore, an increasing number of studies have been carried out on the role of corporate governance on banks' risk-taking behaviour and how the regulatory framework affects it. The aim of our empirical analysis was to examine in greater detail these different subjects and the dynamics between them. From our main results, we can conclude that a large shareholder structure has no material impact on bank risk, although the board structure is significantly associated with risk. More specifically, a higher percentage of independent board members leads to a lower probability of bank default. On the other hand, in certain circumstances, the board size shows some mixed results, where a positive or negative correlation with the bank's risk-taking behaviour can be observed. Finally, no evidence was found regarding the existence of a relation between regulation and bank risk.

Our model presents some limitations with regards ownership concentration. The first is that we only consider voting rights, rather than include cash flow rights and voting rights, like the research of Laeven and Levine (2009). Accordingly, to empirical studies, the presence of indirect chains of control generates differences between cash flow and voting rights (Caprio et al., 2007). The second limitation is that we use the direct percentage of voting rights, even though most large shareholders are corporations which are owned by other entities. Additionally, the information related to corporate governance concerns the year 2016, albeit all the specific variables cover the period of 2011 to 2016. From this point of view, we suggest that future studies use total (direct and indirect) cash flow rights, rather than direct voting rights. Furthermore, it could be relevant to collect information on corporate governance for the same period under study (2011-2016), to check for sensitiveness on bank risk-taking behaviour of relatively small changes in the corporate governance model.

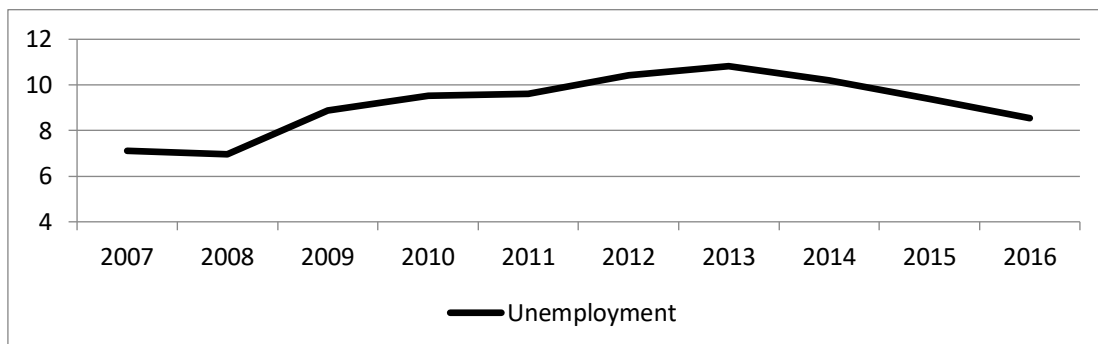
FIGURES

Figure 1. GDP per capita in European Union countries (€), 2007-2016



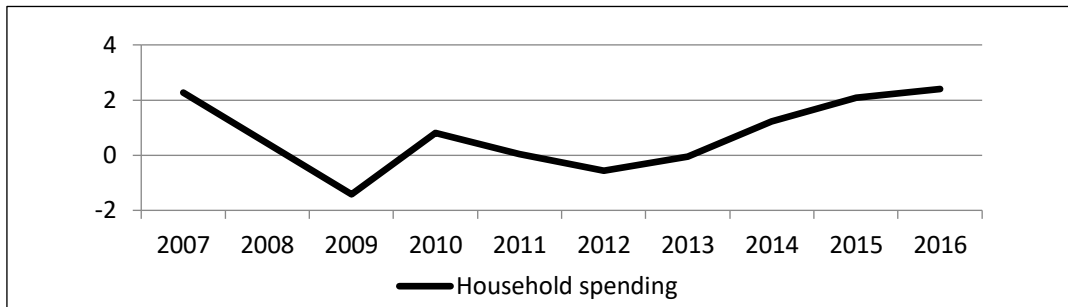
Source: Eurostat

Figure 2. Unemployment rate (% of labour force) in European Union countries, 2007-2016



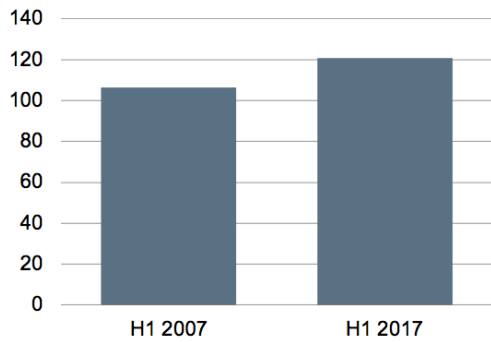
Source: OECD

Figure 3. Household spending (annual growth rate - %) in European Union countries, 2007-2016



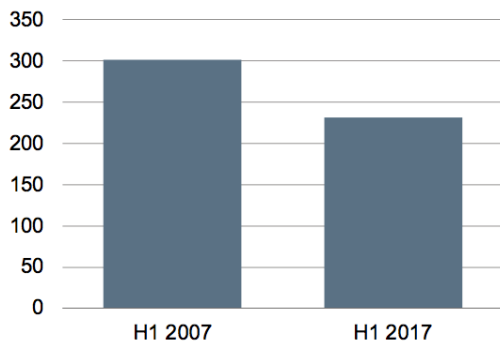
Source: OECD

Figure 4. Net interest income of the top 20 European banks (€ bn), 2007 and 2017



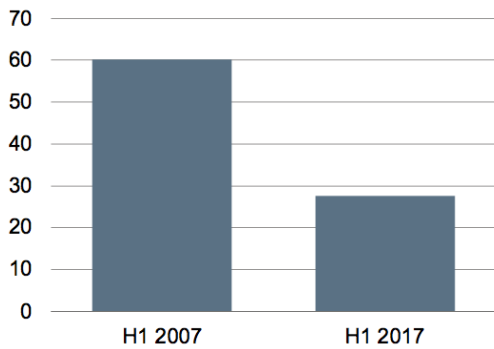
Source: Schildbach (2017, p. 2 – Figure 2)

Figure 5. Total revenues of the top 20 European banks (€ bn), 2007 and 2017



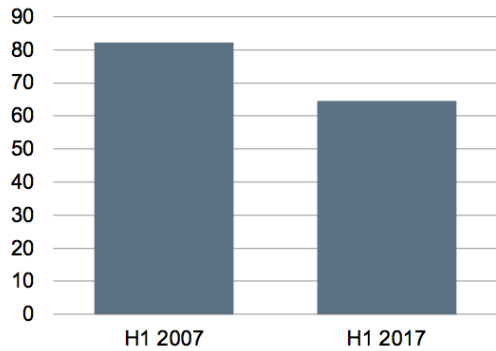
Source: Schildbach (2017, p. 3 – Figure 6)

Figure 6. Trading income of the top 20 European banks (€ bn), 2007 and 2017



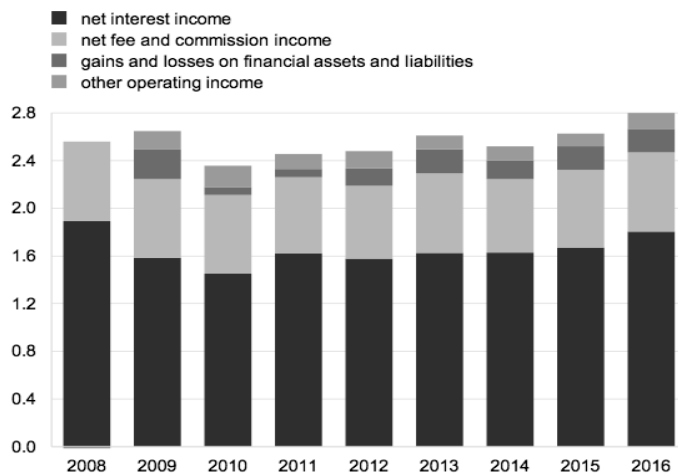
Source: Schildbach (2017, p. 3 – Figure 4)

Figure 7. Fees and Commissions of the top 20 European banks (€ bn), 2007 and 2017



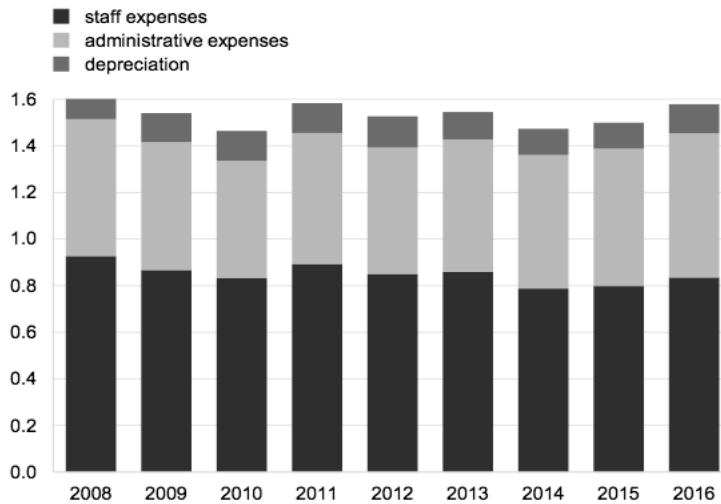
Source: Schildbach (2017, p. 3 – Figure 3)

Figure 8. Operating income structure of the euro area banking sector (all domestic banks) (percentage of total assets), 2008 to 2016



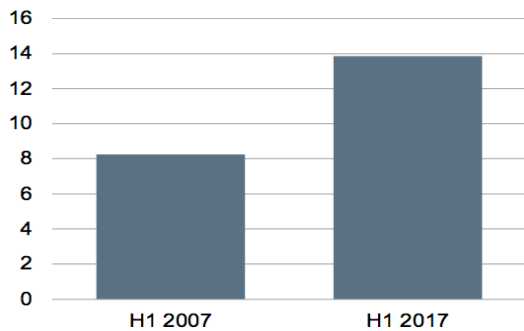
Source: European Central Bank (2017), p. 41 – Chart 2.28

Figure 9. Composition of operating expenses of the euro area banking sector (all domestic banks) / (percentage of total assets), 2008 to 2016



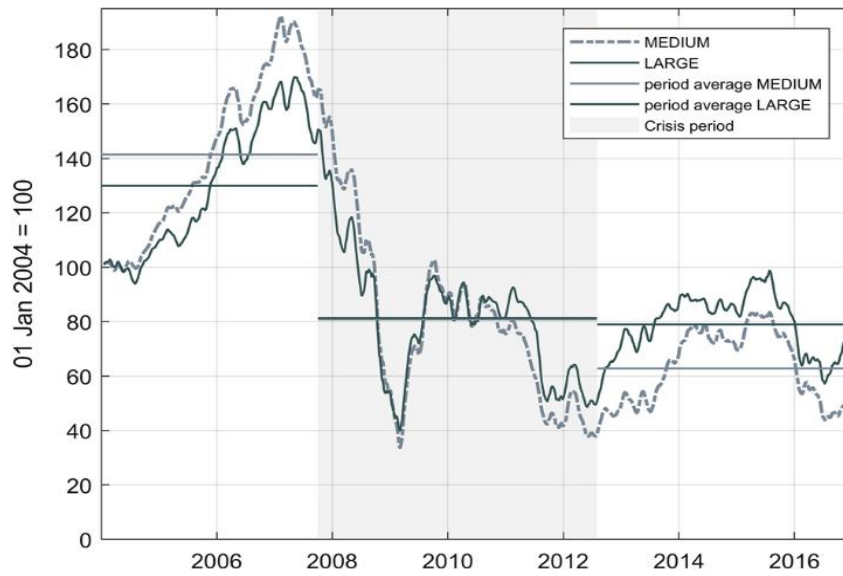
Source: European Central Bank (2017), p. 42 – Chart 2.32

Figure 10. Core risk-weighted capital ratio* of top 20 European banks (% unweighted average), 2007 and 2017



Source: Schildbach (2017, p. 5 – Figure 12); * 2007: Tier 1 ratio; 2017: Common Equity Tier 1 ratio (Basel III fully loaded)

Figure 11. Evolution of the share prices of European banks, 2004 to 2017



Source: Basten & Serrano (2018, Figure 1)

TABLES

Table 1.

Value added by activity (annual growth rate - %), 2007-2016

Activity	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Agriculture, forestry, fishing	1.40	5.23	-0.04	3.57	2.82	5.55	3.74	6.12	0.94	0.94
Construction	1.96	1.06	-7.24	2.66	1.95	4.98	2.61	1.42	2.00	1.61
Finance and insurance	6.07	1.61	-1.27	0.60	1.93	0.11	0.39	1.45	0.23	1.68
Industry (including energy)	3.39	1.39	11.34	7.68	2.84	1.58	0.71	2.46	3.09	3.07
Information, communication	7.80	3.99	-1.14	2.54	4.19	2.74	2.18	3.87	5.82	4.35
Manufacturing	3.86	1.72	13.49	9.16	4.62	2.31	0.29	3.59	3.89	3.27
Other services activities	0.97	2.10	-1.38	0.28	1.06	0.65	0.85	1.30	1.48	0.74
Professional, scientific, support services	6.26	1.97	-6.94	2.66	3.06	0.58	1.63	3.49	3.68	2.71
Public administration, defense, education, health, social work	0.88	1.74	1.40	1.10	0.66	0.32	0.27	0.74	0.79	1.09
Real estate	2.24	1.29	1.06	0.79	1.55	0.98	1.80	1.41	1.32	0.61
Wholesale, retail trade, repairs, transport, accommodation, food, services	3.54	0.08	-5.87	1.33	1.96	0.24	0.12	2.12	2.69	2.13
Total	3.28	0.74	-4.34	2.11	1.81	0.30	0.28	1.88	2.21	1.97

Source: OECD

Table 2.

Definition of the variables

Variable	Definition	Measures	Expected sign
Risk variables			
Z-SCORE	Z-score (ln)	$Z\text{-SCORE} = (\text{ROA} + \text{CAR}) / \sigma(\text{ROA})$, where ROA correspond to Return on Assets, calculated as Net income plus Interest Expense divided by Total assets. $\sigma(\text{ROA})$ indicates the volatility of Return of Assets.	Dependent variable
CAR	Capital Adequacy Ratio (%)	Division of Tier 1 Capital to Risk-Weighted Assets.	Dependent variable
Corporate Governance variables			
LARGE	Large Shareholder	Dummy variable that assumes 1 when it is classified as large shareholder (holds more than 10% of voting rights), and 0 otherwise.	Positive/Negative

RIGHTS	Voting Rights (%)	Percentage of direct voting rights of the largest shareholder.	Positive/Negative
IND	Independence (%)	Percentage of independent members on the board of directors.	Positive
BS	Board Size	Number of directors on the board.	Negative
Regulation variables			
RESTRICT	Restrict	Index of regulatory restrictions on bank activities	Positive/Negative
CAPITAL	Capital Stringency	Index of regulatory oversight of bank capital	Positive/Negative
OFFICIAL	Official Supervisory Power	Index of the power of the bank supervisory authority	Positive/Negative
PRIVATE	Private Monitoring	Index of monitoring of the private sector part of the banking system	Positive/Negative
Control variables			
LEVERAGE	Leverage Risk (%)	Ratio of Tier 1 capital to total assets	Positive
LIQUIDITY	Liquidity Risk (%)	Ratio of liquid assets (cash and balances with central banks plus net loans and advances to banks plus level one assets) divided by deposits and short-term funding (customer deposits plus short term funding)	Positive
BUSINESS	Bank Business Activity (%)	Ratio of loans divided by total assets	Negative
ASSETQUALITY	Asset Quality (%)	Ratio of loan loss provision to net interest revenue	Positive
CREDIT	Bank Credit Risk (%)	Ratio of impaired loans to gross loans	Negative
EFFICIENCY	Efficiency (%)	Ratio of total operating expenses divided by total operating income	Negative
SIZE	Bank Size (ln)	Total assets	Negative
M&A	Merges & Acquisitions	Dummy variable that assumes 1 when a bank was subject to a merger or a major acquisition, and 0 otherwise	Negative
GDP	GDP (ln)	GDP per capita	Positive

Table 3.

Detailed information regarding the regulatory index

Variable	Definition	Range	Description
Restrict	Index of regulatory restrictions on bank activities	3-12	Three questions are considered for this index, measuring the conditions for banks to engage in securities activities, insurance activities, and real estate activities. The possible answers are whether it is unrestricted (=1), permitted (=2), restricted (=3), or prohibited (=4). Higher value indicates a higher restriction on bank activities.
Capital Stringency	Index of regulatory oversight of bank capital	0-10	This index measures whether the capital requirement reflects certain risk elements and deducts certain market value losses from capital before minimum capital adequacy is determined. It is based on the following questions: (1) At the end of 2010, was the Basel I the regulatory capital adequacy regime? (Yes = 1; No = 0) (2) The credit risk is covered by the regulatory minimum capital requirements? (Yes = 1; No = 0) (3) The market risk is covered by the regulatory minimum capital requirements? (Yes = 1; No = 0) (4) The item “unrealised losses in fair valued exposures” is deducted from regulatory capital? (Yes = 1; No = 0) (5) What fraction of revaluation gains is allowed as part of capital? (If > 0.75 = 1; otherwise is 0) (6) Are the sources of funds to be used as capital verified by the regulatory/supervisory authorities? (Yes = 1; No = 0) (7) Can the initial disbursement or subsequent injections of capital be carried out with assets other than cash or government securities? (Yes = 0; No = 1) (8) Can the initial disbursement or subsequent injections of capital be carried out with assets other than cash or government securities? (Yes = 0; No = 1) The calculation for this index is: (1)+(2)+(3)+(4)*3+(5)+(6)+(7)+(8), with higher values indicating greater stringency.
Official Supervisory Power	Index of the power of the bank supervisory authority	0-14	This index measures whether the supervisory authorities have the authority to take specific actions to prevent and correct problems. It is based on the following questions: (1) Does the banking supervisor have the right to meet with the external auditors and discuss their report without the approval of the bank? (2) Are auditors required to communicate directly to the supervisory authority any presumed involvement of bank directors or senior managers in illicit activities, fraud, or insider abuse? (3) In cases where the supervisor identifies that the bank has received an inadequate audit, does the supervisor have the powers to take action against the external auditor? (4) Can the supervisory authority force a bank to change its internal organisational structure? (5) Do banks disclose off-balance sheet items to the supervisors? (6) The following enforcement powers: “Require banks to constitute provisions to cover actual or potential losses” is available to the supervisory authority? (7) The following enforcement powers: “Require banks to reduce or suspend dividends to shareholders” is available to the supervisory authority? (8) The following enforcement powers: “Require banks to reduce or suspend bonuses and other remuneration to bank directors and managers” is available to the supervisory authority? (9) Which authority has the powers to declare insolvency?

			<p>(10) Which authority has the powers to supersede shareholders' rights? (11) Which authority has the powers to remove and replace bank senior management and directors? For questions 1-8, the value of 1 indicates that the answer is yes, otherwise it is 0. Concerning Questions 9-11, these take the value of 1 when the authority is the Bank Supervisor, 0.5 when is the Deposit Insurance Agency or the Bank Restructuring or Asset Management Agency, and 0 when the authority is the Court or Other. The calculation for this index is: $(1)+(2)+(3)+(4)+(5)+(6)+(7)+(8)*2+(9)+(10)*2+(11)*2$, with higher values indicating more power.</p>
Private Monitoring	Index of monitoring on the part of the private sector of the banking system	0-12	<p>This index measures whether incentives/ability exist for the private monitoring of firms, with higher values indicating more private monitoring. It is based on the following questions: (1) Is an audit by a professional external auditor required for all commercial banks in your jurisdiction? (Yes = 1; No = 0) (2) If Yes, does the external auditor have to obtain a professional certification or pass a specific exam to qualify as such? (Yes = 1; No = 0) (3) How many of the top ten banks (in terms of total domestic assets) are rated by international credit rating agencies (e.g., Moody's, Standard and Poor)? And how many commercial banks were there at the end of 2010? (1 = 100%; 0 ≠ 100%) (4) How many of the top ten banks (in terms of total domestic assets) are rated by domestic credit rating agencies? And how many commercial banks were there at the end of 2010? (1 = 100%; 0 ≠ 100%) (5) Is there an explicit deposit insurance protection system for commercial banks? (Yes = 1; No = 0) (6) Were insured depositors wholly compensated (to the extent of legal protection) the last time a bank failed? (7) Does accrued, albeit unpaid, interest/principal enter the income statement while the loan is still performing? (Yes = 1; No = 0) (8) Does accrued, albeit unpaid, interest/principal enter the income statement while the loan is non-performing? (Yes = 0; No = 1) (9) Are banks required to prepare consolidated accounts for accounting purposes? (Yes = 1; No = 0) (10) Are bank directors legally liable if information disclosed is erroneous or misleading? (Yes = 1; No = 0) (11) Is the subordinated debt item allowed as part Tier 1 capital? (Yes = 1; No = 0) (12) Is the subordinated debt allowed as part of Tier 2 capital? (Yes = 1; No = 0) (13) Do banks disclose off-balance sheet items to the public? (Yes = 1; No = 0) (14) Are bank regulators/supervisors required to make public formal enforcement actions, which include cease and desist orders and written agreements between a bank regulatory/supervisory authority and a banking organisation? (Yes = 1; No = 0) The calculation for this index is: $(1)*(2)+(3)+(4)+(5)+(6)+(7)+(8)+(9)+(10)+(11)*(12)+(13)+(14)$, with higher values indicating more private oversight. Note: The calculation of Questions 3 and 4 differs according to the number of commercial banks. If it is > 9, then the calculation is (number of rated banks)/10*100. If it is < 10 then the calculation is (number of rated banks)/(total number of banks).</p>

Source: Barth et al. (2012)

Table 4.

Summary statistics of the variables

VARIABLES	N	MEAN	SD	MIN	MAX
Risk variables					
Z-score (ln)	722	7.970	1.021	4.700	10.483
Capital Adequacy Ratio (%)	724	16.725	9.182	-5.000	222.920
Governance variables					
Large Shareholder	724	0.801	0.399	0.000	1.000
Voting Rights (%)	724	31.576	27.570	0.000	99.990
Independence (%)	724	61.675	23.022	14.286	100.000
Board Size	724	10.702	4.051	3.000	20.000
Regulation variables					
Restrict	646	6.610	1.994	4.000	11.000
Capital Stringency	568	6.599	1.724	3.000	9.000
Official Supervisory Power	598	11.378	1.114	9.000	13.000
Private Monitoring	694	8.242	0.869	6.000	10.000

Control variables					
Leverage Risk (%)	724	8.050	5.688	-4.196	65.010
Liquidity Risk (%)	724	34.388	58.327	1.550	819.090
Bank Business Activity (%)	724	53.910	19.041	1.340	87.480
Asset Quality (%)	723	35.464	68.231	-878.890	693.950
Bank Credit Risk (%)	705	10.863	11.696	0.000	88.970
Efficiency (%)	724	64.269	36.972	-484.150	586.120
Bank Size (ln)	724	16.579	2.550	10.861	21.536
Merges & Acquisitions	724	0.0580	0.2339	0.0000	1.0000
GDP (ln)	724	10.143	0.549	8.631	10.787

Table 5.

Averages of all variables clustered by country

Panel A – Dependent and corporate governance variables								
Country	No. Banks	Z-score	CAR	Large Shareholder	Voting Rights	Independence	Board Size	
Austria	6	8.055	22.199	1.000	24.165	86.765	14.000	
Belgium	2	8.231	17.749	1.000	34.275	26.042	14.000	

Bulgaria	1	6.943	14.112	1.000	42.500	50.000	6.000
Croatia	4	7.977	17.875	1.000	36.490	100.000	6.500
Cyprus	1	7.276	15.728	1.000	26.200	76.923	13.000
Czech Republic	1	7.975	15.670	1.000	60.350	22.222	9.000
Denmark	21	8.427	16.920	0.857	17.856	62.412	9.238
Finland	2	8.577	17.522	0.857	12.080	100.000	7.500
France	4	8.827	15.080	0.857	34.485	52.459	14.750
Germany	8	8.685	20.562	0.857	38.913	72.292	11.125
Greece	5	5.998	12.300	1.000	30.098	40.867	11.200
Hungary	1	6.804	18.117	0.000	0.000	67.000	6.000
Italy	17	7.708	15.801	0.647	26.862	51.822	13.412
Lithuania	1	8.141	13.225	1.000	18.240	14.286	7.000
Malta	3	7.689	14.525	1.000	52.153	83.796	8.667
Netherlands	3	8.669	24.900	0.333	33.330	100.000	5.667
Poland	11	7.410	14.821	0.909	50.915	52.783	8.364
Portugal	2	8.114	12.708	1.000	31.084	43.590	15.500
Romania	3	7.029	16.462	0.667	49.710	46.111	6.333
Slovakia	4	8.108	14.877	1.000	96.177	63.766	6.500
Spain	8	7.845	13.315	0.875	27.564	51.041	13.625
Sweden	4	8.686	20.725	0.875	13.010	71.827	11.250
United Kingdom	9	8.009	17.576	0.556	18.983	63.958	12.333
Total	121	7.974	17.544	0.801	31.541	61.781	10.686

Panel B – Regulation country control variables

	No. Banks	Real GDP	Restrict	Capital Stringency	Official Supervisory Power	Private Monitoring
Austria	6	10.566	4	4	12	8
Belgium	2	10.484	5	8	11	8
Bulgaria	1	8.700	5	9	11	8
Croatia	4	9.260	6	8	13	8
Cyprus	1	9.981	7	9	11	9
Czech Republic	1	9.654	n.a.	n.a.	n.a.	n.a.
Denmark	21	10.748	7	n.a.	11	8
Finland	2	10.536	5	6	n.a.	7
France	4	10.384	8	8	10	10
Germany	8	10.486	n.a.	8	11	7
Greece	5	9.733	6	7	n.a.	8
Hungary	1	9.273	5	4	13	8
Italy	17	10.204	7	6	13	8
Lithuania	1	9.391	6	7	11	7
Malta	3	9.852	8	7	12	8

Netherlands	3	10.594	5	8	11	8
Poland	11	9.263	11	8	11	9
Portugal	2	9.730	5	4	12	6
Romania	3	8.916	4	8	12	7
Slovakia	4	9.542	9	6	11	8
Spain	8	10.034	5	8	9	9
Sweden	4	10.714	n.a.	n.a.	n.a.	n.a.
United Kingdom	9	10.445	4	3	n.a.	10
Total	121	10.144	6.602	6.589	11.380	8.241

Panel C – Bank-specific control variables

	No. Banks	Leverage	Liquidity	Business Activity	Asset quality	Credit Risk	Efficiency	Bank Size
Austria	6	8.651	19.211	58.466	24.385	5.942	62.599	16.68
Belgium	2	4.352	38.688	50.058	-3.963	5.183	-31.372	19.394
Bulgaria	1	9.206	20.688	63.467	60.117	14.925	54.338	15.231
Croatia	4	10.063	21.342	54.094	31.515	13.355	65.839	13.665
Cyprus	1	8.229	37.813	49.382	100.437	40.418	57.453	15.834
Czech Republic	1	7.189	16.080	57.177	7.768	5.057	42.745	17.288
Denmark	21	10.718	42.576	59.195	34.959	13.138	62.755	14.289
Finland	2	4.084	9.577	71.187	5.532	1.229	77.498	15.684
France	4	3.063	75.608	24.938	20.017	5.968	70.992	20.907
Germany	8	7.483	45.689	-26.921	-2.239	5.178	81.292	16.714
Greece	5	7.817	5.552	66.183	147.481	33.912	72.546	17.579
Hungary	1	10.227	16.770	58.045	45.345	17.653	58.088	17.36
Italy	17	9.367	55.151	52.388	55.061	16.058	67.767	16.845
Lithuania	1	7.769	10.708	57.227	32.045	7.968	53.945	14.097
Malta	3	6.742	42.693	42.746	23.159	5.588	61.842	15.163
Netherlands	3	5.578	33.442	34.324	7.791	2.511	83.793	15.664
Poland	11	8.916	10.399	66.015	23.412	7.035	56.825	16.596
Portugal	2	6.753	13.286	65.448	72.977	4.932	64.705	17.88
Romania	3	8.685	16.527	46.361	64.782	23.408	65.546	15.238
Slovakia	4	7.665	9.525	70.418	21.845	7.454	66.545	15.262
Spain	8	5.333	21.472	53.993	58.915	9.159	62.305	18.536
Sweden	4	4.333	61.333	58.008	5.457	0.942	49.653	19.6
United Kingdom	9	6.865	39.460	49.742	23.590	5.221	73.334	18.391
Total	121	8.115	34.494	53.856	36.906	10.838	64.301	16.579

Table 6.

Correlation matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
(1) Z-score	1.000																		
(2) CAR	0.262*	1.000																	
(3) Large Shareholder	-0.138*	-0.040	1.000																
(4) Voting Rights	-0.143*	-0.030	0.571*	1.000															
(5) Independence	0.196*	0.197*	-0.065	-0.071	1.000														
(6) Board Size	0.177*	-0.146*	-0.139*	-0.237*	-0.191*	1.000													
(7) Leverage	-0.266*	0.104*	0.167*	0.074*	-0.100*	-0.275*	1.000												
(8) Liquidity	-0.083*	0.043	0.013	-0.006	-0.066	-0.036	0.709*	1.000											
(9) Business	-0.219*	-0.268*	0.051	-0.048	-0.151*	0.012	-0.029	-0.371*	1.000										

Activity																							
(10)	-0.318*	-0.155*	-0.021	-0.074*	-0.136*	0.104*	0.054	0.040	0.231*	1.000													
Asset Quality	0.000	0.000	0.567	0.046	0.000	0.005	0.146	0.283	0.000														
(11)	-0.537*	-0.144*	0.067	-0.013	-0.186*	-0.090*	0.556*	0.421*	0.042	0.398*	1.000												
Credit Risk	0.000	0.000	0.075	0.729	0.000	0.017	0.000	0.000	0.268	0.000													
(12)	-0.033	-0.001	-0.032	0.031	0.122*	-0.032	0.174*	0.236*	-0.145*	0.097*	0.137*	1.000											
Efficiency	0.372	0.988	0.388	0.407	0.001	0.396	0.000	0.000	0.000	0.009	0.000												
(13)	0.172*	-0.100*	-0.269*	-0.150*	-0.076*	0.635*	-0.529*	-0.134*	-0.015	0.049	-0.258*	-0.127*	1.000										
Bank Size	0.000	0.007	0.000	0.000	0.040	0.000	0.000	0.000	0.687	0.188	0.000	0.001											
(14)	-0.032	-0.051	-0.024	-0.063	-0.074*	0.166*	-0.126*	0.004	-0.045	0.018	-0.025	-0.051	0.276*	1.000									
M & A	0.392	0.170	0.513	0.089	0.046	0.000	0.001	0.920	0.223	0.622	0.503	0.168	0.000										
(15)	0.402*	0.151*	-0.117*	-0.379*	0.185*	0.253*	-0.014	0.197*	-0.165*	-0.147*	-0.155*	0.034	0.033	0.015	1.000								
GDP	0.000	0.000	0.002	0.000	0.000	0.000	0.715	0.000	0.000	0.000	0.000	0.360	0.374	0.680									
(16)	-0.051	-0.104*	0.139*	0.324*	-0.146*	-0.224*	0.093*	-0.015	0.162*	-0.075	-0.025	-0.037	-0.128*	-0.053	-0.340*	1.000							
Restrict	0.193	0.008	0.000	0.000	0.000	0.000	0.018	0.711	0.000	0.057	0.523	0.352	0.001	0.180	0.000								
(17)	-0.026	-0.055	0.150*	0.214*	-0.080	-0.237*	-0.035	-0.027	-0.113*	-0.016	0.109*	-0.063	-0.110*	0.027	-0.401*	0.466*	1.000						
Capital	0.539	0.192	0.000	0.000	0.056	0.000	0.407	0.521	0.007	0.699	0.010	0.134	0.008	0.522	0.000	0.000							
(18)	-0.164*	0.054	-0.122*	-0.043	0.122*	-0.001	0.171*	0.061	0.043	0.070	0.198*	0.032	-0.198*	-0.154*	-0.122*	-0.041	-0.537*	1.000					
Official	0.000	0.191	0.003	0.289	0.003	0.979	0.000	0.135	0.291	0.087	0.000	0.441	0.000	0.000	0.003	0.334	0.000						
(19)	-0.043	-0.060	-0.061	-0.035	-0.085*	0.151*	-0.105*	0.034	-0.024	0.009	-0.113*	-0.017	0.343*	0.145*	-0.007	0.101*	-0.185*	-0.433*	1.000				
Private	0.256	0.117	0.110	0.355	0.026	0.000	0.005	0.377	0.520	0.819	0.003	0.652	0.000	0.000	0.862	0.010	0.000	0.000					

Table 7.

Generalised least squared random effect regression results between bank risk
(dependent variable - Z-score) and corporate governance

VARIABLES	z-score (1)	z-score (2)	z-score (3)	z-score (4)	z-score (5)	z-score (6)
LARGE	-0.363* (0.209)				-0.208 (0.247)	-0.221 (0.262)
RIGHTS		-0.005* (0.003)			-0.001 (0.004)	-0.002 (0.004)
IND			0.009** (0.004)		0.010*** (0.004)	0.010** (0.004)
BS				0.045** (0.019)	0.052** (0.021)	0.057** (0.028)
LEVERAGE						0.064*** (0.013)
LIQUIDITY						-0.002*** (0.001)
BUSINESS						-0.011*** (0.002)
ASSETQUALITY						-0.000*** (0.000)
CREDIT						-0.003* (0.002)
EFFICIENCY						-0.000** (0.000)
SIZE						0.047 (0.039)
M&A						-0.033 (0.026)
Constant	8.252*** (0.181)	8.127*** (0.128)	7.426*** (0.266)	7.478*** (0.234)	6.983*** (0.425)	6.427*** (0.682)
Observations	722	722	722	722	722	702
Number of banks	121	121	121	121	121	121

Note: Robust standard errors in brackets; *** significance at the 1% level; ** significance at the 5% level; * significance at the 10% level

Table 8.

Generalised least squared random effect regression results between bank risk
(dependent variable - CAR) and corporate governance

VARIABLES	CAR (1)	CAR (2)	CAR (3)	CAR (4)	CAR (5)	CAR (6)
LARGE	-0.806 (1.202)				-0.416 (1.490)	-0.373 (1.097)
RIGHTS		-0.012 (0.019)			-0.015 (0.026)	-0.028 (0.022)
IND			0.085** (0.034)		0.072** (0.029)	0.051** (0.020)
BS				-0.363** (0.171)	-0.312** (0.142)	-0.249* (0.136)
LEVERAGE						1.178** (0.534)
LIQUIDITY						-0.067** (0.030)
BUSINESS						-0.192*** (0.056)
ASSETQUALITY						0.001 (0.005)
CREDIT						-0.200** (0.089)
EFFICIENCY						-0.006 (0.005)
SIZE						0.673** (0.289)
M&A						-0.629 (0.502)
Constant	17.470*** (1.010)	17.194*** (0.865)	11.582*** (1.756)	20.707*** (2.283)	16.475*** (1.577)	12.173** (5.276)
Observations	724	724	724	724	724	704
Number of Banks	121	121	121	121	121	121

Note: Robust standard errors in brackets; *** significance at the 1% level; ** significance at the 5% level; * significance at the 10% level

Table 9.

Ordinary least squared regression results between bank risk (dependent variable - Z-score) and corporate governance

VARIABLES	z-score (1)	z-score (2)	z-score (3)	z-score (4)	z-score (5)	z-score (6)
LARGE	0.325 (0.362)				0.474 (0.368)	0.445 (0.368)
RIGHTS		-0.000 (0.004)			-0.005 (0.003)	-0.006 (0.004)
IND			0.015*** (0.005)		0.013** (0.005)	0.010** (0.005)
BS				-0.073*** (0.022)	-0.058** (0.025)	-0.046 (0.029)
LEVERAGE						-0.129** (0.056)
LIQUIDITY						0.011*** (0.004)
BUSINESS						0.023*** (0.009)
ASSETQUALITY						-0.009*** (0.003)
CREDIT						-0.007 (0.009)
EFFICIENCY						-0.005 (0.007)
SIZE						-0.099 (0.065)
M&A						-0.150 (0.374)
Constant	7.468*** (0.346)	7.729*** (0.194)	6.790*** (0.289)	8.512*** (0.266)	7.352*** (0.529)	9.203*** (1.309)
Observations	116	116	116	116	116	114
R-squared	0.012	0.000	0.085	0.063	0.139	0.345

Note: Robust standard errors in brackets; *** significance at the 1% level; ** significance at the 5% level; * significance at the 10% level

Table 10.

Generalised least squared random effect regression results between bank risk
(dependent variable - Z-score) and regulation

VARIABLES	z-score (1)	z-score (2)	z-score (3)	z-score (4)	z-score (5)	z-score (6)
RESTRICT	-0.024 (0.053)				-0.053 (0.054)	0.024 (0.063)
CAPITAL		-0.014 (0.058)			-0.077 (0.081)	0.032 (0.080)
OFFICIAL			-0.141 (0.097)		-0.073 (0.083)	-0.111 (0.108)
PRIVATE				-0.048 (0.142)	0.170 (0.218)	-0.157 (0.200)
LEVERAGE						0.062*** (0.022)
LIQUIDITY						-0.003*** (0.001)
BUSINESS						-0.009*** (0.002)
ASSETQUALITY						-0.001*** (0.000)
CREDIT						-0.002 (0.002)
EFFICIENCY						-0.000 (0.000)
SIZE						0.093*** (0.032)
M&A						-0.036 (0.024)
GDP						0.443** (0.198)
Constant	8.036*** (0.359)	7.919*** (0.289)	9.622*** (1.191)	8.333*** (1.215)	8.145*** (2.182)	4.245* (2.490)
Observations	644	566	598	692	424	418
Number of Banks	108	95	100	116	71	71

Note: Robust standard errors in brackets; *** significance at the 1% level; ** significance at the 5% level; * significance at the 10% level

REFERENCES

- Acharya, V., Schnabl, P., Suarez, G. 2013: Securitization without risk transfer. *Journal of Financial Economics* 107 (3), 515–536.
- Adams, R.B. 2012: Governance and the financial crisis. *International Review of Finance* 12 (1), 7–38.
- Arteta, C., Carey, M., Correa, R., Kotter, J. 2013: Revenge of the streamroller: ABCP as a window on risk choices. *Board of Governors of the Federal Reserve System, International Finance Discussion Papers* 1076.
- Baltagi, B.H., Wu, P.X. 1999: Unequally spaced panel data regressions with AR(1) disturbances. *Econometric Theory* 15, 814–823.
- Barako, D., Tower, G. 2007: Corporate governance and bank performance: does ownership matter? Evidence from Kenyan banking sector. *Corporate Ownership & Control* 4 (2), 133–144.
- Barth, J.R., Caprio, G., Levine, R. 2012: Bank Regulation and Supervision Survey, September 2012. World Bank. Available from: <https://www.worldbank.org/en/research/brief/BRSS>.
- Basel Committee on Banking Supervision 2005: Basel II: International convergence of capital measurement and capital standards: a revised framework. *Discussion Paper Bank for International Settlements November*.
- Basel Committee on Banking Supervision 2009: Enhancements to the Basel II framework. *Bank for International Settlements, Basel*.
- Basel Committee on Banking Supervision 2010: Principles for Enhancing Corporate Governance. *Bank for International Settlements, Basel*.
- Basel Committee on Banking Supervision 2010: Basel III: A global regulatory framework for more resilient banks and banking systems. *Bank for International Settlements, Basel*.

- Basten, M., Serrano, A.S. 2018: European banks after the global financial crisis: a new landscape. *Journal of Banking Regulation*, 1-23
- Battaglia, F., Gallo, A. 2017: Strong boards, ownership concentration and EU banks' systemic risk-taking: Evidence from financial crisis. *Journal of International Financial Markets, Institutions & Money* 46, 126-146.
- Beltratti, A., Stulz, R. 2012: The credit crisis around the globe: Why did some banks perform better? *Journal of Financial Economics* 105, 1–17.
- Berger, A., Saunders, A., Scalise, J., Udell, G. 1998: The effects on bank mergers and acquisitions on small business lending. *Journal of Financial Economics* 50, 187–229.
- Berle, A.A., Means, G.C. 1932: *The Modern Corporation and Private Property*. New York: Macmillan Publishing Company.
- Bernanke, B. 1983: Nonmonetary Effects of the Financial Crisis in the Propagation of the Great Depression. *American Economic Review* 73, 257–276.
- Black, B.S., Jang, H., Woochan, K. 2006: Predicting firms' corporate governance choices: evidence from Korea. *Journal of Corporate Finance* 12, 660–691.
- Bouwens, J., Verriest, A 2014: Putting Skin in the Game: Managerial Ownership and Bank Risk-Taking. *Harvard Business School Working Paper* 14-070
- Buser, S., Chen, A., Kane, E. 1981: Federal deposit insurance, regulatory policy, and optimal bank capital. *Journal of Finance* 36, 51–60.
- Calomiris, C., Mason, J. 2003a: Consequences of US bank distress during the Depression. *American Economic Review* 93, 937–947.
- Calomiris, C., Mason, J. 2003b: Fundamentals, panics and bank distress during the Depression. *American Economic Review* 93, 1615–1647.
- Caprio, G., Laeven, L., Levine, R. 2007: Governance and bank valuation. *Journal of Financial Intermediation* 16, 584-617

- Casu, B., Clare, A., Sarkisyan, A., Thomas, S. 2011: Does securitization reduce credit risk taking? Empirical evidence from US bank holding companies. *European Journal of Finance* 17, 769–788.
- Cohen, L.J., Cornett, M.M., Marcus, A.J., Tehranian, H. 2014: Bank earnings management and tail risk during the financial crisis. *Journal of Money, Credit and Banking* 46, 171–197.
- Cremers, K., Ferrell, A. 2010: Thirty years of corporate governance. Firm valuation & stock returns. *Yale School of Management and Harvard Law School Working Paper*.
- De Andres, P., Vallelado, E. 2008: Corporate governance in banking: the role of board of directors. *Journal of Banking & Finance* 32, 2570–2580.
- Demsetz, R., Strahan, P. 1997: Diversification, size, and risk at bank holding companies. *Journal of Money, Credit & Banking* 29, 300-313.
- Ellul, A., Yerramilli, V. 2013: Stronger risk controls, lower risk: evidence from U.S. Bank Holding Companies. *Journal of Finance* 68, 1757–1803.
- Erkens, D., Hung, M., Matos, P. 2012: Corporate governance in the 2007–2008 financial crisis: evidence from financial institutions worldwide. *Journal of Corporate Finance* 18, 389–411.
- Esty, B. 1998: The impact of contingent liability on commercial bank risk taking. *Journal of Financial Economics* 47, 189–218.
- European Central Bank 2017: Report on financial structures. *European Central Bank Publications, October 2017*
- Galai, D., Masulis, R. 1976: The option pricing model and the risk factor of stock. *Journal of Financial Economics* 3, 53–81.

- Gornall, W., Strebulaev, I. A. 2014: Financing as a supply chain: The capital structure of banks and borrowers. *Stanford University, Rock Center for Corporate Governance, Stanford, CA, Working Paper 166*
- Grossman, R.S. 1992: Deposit Insurance, Regulation, and Moral Hazard in the Thrift Industry, Evidence from the 1930's. *American Economic Review* 82 (4), 800-821.
- Gujarati, D.N. 2003: *Basic Econometrics*, 4th Ed. New York: McGraw-Hill.
- Iannotta, G., Nocera, G., Sironi, A. 2007: Ownership structure, risk and performance in the European banking industry. *Journal of Banking & Finance* 31, 2127–2149.
- Jeitschko T. D., Jeung S. D. 2005: Incentives for risk-taking in banking - A unified approach. *Journal of Banking & Finance* 29, 759–777.
- Jensen, M., Meckling, W. 1976: Theory of the firm: managerial behavior, agency costs, and ownership structure. *Journal of Financial Economics* 3, 305–360.
- John, K., Litov, L., Yeung, B. 2008: Corporate governance and managerial risk taking: theory and evidence. *Journal of Finance* 63, 1679–1728.
- John. K., Masi, S.D., Paci, A. 2016: Corporate governance in banks. *Corporate Governance: An International Review* 24 (3), 303-321.
- John K., Saunders A., Senbet L.W. 2000: A theory of bank regulation and management compensation. *The Review of Financial Studies* 13 (1), 95–125.
- Keeley, M. 1990: Deposit insurance, risk, and market power in banking. *American Economic Review* 80, 1183–1200.
- Kirkpatrick, G. 2009: The corporate governance lessons from financial crisis. *OECD, Financial markets trends*, 2009/1.
- Koehn, M., Santomero, A. 1980: Regulation of bank capital and portfolio risk. *Journal of Finance* 35, 1235–1244.

- Köhler, M. 2010: Ownership structure, regulation and the market for corporate control in the EU banking sector. *European Journal of Law and Economics* 34, 173-196.
- Konstantinos, A. 2012: The determinants of European bank profitability before, during and after the financial crisis of 2008. *Master degree, Tilburg University, Tilburg.*
- Kosmidoua, K., Kousenidisa, D., Ladasb, A., Negkakis, C. 2017: Determinants of risk in the banking sector during the European Financial Crisis. *Journal of Financial Stability* 33, 285–296.
- La Porta R., Lopez-De-Silanes F., Shleifer A. 1999: Corporate ownership around the world. *Journal of Finance* 54 (2), 471–517.
- La Porta, R., Lopez-de-Silanes, F., Shleifer, A., Vishny, R. 1998: Corporate ownership around the world. *Journal of Political Economy*, 106 (6), 1113–1155.
- Laeven, L., Levine, R. 2009: Bank governance, regulation and risk taking. *Journal of Financial Economics* 93, 259–275.
- Levine, R. 2004: The Corporate Governance of Banks, A Concise Discussion of Concepts and Evidence. *World Bank Policy Research Working Paper WPS3404.*
- Longstaff, F.A. 2010: The subprime credit crisis and contagion in financial markets. *Journal of Financial Economics* 97, 436–450.
- Pathan, S. 2009: Strong boards, CEO power and bank risk-taking. *Journal of Banking & Finance* 33, 1340–1350.
- Provopoulos, G.A. 2014: The Greek Economy and Banking System: Recent Developments and the Way Forward. *Journal of Macroeconomics* 39, 240–249.
- Roy, A.D. 1952: Safety first and the holding of assets. *Econometrica* 20, 431–449.
- Saunders, A., Strock, E., Travlos, N.G. 1990: Ownership structure, deregulation, and bank risk taking. *Journal of Finance* 45, 643–654.

- Schildbach, J. 2017: Where do European banks stand? 10 years after the start of the financial crisis. *Deutsche Bank Research*, August 2017
- Schranz, M. 1993: Takeover improve firm performance: evidence from the banking industry. *Journal of Political Economy* 101, 299–326.
- Wang, T., Hsu, C. 2013: Board composition and operational risk events of financial institutions. *Journal of Banking & Finance* 37, 2042–2051.
- Wooldridge, J.M. 2015: *Introductory Econometrics*, 6th Ed. United States of America: Cengage Learning.