



The impact of board characteristics and CEO power on banks' risk-taking: stable versus crisis periods

Catarina Fernandes¹ · Jorge Farinha² · Francisco Vitorino Martins³ · Cesario Mateus⁴

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Abstract

We examine the impact of board structure, CEO power and other bank-specific factors on bank risk-taking for a sample of 72 publicly listed European banks in both stable and crisis periods. Using a simultaneous equations approach, our main findings indicate that the proportion of independent directors, the board size, and Chief Executive Officer (CEO) power affected bank risk-taking negatively during the recent financial crisis. On the contrary, institutional shareholder ownership and the presence of an ex-CEO as Chairman influenced bank risk-taking positively. Additionally, we separately analyse stable and crisis periods and observe that in the pre-crisis period only board independence and institutional ownership keep the same impact on risk while CEO power has no influence and the existence of an ex-CEO as Chairman reduces risk-taking by banks. We conclude that different governance characteristics have different relevance for banks' risk-taking contingent on the economic environment being one of stability or crisis.

Keywords Corporate governance · Banks · Financial crisis · Risk · Simultaneous equations

JEL classification G01 · G21 · G34

Introduction

By the end of 2008 many banks throughout the world had seen most of their equity destroyed by the crisis started in 2007 in the United States (US) subprime sector, considered the most serious crisis since the Great Depression (e.g.,

[20]). This reality illustrates how vulnerable unprotected economies are to the irresponsible risk-taking behaviour of financial institutions in general and banks in particular. For Stulz [88], the success of banks and the health of the financial system depend critically on how they take risks. Undue risk-taking by banks threatens the safety and soundness of individual institutions as well as the stability of the entire financial sector [84].

In the context of the financial crisis, several academics and practitioners argue that the mechanisms of corporate governance did not serve their purpose in properly safeguarding the interests of stakeholders, so increasing risk-taking without appropriate management [43]: *In retrospect, it seems clear that many banks took excessive risks in the mid-2000s* [45], p. 892). Given the significance of the risk-taking behaviour in the recent crisis context and the renewed emphasis on bank internal governance mechanisms, especially concerning the board of directors, studying bank risk-taking and whether bank governance influences the level of risk undertaken is extremely relevant.

Bank risk is a major concern for bank regulators due to the special role that the banking sector plays in the economy: *Increased riskiness of banks to the extreme may lead*

✉ Jorge Farinha
jfarinha@fep.up.pt

Catarina Fernandes
cfernandes@ipb.pt

Francisco Vitorino Martins
vmartins@fep.up.pt

Cesario Mateus
cmateus@business.aau.dk

¹ Polytechnic Institute of Bragança and Center of Economics and Finance, University of Porto, Porto, Portugal

² Faculty of Economics and Center of Economics and Finance, University of Porto, Porto, Portugal

³ Faculty of Economics, University of Porto, Porto, Portugal

⁴ Department of Business and Management, Aalborg Universitet, Aalborg, Denmark



to financial crises and the collapse of the financial system, causing huge negative externalities to the entire economy [33], p. 387). As banks are crucial to the stability of the financial system they are more tightly regulated. Moreover, problems with poor governance are more severe for banks than for non-bank firms and their failures have even more substantial costs [75]. This is because banks are “special” firms due to their specificities (e.g. complexity and opacity) and their distinct roles in financial intermediation¹ (payments system, and liquidity, amongst others). To ensure sound governance, the critical role of the board of directors is especially important in banks because the fiduciary duties of directors (“duty of care” and “duty of loyalty”) expands beyond shareholders to depositors, other creditors and regulators² (e.g., [66]). Therefore, shareholders are not the exclusive beneficiaries of directors’ fiduciary duties.

In its final document *Principles for Enhancing Corporate Governance*, the Basel Committee on Banking Supervision [15], p. 8) attributes to the board a vital role in monitoring and guiding corporate strategy and risk policy, being that the board should *approve and oversee the implementation of the bank’s overall risk strategy, including its risk tolerance/appetite; policies for risk, risk management and compliance; internal controls system; corporate governance framework, principles and corporate values (...)*.

Compared to non-financial firms, the complexity and opacity of banks, as well as the singularity of their assets, make the risk-taking problem more serious for these institutions, while risk-taking itself is critical to corporate success [74].

Notwithstanding the greater severity of the recent global financial crisis, past decades have also been characterised by repeated banking crises, such as 1994–1995 Mexican and the 1997–1998 Asian financial crises. Such episodes highlight the inherently unstable nature of banking and the tendency of banks toward excessive risk-taking [12], so justifying a deep review of what is behind bank risk-taking incentives. The success of banks, the health of the financial system and the economy depend critically on how banks take risks [88, 89].

However, to the best of our knowledge, the issue of whether corporate governance mechanisms affect non-US bank risk-taking in the financial crisis has not been

sufficiently analysed. Hence, our study tries to fill this gap, specifically by using a cross-country sample of European banks to analyse the impact of a set of governance mechanisms at the bank-level on risk-taking in the crisis. Here, we also complement the research by replicating the analysis for a non-crisis period to study whether our results are sensitive to the economic conditions. The underlying idea is that governance mechanisms may have a different impact or relevance in crisis and non-crisis periods.

An additional and distinct dimension to our paper is an endogeneity concern that we address as we take into account a potential bidirectional causality between risk and board characteristics. According to some existing literature, the causal nature of the relationship between these variables is not completely clear; it is possible not only that board characteristics impact risk-taking, but that risk-taking may also affect board characteristics. For instance, banks increase risk-taking in response to poor corporate governance (e.g., the structure of the board of directors may affect its ability to function effectively entailing that corporate boards influence risk-taking), but poor corporate governance of banks may be a consequence of greater risk-taking by banks (thus, risk-taking determines governance).

To identify the underlying causal relationship we apply a system of simultaneous equations, which treats risk-taking and board characteristics as being endogenous. The board features two variables endogenised in the system: board independence and board size. On the one hand, more independent directors lead to less risk-taking [43, 75] while smaller board size results in more risk-taking [29, 74, 75]. On the other hand, both board independence and board size may impact on bank risk. Linck et al. [65], for example, report that high stock return volatility is associated with smaller and less independent boards.

Our paper seeks to contribute to the existing literature in three fundamental ways. First, our study explores the relationship between a set of corporate governance variables—as well as various bank-specific characteristics—and risk-taking for a non-US sample of banks. It covers a global financial crisis that is commonly directly linked to the much criticised risk-taking behaviour of banks, in which we witness a renewed focus on bank internal governance mechanisms. To prevent new crises, it is thus vital to understand the factors that influence risk-taking [56]. Given that excessive risk-taking by banks can lead to the instability of the banking system [57],³ there has been considerable academic and regulatory interest in recent years in understanding how better to mitigate bank risk-taking behaviour [84]. Therefore,

¹ The principal distinctive attribute of banks is their liquidity production function [66],[73]. By holding illiquid assets and issuing liquid liabilities, banks create liquidity for the economy, see Diamond and Dybvig [37].

² Also, Macey and O’Hara ([66], p. 93) argue that “to the extent that fiduciary duties lower agency costs by reducing the freedom of management to act in its own unconstrained self-interest, such duties will be especially valuable devices in the banking context because of the inherent difficulties in monitoring banks.”.

³ For instance, for Mongiardino and Plath ([71], p. 116) “the failure of the directorial boards of such [financial] institutions to oversee risks properly is widely viewed as contributing to the crisis.”.



the results of this paper contribute to the process of reforming bank governance to constrain potentially undesirable risk-taking by banks and ensuring the stability of the financial system. Furthermore, at a bank-level, the findings of this study are important for bank managers and shareholders.

Second, our study provides a cross-country analysis of the determinants of bank risk-taking from a contextualised agency theory perspective.⁴ We accordingly expand the analysis by investigating whether the impact of corporate governance mechanisms is contingent upon macroeconomic conditions (stable versus crisis periods) to understand the extent to which governance recommendations are universally valuable. As such, our study seeks to contribute to the growing body of literature that suggests the efficacy and universality of governance prescriptions and impact to depend on firm-specific context or contingencies (e.g., [6, 36, 58]). concerning the organisational and environmental circumstances.

Third, when analysing the two issues outlined above, we address the endogeneity problem arising from a potential simultaneity bias using a simultaneous equations framework. The econometric methodology used is a significant contribution regarding the existing literature, allowing leads to shedding light on various interesting aspects of the simultaneous effects of several variables on bank risk and corporate governance (i.e., board independence and board size).

Our findings show that during the financial crisis period, board independence, board size, and CEO power decrease bank risk-taking while institutional ownership and the existence of an ex-CEO as Chairman have a positive impact on risk-taking. Additionally, we find that in the pre-crisis period only board independence and institutional ownership keep the same impact on risk while CEO power has no influence and the existence of an ex-CEO as Chairman now reduces risk-taking by banks. Our results, therefore, suggest that the influence of these governance mechanisms and other bank-specific factors on bank risk-taking is contingent upon economic context (stable or crisis periods).

We also notice that the findings in the context of the 2007–2008 financial crisis can potentially apply to the current pandemic crisis. Although the ongoing COVID-19 crisis represents a purely exogenous shock to the global financial system, banks are exposed to several sources of vulnerability related, for example, to the financing of the real economy, the decrease in assets due to the delay in repayment of small and medium-sized firms and the increase in non-performing loans (NPLs). Therefore, corporate governance mechanisms can help banks to cope adverse impacts of COVID-19 crisis.

⁴ Contextualised agency theory perspective in the sense that the agency theory must adequately consider the context and so, take into account the governance environment (e.g., [58]).

The remainder of the study proceeds as follows. Section 2 presents the literature review and the hypotheses development, Sect. 3 describes the data, methodology and descriptive statistics, Sect. 4 provides the empirical results and Sect. 5 provides the conclusions.

Literature review and hypotheses development

Board independence and bank risk-taking

The effectiveness with which the board of a bank monitors bank managers and limits their opportunistic behaviour depends upon its characteristics, such as size and composition [75]. The agency literature suggests that independent directors on the board play an important monitoring role in an attempt to resolve, or at least mitigate, agency conflicts between management and shareholders. In this framework, board independence can be seen as a mechanism to control excessive risk-taking.

Prior studies have analysed the relationship between board independence and performance, however, the relation between board independence and risk-taking might not be in the same direction. For instance, although Erkens et al. [39] find that financial firms with more independent boards performed worse during the crisis, they do not find that firms with more independent boards had taken on more risk before the crisis. In turn, Pathan [75] finds that the presence of more independent directors led to less risk-taking by banks in the period 1997–2004, which may have occurred because independent directors are more sensitive to regulatory compliance. Also, under this reputation hypothesis, independent directors would support less risky projects which will help firms in avoiding losses, thus protecting the image of their firms and their reputation in the directorship market. Ferrero-Ferrero et al. [43] find that a higher proportion of independent directors on a board leads to lower levels of corporate risk-taking in an economic recession period (2008), but not in a period of economic growth. Over the period 2003–2012, Akbar et al. [7] based on a sample of financial firms in the UK show that more independent boards take less risk. Also, using a cross-country sample of large banks for the period 2004–2014, the results of Vallascas et al. [90] indicate that post-2009 an increase in board independence leads to more prudent bank risk-taking compared to the rest of the sample period.

Thus, based on the above studies, the first Hypothesis (H_1) is stated as follows:

H_1 Board independence is negatively related to bank risk-taking.



Board size and bank risk-taking

The board of directors is an essential governance mechanism that can mitigate the agency problem between management and shareholders. Although there is no optimal board size for all firms [32], the size of the board appears to affect corporate value (e.g., [4, 76, 85]), and firm policy choices and risk-taking [29, 55, 74, 75, 92]. However, while the impact of board size on the performance of firms is well documented in the literature, relatively few studies explicitly investigate how risk-taking by firms is related to board size [92].

Board size affects the decision-making process and the effectiveness of the board and, in turn, the decision-making process and the quality of monitoring impact on risk-taking. Several prior studies on group decision-making (in the fields of economics and social psychology) suggest that it takes more effort for a larger group to reach a consensus; hence, the final decisions of larger groups reflect more compromises and are less extreme than those of smaller groups (e.g., [72, 82]). Thus, it is likely that by making less extreme decisions, larger boards are associated with less variability of corporate performance. A larger board *moderate the extremity of board decisions, as it takes more negotiation and compromise for a larger board to reach a final decision* [29], p. 159). For Moscovici and Zavalloni [72], larger groups should express moderate positions that represent a compromise among individual positions, while for Sah and Stiglitz [82] the final decision of a group reflects a compromise among different views of each group member. Therefore, riskier projects are more likely to be rejected because it is more difficult to reach an agreement in a large group.⁵

Consistent with the above arguments related to the literature on group decisions, and applied to corporate boards, Cheng [29] shows that firms with larger boards exhibit lower performance volatility. Furthermore, in a sample of US firms, the results of Wang [92] support the hypothesis that board size harms risk-taking by firms. Also, in the case of Japanese firms [74] and Chinese firms [55] board size is associated with lower return volatility. This finding is confirmed by Ferrero-Ferrero et al. [43] in an economic growth period, but not during the financial crisis.

Given the complexity and opacity of the banking business, which increases the asymmetry of information, larger boards are especially beneficial for banks. These particularities as well as the uniqueness of the bank assets make the risk-taking issue more severe for these institutions compared

to non-financial firms and the role of larger boards even more relevant. Pathan [75], using US bank holding companies (BHCs), finds that board size negatively affects bank risk-taking. More recently, Akbar et al. [7] find no significant effect of the board size on risk-taking in the UK financial firms and Battaglia and Gallo [14] show a significant inverted U-shaped relation between board size European bank risk-taking.

In line with the majority of the previous literature, we thus hypothesise that smaller boards tend to encourage and approve risky policies and consequently lead to higher risk-taking by banks. Thus, we formulate the second Hypothesis (H_2) as follows:

H_2 Board size is negatively related to bank risk-taking.

CEO power and bank risk-taking

As a central element of the top management team, the CEO occupies a position of unique influence in the firm. Sources of structural power, such as the dual leadership structure (CEO duality), are the most commonly employed proxies of CEO power. According to agency theory, board effectiveness in monitoring and controlling management will be reduced when duality is present, in which case the board will have less power and the monitoring of the CEO will be lessened. Agency theory is supported by the divergence of interests when ownership and control of the firm are separate, which creates “agency problems” between shareholders and managers specifying that, to protect their non-diversifiable human capital (talent, job-related experience), managers will be more risk-averse than shareholders (e.g., [17, 38]).

Thus, risk-averse bank managers may accept safer, value-decreasing projects, while rejecting riskier, but value-increasing, projects. In short, in the agency theory framework, powerful CEOs are expected to pursue actions and make decisions, which are in their own personal best interests; hence, because of the assumption of risk aversion, it will not be anticipated that they make choices that are considered risky. Accordingly, Kim and Buchanan [59] provide empirical evidence that firms adopting CEO duality leadership show significantly lower levels of risk. Using a sample of US BHCs, Pathan [75] also finds that CEO power is associated with lower bank risk. Similarly, the findings of Akbar et al. [7] show that powerful CEOs reduce risk-taking in financial firms. The negative relationship can be explained within the agency theory context, where managers are viewed as more risk-averse due to the reputational and employment risk. On the other hand, Lewellyn and Muller-Kahle [64] and Altunbaş et al. [8] show, using respectively a sample of subprime lending firms and US banks, that CEO power is positively related to risk-taking, which is not in line with the assumptions of the agency theory.

⁵ The same is true for good projects as their approval also requires a convergence of opinions between group elements. Hence, larger groups select neither very good nor very bad projects; that is, they choose projects whose performance tends to be more stable.



Under the agency theory, managers opt for less risky projects to protect their wealth in terms of job, salary, and other perks. As risk-averse managers, bank CEOs have incentives to take less risk. Hence, our third Hypothesis (H_3) is stated as follows:

H₃ CEO power is negatively related to bank risk-taking.

Institutional ownership and bank risk-taking

In recent decades, institutional investors have become the largest shareholders of publicly-traded firms [33]. According to the literature, agency problems and risk-taking behaviour are distinctive depending on the nature of the shareholder. Institutional investors who exert significant voting power can influence the nature of corporate risk-taking activity [12, 94]. Both the theory and empirical evidence confirm that institutional investors can provide active monitoring that is difficult for smaller, more inactive, or less-informed investors.⁶ However, the intensity of institutional investors' monitoring can be limited by distinct factors such as potential business relationships with the firm (e.g., [24]) and concerns about the liquidity of their portfolios (e.g., [22, 31]). Moreover, since institutional investors have a diversified portfolio of investments, they may have lower incentives to exercise control [12].

Accordingly, Wright et al. [94] find evidence that institutional investors positively influence risk-taking for firms with larger growth opportunities. Erkens et al. [39] find that financial firms with higher institutional ownership took more risk before the crisis, which resulted in larger shareholder losses during the crisis period. Institutional investors may find it optimal to increase risk to increase their returns because they do not internalise the social costs of financial institution failures. Additionally, institutional arrangements such as deposit insurance may weaken debtholder discipline. More recently, Cheng et al. [28] also find a positive relationship between institutional investors and risk-taking choices. Accordingly, the fourth Hypothesis (H_4) is formulated as follows:

H₄ Institutional ownership is positively related to bank risk-taking.

Risk governance mechanisms and bank risk-taking

In many recent public policy documents published in the aftermath of large-scale financial scandals and the financial crisis, *one common recommendation is to put risk high on the agenda by creating respective structures* [5], p. 3214).

Specific measures involve either the establishment of a dedicated risk committee or designating a CRO who oversees all relevant risks within the firm (e.g., [71, 81]). For Sabato [81] the risk governance structure may have played a crucial role in the failure of risk management practices at most banks. The existence of a separate risk committee as well as the presence of a CRO, whose position and reporting line ensure an appropriate level of accessibility to the board of directors, are important elements of robust risk governance.

Furthermore, for Stulz [88], risk managers play a crucial role in measuring, monitoring and managing risk. Following high-quality risk governance practices, we expect that the existence of a separate risk committee as well as a CRO who is a board member induces the board to take less risk. Hence, we predict the fifth Hypothesis (H_5) as follows:

H₅ Risk governance mechanisms, (existence of a separate risk committee and a CRO who is a board member) are negatively related to bank risk-taking.

Data, methodology and descriptive statistics

Sample and data sources

The cross-country sample includes 72 publicly-listed European banks. We use the following criteria to compile our sample. First, we restrict our sample to European banks that were publicly listed at the end of December 2005; that is, listed for at least the whole of 2006 (so, at least one complete year before the beginning of 2007) and not delisted during the crisis period, which results in 191 banks. Second, we restrict our sample to banks with common shares traded on a regulated market and are not a subsidiary of a bank already included in the sample to prevent duplication of data. These restrictions reduce our sample to 164 banks. Third, we restrict our sample to banks that are covered by BoardEx, our data source on board information, and for firms classified by BoardEx as being banks. While BoardEx is the leading database on board composition of publicly listed firms, there are some limitations to this database's coverage of European banks. Hence, our final sample consists of 72 publicly listed banks. "Appendix 1" provides a list of our sample banks and their countries.

The data is sourced from Datastream, BoardEx, Thomson Financial and annual reports. The information on bank risk-taking was collected from Datastream, with the detailed data on bank board characteristics and risk governance structure mostly obtained from BoardEx and complemented with the information contained in the annual reports. Finally, the ownership information was extracted from Thomson Financial. Two different periods are considered in the risk-taking

⁶ See, for example, Gillan and Starks [48].



analysis: during the financial crisis (2007–2008) and before the financial crisis, or stable period (2006).

Description of variables

In this sub-section, we describe in detail the set of variables considered in our study: the dependent variable, the main explanatory variables, and the control variables. A clear definition of each of them is provided.⁷

Dependent variable

The dependent variable is a risk variable, *Bank risk*, which represents the risk-taking by a bank. A significant body of literature uses the standard deviation of stock returns as a measure of risk-taking [9, 29, 43, 45, 61, 74, 75]. Hence, following previous studies, our risk measure is calculated as the standard deviation of the bank's daily stock returns and represents total risk.⁸ This measure captures the overall variability in bank stock returns and incorporates the market's perception of the risks underlying the bank's positions [75].

Independent variables

The independent variables according to our hypotheses are *Board independence*, *Board size*, *CEO power*, *Institutional ownership*, *Risk committee*, and *CRO*. *Board independence* is the percentage of independent directors. *Board size* is the total number of directors on the board. *CEO power*, which is used to capture CEO influence over bank board decisions, is a dummy variable with a value of one whether the CEO is simultaneously the Chairman of the board and zero otherwise. Regarding ownership structure, we define *Institutional ownership* as the percentage of shares owned by institutional investors. Finally, two proxies of risk governance mechanisms are used. Our first proxy is the *Risk committee*, which is a dummy variable that takes the value of one whether the bank has a separate risk committee and zero otherwise. Our second proxy is *CRO*, which is a dummy variable that takes the value of one whether the CRO is a board member and zero otherwise.

Control variables

Other variables that may affect bank risk are used to check for differences in the sample of banks so that the actual relationship between the independent and dependent variables can be determined. Five variables are included to control

for: *i.* the previous position of the bank's Chairman or, more specifically, whether the Chairman is an ex-CEO (*Chair ex_CEO*); *ii.* bank past performance (*Performance*); *iii.* bank size (*Bank size*); *iv.* bank capital (*Capital*); and *v.* growth opportunities (*Growth opportunities*).

Chairman ex_CEO is a dummy variable which equals one if the current Chairman has previously occupied the position of CEO in the bank and zero otherwise.

Since banks may change their level of risk-taking following a previous performance, we follow Cheng [29] in using lagged performance as a control variable. Managers with poor prior performance may be inclined to take up excessive risk in the hope of meeting performance targets [91].⁹ Thus, we use bank past performance (*Performance*) as a control variable. *Performance* is computed as the natural logarithmic of the adjusted stock price ratio for two subsequent days over the previous year (January 2006 to December 2006 when analysing the crisis period).

It has been argued that firm size affects several organisational outcomes, namely risk-taking, and is often used as a control variable in several previous research [12, 29, 33, 43, 55, 64, 74, 75, 92]. Therefore, used to control for differences in sizes of the banks, *bank size* is measured by the natural logarithm of market capitalisation as, for example, Wang [92].

As in other studies (e.g., [12, 29, 74, 75]), we control for bank capital. Our measure of bank capital (*Capital*) is defined as shareholders' total equity over total assets. We then expect that higher capitalised banks are subject to less risk.

Finally, following past research, [55, 92], we control for growth opportunities (*Growth opportunities*). Specifically, we use the market-to-book ratio, defined as the ratio of the market value of equity to the book value of equity, as a proxy for growth opportunities.¹⁰

Finally, we also control for possible country-specific effects by including country dummies variables, the *DCountry* variable.

Endogeneity and the determinants of board characteristics

Based on previous literature, the causal nature of board attributes and risk-taking is not clear. Risk-taking by banks may change following changes in board characteristics but board characteristics may also change due to bank risk-taking. In this way, risk-taking may be simultaneously a consequence and a cause of the board structure, specifically

⁷ See "Appendix 2" for detailed definition.

⁸ Total risk includes both the risk involved in the particular stock (idiosyncratic risk) and market risk (systematic risk).

⁹ In addition, Chevalier and Ellison [30], for instance, show that mutual fund companies increase the riskiness of their portfolios in the fourth quarter when their performance is below comparable benchmarks.

¹⁰ The market-to-book ratio is commonly used in the literature to proxy for growth opportunities (e.g., [27]).



board independence and board size. Accordingly, we take into consideration the bidirectional causality and complex interrelationships that may exist between risk-taking and board characteristics, more specifically board independence and board size.

As Srivastav and Hagendorff (84, p. 338) state, *The board ensures bank stability by monitoring executives over the impact of firm policies on bank risk, evaluating whether current and future risk-exposure is consistent with risk appetite, and designing executive incentives to promote prudent risk-taking*. Along similar lines, BCBS (16, p. 10) stresses that *as part of the overall corporate governance framework, the board is responsible for overseeing a strong risk governance framework*. Thus, motivated by the relevance of the role of the board in ensuring an effective system of governance, the current literature has been analysing the impact of the board on bank risk-taking.¹¹ Additionally, the existing research has been examining the determinants of board structure, including risk as an explanatory variable.

On the one hand, the causal relationship between the variables may result from board independence and board size to corporate performance variability. Pathan [75] and Ferrero-Ferrero et al. [43], for example, find that a higher level of independent directors leads to a lower level of risk-taking, while Cheng [29] and Nakano and Nguyen [74] show that larger boards lead to lower performance variability. Moreover, for Huang and Wang [55], smaller boards are associated with riskier firm policy choices and consequently greater firm risk. On the other hand, the causal association between the variables may run from corporate performance variability to board independence and board size. For instance, Boone et al. [23] and Linck et al. [65] show that stock return variability is negatively related to independent directors and board size.

We deal with this issue by using a system of simultaneous equations, which treats risk-taking, board independence, and board size as endogenous variables.

Explanatory variables of endogenous board characteristics

The existing literature on boards of directors treats the independence and size of the board as endogenous variables [3, 53] and provides evidence regarding the determinants of these board characteristics [23, 32, 65]. To estimate the equations concerning board independence and board size we identify, following the existing literature, a set of variables that we describe below.

Scope of operations

The expression *scope of operations* refers to the nature, diversity, and complexity of the firm's business production process [23]. To capture the different aspects of the scope of operations, previous studies have used several proxies for it, such as firm size, age, leverage, and the number of business segments involved (e.g., [23, 32, 65, 75]). For instance, Coles et al. (32, p. 351) argue that *complex firms such as those that are diversified across industries, large in size, or have high leverage are likely to have greater advising requirements. Hence, these firms are more likely to benefit from a larger board of directors, particularly from outside directors who possess relevant experience and expertise*.

Bank size As the benefits of monitoring increase, boards will do more monitoring, leading to more outsiders on the board [65]. Since independent directors are presumably better monitors and the potential for agency conflicts are expected to increase with firm size, large firms could require more of such directors to diminish the augmented agency problems of being large [63]. On the one hand, outside directors bring expertise, experience, and potentially important connections to the firm, and therefore, they are of high importance to large firms [32, 65]. On the other hand, in-depth knowledge of the firm is particularly important for larger firms; namely in advising managers concerning the firm's business strategy.

In addition to board independence, firm size can also affect board size. Larger or more diverse firms may require more new board members to serve on their board committees, [23]. In the same way, the information requirements of larger and more complex firms generally result in the need for larger boards [77]. Due to the higher volume and greater diversity of activities, larger firms have more demand for information than their smaller counterparts [63]. As firms grow, boards grow in response to the increasing net benefits of monitoring and specialisation by board members [23], as well as the increased gains of advising. Hence, we expect a positive relationship between bank size and board size. Previous studies (e.g., [19, 23, 32, 34, 49, 62, 63, 65]) have established a positive relationship between firm size and, respectively, board size and board independence.

However, according to current arguments, the impact of bank size on board independence is not, a priori, completely clear. On the one hand, since larger firms require more managerial effort and more diverse expertise, they will have more independent directors. On the other hand, as larger firms require a broad knowledge regarding their multiple specificities (internal policies, strategies, etc.) and complexities, inside directors will be an important source of firm-specific information [79], entailing that larger firms will have more of them. As Lasfer [62], Boone et al. [23], and

¹¹ Srivastav and Hagendorff [84], for instance, review the literature on the corporate governance of banks with a particular focus on the implications of governance for bank risk-taking.



Lehn et al. [63] confirm, the size of the bank (*Bank size*) is measured as the natural logarithm of market capitalisation.

Bank capital, bank age, and bank diversification Empirical studies, such as Boone et al. [23], Coles et al. [32], Guest [49], and Linck et al. [65] suggest that board size and independence are positively associated with leverage, firm age, and diversification. These findings reflect the idea that firms with higher financial leverage, older, and with higher diversification are more complex, thereby demanding more experience and skills, as well as greater advisory requirements (e.g., [32, 41, 49]).

Firms with high leverage depend significantly on external resources and may have a greater need for advice [60, 78]. A larger board and a higher proportion of outsiders can provide greater information; therefore, both should increase as advisory needs increase [49]. Consistent with this view, Pfeffer [78] finds that firms with a greater need for access to external capital have a higher number of directors and a higher percentage of outside members on their boards. However, Pathan and Skully [77] find a positive relationship between board size and bank capital, while Chen and Al-Najjar [26] find no significant association between board size and non-financial firm leverage.

Moreover, bank capital may affect board independence positively because a high capital ratio means a lower level of debt. Here, debt is considered to be an important market monitoring mechanism in disciplining bank managers [44]. Thus, given the lack of such a monitoring mechanism, other internal governance devices, such as independent directors, may become more important [77].

Moreover, we should account for the age of the bank. As time passes (banks become more established), managers are promoted to directors, increasing board size [67]. Accordingly, a positive relationship between board size and bank age is expected. However, for Mak and Li [67], Hillier and McColgan [54] and Pathan and Skully [77], firm age is not significantly associated with board size.

Furthermore, we account for diversification. We use the primary measure of revenue diversification proposed by Stiroh and Rumble [86], which *seemed more appropriate because it captures the complexity and the level of diversification of banks through their income sources* [77], p. 1594). For instance, Mak and Li [67] predict that diversified firms will have larger boards because of the need for more directors with expertise in different areas of business. Pathan and Skully [77] also find that bank diversification increases bank board size but not board independence.

Similar to Pathan and Skully [77], we measure bank capital (*Capital*) as the ratio of total equity to total assets. The age of the bank (*Bank age*), as Guest [49] and Pathan and Skully [77] recognise, is measured as the number of years since the bank was first listed on Datastream. Finally,

regarding bank diversification (*Diversification*), we use a measure of revenue diversification by Stiroh and Rumble [86] which is calculated as one minus (squared share of net operating revenue from net interest sources plus squared share of net operating revenue from non-interest sources). A higher value indicates a more diversified mix: zero means that all revenue comes from a single source (complete concentration), while 0.5 is an even split between net interest income and non-interest income (complete diversification).

Growth opportunities

The information asymmetry associated with high-growth firms is expected to affect board composition [68]. It may be argued that firms with more future growth opportunities may have more outside directors on the board to control the higher agency problems inherent in such firms [13]. In other words, to mitigate the potential agency problems associated with high-growth firms, one might expect to find a greater representation of outside directors on the boards of these firms. Consistent with this argument, Mak and Roush [68] show that the proportion of outside directors is positively related to the extent of growth opportunities available to a firm.

On the other hand, information asymmetry impairs the ability of outside directors to fulfill their advisory function in high-growth firms [63]. Either the outside directors make decisions based on less information than their peers in low growth firms, or they incur higher costs when obtaining information to enable them to make more informed decisions. Also, being that outside directors serve a monitoring function, the CEO may have an incentive to hide certain types of information. These arguments support an inverse relationship between growth opportunities and the proportion of independent directors. In accordance, Linck et al. [65] find that firms with high growth opportunities are associated with less independent boards.

Board size is also likely to be affected by the firm's growth opportunities. The costs of monitoring managers increase with a firm's growth opportunities [83]. Consequently, the free-rider problem of large boards is more pronounced in high-growth firms [62, 63]. For board members to have enough incentive to bear the high monitoring costs in firms with high growth opportunities, boards are expected to have a small size [63]. Also, Lehn et al. [63] argue that since high growth firms operate in more volatile environments than low growth firms, they require board structures that facilitate rapid decision-making and redeployment of assets. Thus, the more volatile the environment in which a firm operates, the smaller its board is likely to be.

Growth firms may find it important to have boards that can make timely strategic decisions and such firms may, therefore, prefer smaller boards [68]. For Mak and Roush



[68], there is some evidence that firms expected to have more growth opportunities tend to employ smaller boards. Similarly, Linck et al. [65] find that firms with high growth opportunities are associated with smaller boards, as do Lehn et al. [63] when using the market-to-book value of assets ratio as a proxy for growth opportunities. We hence use the market-to-book ratio to measure growth opportunities (*Growth opportunities*).

CEO characteristics

Board independence decreases with the CEO's bargaining power [11, 52] and such CEO power derives from his/her perceived ability, relative to a replacement [52], to influence board decisions. The findings of Hermalin and Weisbach [52] suggest that board independence will decline throughout the CEO's tenure. Keeping his/her job for a long period gives the CEO bargaining power *vis-à-vis* the directors. Therefore, he/she can pressure for a board that is more favourable to him/her and so more insiders are placed in board positions. Instead, *a new CEO is an unknown quantity with relatively less power than an established CEO. Consequently, shareholders feel that a new CEO requires more scrutiny, so they will put more outsiders on the board to monitor him. In addition, shareholders are better able to put monitors on the board because the new CEO is not yet powerful enough to keep them off* [51], p. 605).

Furthermore, the longer the CEO has been with the firm, the more entrenched that person is likely to be. This entrenchment derives from the fact that over time, CEOs can influence the composition of their boards through the director nomination process [69]. Other existing literature, such as the research of Bathala and Rao [13], finds a negative association between CEO tenure and board independence, indicating that the longer a CEO has held this position, the greater the influence he/she has to change the board into a more favourable one with insiders. However, Pathan and Skully [77] find that the coefficient on the CEO tenure variable is not statistically significant in their board independence regression. We measure *CEO tenure* as the number of years the CEO has served in this position.

Board independence can also be affected by the CEO succession process [51, 65]. Although for Hermalin and Weisbach [51] as a CEO nears retirement firms tend to add insiders to the board. Meanwhile, for Pathan and Skully [77] there is no significant relationship between CEO age, a proxy for CEO succession planning, and board independence. Similar to Linck et al. [65] and Pathan and Skully [77], *CEO age* is the bank CEO's age in years.

Empirical framework

Equation (1) shown below is formulated to test empirically the main hypotheses, H₁ to H₅. In this paper, we intend to analyse whether bank risk-taking and the efficacy of governance mechanisms are contingent upon macroeconomic conditions: crisis and non-crisis periods. So, we test the hypotheses for two different economic contexts: during the financial crisis and before the financial crisis. First, the equation is regressed in a recession period, using data for 2007 and 2008 and second, the equation is regressed in a *normal* period using data for 2006. In the former case, except for dummies, the independent variables are averaged over the period.

As it is possible that not only board independence and board size may influence bank risk, but also that bank risk may influence these board characteristics,¹² we use a simultaneous equations approach. This way, we take into account the interdependencies between risk and board characteristics. In terms of methodology, we develop a system of simultaneous equations in which bank risk, board independence and board size are endogenised. So, we estimate three equations in the system, one for each endogenous variable. Equations (2) and (3) relate, respectively, to board independence and board size.

The three regression equations are:

$$\begin{aligned}
 & \text{(Bank risk)}_{i,t} \\
 & = \beta_0 + \beta_1(\text{Board independence})_{i,t} + \beta_2(\text{Board size})_{i,t} \\
 & \quad + \beta_3(\text{CEO power})_{i,t} + \beta_4(\text{Institutional ownership})_{i,t} \\
 & \quad + \beta_5(\text{Risk committee})_{i,t} + \beta_6(\text{CRO})_{i,t} + \beta_7(\text{Chair ex_CEO})_{i,t} \\
 & \quad + \beta_8(\text{Performance})_{i,t-1} + \beta_9(\text{Bank size})_{i,t} \\
 & \quad + \beta_{10}(\text{Capital})_{i,t} + \beta_{11}(\text{Growth opportunities})_{i,t} \\
 & \quad + \sum_{j=1}^n \beta_{(11+j)}(\text{DCountry})_{j,i,t} + \varepsilon_{i,t}
 \end{aligned} \tag{1}$$

$$\begin{aligned}
 & \text{(Board independence)}_{i,t} \\
 & = \beta_0 + \beta_1(\text{Board size})_{i,t} + \beta_2(\text{Bank risk})_{i,t} \\
 & \quad + \beta_3(\text{Bank size})_{i,t} + \beta_4(\text{Capital})_{i,t} \\
 & \quad + \beta_5(\text{Diversification})_{i,t} \\
 & \quad + \beta_6(\text{Growth opportunities})_{i,t} + \beta_7(\text{CEO tenure})_{i,t} \\
 & \quad + \beta_8(\text{CEO age})_{i,t-1} \\
 & \quad + \sum_{j=1}^n \beta_{(8+j)}(\text{DCountry})_{j,i,t} + \varepsilon_{i,t}
 \end{aligned} \tag{2}$$

¹² The relationship can then be bidirectional and accordingly the variables will be determined simultaneously.



Table 1 Descriptive statistics

Variable	# Obs.	Mean	Median	Std. dev.	Max.	Min.
<i>Panel A: board structure variables</i>						
Board independence (%)	72	41.468	47.078	26.796	92.308	0.000
Board size (number)	72	16.472	15.000	6.015	34.000	6.000
CRO	72	0.208	0.000	0.409	1.000	0.000
Chair ex_CEO	72	0.250	0.000	0.436	1.000	0.000
<i>Panel B: ownership structure variable</i>						
Institutional ownership (%)	69	49.600	48.485	24.993	99.015	0.050
<i>Panel C: CEO characteristics variables</i>						
CEO power	72	0.056	0.000	0.231	1.000	0.000
CEO tenure (years)	72	5.040	3.500	4.843	27.400	0.350
CEO age (years)	72	53.924	54.250	8.110	77.500	33.500
<i>Panel D: bank-specific variables</i>						
Bank risk (%)	72	3.315	3.018	1.484	9.100	0.541
Risk committee	72	0.403	0.000	0.494	1.000	0.000
Performance (%)	72	25.072	20.836	19.611	93.981	-29.251
Bank size (€ bil.)	72	14.185	7.421	19.107	109.975	0.236
Capital (%)	72	5.694	4.699	4.478	34.936	1.501
Bank age (years)	72	21.507	20.489	11.112	43.500	2.733
Diversification	72	0.420	0.452	0.083	0.499	0.103
Growth opportunities (%)	72	133.871	125.129	67.058	480.742	45.080

The table reports the descriptive statistics of each variable by showing mean, median, standard deviation (Std. dev.), maximum (Max.) and minimum (Min.) for the banks of our sample

Please refer to “Appendix 2” for the definition of each variable

$$\begin{aligned}
 (\text{Board size})_{i,t} = & \beta_0 + \beta_1(\text{Board independence})_{i,t} + \beta_2(\text{Bank risk})_{i,t} \\
 & + \beta_3(\text{Bank size})_{i,t} + \beta_4(\text{Capital})_{i,t} + \beta_5(\text{Bank age})_{i,t} \\
 & + \beta_6(\text{Diversification})_{i,t} + \beta_7(\text{Growth opportunities})_{i,t} \\
 & + \sum_{j=1}^n \beta_{(7+j)}(\text{DCountry})_{j,i,t} + \varepsilon_{i,t}
 \end{aligned}
 \tag{3}$$

where, i is the i th bank, t is the time period, n is the number of country dummies and $\varepsilon_{i,t}$ is the error term. $DCountry$ are country dummies indicating the country of the bank.

To estimate the system of simultaneous equations, we employ the 3SLS estimation method and, as a robustness test, the 2SLS estimation method.¹³

The endogenous variables in our system of equations are *Bank risk*, *Board independence* and *Board size*. Under our system of equations, these variables are dependent on each other, and also on other exogenous variables. In estimating the system of equations, we use the exogenous variables as instruments.

Descriptive statistics

Table 1 presents the descriptive statistics for board structure, ownership, CEO characteristics and bank-specific variables in the crisis period, except for the *Performance* variable, which measures past performance (year 2006).

The board structure variables in Panel A of Table 1 show that the mean percentage of independent directors is 41.47%, with a minimum of 0%. The average number of bank board directors is 16.47, a higher value than the one that has been found in non-financial firms (e.g., 12.25 in Yermack [95], 10.4 in Coles et al. [32] and 9.14 in Francis et al. [46]), confirming that, as stated by Adams and Mehran [1] and Adams [2] banks have, on average, larger boards. In our sample of banks, 20.8% of the CROs are board members and 25% of the current Chairmen have previously occupied the position of CEO. Regarding the ownership structure variable, in Panel B, the mean value of institutional ownership is 49.6%. Panel C indicates that only 5.6% of the CEOs also serve as Chairman of the board, which is greater than what is reported by McNulty et al. [70], 4.95%, in a sample of non-financial firms and much lower than the percentage shown by Lewellyn and Muller-Kahle [64], 73%, in a sample of financial firms. On average, the CEO served 5 years in this position, which is below the value reported by Bathala and Rao [13], 10.5 years, and Pathan and Skully [77], 8.9 years.

¹³ We note that OLS estimation of an equation that contains an endogenous explanatory variable generally produces biased and inconsistent estimators [93].



Table 2 Pearson correlation matrix (Panels A to C)

Panel A/Variables	Bank Risk	Board Independence	Board Size	CEO Power	Institutional Ownership	Risk Committee	CRO	Chair ex_CEO	Performance	Bank size	Capital	Growth opportunities
Bank risk	1.000											
Board Independence	0.313***	1.000										
Board size	0.020	-0.235*	1.000									
CEO power	-0.084	-0.043	-0.061	1.000								
Institutional ownership	0.015	-0.024	0.175	-0.350***	1.000							
Risk committee	0.235*	0.114	0.088	0.048	0.118	1.000						
CRO	0.023	-0.025	0.164	-0.053	0.134	0.258**	1.000					
Chair ex_CEO	-0.003	0.116	-0.088	0.146	0.003	0.075	-0.122	1.000				
Performance	-0.043	-0.174	0.066	-0.033	-0.001	-0.058	-0.006	-0.124	1.000			
Bank size	0.358***	0.369***	0.353***	0.070	-0.140	0.239**	0.105	-0.098	-0.100	1.000		
Capital	-0.247**	0.043	-0.253**	0.046	-0.127	-0.155	-0.115	0.034	0.090	-0.210	1.000	
Growth opportunities	-0.268**	-0.091	-0.299**	0.174	-0.188	-0.095	-0.040	0.096	0.151	-0.176	-0.027	1.000
Panel B/Variables	Bank Risk	Board Independence	Board Size	CEO Power	Institutional Ownership	Risk Committee	CRO	Chair ex_CEO	Performance	Bank size	Capital	Growth opportunities
Bank risk	1.000											
Board independence	0.313***	1.000										
Board size	0.020	-0.235*	1.000									
Bank size	0.358***	0.369***	0.353***	1.000								
Capital	-0.247**	0.043	-0.253**	-0.210	1.000							
Growth opportunities	-0.268**	-0.091	-0.299**	-0.176	-0.027	1.000						
Diversification	0.153	0.183	0.187	0.290**	-0.399***	-0.069	1.000					
CEO tenure	-0.233*	-0.281**	0.017	-0.163	0.035	0.092	-0.032	1.000				
CEO age	-0.077	-0.233*	0.210*	0.215*	-0.034	-0.198	-0.028	0.381***	1.000			
Panel C/Variables	Bank risk	Board independence	Board size	CEO Power	Institutional Ownership	Risk Committee	CRO	Chair ex_CEO	Performance	Bank size	Capital	Growth opportunities
Bank risk	1.000											
Board independence	0.313***	1.000										
Board size	0.020	-0.235*	1.000									
Bank size	0.358***	0.369***	0.353***	1.000								
Capital	-0.247**	0.043	-0.253**	-0.210	1.000							
Growth opportunities	-0.268**	-0.091	-0.299**	-0.176	-0.027	1.000						
Diversification	0.153	0.183	0.187	0.290**	-0.399***	-0.069	1.000					
CEO tenure	-0.233*	-0.281**	0.017	-0.163	0.035	0.092	-0.032	1.000				
CEO age	-0.077	-0.233*	0.210*	0.215*	-0.034	-0.198	-0.028	0.381***	1.000			

Asterisks indicate significance at the 1% (***), 5% (***) and 10% (*) using a two-tailed test. Please refer to "Appendix 2" for the definition of each variable.



Finally, Panel D presents the descriptive statistics of the bank-specific characteristics variables. In our sample, 40.3% of the banks have a risk committee. The mean past performance is 25.072%, reaching a negative minimum value of 29.25%. The mean bank size is €14.19 billion and the mean capital ratio is 5.69%.

Table 2 presents the Pearson correlation matrix for all the variables in three different panels, calculated for the common observations ($N=69$). Panel A to C presents the correlation matrix between the variables used in Eq. (1) to (3), respectively. Multicollinearity among the variables should not be a concern as the maximum value of the correlation coefficient is, in absolute value, 0.399.¹⁴

Empirical results

Three-stage least squares (3SLS) estimation results

We first present and analyse the 3SLS estimation results in the crisis period (Table 3) and next whether the impact of the determinants of bank risk and board structure depends on macroeconomic conditions and therefore, whether the effect of such determinants is different in crisis and pre-crisis periods (Table 4).

Crisis Period

Table 3 reports the 3SLS estimates of the system of the three regression equations, that is, Eqs. (1) to (3) for *Bank risk*, *Board independence* and *Board size* respectively.

To consider the (potential) impact of outliers on our results, we winsorise all the variables at the 1st and 99th percentile.

During the financial crisis, results provide evidence that a higher proportion of independent directors leads to lower levels of bank risk-taking, as the coefficient on the *Board independence* variable is negative and statistically significant at 10 percent level, supporting hypothesis H_1 . A reason that may explain this result is that independent directors are more sensitive to the regulatory requirements and consequently take more prudent, moderate and conservative actions. Thus they influence bank manager's actions, to avoid loss of professional reputation and even lawsuits in the event of large-scale destruction of shareholder value resulting from lax monitoring. Therefore, they are particularly

Table 3 3SLS regression results for Bank risk, Board independence, and Board size in the financial crisis (July 2007 to December 2008), with winsorisation at the 1st and 99th percentile

Variable	Equation (1) Bank risk	Equation (2) Board independ- ence	Equation (3) Board size
Bank risk	–	4.845** (0.027)	–0.216 (0.224)
Board independ- ence	–0.016** (0.022)	–	0.047*** (0.000)
Board size	–0.289*** (0.010)	15.766*** (0.000)	–
CEO power	–2.210* (0.069)	–	–
Institutional own- ership	0.017** (0.016)	–	–
Risk committee	0.370 (0.339)	–	–
CRO	–1.624 (0.569)	–	–
Chair ex_CEO	2.029*** (0.000)	–	–
Performance	–0.023** (0.027)	–	–
Bank size	1.491*** (0.000)	–41.352*** (0.000)	3.968*** (0.000)
Capital	–0.105 (0.221)	6.244*** (0.000)	–0.374*** (0.000)
Growth opportu- nities	–0.002 (0.496)	0.344*** (0.000)	–0.018*** (0.000)
Bank age	–	–	0.035 (0.289)
Diversification	–	–164.623*** (0.000)	10.348*** (0.000)
CEO tenure	–	–1.528** (0.031)	–
CEO age	–	0.879** (0.034)	–
Country dummies	Yes	Yes	Yes
# observations	69	69	69
Adj-R ²	0.937	0.863	0.989

p-values are in brackets and asterisks indicate significance at the 1% (***), 5% (**) and 10% (*) levels, using a two-tailed test. Please refer to “Appendix 2” for the definition of each variable

careful in carrying out the monitoring role. This result is consistent with Pathan [75] and Ferrero-Ferrero et al. [43] for the crisis period.

Concerning the size of the board, the coefficient on the *Board size* variable is also negative and statistically significant a one percent level. Therefore, as hypothesised, a small board is associated with more bank risk-taking or, in other words, associated with more variability of bank performance. This result is following previous studies related to group decision-making process, which argue that larger

¹⁴ As a rule-of-thumb, multicollinearity is considered harmful only when the correlation between two regressors exceed 0.8 (e.g., [50]). To double check for any multicollinearity issue we also compute the Variance Inflation Factor (VIF) for each independent variable. All the VIF values are significantly below the critical value of 10, which indicate that multicollinearity is not a major problem (e.g., [50]).



Table 4 3SLS regression results for Bank risk, Board independence and Board size in the pre-crisis period (2006), with winsorisation at the 1st and 99th percentile

Variable	Equation (1) Bank risk	Equation (2) Board independ- ence	Equation (3) Board size
Bank risk	–	16.696* (0.057)	–2.611*** (0.003)
Board independ- ence	–0.004** (0.023)	–	0.110*** (0.000)
Board size	–0.014 (0.436)	3.467* (0.069)	–
CEO power	0.059 (0.767)	–	–
Institutional own- ership	0.010*** (0.000)	–	–
Risk committee	–0.003 (0.978)	–	–
CRO	–0.378 (0.549)	–	–
Chair ex_CEO	–0.429*** (0.001)	–	–
Performance	0.020*** (0.000)	–	–
Bank size	0.039 (0.236)	–4.074 (0.463)	1.082** (0.023)
Capital	0.005 (0.812)	–5.455*** (0.000)	0.432*** (0.006)
Growth opportu- nities	0.001 (0.138)	0.069*** (0.002)	–0.009*** (0.002)
Bank age	–	–	0.121*** (0.003)
Diversification	–	–102.939*** (0.000)	19.415*** (0.000)
CEO tenure	–	–1.075* (0.086)	–
CEO age	–	0.476 (0.329)	–
Country dummies	Yes	Yes	Yes
N	67	67	67
Adj-R ²	0.990	0.963	0.984

p-values are in brackets and asterisks indicate significance at the 1% (***), 5% (**) and 10% (*) levels, using a two-tailed test. Please refer to “Appendix 2” for the definition of each variable

groups tend to make less extreme decisions. Also, a larger board facilitates monitoring and advising by managers due to the additional human capital available. This finding is also consistent with several previous studies such as Cheng [29], Pathan [75], Ferrero-Ferrero et al. [43] in an economic growth period, Nakano and Nguyen [74], Wang [92] and Huang and Wang [55] and it confirms hypothesis **H₂**.

As expected, the coefficient on the *CEO power* variable is negative and statistically significant. Thus, a powerful CEO decreases bank risk-taking, supporting hypothesis **H₃**. This

may be because as managers are risk-averse they have less incentive to take risk. To safeguard their non-diversifiable wealth they are not inclined to invest in riskier projects. Additionally, whenever his/her remuneration is not linked to risk-taking (fixed compensation) the CEO prefers safer projects.

For ownership structure, the coefficient on the *Institutional ownership* variable is positive and so, we find that institutional investors increase bank risk-taking, thus confirming hypothesis **H₄**. This finding is supported by the argument that such investors encourage managers to take more risk to increase bank value and consequently, their wealth. The focus of institutional ownership on short-term profitability encourages bank risk-taking.

Contrary to the expectation, neither the coefficient on the *Risk committee* variable nor the coefficient on the *CRO* variable is statistically significant. Although following the financial crisis, the existence of a separate risk committee and the presence of a CRO on the board were commonly recommended, we do not find evidence that these risk governance mechanisms influence bank risk-taking and so, hypothesis **H₅** is not confirmed. The reasons that may explain this finding are that, on the one hand, *even though most large banks had a dedicated risk committee, most of them met very infrequently* [5], p. 3214, as confirmed by Mongiardino and Plath [71] in their sample of banks. According to them, the risk committee should meet frequently (at least bi-monthly). On the other hand, most risk committees may not be comprised of a sufficient number of independent and financially knowledgeable/experienced members who know how to implement appropriate risk management strategies, resulting in a failure of risk management at banks.¹⁵ Mongiardino and Plath ([71], p. 119) argue that the experience and independence of the risk committee members is a relevant factor to consider *given that board members with the appropriate expertise may be in a better position to challenge and provide the appropriate checks and balances to management*.

The coefficients on the other bank characteristics also offer important insights. In the financial crisis, as expected, the coefficient on the *Chair ex_CEO* variable is positive and statistically significant, meaning that banks in which the Chairman has previously served as CEO take more risk, as he/she may not be (completely) independent from current management. The motivation to monitor management seems to be compromised due to the Chairman's (potential) lack of independence, failing to properly oversee bank risk-taking, which is especially relevant in a crisis. Holding a previous

¹⁵ Stulz [87] characterizes a failure of risk management as one of the following: failure to identify and measure risks, failure to communicate effectively risk exposures, providing timely information to the board and top management and failure to monitor and manage risks.



management position (executive role) at the bank negatively interferes with the Chairman's current duties and responsibilities as monitor due, possibly, to his/her previous ties/affiliation with current management and lack of impartiality. In an economic recession period the effectiveness of the supervisory role is critical and the advantages of monitoring (namely the implementation of key strategies in a timely and effective manner), as well as evaluating management performance outweigh the potential benefits of the advisory role (that one might associate with the ex-CEO's human capital and consequently, with the retention of the former CEO in the board). It is also possible that the Chairman may have to control the effects of a (bad) decision originally made by him/her. It seems difficult to appropriately monitor risk strategies with a board that includes the person who, probably, defined such (eventually inadequate) strategies, being their poor quality and the devastating effects related to it highlighted during the financial crisis, which is an additional incentive to be ineffective and inactive. Following the expectation, the statistically significant negative coefficient on the *Performance* variable, which measures past performance, demonstrates that bank risk-taking increases following poor performance. This finding is following previous research arguing that executives are encouraged to take excessive risks when they find themselves close to missing performance targets (e.g., [91]). If bank return is low (or, even, below internal or external defined benchmarks) in the previous year, managers to achieve the desired performance targets increase bank risk in the current year. Thus, past weak performance is associated with higher current risk. Facing poor performance, banks appear to be risk-seeking. The coefficient on the *Bank size* variable is positive and statistically significant, suggesting that bank size is associated with more risk-taking. Our result is in line with the "too big to fail" argument. Large banks have an incentive to take more risk since their size gives them such relevance in the economy that in case of misfortune they will be saved. In fact, given the significant costs to the economy from a large bank failure, governments are resistant to let large banks fail.¹⁶ As long as some banks are considered too big to fail, those banks will be engaged in riskier strategies and, consequently, will take a higher (and, eventually, exceptionally large) risk. Additionally, both the coefficient on the *Capital* and the *Growth opportunities* variables are not statistically significant and so, contrary to our expectations, neither bank capital nor growth opportunities impact bank risk-taking.

Column (2), in Table 3, presents the 3SLS estimates of regression Eq. (2), when *Board independence* is the dependent variable. Specifically, we find that board independence increases as bank risk-taking increases. Increased risk leads to increased independent directors, which in turn leads to a decline in bank risk-taking (see Column (1), Eq. (1) in Table 3). In other words, as risk rises banks are encouraged to include more independent directors given that more independent boards originate less risk-taking. Also, as the board becomes larger board independence increases. On the contrary, bank size negatively impacts board independence suggesting that larger banks demand more inside directors because their large size requires more specific information (and so, the inclusion of insiders can lead to more effective decision making), although it gives rise to more significant agency problems [63]. Similarly, Berry et al. [21] find that firm size is also negatively related to board independence, showing that as firms get larger outside board representation declines. As expected, bank capital positively affects board independence. A high capital ratio implies a low debt ratio and with debt being a market monitoring device, in the absence (scarcity) of this mechanism, board independence works as a substitute control mechanism and so, it increases. Similarly, growth opportunities have a positive impact on board independence. This finding provides support for the argument that firms with greater agency problems, related to growth opportunities, are likely to choose boards of directors that are more effective at mitigating such problems. Lastly, for bank-specific characteristics, we find that bank diversification is negatively related to board independence. The direction of this relationship is consistent, for example, with Pathan and Skully [77], however, they do not find statistical significance. Regarding the CEO characteristics, the significant negative coefficient on the *CEO tenure* variable indicates that as the length of time during which the CEO has served as CEO increases, the proportion of independent directors decreases. This result is consistent not only with the bargaining/negotiation hypothesis, which predicts that board independence is negatively related to CEO job tenure (a measure of the CEO's influence) but also with the entrenchment theory. The longer the tenure of a firm's CEO, the more entrenched he/she is likely to be. Finally, at odds with the expectation, the coefficient on the *CEO age* variable is positive and statistically significant. Thus, as a CEO approaches retirement banks to increase independent directors to the board. A potential explanation for this unexpected result is that as the CEO approaches retirement there is a loss of power on his/her part and shareholders may, in that case, be more readily able to impose additional independent members on the board, thus signaling a future change in the strategy [80] and perhaps intending to engage such members more intensely in succession planning activities at the board level.

¹⁶ Thus, there are banks that are "too big to fail", being bailed out. Actually "large banks have received generous sums of government money and other support measures in order to keep them afloat, given their looming insolvency" ([42], pp. 720).



Column (3), in Table 3, reports the results of the 3SLS estimates of regression Eq. (3), when *Board size* is the dependent variable. More precisely, we find that neither the coefficient on the *Bank risk* variable nor the coefficient on the *Bank age* variable is statistically significant. Consistent with Mak and Li [67], Hillier and McColgan [54], Guest [49], and Pathan and Skully [77] respectively, in a sample of non-financial firms and banks, firm age has no impact on explaining board size. The coefficient on the *Board independence* variable is positive and statistically significant and so, as the proportion of independent directors increases the board becomes larger. Also, the coefficient on the *Bank size* variable is positive and statistically significant providing support for the hypothesis that larger banks have larger boards. This result is consistent with Baker and Gompers [11], Boone et al. [23], Coles et al. [32], Guest [49], Linck et al. [65], Lehn et al. [63], and Pathan and Skully [77]. Furthermore, both the coefficients on the *Capital* and *Growth opportunities* variables are negative and statistically significant, at one percent level. Thus, banks with high capital ratios are associated with smaller boards, which follows previous studies that show a positive relationship between debt and board size [49, 65]. Also, banks with high growth opportunities have smaller boards, which facilitate faster and timely decisions. This result confirms the view that firms with high growth opportunities generally require more agile governance structures. Finally, the positive and statistically significant coefficient on the *Diversification* variable indicates that diversified banks have larger boards (e.g., [77]).

Three-stage least squares (3SLS) in the pre-crisis period

We repeat the estimation of Eqs. (1)–(3) as specified in Sect. 3.5 for the pre-crisis period. Table 4, reports the 3SLS estimates from Eqs. (1) to (3), in the pre-crisis period, also with winsorisation at the 1st and 99th percentile. We identify clear deviations from the results reported in Table 3 (crisis period).

For Eq. (1) and regarding our main variables, both the coefficients on the *Board size* and *CEO power* variables are not statistically significant and so, neither the size of the board nor a powerful CEO affects bank risk-taking in the pre-crisis period (proxy to “normal” periods). In a non-recession period, the advantages of larger boards in minimising risk do not seem to be relevant. Board decisions in such a period involve less uncertainty and are more predictable. In this sense, macroeconomic stability produces less performance variability. Also, bank risk is not influenced by leadership power. The risk-averse behaviour of bank managers, which encourages them to take less risk, becomes insignificant in the presence of more favourable macroeconomic conditions. In short, the impact of these governance mechanisms on risk-taking reduction disappears in a pre-crisis

period. Regarding the control variables, both the coefficients on the *Chair ex_CEO* and *Performance* variables maintain their statistical significance but change sign. So, their impact on bank risk-taking in a non-recession period is exactly the opposite of that in a crisis period. One may reason that having on the board a Chairman who is ex-CEO has some disadvantages in terms of the control of the bank management—supervisory role (as explained in Sect. 4.1.1), which can be critical in an economic recession period. However, it also has potential benefits in terms of valuable advice—advisory role—as the bank is likely to benefit from the former CEO's human capital (such as bank-specific knowledge), which can be very important in a non-crisis period. In a stable period, banks operate in a less uncertain environment and are less dependent on urgent and rapid decision-making. Thus, with less external pressure the quality of bank decisions may be improved, decreasing risk when a strong advisory role is in place. Having as chairman a former CEO has disadvantages regarding the supervisory role because he/she doesn't have adequate incentive to control managers. Thus, being the first role especially important in economically turbulent periods, in the financial crisis having as Chairman an ex-CEO should impact positively on risk. On the other hand, being the second role especially relevant in periods of macroeconomic stability, in the non-crisis period having as Chairman an ex-CEO should negatively influence risk. Additionally, in the financial crisis, past performance negatively influences bank risk, meaning that bank risk increases following low performance.

However, in the pre-crisis period we observe that the impact of the presence of an ex-CEO Chairman is the opposite of what was expected (a positive rather than a negative impact). A potential explanation for this is that in a non-recession/growth period managers may not have incentives to implement adequate risk mitigating strategies since they may wrongly believe that the economic growth, health and apparent robustness of the financial market will enable higher bank returns without affecting risk levels. Finally, we note that the positive coefficient on the *Bank size* variable and the negative coefficient on the *Capital* variable are now not statistically significant and thus, both the size and capital of the bank have no impact on bank risk in the pre-crisis period. One possible explanation is that in the pre-crisis period the common perception was that the banking system was in general secure (due, namely, to the strong regulation and supervision)¹⁷ and that the governments, in

¹⁷ Banks are heavily regulated and supervised (e.g., [18, 25, 73]) and strong regulation and supervision plays an essential part in ensuring a safe and sound banking system ([35], p. 537). Given the role of banks as the key players in both the credit and payment systems [10, 25] and in the economic development and the stability of the overall financial system [32, 41, 49] and due to the vulnerability of banks to runs [73] since, for instance, the effects of individual bank failure might be a contagious run on otherwise healthy banks [25], govern-



general, would always help banks regardless of their size and capital.¹⁸ Thus, bank size and capital would have no particular impact on their level of risk, which can justify the lack of significance of the bank size and capital variables in explaining bank risk. Taken together, our findings indicate that some governance mechanisms (and other control variables) are helpful in crisis conditions but not in stable conditions and thus, their effect seems to be contingent upon macroeconomic conditions.

For Eq. (2) in Table 4, we also find deviations from the results reported in Table 3. Both the coefficients on the *Bank size* and *CEO age* variables are no longer statistically significant. Consequently, neither the size of the bank nor the age of the CEO has an influence on board independence in the pre-crisis period. Furthermore, the coefficient on the *Capital* variable is still statistically significant but is now negative. In a stable period perhaps banks are less concerned about board vigilance carried out by independent directors. Thus, despite the increase in capital implying a relative decrease of debt and a decrease in its monitoring role, the proportion of independent directors also decreases.

Finally, results from Eq. (3) deviate from those reported in Table 3 (in the crisis period). Both the coefficients on the *Bank risk* and the *Bank age* variables are now statistically significant. Therefore, both bank risk-taking and bank age influence board size in the pre-crisis period. For instance, as banks become older, more directors join the board and as result boards become larger [67]. Additionally, the coefficient on the *Capital* variable remains statistically significant but is now positive, consistent with Pathan and Skully [77].

Our results show that the influence of some governance mechanisms and other factors on bank risk-taking have different effects in stable and crisis conditions. Thus, such influence depends on the macroeconomic environment.

Regarding Bank risk equation, our main equation (and for that reason we only summarise the results relating to risk), we briefly remark the existence of different effects during the pre-crisis and crisis periods. Concerning our main variables, underlying the hypotheses presented we found that in the financial crisis board independence, board size and CEO power decrease bank risk. On the contrary, institutional

ownership increases bank risk and both the existence of a risk committee and a CRO do not have an impact on bank risk. In the pre-crisis period, such impact remains the same except for board size and CEO power, which do not influence risk. So, neither the size of the board nor a powerful CEO seems to affect bank risk in the pre-crisis period (proxy to “normal” periods). Concerning the control variables, in the financial crisis, the Chairman who is ex-CEO and bank size increase bank risk, past performance and capital decrease bank risk, and, finally, growth opportunities have no impact on bank risk. In the pre-crisis period, the Chairman who is ex-CEO and past performance also have an influence on bank risk but in the opposite direction. Bank size and capital, contrary to the crisis period, have no impact on bank risk. Finally, growth opportunities also do not influence bank risk as in the financial crisis period.”

Robustness checks

We perform an additional test to check the robustness of the previous results, in the crisis and pre-crisis periods by estimating Eqs. (1)-(3) in a simultaneous system using the 2SLS estimation method with winsorisation at the 1st and 99th percentile.

Given that Eq. (1), *Bank risk* equation is the main equation we only present the findings regarding bank risk-taking.¹⁹

Two-stage least squares (2SLS) in the crisis and pre-crisis periods

Estimation results of Eq. (1) using 2SLS in the crisis and pre-crisis period are shown in Table 5, respectively, in Column (1) and Column (2).

Column (1), in Table 5, reports the results for the determinants of bank risk as specified by Eq. (1) in the crisis period. The results remain the same as those reported in Column (1), in Table 3, except that the coefficients on *CEO power* and *Performance* variables are no longer statistically significant. Column (2), in Table 5, reports the results for the determinants of bank risk as specified by Eq. (1) in the pre-crisis period. The findings remain unchanged compared to those presented in Column (1), in Table 4.

In summary, the qualitative findings for the main explanatory variables (except for the *CEO power* variable, in the crisis period) and the control variables (except for the *Performance* variable also in the crisis period) remain unchanged, providing robustness for our results.

Finally, we note that, for robustness checks, we also ran our tests using the natural logarithm of the bank’s total assets

Footnote 17 (continued)

ments tightly regulate and supervise banks. For Furfine ([47], p.33) *banks have traditionally been both regulated and supervised in order to protect them from failure and to maintain the safety and viability of the financial system.*

¹⁸ During the crisis period the banking sector suffered losses not observed since the Great Depression [40]. Given that the 2007–2008 financial crisis was the worst crisis since the Great Depression, the severity of the financial crisis and its tremendous consequences may have been largely unexpected, contributing to the idea that, even if governments intervention was necessary, they could help the generality banks given that the amount of public funds needed would not be excessively high.

¹⁹ Results for Eqs. (2) and (3), *Board independence* and *Board size*, respectively, are available upon request.



Table 5 2SLS regression results for Bank risk in the financial crisis (July 2007 to December 2008) and in the pre-crisis period (2006), with winsorisation at the 1st and 99th percentile

Variable	(1) Bank risk (crisis period)	(2) Bank risk (pre-crisis period)
Board independence	-0.016** (0.034)	-0.008** (0.035)
Board size	-0.256*** (0.001)	-0.125 (0.433)
CEO power	-1.443 (0.179)	0.367 (0.591)
Institutional ownership	0.023*** (0.001)	0.053*** (0.001)
Risk committee	0.329 (0.855)	-0.211 (0.654)
CRO	-0.857 (0.717)	-0.761 (0.711)
Chair ex_CEO	2.387*** (0.000)	-0.303*** (0.007)
Performance	-0.012 (0.231)	0.042*** (0.000)
Bank size	2.387*** (0.000)	0.123 (0.253)
Capital	-0.119* (0.058)	-0.019 (0.614)
Growth opportunities	-0.004 (0.421)	0.003 (0.821)
Country dummies	Yes	Yes
N	69	67
Adj-R ²	0.936	0.990

p-values are in brackets and asterisks indicate significance at the 1% (***), 5% (**) and 10% (*) levels, using a two-tailed test. Please refer to "Appendix 2" for the definition of each variable

as a proxy for bank size alternatively to the natural logarithm of the bank's market capitalisation. Also, regarding performance, we used return on assets (ROA) as an alternative to stock returns. Results (unreported) show that essentially our qualitative results remain unchanged.

Conclusions

The global financial crisis that began to unfold in 2007 highlighted the importance of the need for robust bank risk-taking supervision to ensure their safety and soundness. Key potential ingredients for effective risk oversight at banks include several internal governance mechanisms. Focusing the attention on European banks which are much less analysed, this paper examined the relationship between internal governance mechanisms and risk-taking by banks both during a crisis and stable period and tested whether the impact of governance characteristics on bank risk-taking is contingent on the economic environment.

First analysing the financial crisis period, and under a simultaneous Eq. (3SLS) framework, we find that *board independence*, *board size* and *CEO power* are negatively related to bank risk-taking in the financial crisis. These results suggest that: (i) the role of the independent directors is performed as a trade-off between the interests of shareholders (who prefer more risk), regulators and other public authorities (who prefer less risk and safer policies) and it is particularly sensitive to regulatory recommendations/requirements; (ii) larger boards decrease risk-taking due to the availability of more human capital and greater moderation in the decision-making process; and (iii) CEO power also reduces bank risk-taking, consistent with the idea that bank managers exhibit risk aversion due to their non-diversifiable wealth, which may be aggravated by the form of their compensation. Thus, such governance mechanisms are important determinants of risk-taking by European banks during a financial crisis period. Regarding ownership structure, we also find that institutional ownership positively affects risk-taking, meaning that institutional shareholders encourage bank managers to take more risk. However, contrary to our expectations, the risk *governance* mechanisms are not associated with bank risk-taking. Furthermore, we document that the existence of a Chairman (that is an ex-CEO), past performance, bank size and capital influence risk. Our main findings are robust and remain essentially unchanged using either 3SLS or 2SLS (winsorisation was performed on all variables).

Next, our paper extended the analysis to a pre-crisis period (more specifically the year immediately before the financial crisis) to verify whether the influence of the governance mechanisms and other bank-specific factors are subject to contextual contingencies. The results showed that the influence of governance mechanisms was not the same during and before the financial crisis. In the pre-crisis period, we found that board size, CEO power, bank size and bank capital were not significant in explaining risk-taking. Another relevant factor was the influence of past performance and the current chairman who is an ex-CEO who were documented to influence risk-taking in the opposite direction of the one observed for the financial crisis period.

Overall, the findings of our study imply that bank internal governance mechanisms are important determinants of bank risk-taking, but that their impact or effectiveness is very much sensitive to the economic environment. These results bring important insights for corporate practice namely by putting into question whether common governance recommendations should be encouraged regardless of any consideration for the external economic setting. For instance, our results suggest that, unlike in more stable periods, smaller boards and stronger CEO power may be conducive to greater control over risk-taking during crisis periods, which contrasts with typical corporate governance recommendations.



Furthermore, it should be noted that, although the Covid-19 crisis is not directly related to the financial sector, we may argue that bank governance mechanisms also potentially play an important role on the current pandemic crisis. As shown in the 2007–2008 crisis, we expect that in times of crisis, the presence of more independent directors led to less risk-taking as they take more prudent and moderate actions as well as are likely to signal the firm's creditworthiness to external stakeholders and thus banks are better able to cope with the expected increase in NPLs in the current COVID-19 pandemic. Similar to the 2007–2008 financial crisis, it is expected that larger boards decrease bank risk-taking. Larger boards facilitate controlling and advising by managers due to the additional intellectual capital available, which are particularly important in times of crisis. Also, it is expected that CEO power reduces bank risk-taking, regardless of the nature of a crisis (a global financial crisis or a health crisis that becomes a global economic crisis), serving managerial risk minimization preferences. Similarly, institutional investors, expectably, have an important role in bank governance in any crisis period because of their role in bank risk behaviour. Finally, we expect that risk governance mechanisms do not influence bank risk-taking, as in the 2007–2008 financial crisis. On the one hand, most of the bank risk committee met very infrequently. On the other hand, most of their members may have not sufficient knowledge about the ease of spread of contagion of the economic crisis, originated from COVID-19, on the stability of the financial system as well as the impact of the set of policies introduced by the governments to mitigate the adverse impact of such crisis on banks' soundness.

Although the findings of this study are significant, they must be interpreted in light of the following limitations, which may be addressed in future research. First, it covers several board characteristics (e.g., board independence, board size and CEO power). However, other board characteristics, such as, directors' ethnicity, level of qualifications and area of expertise as well as the university where each of the directors got his/her academic degree. An interesting question to answer is if there is a relationship between university rankings and director behaviour. Future studies could extend our analyses by including these and other personal characteristics of directors to provide additional useful insights to this line of research. Second, as a proxy to "normal" or stable periods, we consider only one year before the financial crisis and, thus, the results might be driven by events that occurred in 2006. Therefore, to address this limitation, in future research the pre-crisis period should be extended.

Appendix 1

See Table 6.

Table 6 List of sample banks and countries

Bank name	Country
1. Aareal Bank AG	Germany
2. Allied Irish Banks	Ireland
3. Alpha Bank A E	Greece
4. Anglo Irish Bank Corp Plc (De-Listed 01/2009)	Ireland
5. Atebank (Agricultural Bank of Greece Prior to 05/2006)	Greece
6. Avanza Bank Hldg AB (Avanza AB prior to 05/2008)	Sweden
7. Banca MPS	Italy
8. Banca Popolare Dell'Emilia Romagna SCARL	Italy
9. Banca Popolare Di Milano SCARL	Italy
10. Banca Popolare Di Sondrio SCARL	Italy
11. Banco BPI SA (BPI SGPS prior to 01/2003)	Portugal
12. Banco Comercial Português SA	Portugal
13. Banco Espírito Santo SA	Portugal
14. Banco Guipuzcoano SA (De-listed 11/2010)	Spain
15. Banco Pastor SA	Spain
16. Banco Popular Espanol SA	Spain
17. Banco Sabadell SA	Spain
18. Banco Santander SA (Banco Santander Central Hispano SA prior to 08/2007)	Spain
19. BANESTO—Banco Espanol de Credito SA	Spain
20. Bank of Cyprus	Cyprus
21. Bank of Ireland (Governor & CO OF)	Ireland
22. Bankinter SA	Spain
23. Banque Cantonale de Geneve	Switzerland
24. Barclays PLC	UK
25. BBVA—Banco Bilbao Vizcaya Argentaria SA	Spain
26. Binckbank NV (Binck NV prior to 10/2006)	Netherlands
27. BNP Paribas	France
28. Commerzbank AG	Germany
29. Credem—Credito Emiliano SPA	Italy
30. Credit Agricole SA	France
31. Credit Industriel et Commercial (CIC) SA	France
32. Credit Suisse Group AG	Switzerland
33. Credito Bergamasco SPA	Italy
34. DAB Bank AG	Germany
35. Danske Bank A/S	Denmark
36. Deutsche Bank AG	Germany
37. Deutsche Postbank AG	Germany
38. Dexia SA	Belgium
39. DnB ASA (DnB Nor ASA prior to 11/2011)	Norway
40. EFG Eurobank Ergasias SA	Greece
41. EFG International AG	Switzerland
42. Erste Group Bank AG (Erste Bank Der Oesterreichischen Sparkassen AG prior to 09/08/2008)	Austria
43. Fortis (until 04/2010)	Belgium
44. HSBC Hldgs PLC	UK
45. HSBC Trinkaus & Burkhardt AG (HSBC Trinkaus & Burkhardt KGaA prior to 08/2006)	Germany
46. IKB Deutsche Industriebank AG	Germany



Table 6 (continued)

Bank name	Country
47. Intesa Sanpaolo SPA (Banca Intesa SpA prior to 01/2007) (IntesaBCI SpA prior to 01/2003)	Italy
48. Jyske Bank A/S	Denmark
49. KAS Bank	Netherlands
50. KBC Group NV (KBC Bankverzekeringsholding prior to 03/2005)	Belgium
51. Landesbank Berlin HLDG AG (Bankgesellschaft Berlin prior to 08/2006)	Germany
52. Lloyds Banking Group PLC (Lloyds TSB Group PLC prior to 01/2009)	UK
53. Marfin Popular Bank Public CO LTD (Cyprus Popular Bank Public Co Ltd prior to 10/2006)	Cyprus
54. Mediobanca SPA	Italy
55. National Bank of Greece SA	Greece
56. Natixis (Natexis Banques Populaires prior to 11/2006)	France
57. Nordea Bank AB	Sweden
58. Piraeus Bank SA	Greece

Table 6 (continued)

Bank name	Country
59. Raiffeisen Bank International AG (Raiffeisen International Bank Holding AG prior to 10/2010)	Austria
60. Royal Bank of Scotland Group PLC	UK
61. Sampo OY	Finland
62. Skandinaviska Enskilda Banken (SEB) AB	Sweden
63. Société Générale	France
64. Standard Chartered PLC	UK
65. Svenska Handelsbanken AB	Sweden
66. Swedbank AB (ForeningsSparbanken AB prior to 09/2006)	Sweden
67. Sydbank A/S	Denmark
68. UBS AG	Switzerland
69. Unicredit SPA (Unicredito Italiano SpA prior to 01/2008)	Italy
70. Unione Di Banche Italiane SCPA (UBI Banca) (Banche Popolari Unite SCRL prior to 04/2007)	Italy
71. Valiant Holding AG	Switzerland
72. Van Lanschot NV	Netherlands

Appendix 2

See Table 7.



Table 7 Variables definitions

Variables	Definitions	Measurement period	Data sources
Bank risk	Standard deviation of the daily bank stock returns	January 2006 to December 2006 (pre-crisis period); July 2007 to December 2008 (crisis period)	Datastream
Board independence	Percentage of independent directors, that is, the number of independent board directors on the board divided by board size	December 2006 (pre-crisis period); (average) December 2007/December 2008 (crisis period)	BoardEx
Board size	Total number of directors serving on the board of the bank	December 2006 (pre-crisis period); (average) December 2007/December 2008 (crisis period)	BoardEx
CEO power	A dummy variable equal to 1 if the CEO is also the Chairman, 0 otherwise	December 2006 (pre-crisis period); December 2007/December 2008 (crisis period)	BoardEx; Annual Reports
Institutional ownership	Percentage of shares owned by institutional investors	December 2006 (pre-crisis period); (average) December 2007/December 2008 (crisis period)	Thomson Financial
Risk committee	A dummy variable equal to 1 if the bank has a risk committee, 0 otherwise	December 2006 (pre-crisis period); December 2007/December 2008 (crisis period)	BoardEx; Annual Reports
CRO	A dummy variable equal to 1 if the CRO is a board member, 0 otherwise	December 2006 (pre-crisis period); December 2007/December 2008 (crisis period)	BoardEx; Annual Reports
Chair ex_CEO	A dummy variable equal to 1 if the current Chairman is ex-CEO, that is, if he/she has previously served as CEO, 0 otherwise	December 2006 (pre-crisis period); December 2007/December 2008 (crisis period)	BoardEx; Annual Reports
Performance	Past buy-and-hold stock returns	January 2005 to December 2005 (pre-crisis period); January 2006 to December 2006 (crisis period)	Datastream
Bank size	Natural logarithm of the bank's market capitalisation	December 2006 (pre-crisis period); (average) December 2007/December 2008 (crisis period)	Datastream
Capital	Bank capital, computed as the ratio of total equity to total assets	December 2006 (pre-crisis period); (average) December 2007/December 2008 (crisis period)	Datastream
Growth opportunities	Market-to-book ratio, i.e., ratio of the market value of equity to the book value of equity	December 2006 (pre-crisis period); (average) December 2007/December 2008 (crisis period)	Datastream
Bank age	Number of years since the bank was listed in the Datastream database	December 2006 (pre-crisis period); (average) December 2007/December 2008 (crisis period)	Datastream
Diversification	Measure of revenue diversification of Stiroh and Rumble [86] which is calculated as 1-(squared share of net operating revenue from net interest sources plus squared share of net operating revenue from non-interest sources)	December 2006 (pre-crisis period); (average) December 2007/December 2008 (crisis period)	Datastream
CEO tenure	Number of years the CEO of the bank has served as CEO	December 2006 (pre-crisis period); (average) December 2007/December 2008 (crisis period)	BoardEx; Annual Reports
CEO age	Bank CEO's age in years	December 2006 (pre-crisis period); (average) December 2007/December 2008 (crisis period)	BoardEx; Annual Reports



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Declarations

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

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Catarina Fernandes is an Assistant Professor of Finance and Entrepreneurship at Instituto Politécnico de Bragança, Portugal and a researcher at CEF.UP – Center of Economics and Finance at University of Porto (UP), Portugal. She holds a Licenciatura in Management from ISEG – Lisbon School of Economics and Management, University of Lisbon, Portugal, a Master in Monetary and Financial Economics also from ISEG and a Ph.D in Finance from the Faculty of Economics, UP. She is author of publications in international academic peer-reviewed journals, book chapters and proceedings and has several communications at international academic conferences. Her research interests include Corporate Governance, Corporate Finance and Banking.

Jorge Farinha is an Assistant Professor of Finance at the Faculty of Economics, University of Porto (UP), Portugal and a researcher at CEF. UP – Center for Economics and Finance at UP. He holds a Licenciatura in Economics from UP, a MBA from INSEAD, France and a Ph.D in Accounting and Finance from Lancaster University, UK. He was a non-executive Director at Martifer SGPS (2008–18) and at IFD-Instituição Financeira de Desenvolvimento (2018–20), Portugal's State-owned Promotional Bank. He also served as Vice-Dean of Porto Business School (2009–2015) while also running its full-time Magellan MBA Programme (2002–15). He is currently the Master in Finance Director at UP's Faculty of Economics (since 2019). His research interests include Corporate Governance, Corporate Finance, Banking and M&A.

Francisco Vitorino Martins is an Assistant Professor of Econometrics at the Faculty of Economics, University of Porto (UP), Portugal. He teaches in Bachelor, Master and Ph.D degrees at UP. He holds a Licenciatura in Economics from UP, a DEA in Management from University of Aix-Marseille III and a Ph.D in Management Sciences from Paris-Dauphine University. His research interests include Applied Econometrics, Forecasting Methods and Business Statistics.

Cesarío Mateus is a Full Professor of Finance. He has joined Aalborg University in 2019. Prior he has worked at different universities in various countries, these including Cass Business School, Universitat Pompeu Fabra, University of Melbourne, University of Greenwich and Southampton Business School, among others. He also worked for private and public companies (e.g. Portuguese Securities and Exchange Commission, Banco Comercial Português, Ocidental Insurance Company, Aldersgate Investment Managers). His research interests include Corporate Finance (Taxation, Capital structure, Cash Holdings, Right Issues, etc) and Asset Management (Mutual Funds' Performance, Style Investments, Institutional Investors, Hedge Funds). He has published over 40 papers in international refereed journals.

