

Essays on Corporate Governance of Financial Institutions

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Declaration

I certify that the thesis I have presented for examination for the PhD degree of Salford Business School, University of Salford is solely my own work other than where I have clearly indicated that it is the work of others.

I declare that no portion of the work referred to in the thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institutes of learning.

The following chapters have been presented at conferences and submitted to peer-reviewed journals:

1) Chapter two "Revisiting Corporate Governance and Financial Risk Taking" have been presented at the 11th International Conference on Business, Economics, Management and Marketing at the University of Oxford. March 2020.
2) Chapter two "Revisiting Corporate Governance and Financial Risk Taking" have been presented at the 11th Business and Management Conference organized by the International Institute of Social and Economic Sciences. January 2020.
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4) Chapter three "Bank Failure prediction: corporate governance and financial indicators" has been edited according to the reviewers' comments and re-submitted to the Review of quantitative finance and accounting.

Abbreviations

AperE	Asset per Employee
CAMEL	Capital, Asset, Management, Earning and Liquidity
CAMELS	Capital, Asset, Management, Earning, Liquidity and Sensitivity
CEO	Chief Executive Officer
CG	Corporate Governance
CPS	CEO Pay Slice
DA	Discriminant Analysis
ECofNCO	Earnings coverage of net charge-offs
FDIC	Federal Deposit Insurance Corporation
FDICIA	Federal Deposit Insurance Corporation Improvement Act
GICS	Global Industry Classification Standard
GMM	Generalized Methods of Moments
GLtoTD	Gross Loans to Total Deposits
IBEItoA	Income before extraordinary items to assets
ISS	Institutional Shareholder Services
ISS Audit	Audit quality score developed by Institutional Shareholder Services
ISS Board	Board structure score developed by Institutional Shareholder Services
ISS Compensation	Compensation score developed by Institutional Shareholder Services
ISS Shareholders	Shareholders' rights score developed by Institutional Shareholder Services
LR	Logit Regression
M-to-B	Market to Book ratio

NIEtoTI	Non-interest expense to total income
NLLtoD	Net loans and leases to deposits
OECD	The Organization for Economic Co-operation and Development
PCA	Principal Component Analysis
PLS-DA	Partial Least Square – Discriminant Analysis
PTItoE	Pre-tax income to equity
REtoTA	Retained earnings to total assets
ROA	Return On Assets
ROAV	Return On Assets Volatility
ROE	Return on Equity
SEM	Structural Equation Modeling
UFIRS	Uniform Financial Institutions Rating System
UK	United Kingdom
US	United States
UVR	Unequal Voting Rights

Abstract

Despite the importance of corporate governance in financial institutions, it remains an under researched area. Thus, this research includes three studies that examine the significant characteristics of corporate governance for financial institutions.

The first study examines the effect of corporate governance on risk taking. Previous studies have used indices, but the validity of using an index to show the complex effects of different characteristics is questioned. Thus, this study examines the effect of various corporate governance characteristics on several risk measurements using Principal Component Analysis and Structural Equation Modelling. The findings show that while corporate governance as a whole has a positive effect on risk, there are certain variables including board characteristics that have a negative effect.

The second study predicts the failure of banks using corporate governance variables and CAMEL ratios. Previous studies have used financial ratios without the utilization of corporate governance as non-financial ratios. Using discriminant analysis and logit regression, this study shows that combining these ratios and variables not only enhances the accuracy of prediction but also extends the time horizon of prediction to three years before failure. The results also show that the earnings of banks are the most significant aspects of the CAMEL ratios.

The first two studies show that institutional ownership is a significant characteristic. Thus, the third study examines the effect of institutional ownership on the Governance Quality Score developed by the Institutional Shareholders Services. Using a two-steps system Generalized Methods of Moments, this study shows that institutional ownership has a negative effect on corporate governance, but the change of ownership has a positive effect. To investigate this matter, the study includes both graphs and additional analysis in which the governance score is divided into high and low scores. The results show that institutional ownership has a U-shaped effect on corporate governance.

1

Chapter 1: Introduction

1.1. What is Corporate Governance?

Many Scholars have defined Corporate Governance (CG) and highlighted its importance. When looking back to the origin of CG, it is clear that it was perceived after historical scandals, its purpose is to prevent similar scandals in the future. The first to bring governance issues in the finance field are Jensen and Meckling (1976) in their seminal work. Then, the importance of CG arose after the latest financial crisis in 2008 to 2009, along with serious financial scandals all around the world. Perhaps the most famous cases are Enron and WorldCom scandals in the United States (US); others include Parmalat in Europe, Nortel in Canada, Renong in Malaysia and Satyam in India. The reason behind these scandals is believed to be weak CG systems. These corporate scandals have resulted in losing public confidence in the financial markets and have exposed weaknesses in CG (Alhazaimeh *et al.*, 2014). Also, these meltdowns raised the shareholders' concern about the protection of their investments. As a consequence, CG comes to prevent the loss of value that is caused by the separation of ownership and control (Fama and Jensen, 1983). Further studies state that CG has become a global interest where countries compete to implement sound CG practices for economical reasons; where good CG is believed to build marketplace confidence, contribute to the economical growth of the country and attract foreign investors (Kukreja, 2013; Lal Bhasin, 2013; Segreto and Segreto, 2019).

Many scholars have tried to define CG, and perhaps the most popular definitions are by Cadbury (1992) and Shleifer and Vishny (1997). Cadbury (1992) broad definition states that CG is a system that directs and controls business corporations. While Shleifer and Vishny (1997) specify that CG ensures that the suppliers of finance get a return on their investment. Moreover, the OECD state that CG is a set of relationships between the firm's management, board, shareholders and other stakeholders (OECD, 2015).

From the preceding definitions, it can be perceived that CG is a system that directs and controls the interaction between shareholders, managers, boards, and stakeholders in a way that preserves the rights and values of all these parties. Also, when studying and analyzing these definitions, it can be noticed that they all have main elements in common, which are being a system of control, having a relationship between the company's stakeholders and addressing the accountability to users of information. However, Claessens and Yurtoglu (2013) conclude that the definitions fall into two categories, the first category addresses the rules by which the company is operating, while the second category addresses the behaviour patterns of the company including its performance, efficiency and treatments of its stakeholders.

Many researchers have discussed the purpose and aim of CG. Todd (2010) believes that the main goal of CG is to ensure proper decision making by directing and controlling the organization's activities. Others believe that its importance is to reduce fraudulent financial reporting (Beasley, 1996; Razali and Arshad, 2014). Furthermore, Baydoun *et al.* (2013) believe that the purpose of CG varies depending on the region it's aimed at. They explain that the CG in the US focuses on the interest of shareholders, while in Europe and Japan the focus is on the interest of all stakeholders.

In that notion, Turnbull (2011) believes that good governance is when corporations achieve their purpose while protecting the interests of stakeholders. Also, the latest code by OECD state that a good CG creates market confidence and business integrity (OECD, 2015). Moreover, Shleifer and Vishny (1997) confirm that good CG systems are embedded in a proper legal protection of investors. This leads to the conclusion that the features of good CG include attracting investors by maintaining their confidence, enhancing the firm's value and performance, and promoting accountability and sound management, prevent structural weaknesses in flawed internal controls and fraudulent financial statements.

1.2. Agency Theory

This paper adopts the most common and popular theory relevant to CG which is the agency theory. Therefore, the theoretical reviews of the agency theory along with empirical analyses related to each study in this thesis will allow for the formulation of all research hypotheses included in the three studies of this research.

The agency theory proposes that there is an agency loss arising from the separation of ownership and management, where in a corporation, the principals are the owners while the agents are the managers. According to the theory, the managers of a corporation will not aim at maximizing shareholders' values unless governed in a way to protect the interests of the

shareholders (Jensen and Meckling, 1976). CG should address the agency problem by ensuring that managers do not seek their own interests at the expense of shareholders' interests and that they do not invest in unappealing projects (Shleifer and Vishny, 1997).

To further understand the difference between what shareholders and managers want, Ricciardi (2010) explains that the interest of shareholders is to maximize stock prices in the long run, while the managers aim at increasing their personal wealth in the period of their tenancy. This means that managers will focus on short term profit maximization and low risk projects that are not necessarily addressed to maximize the wealth of shareholders in the long run. Therefore, corporations need to be governed and managers need to be monitored in order to align their interests with shareholders' interests. This can be done by regulating the board and management of a corporation by certain measures including ensuring the independence of the board and aligning executive compensation to firm performance (Todd, 2010).

It is challenging to measure the agency conflict because there are many situations in which managers are able to seek their own interests at the cost of the interests of shareholders (Choi *et al.*, 2020; Dey, 2008). Many empirical studies examine the effect of different CG mechanisms on decision making and firm performance in an attempt to find the optimal solution to minimize the agency conflict. Chen et *al.* (2012) examine the relationship between the agency conflict and selling, general and administrative costs in firms listed in the US stock market over the period 1996–2005. They measure the agency conflict by free cash flow, CEO horizon, CEO tenure, and CEO compensation. Their results suggest that a good CG system mitigates the examined issues. Furthermore, Dey (2008) conducts a study for the years 2000 and 2001 to study the effect of different CG mechanisms on agency conflict. The mechanisms that the researcher examines include executive compensation, board composition and duties, auditor independence, and board control over financial reporting. As for the agency conflict, it is measured by firm characteristics that are indicative of agency conflict including firm size, ownership structure, operating risk, and free cash flow. The results of the study reveal that firms have better CG systems when they have greater agency conflict.

1.3. Corporate Governance in Financial Institutions

Regulators worldwide have been paying more attention to the CG of financial institutions. That is because the importance of CG has been highlighted since the crisis which has started in the financial sector. After the crisis, the literature revealed the weakness and inadequate application of CG. Following the financial crisis, the European Commission has issued a green paper to report CG practices of financial institutions, particularly banks, and to

provide recommendations. The report states that the crisis led governments around the world to question the effectiveness, strength, and stability of the regulatory and supervisory systems of financial institutions. The report also details that the boards of financial institutions have failed to fulfil their duties as principal decision making bodies (European Commission, 2010). In addition, the Organisation for Economic Co-operation and Development (OECD) provides a report on the financial crisis. They state that one of the causes of the crisis was the board's limited knowledge and poor understanding of risk management (Kirkpatrick, 2009). Most importantly, the Basel Committee on Banking Supervision has stressed the importance of CG to banks (Basel Committee on Banking Supervision, 2006, 2015).

Researchers have emphasized the importance of financial institutions in the market because the failure of this sector eventually reaches other sectors in the market. Also, financial institutions have a great effect on the wider economy where CG for financial institutions, especially banks, affects the financial and economic stability. financial institutions have a strong influence on economic development as they can affect the CG of other firms and they also have an important role in the development and growth of the economies (Braendle, 2012). Akbar *et al.* (2017) explain that the financial crisis started initially in the financial institutions in the US, the United Kingdom (UK) and other developed countries which resulted in big losses worldwide in a matter of few months. They also state that the financial sector was severely hit by the crisis even though it is heavily regulated, and this led to substantial losses with long term effects on other sectors as well.

Berger et *al.* (2016) state that the crisis revealed to regulators how the CG of financial institutions was a set of arrangements that encouraged risky decisions that often produced short term benefits and remuneration, and that the governance of the financial institutions did not account for the hidden danger that existed in the balance sheets and the global economy, which resulted to the failure of not just financial institutions but their customers, shareholders and the economy. They also believe that the distress of the banking industry caused by the financial crisis has led not only regulators but politicians, non-profit organizations, and academic researchers to discuss the role of CG in the stability of the economy.

There is some evidence to suggest that CG arrangements for financial institutions differ from those of non-financial firms. Indeed, the board of directors in financial institutions tend to differ from non-financial firms because the former are characterized by bigger sizes and more independence, while they are subject to more scrutiny (de Andres *et al.*, 2012; García-Meca *et al.*, 2015). Hence, the Basel Committee on Banking Supervision has emphasized the importance

of CG for financial institutions (Basel Committee on Banking Supervision, 2006, 2015), while calling for improvements in the overall CG of financial institutions and a better understanding of its links with drivers of risk taking (Berger *et al.*, 2014; Laeven and Levine, 2009).

One of the important characteristics that differ the financial sector from the other sectors is the risk taking behaviour, where financial institutions take excessive risk in comparison to the other firms which was one of the main causes of the financial crisis (Kirkpatrick, 2009). The excessive risk in this sector is due to the operating systems and the way revenue is generated in financial institutions (Akbar *et al.*, 2017). Other characteristics of the financial sector include the presence of more opaqueness and greater information asymmetry and greater leverage which makes this sector different from the non-financial sector (Akbar *et al.*, 2017; Srivastav and Hagendorff, 2016). Given the special nature of these institutions, the role of prudential regulation is much needed (Claessens and Yurtoglu, 2013).

For banks in specific, the risk taking behaviour is even more intense than the other non-bank firms in the financial sector, this is because banks benefit from deposit insurance and are supported by the public to prevent their failures. This financial safety net encourages banks to take more risk in order to generate more return. On top of that, the big banks are also more risk takers and have more benefits and safety nets as regulators deem them to be too big to fail (Anginer *et al.*, 2018).

Empirical studies that examined the CG of the financial sector include Erkens *et al.* (2012) who examine the impact of CG on firms' performance in financial institutions during the financial crisis period from 2007 to 2008. Their sample included 296 financial firms from 30 countries, and the results show that more board independence and higher institutional ownership are related to worse stock returns. Their further analysis suggests that this is because firms with higher institutional shareholding took more risk before the crisis which caused larger losses for the shareholders, and that firms with more independent boards raised more equity capital during the crisis which resulted in transferring the wealth from shareholders to debtholders. Moreover, Mallin *et al.* (2005) explain the importance and the need for a good CG framework for financial institutions by studying the development of the UK code and the adaptation of the UK principles in the US and Europe. They believe that forming a strong CG with characteristics that are suitable to the financial sector are key factors that ensure financial stability. They argue that institutional shareholders, auditing, and competitive markets are important characteristics of the CG code for the financial sector. Also, Akbar *et al.* (2017) study the effect of board structure on risk taking in financial firms in the UK. They find that the

existence of non-executive directors and powerful CEOs on boards results in lower risk taking. They explain that these findings are due to the risk aversion of managers, where an increase in the power of management leads to more risk aversion for reputational and employment reasons.

Studies that focused on banks include Berger, Imbierowicz and Rauch (2016) who analyse a sample of failed and non-failed commercial banks in the US during the crisis period from 2007 to 2010 to study the roles of CG variables in the failure of banks during the financial crisis. They examine ownership, management and compensation structure and find that the ownership structure plays an important role in showing the likelihood of failure, where banks are more likely to fail if they have lower level management shareholding. In addition, Anginer *et al.* (2016) examine the effect of several aspects of CG and executive compensation on bank capitalization strategies for the period from 2003 to 2011. They aim to test whether banks with shareholder friendly CG adopt more risky bank capitalization strategies. The CG aspects that they include in their study are board independence, board size, and anti-takeover provisions, and find that banks with more shareholder-friendly CG have lower capitalization. They explain that banks with more shareholder friendly CG aim to maximize the shareholder value and thus take more risk in their capitalization strategies. Moreover, Qian and Yeung (2015) demonstrate that the efficiency of banking governance affects the disciplinary power of the equity capital markets. They study the effect of the tunnelling activity of the controlling shareholders on a firm's bank loan access and find that tunnelling activity has a higher effect on bank loan access in an inefficiently governed banking system. They believe that these results imply that economies need to improve banking efficiency in order to develop mature capital markets.

1.4. Research Gaps

As mentioned earlier, the importance of CG in regulating risk has been recently perceived and highlighted. However, many researchers confess that there is a need for more research in this area. Laeven and Levine (2009) argue that regulating risk in banks is an important factor for financial and economic stability, and they emphasize the need for more research to help form suitable regulation of risk. They also suggest the importance of setting ownership structure regulations. Furthermore, Berger *et al.* (2016) believe that there is little evidence that exists on the effectiveness of CG variables in predicting the failure of banks, where most studies only utilise financial ratios despite the perceived importance of CG in the success and failure of banks.

In addition, most systematic empirical studies of CG examine performance within the non-financial sector (Bernile *et al.*, 2018; Harjoto *et al.*, 2018; Poletti-Hughes and Briano-

Turrent, 2019), while only a handful of systematic studies address the CG of financial institutions (Akbar *et al.*, 2017; Minton *et al.*, 2014; Wang and Hsu, 2013).

Also, prior literature shows that the CG arrangements for financial institutions differ from those of non-financial firms. Therefore, regulators and academics have been keen on how to improve the CG for financial institutions that would contribute to the financial stability of the markets (Berger *et al.*, 2014; Laeven and Levine, 2009). Thus, this research aims to determine a suitable CG framework for financial institutions to ensure the protection of investors' rights and the maximization of their value. In specific, the research includes three studies that examine and determine important characteristics of CG that have the most significant impact on risk taking policies, examine CG significance in the prediction of bank failure, and examine the impact of institutional shareholders on the quality of CG.

1.5. Research Objectives and Questions

The main aim that this thesis seeks to achieve through the three studies is to identify the principles and recommendations that a suitable CG framework should include for financial institutions in order to reflect effective protection of shareholders' rights.

Given the described research gaps in the previous section, and the main aim of this research, the main research question of this thesis is:

"What are the significant CG characteristics that form a CG framework that is suitable for financial institutions?"

The main aim and question inevitably lead to the following specific objectives:

a) Explore the significant CG characteristics that have a significant impact on risk taking in financial institutions. (First study)

b) Explore a replacement of the single index used to represent CG as a complex issue. (First study)

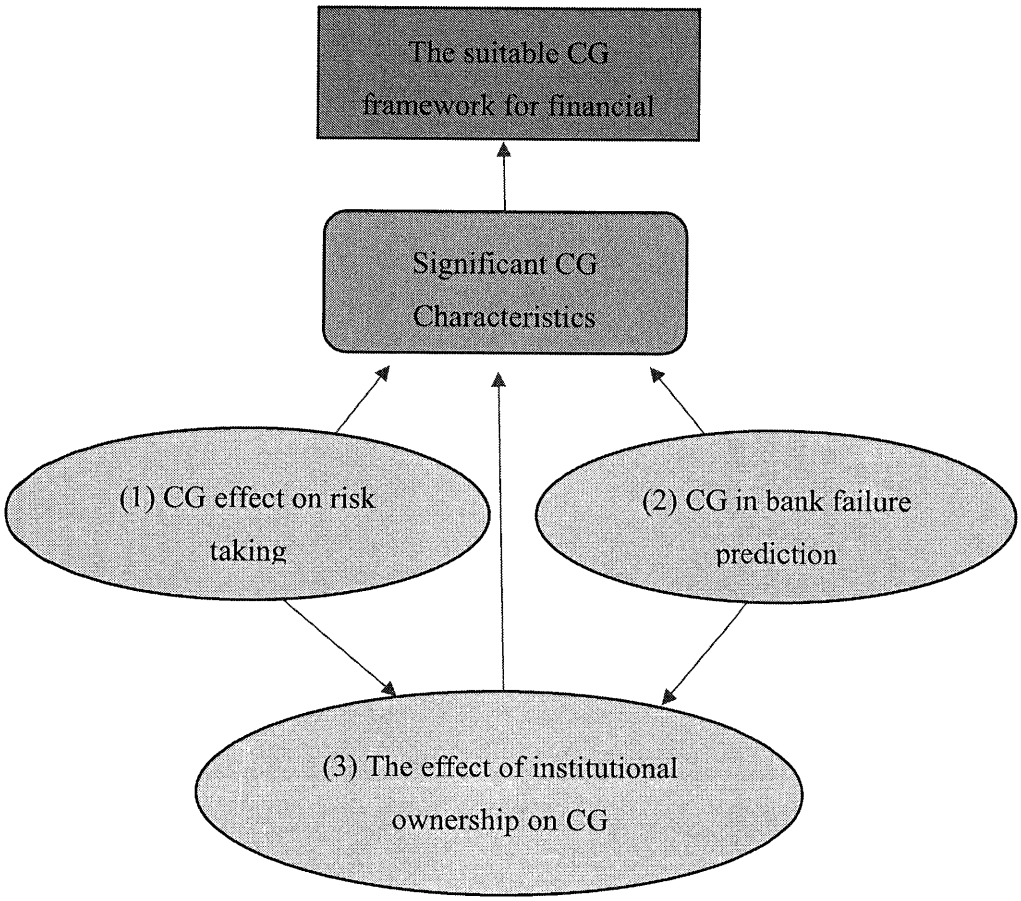
c) Explore the significant predictors of bank failure. (Second study)

d) Investigate the role of CG variables in predicting bank failure. (Second study)

e) Investigate the role of the most significant CG characteristic in affecting the quality of CG. (Third study)

The schematic framework of the research is presented in figure 1.1. The figure shows what this thesis aims to achieve. In order to address the main aim of the research, each study has a specific objective with an ultimate aim to find the significant CG characteristics that can form a suitable CG framework for financial institutions. Consequently, the objectives related to the first study are (a) and (b) that are listed above. The first study aims to find the significance CG characteristics that can address the risk taking issue in financial institutions. The study also addresses the utilisation of indices in studying a complex topic such as CG. Next, the objectives related to the second study are (c) and (D) which are in the list of the research objectives. This study aims to explore the significant characteristics of CG that can contribute to the accurate prediction of failure. Finally, the last objective is to investigate the most significant characteristic found in the first two studies. The first two studies result in a common significant CG variable which is institutional ownership. Therefore, the third and final study explore institutional ownership's role in affecting the quality of CG, this further investigation of the variable will confirm its significance and provide more insight into the behaviour of the variable.

Figure 1.1: The schematic framework of the research



To address the aims and objectives of this research, the choice of platform to execute the three studies is very important. Since the three studies adopt quantitative research, which will be discussed individually in each study, the matter of how far generalised the results can be made would rely on the number of participants in the research, the way in which they are selected, and if they represent a larger group (Creswell, 2009). Therefore, this research uses publicly listed financial institutions in the US as the platform to execute the analysis.

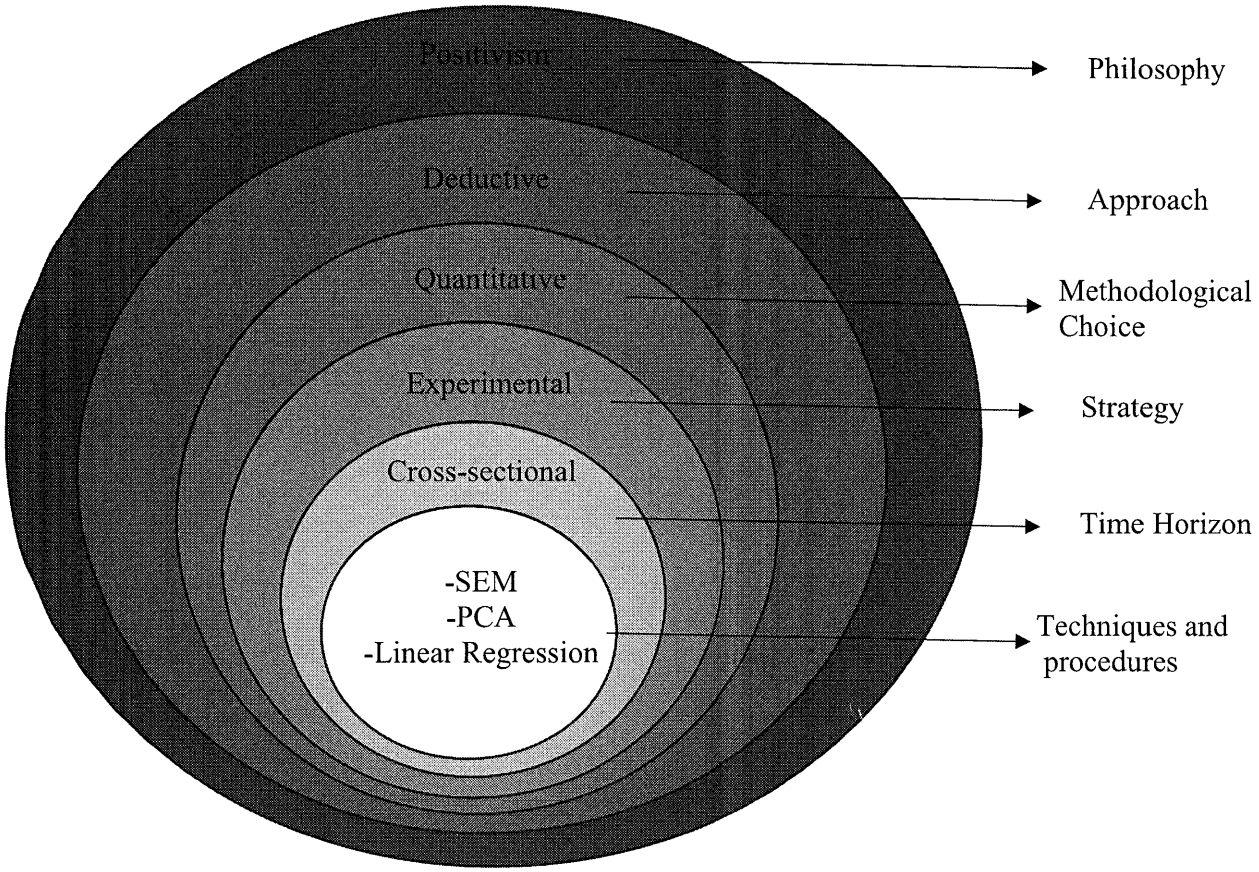
Following are the justifications for choosing the US. First, the US has a strong legal and institutional environment, which results in weaker agency conflicts compared to other countries (Feito-Ruiz *et al.*, 2015). This implies that the US is an important representative market in terms of CG practices and the development of governance quality. In addition, Yoshikawa and Rasheed (2009) point out that there are countries and firms outside the Anglo-American zone that adopt some elements of the Anglo- American or US governance system. Likewise, Sayari and Marcum (2018) find that the US governance standards adopted by the firms in the emerging markets strengthen CG, and that the impact of CG on corporate decisions demonstrates similar implications for US and emerging markets. Finally, data extracted for US firms is considered accurate due to the higher disclosure standards required by the US security and exchange commission that mitigates information asymmetries (von Eije and Wiegerinck, 2010).

1.6. Research Methodology

This part examines the research methodology adopted in the studies in order to justify the approaches that were chosen to address the research questions and objectives. Saunders *et al.* (2019) explain that any research should involve an explanation of the methods used to collect data and an argument on why the results obtained are meaningful. In addition, Neuman (2014) defines methodology as the means to understand the research process and the philosophical assumptions, while methods are the specific techniques used to gather data.

Therefore, the methodological approach in this thesis is supported by the research onion developed by Saunders *et al.* (2012) which includes the stages of the research philosophy. This part includes the discussion of the research onion shown in figure 2.1. which includes the research philosophy, approaches, strategy, methodological choices, time horizon and techniques and procedures used in the analysis of this study.

Figure 2.1: The research philosophy in the research onion (Saunders *et al.*, 2012)



Saunders *et al.* (2012) state that a research philosophy underlines the development of new knowledge in a particular field. Therefore, the adoption of the research philosophy depends on the research questions and objectives of the study.

First, the two traditional and broad philosophical approaches that are used in the social sciences are positivism and interpretivism (Baker and Foy, 2012; Saunders *et al.*, 2012). The positivist approach uses a scientific model of viewing research, where the researcher examines numeric data. Also, the positivist style of approach is an organised paradigm of carrying out the research, where the researcher has a general knowledge of the direction of the study (Neuman, 2014). Also, research that adopts positivism philosophy is based on facts rather than on impressions (Saunders *et al.*, 2012).

On the other hand, a researcher that adopts an interpretivist approach does not start with a theory but seeks to develop a theory through an inductive approach and qualitative data collection (Creswell, 2009). Also, the aim of interpretivism is to put the interpretation of the phenomena meaning in a social and cultural context (Cohen *et al.*, 2007).

This research adopts a positivist philosophy since it aims to unlock assumptions connected to social phenomena using strategies that attempt to uncover the reality and differentiate between facts. Also, the research procedure includes statistical techniques that are used to measure reality.

The second layer of the research onion which is the research approach includes two main methods of reasoning which are inductive and deductive approaches. The deductive method includes the development of hypotheses and theories along with designing a research technique to investigate these hypotheses. On the other hand, the inductive method includes the development of theory resulting from the analysis of data (Saunders *et al.*, 2012). In addition, the positivist philosophy is linked with the deductive approach, while the interpretivist philosophy is linked with the inductive approach. (Bryman and Bell, 2007). For the aforementioned reasons, this research adopts a deductive approach as it starts with theories and hypotheses and attempts to investigate them.

The third layer of the research onion is the methodological choice of the study. The two main types of choices are quantitative and qualitative, where quantitative is related to numerical data and qualitative is related to non-numerical data (Aspers and Corte, 2021). In addition, researchers can combine these two approaches resulting in a mixed methodology (Fielding, 2012). Examples of quantitative methodologies include questionnaires that are designed for statistical analysis (De La Rosa De Sáa *et al.*, 2015). While examples of qualitative methodologies include interviews and focus groups (Gill *et al.*, 2008).

The studies in this thesis adopt the quantitative methodology which is defined as a deductive approach that is applied in a positivism philosophy (Creswell, 2009; Neuman, 2014). This method includes the collection and conversion of data into numerical data to generate statistical calculations (Neuman, 2014).

Following the methodological choice is the research strategy. Experimental research is the adopted strategy in this study since the methodological choice is quantitative. Tuli (2011) states that fixed designs experimental research achieve quantitative outcomes. In addition, the primary aim of experimental research is to contribute to theory (Dennis and Valacich, 2001), which is valid reasoning for choosing it as the strategy of this study.

The fifth layer of the research onion is the time horizon of the study. This research conducts a cross-sectional experiment where the data is obtained at one point in time over a span of months or years (Creswell, 2009). The final layer of the research onion is the techniques and procedures used in the study to address the research question and objectives. There are

diiferent techniques used in each study in this thesis, thus, the techniques relevant to each study are discussed separately within the relevant chapter.

1.7. Research Contribution

The main contribution that this thesis aims to provide through the three studies is to identify the principles and recommendations that a suitable CG framework should include for financial institutions in order to reflect effective protection of shareholders' rights. Also, the findings and implications of the three studies benefit not only regulators butt managers, investors, and stakeholders, where the findings provide guidelines on risk regulation as well as failure prediction and institutional ownership for financial institutions.

The first study that examines the effect of CG characteristics on risk taking contributes to the literature in several ways. First, the study incorporates several characteristics covering most aspects of CG which are examined in a single model and shows the importance of studying CG in detail rather than in a single index; the results question the validity of using a single index that represents several aspects of CG. Second, in examining the relationship between CG and risk taking, there are limited studies that focus on financial institutions, while this study covers all institutions classified as financial in the Global Industry Classification Standard (GICS). Finally, the study includes new statistical methods in examining the CG variables' effect on risk taking which are the utilization of Principal Component Analysis (PCA) and Structural Equation Modelling (SEM). Finally, this study provides an insight to regulators in determining a suitable CG framework that would ensure the protection of investors' rights in financial institutions by showing the different impacts of different characteristics on risk taking.

The second study that explores the prediction of bank failure contributes to the literature by examining the prediction accuracy of combining financial (CAMEL ratios) and non-financial (CG variables), and by showing the important aspects of CG that most contribute to the prediction of failure which can be used as a guideline to prevent failures of banks. This study shows that CG plays a key role in the success or failure of banks. The regulatory implication of this study is that more attention needs to be directed to CG and earnings aspects of banks rather than focusing on capital structure.

The third study that examines the role of institutional shareholders in CG contributes to the literature on ownership by showing that higher ownership may worsen the quality of governance and increase agency issues for financial institutions with less developed CG. This finding supports and encourages the preference of institutional investors to invest in financial institutions with a high quality CG. In addition, the findings of this study are contrary to the

findings of the previous studies on non-financial firms which show that institutional investment enhances the CG of non-financial firms. This implies that regulators should be alert to the potential adverse effects of institutional ownership on different sectors.

Finally, the three studies highlight the main CG characteristics that are significant for financial institutions. The first common characteristic is institutional ownership which is found to be significant in affecting risk taking, predicting bank failure, and affecting the quality of CG. Secondly, compensation elements including equity-based compensation and CEO Pay Slice (CPS) have a significant effect on risk taking and failure prediction. Similarly, shareholders rights have a significant impact on both risk taking and failure prediction. These CG characteristics that are commonly significant across the different studies in this research could be used to form a CG that is suitable for financial institutions, which can address the specific issues related to this sector and ensure the maximisation of shareholders rights.

1.8. Structure of the Thesis

The first study examines the relationship between various CG variables and different risk measurements. In studying CG effect on risk taking, existing studies have used indices as proxies for CG or focused on specific variables. The overall finding of these studies is that shareholder friendly CG is positively related to excessive risk taking when using governance indices, but when variables are examined separately, the literature shows that different characteristics have different effects on risk. Thus, the utilization of indices only gives a general view. Therefore, the first study includes a thorough investigation of various variables by examining the effect of various CG characteristics on several risk measurements in a single model to determine how these variables differ in their effect on risk taking. This investigation is conducted using PCA as a variables reduction tool and as a replacement for indexing, SEM to combine several models in one structured model, and an additional analysis using Institutional Shareholder Services (ISS) governance score as a replacement of the PCA factors and as a robustness test.

The findings confirm that CG as a whole has a positive effect on risk. However, this is not true for all CG characteristics. Although certain characteristics drive the positive effect, like compensation structure, some characteristics have a negative effect, like board level attributes. These results shed light on the importance of studying CG at a micro level rather than using a single index by showing that not all CG characteristics are positively related to risk taking in financial institutions

The second study reiterates the importance of CG in banks. This study utilizes CG variables as predictors of failure along with CAMEL ratios in predicting bank failure. Most failure prediction studies have relied on using financial ratios as predictors (Hosaka, 2019; Jones, 2017). For banks in specific, the most suitable financial predictors are financial ratios classified under the CAMEL rating system which is a system developed by the Federal Deposit Insurance Corporation (FDIC) to rate banks and includes ratios that show the Capital structure, Asset quality, Management, Earnings, and Liquidity of a bank. On the other hand, CG has been proven to be an important aspect of banks. Given the importance of CG variables for banks that has been highlighted by researchers and regulators including the Basel Committee (Basel Committee on Banking Supervision, 2015; Jones, 2017; Liang *et al.*, 2016; Wu, 2016), the study examines the ability of CG to predict failure. Using Discriminant Analysis (DA), this study predicts the failure of FDIC insured banks during the period from 2010 to 2018 using financial and non-financial predictors. The findings show that combining CAMEL ratios with CG variables not only enhance the accuracy of prediction but also extends the time horizon of prediction to three years before failure. The findings also show that the earnings of banks are more significant in predicting bank failure than the capital structure and asset quality. The results further reveal that the Chief Executive Officer (CEO) compensation, voting rights and institutional ownership are more significant predictors than the board characteristics. These results are robust when using Logit Regression (LR).

The findings of the first two studies include a common significant characteristic of CG, which is institutional ownership. Thus, the third study investigates the effect of institutional ownership on the quality of CG for financial institutions. Most existing studies focused on non-financial institutions or studied the effect of CG on institutional ownership but not the reverse effect. However, there is enough evidence in the literature to suggest that institutional shareholders have strong monitoring power that affects the quality of CG and mitigates the agency conflict (Choi *et al.*, 2020; Hartzell and Starks, 2003; Sakawa and Watanabel, 2020). Therefore, this study examines the effect of institutional ownership on the quality of CG represented by a governance score and four sub-scores (board structure, shareholders rights, compensation structure, and audit quality) developed by Institutional Shareholder Services (ISS). using a two-steps system Generlazied Methods of Moments (GMM) with an unbalanced sample of US financial institutions for the period from 2013 to 2018, the findings show that institutional ownership has a significant and negative effect on the main score of governance. The analysis of the four sub-scores shows that this negative effect stems from the negative impact that institutional shareholders have on shareholders rights and the compensation

structure. This implies that institutional owners exercise their power as controlling shareholders to benefit at the expense of minority shareholders, which eventually affects the governance score. These results are supported by two robustness tests which are using an alternative measure of institutional ownership and using linear regression instead of GMM.

In addition, the results of this study show that the change of ownership has a positive effect on the governance score, which contradicts the results that show the negative effect of the institutional ownership variable. To further investigate these results, the study includes both graphs and additional analysis in which the governance score is divided into high and low scores. The findings show that institutional ownership has a U-shaped effect on governance scores. These findings show that institutional shareholders have a negative effect on institutions with low scores, but a positive effect on institutions with high scores. This implies that institutions with high quality of governance have strong shareholders rights which provide immunity from the effect of controlling shareholders. Therefore, these institutions are able to reduce agency costs and increase the quality of the governance score. Finally, another additional analysis which compares banks and non-bank financial institutions shows that the negative effect of institutional ownership in banks stems from the board structure rather than the shareholders rights.

The rest of the study is organized as follows; the second chapter presents the first study which is the examination of CG effect on risk taking and includes an introduction, literature review, the data and variables description, methodology and findings, an additional analysis, a robustness test, and finally a conclusion. The third chapter presents the second study which is the utilization of CG variables along with CAMEL ratios in predicting bank failure and includes the same parts as the second chapter with a robustness test and an additional analysis. The fourth chapter presents the third study which examines the impact of institutional ownership on the quality of governance, it includes the same parts as the previous chapters along with an additional analysis and a robustness test. The last chapter of the thesis includes the conclusion of the research.

2

Chapter 2: Revisiting Corporate Governance and Financial Risk Taking

Abstract

Literature suggests that corporate governance has a positive effect on risk taking. However, corporate governance characteristics have different effects on risk when variables are examined separately. Thus, this study examines the effects of a large range of corporate governance characteristics on several risk measurements.

Most of the studies have been performed on non-financial institutions, while this study contributes to the broader literature on the relationship between corporate governance and risk in financial institutions. Also, the study sheds light on the importance of studying corporate governance at a micro level rather than using a single index by showing that not all corporate governance characteristics are positively related to risk taking in financial institutions.

Using principal component analysis and structural equation modelling, the findings confirm that, generally, corporate governance has a positive effect on risk, but this is not true for all corporate governance characteristics. Although certain characteristics drive the positive effect, like compensation structure, other characteristics have an opposite effect, like board-level attributes. The findings also show that principal component analysis is an effective replacement of indices, where it groups variables while still showing the individual effect of each variable.

This study provides an insight to regulators in determining a suitable corporate governance framework that would ensure the protection of investors' rights in financial institutions by showing the different impacts of different characteristics on risk taking.

Keywords: Corporate Governance, Risk Taking, Financial Institutions, Principal Component Analysis, Structural Equation Modelling.

2.1. Introduction

The importance of CG in financial institutions has been highlighted since the last financial crisis, where regulators and researchers have been attempting to reach a suitable framework that would prevent such a crisis in the future. Also, Sheedy and Griffin (2018) confess that risk governance in financial institutions lacks research. Thus, this study aims to examine the effect of CG on risk taking policies in financial institutions, areas of importance in CG, and determine the characteristics that have the most significant effect on risk taking. The main contribution that this study aims to provide is to identify the principles that a suitable CG framework should include in order to reflect effective risk regulation and protect shareholders rights.

The research is based on the agency theory, where CG ensures that shareholders get return on their investments and induces managers to increase the shareholders' wealth (Shleifer and Vishny, 1997). In specific, this study examines the role of different CG characteristics in affecting corporate risk policies. This stems from the notion that a suitable CG framework protects shareholders' rights through constraining the managers' self interest pursuit, mitigating managers' risk aversion, directing the decision making towards shareholder value maximization, and inducing effective monitoring powers by shareholders. (Anginer *et al.*, 2018; Ferreira and Laux, 2007; Ferris *et al.*, 2017; John *et al.*, 2008; Laeven and Levine, 2009; Saunders *et al.*, 1990).

This research is conducted in order to understand the complex effect of CG on risk taking, where Kim and Lu (2011) stated that it is essential to study how different governance characteristics work together in mitigating agency cost rather than studying each characteristic individually. Also, even though Sheikh (2019) used indices to study the effect of CG on risk taking, the researcher confessed that there are concerns about the validity of using such indices because CG is an abstract concept and governance indices do not capture the complexity of CG characteristics. Likewise, Black *et al.* (2017) analyze how to address the validity of construing governance indices. Using subindices, they find that the single index omits important aspects of CG, thus it suffers from omitted variable bias. They suggest being cautious in relying on governance indices.

In previous studies, CG was studied by using indices that included many variables. These papers used a kitchen sink approach to study the effect of most of the plausible governance indicators on risk. However, this study argues that CG is a complex issue with

different characteristics and cannot be studied by a single index. Therefore, granular analysis is the most suitable approach.

To replace the traditionally used governance indices, PCA is used which allows for studying the different effects of different characteristics in one model and addresses the multicollinearity. Also, the study focuses on financial institutions which suffer from excessive risk taking.

The study contributes to the literature in several ways. First, in contrast to other papers that use indices (Such as Anginer *et al.* (2018), Ferreira and Laux (200), John *et al.* (2008) and Sheikh (2019)) or study specific characteristics of CG (Such as Cain and McKeon (2016), Deyoung *et al.* (2013), Erkens *et al.* (2012), Lu and Wang (2018) and Wu (2016)), several characteristics are examined that cover most aspects of CG in a single model using PCA. Second, in examining the relationship between CG and risk taking, most articles either focus on non-financial institutions (Ferreira and Laux, 2007; John *et al.*, 2008; Wu, 2016) or focus on banks with the exclusion of other non-bank financial institutions (Anginer *et al.*, 2016, 2018; Berger *et al.*, 2016; Laeven and Levine, 2009; Pathan, 2009; Saunders *et al.*, 1990), while this study covers all institutions classified as financial in the GICS which might have a significant influence on the financial stability. Few studies include all financial institutions including Erkens *et al.* (2012) whose study covers only the years 2007 and 2008 of the financial crisis. Finally, new ways are incorporated to examine the CG variables, which is the usage of PCA as a replacement for a single governance index, as well as the utilization of an SEM to test all models in the study in integration to avoid the biasedness of studying each model separately. To the best of the author's knowledge, this is the first study that uses PCA and SEM in studying the effect of CG on risk taking.

The argument for using PCA as a replacement for indexing is that while previous studies have relied on using one index that shows the overall effect of CG (Aggarwal *et al.*, 2009; Anginer *et al.*, 2018; Bebchuk *et al.*, 2009; Gompers *et al.*, 2003), prior literature suggests that not all CG characteristics have the same impact on risk; while some positively affect risk taking, other characteristics have a negative effect. Thus, PCA is used as a replacement for one governance index and as an unbiased method of grouping different dimensions of CG with similar variances to capture their different effects. Other advantages of PCA analysis over indices are that it shows the individual effect of each variable within each group, and accounts for different loadings of variables in one group.

In addition, an additional analysis is performed using a governance score developed by the ISS that was used to develop the governance index by Aggarwal *et al.* (2009). This index was also used by Anginer *et al.* (2018) to study the effect of CG on risk taking. Then, the results are compared to their sub-scores (Board, Shareholders, Audit, and Compensation). Both analyses confirm the idea that CG characteristics are better studied in detail rather than as a whole; where the findings show that there are specific characteristics including compensation structures and auditing practices that drive the positive relationship between CG and risk, while other variables, including Board characteristics, have a negative impact.

This chapter is organized in the following manner. Section 2 presents the literature review including discussions. Section 3 details the research methodology and sample, construction of variables, and construction of PCA Factors as a replacement for the governance index. Section 4 presents the models and findings. Section 5 includes the robustness test and Section 6 includes the additional analysis. Finally, Section 7 concludes. Excessive

2.2. Literature Review and Hypotheses Development

2.2.1. Corporate Governance in Financial Institutions

The focus on financial institutions mainly stems from their importance in the market, where the failure of financial institutions eventually reaches other sectors and other firms in the market (European Commission, 2010). As pointed out by researchers, the behaviour of risk taking in financial institutions and especially banks affect financial and economic stability (Ferrarini, 2017; de Haan and Vlahu, 2016). Therefore, the importance of CG in regulating risk has been recently perceived and highlighted with the confession of the need for more research in this area (Laeven and Levine, 2009; Srivastav and Hagendorff, 2016). Also, Anginer *et al.* (2018) perform a comparative study between banks and non-financial US firms and find that banks are more risk takers than non-financial firms, which to their beliefs confirms the justification of the safety net advantage of banks. They also confess that there is a need for more research to show the impact of CG practices on risk taking. Studies that focus on financial firms include Erkens *et al.* (2012) who examine the impact of CG on firms' performance during the 2007–2008 financial crisis, with a sample including 296 financial firms from 30 countries. Their study shows the effect of CG on firm performance during the crisis by affecting the risk taking and financial policies in financial firms; they find that more board independence and higher institutional ownership are related to worse stock returns. Moreover, Mallin *et al.* (2005) explain the importance and need for a good CG framework for financial institutions. They believe that forming a strong CG framework that is suitable to the financial sector is a key factor

in ensuring financial stability. They argue that institutional shareholders, auditing, and competitive markets are important characteristics of the CG code for the financial sector.

2.2.2. Corporate Governance and Risk

In an agency theory, shareholders are looked at as risk bearers who bear the risk of decisions taken by managers (Fama and Jensen, 1983; Williamson, 1988). CG ensures that such decisions taken by managers are in the favour of shareholders and that managers do not pursue their personal interests at the expense of shareholders. While managers are believed to be risk averse for career protection purposes, better investor protection motivates managers to take more risk in order to generate more return on investment for the shareholders (Akbar *et al.*, 2017; Lu and Wang, 2018). However, some studies show that high shareholder protection leads to excessive risk taking. Other studies argue that a weaker investor regime with the existence of dominant shareholders works as an effective monitoring tool to decrease managerial conservatism and induces managers to seek the interests of shareholders (Jensen and Meckling, 1976; Shleifer and Vishny, 1986)

John *et al.* (2008) study CG relation to risk taking in non-financial firms using a cross country analysis consisting of 39 counties and a US-only analysis. Their findings suggest that CG with better investor protection leads to higher risk taking measured by earnings volatility. Their results are consistent with the result of Ferreira and Laux (2007). Both papers use the government index by Gompers *et al.* (2003) to conduct studies on non-financial firms but with different risk measurements. Ferreira and Laux (2007) and John *et al.* (2008) results show a significant negative relationship between the governance index and risk taking (higher values of this index indicate lower shareholder protection), which implies that better shareholder protection is related to high risk taking. In specific, Ferreira and Laux (2007) find that firms with less degree of insulation from takeovers, and with more shareholder friendly governance, are associated with higher idiosyncratic volatility. Similarly, Anginer *et al.* (2018) use Aggarwal *et al.* (2009) governance index that includes attributes related to the board size, ownership, compensation, auditing, and antitakeover provisions. Their results show a significant positive relationship between shareholder friendly CG and risk taking using six different measurements. Furthermore, a study conducted by Laeven and Levine (2009) shows a positive relationship between risk taking in banks and strong shareholder protection, which is consistent with the aforementioned articles.

Anginer *et al.* (2018), Ferreira and Laux (2007) and John *et al.* (2008) use CG indices as a proxy for investor protection strength. Perhaps the index that covers most CG aspects is

the Aggarwal *et al.* (2009) index that is extracted from the Governance Score by ISS and is divided into four groups including different CG variables. However, using an index only shows the whole effect of CG without providing details on the different impacts of different characteristics.

Given the aforementioned arguments, the first research hypothesis can be expressed as:

Hypothesis 1: Shareholder friendly corporate governance has a positive effect on risk taking in financial institutions.

2.2.3. Board Composition and Risk

The important role of the board is highlighted in many CG codes across the world. Many codes and guidelines assign the responsibility of monitoring and ensuring the effectiveness of risk management to the board. Those codes include the UK's CG code which gives the responsibility of performing a risk assessment to the board, the OECD CG Principles which requires the board to review and encourage corporate risk management, and the Basel Committee on Banking Supervision which requires the board to ensure a strong risk governance framework including disciplines for excessive risk taking (Basel Committee on Banking Supervision, 2015; Financial Reporting Council, 2018; OECD, 2015). On the other hand, other codes, including the NYSE Listed Company Manual Section 303A, assign the responsibility of risk management and assessment to the senior managers and the audit committee (New York Stock Exchange, 2009). Several papers study the relationship between board characteristics and risk taking policies with different findings and results which suggest a further need for investigation. Also, Srivastav and Hagendorff (2016) highlight the need to study the impact of different board characteristics on risk taking.

Empirically, Anginer *et al.* (2018) show that a governance index with many CG characteristics including board independence, board size, and committees' independence, is associated with excessive risk taking. Likewise, Anginer *et al.* (2016) investigate whether shareholder friendly CG in banks is related to bank capitalization strategies, basing their study on the hypothesis that banks with shareholder friendly CG adopt risky capitalization strategies in order to maximize shareholder value. They include three CG mechanisms that they believe are related to bank governance: board independence, board size, and anti-takeover provisions. Their results show that banks with shareholder friendly CG have lower capitalization suggesting more risk taking policies. Lu and Wang (2018) study the effect of board independence on corporate innovation and managerial risk taking and find that independent boards tend to increase equity based compensation leading to more managerial risk taking.

However, Wu (2016) find that board independence is positively related to bankruptcy, but negatively related in firms with more knowledgeable boards.

The hypothesis below can be drawn from the previous discussion:

Hypothesis 2: Board characteristics including independence have a positive effect on risk taking.

As for other board characteristics including board size, both Pathan (2009) and Wu (2016) find that smaller boards lead to more risk taking, with both studies covering different sectors. Pathan (2009) studies US banks over the period 1997 to 2004 using different risk measurements including total risk, idiosyncratic risk, and systematic risk. While Wu (2016) studies non-financial firms and finds that board size, gender diversity, and CEO tenure are negatively related to bankruptcy risk. Their results suggest that the existence of females on the Board motivates risk aversion behaviour. Therefore, the next hypothesis is as follows:

Hypothesis 3: Board characteristics including Board size and gender diversity have a negative effect on risk taking.

Furthermore, researchers emphasise the importance of the characteristics and attributes of the CEO in influencing corporate decisions. Studies that examined the CEO's attributes impact on decision making include Deyoung *et al.* (2013) who find that in US commercial banks, more CEO risk taking incentives lead to riskier investing and financing decisions. In behavioural finance, managers with more control are believed to take a higher risk (Ricbciardi, 2010). In previous studies, the power of the CEO's controllability is mainly proxied by CEO duality and CEO ownership. Adams *et al.* (2005) show that firms with powerful CEOs experience higher stock return volatility, where a powerful CEO is either the founder of the firm, is also the chairperson of the board, has a portion of ownership in the firm, or has a long tenure. Likewise, Wu (2016) find that CEO power, measured by CEO ownership and duality is positively related to bankruptcy risk. Perhaps what explains these results is that a separation of CEO and chairperson positions is believed to mitigate the agency costs and increase the supervision and monitoring power of investors (Berger *et al.*, 2016). However, some studies show different results including Pathan (2009) who find that boards that are not controlled by CEO tend to take riskier decisions. Also, Berger *et al.* (2016) find that most banks that failed during the crisis had more separation between the CEO and chairperson positions than the non-failed banks. These contradicting results imply the need for further investigation on the effect of CEO duality on risk.

Following these arguments, the below hypotheses can be drawn regarding the CEO duality and risk taking:

Hypothesis 4: CEO Duality has a positive effect on risk taking.

2.2.4. Shareholders' Rights and Risk

As previously discussed, CG with better protection of shareholders' rights is believed to be associated with aggressive risk policies. Gompers *et al.* (2003) Anti-takeover index that represents shareholders rights is used by Ferreira and Laux (2007) and John *et al.* (2008) to study CG impact on risk in non-financial firms. The results of both studies show that shareholder friendly CG positively affects risk taking. Similarly, Anginer *et al.* (2016) show that better shareholder protection is associated with risky capitalization strategies. They justify these results with the fact that shareholder friendly CG induces managers to take risky decisions to increase shareholder value. In this study, shareholders rights is proxied by the equality of voting rights, where dual classes with Unequal Voting Rights (UVR) represent lower minority shareholders rights. Kieschnick and Moussawi (2018) find that firms with UVR tend to lower their cost of financing by choosing debt to avoid the risk of expensive equity financing caused by the lower shareholders rights of dual classes. This implies that firms with UVR rights are related to less capitalization risk. This notion is consistent with the proposition that CG characteristics with lower shareholders rights are negatively related to risk. Therefore, the following hypothesis is drawn:

Hypothesis 5: Dual classes with unequal voting rights has a negative effect on risk taking.

2.2.5. Ownership Structure and Risk

The proposition that ownership structure influences corporate risk taking is based on the notion that the ability of managers to take corporate decisions depends on the discretion level they enjoy and on the monitoring power enjoyed by shareholders, where the high monitoring power of the shareholders decreases the managerial discretion level and thus decreases the agency cost, and vice versa. Jensen and Meckling (1976) argue that the existence and size of the agency cost depends on the level of monitoring costs and that the monitoring power by itself depends on the type of ownership structure. Thus, having a large and dominant owner with monitoring and controlling powers helps in reducing the discretion enjoyed by managers in diluted ownership, where large shareholders with cash flow and voting rights are believed to have more power to influence and shape the corporate policies (John *et al.*, 2008; Shleifer and Vishny, 1986, 1997). Similarly, researchers believe that there is a residual risk

from diluted ownership, where the residual loss is the reduction in the firm's value caused by managerial discretion, thus, suggesting a higher agency cost in diluted or dispersed ownership (Jensen and Meckling, 1976; Williamson, 1988). However, Shleifer and Vishny (1997) argue that the cost of having large shareholders is that they bear excessive risk. Also, the OECD (2015) states that "while the presence of a controlling shareholder can reduce the agency problem by closer monitoring of management, weaknesses in the legal and regulatory framework may lead to the abuse of other shareholders in the company". Empirically, Laeven and Levine (2009) study the conflict between bank managers and owners over the risk policies of the bank. They find that the strong cash flow rights of large shareholders are related to higher risk taking.

In addition, institutional shareholding is a very important type of ownership and plays an important role in affecting corporate decision strategies. Erkens *et al.* (2012) study three CG mechanisms including institutional ownership, they find that institutional ownership is related to worse stock returns during the crisis. Their additional analysis examines the relationship between institutional ownership and risk taking level measured by expected default frequency and stock return volatility, and find that firms with greater institutional ownership took more risk before the crisis, this shows that firms with higher institutional ownership encouraged managers to take more risk before the crisis resulting in shareholder losses during the crisis period. Other studies support the findings of a positive relationship between the existence of institutional shareholders and risk taking including Hutchinson *et al.* (2015) and Wu (2016).

Given the above-mentioned arguments, the following hypothesis is formulated:

Hypothesis 6: Insider and Institutional shareholdings have a positive effect on risk taking.

2.2.6. Compensation Structure and Risk

The CG Principles for Banks by Basel Committee on Banking Supervision (2015) require banks to have a compensation structure that supports sound CG and risk management, where the remuneration should be related to risk taking and risk outcomes. Researchers believe that the risk aversion in decision making can be addressed by their ownership in the company and by their compensation structures (Laeven and Levine, 2009; Saunders *et al.*, 1990). By doing so, the decision makers will share the risk bearing with the investors which will contribute to mitigating the agency theory (Fama and Jensen, 1983). Edmans *et al.* (2017) state that all elements of compensation affect risk taking, especially for firms close to bankruptcy.

Cain and McKeon (2016) studied CEO wealth, they found that CEOs with risky behaviours tend to accept more risk pay sensitivity in their compensation. Deyoung *et al.* (2013) study the CEO wealth in relation to changes in stock prices and volatility of stock returns. Their findings show that CEO compensation with high pay risk sensitivity is associated with excessive risk taking in all three measures of market risk used in their study. Similarly, Guay (1999) find that managers tend to invest in risky projects when there is a relation between their wealth and stock prices.

Another study conducted by Cain and McKeon (2016) use the same measurements of CEO wealth to study the effect of CEO risk preference on corporate risk taking, they find that CEOs with risky behaviour tend to accept more risk pay sensitivity in their compensation. As noted in previous studies, CEO wealth has been measured and defined differently in many articles. However, cash compensation which is suggested by Jensen and Meckling (1976) as a proxy for CEO and Executive wealth has rarely been examined in previous studies. The cash compensation or current compensation calculated as the sum of the salary and bonus is used by Cassell *et al.* (2012) and Guay (1999) as a proxy for CEO wealth instead of stock based compensation. This type of compensation is believed to be related to risk taking because, in the event of firm failure, the CEO will be deprived of such benefit (Cassell *et al.*, 2012; Jensen and Meckling, 1976). Therefore, managers with high cash compensation are expected to be more risk averse to maintaining their wealth.

Furthermore, Anginer *et al.* (2016) findings show a positive relationship between bank capitalization and options and stocks awarded in executive compensation. They find that in US banks, options and stock awards in CEO compensation are related to low capitalization and more payout to shareholders even in times of crisis. They provide a behavioural justification for such findings; where they believe that such behaviour of the CEO in times of crisis is driven by fear, where CEOs whose wealth and position depend on the stock prices fear that the announcement of payout cuts will result in a decrease in stock prices and eventually jeopardising their positions as CEOs. Likewise, other empirical studies show that stocks and options in CEO and executives compensations positively and significantly affect risk taking, where more stock awards in a managers compensation are associated with higher risk (Anginer *et al.*, 2018; Berger *et al.*, 2016; Kim and Lu, 2011; Saunders *et al.*, 1990).

As for directors' compensation, studies that examined Board compensation include Ertugrul and Hegde (2008) who find that the percentage of stock and stock options in relation to the total compensation of outside directors is associated with lower yield spreads and Dah

and Frye (2017) who argue that overcompensated directors might deviate from fulfilling shareholders' interests. Likewise, the CG index by Aggarwal *et al.* (2009) used by Anginer *et al.* (2018), includes attributes related to the stock awards in the directors' compensation. These attributes examine the percentage of directors' ownership in the company, and the percentage of stock awards in relation to the total compensation. As mentioned earlier, the results of this study show a positive relationship between the CG index and risk taking.

The arguments detailed above lead to the formulation of the following hypothesis:

Hypothesis 7: Compensation elements including stock and option awards, cash compensation, and CPS have a positive effect on risk taking.

Other important elements of compensation that are believed to be related to risk taking include deferred compensation; where it is believed that more CEO deferred compensation leads to less risk taking. This stems from the idea that more CEO's debt to equity ratio incentivises conservative investment decisions; because the risky decisions that would increase shareholders wealth will not contribute to the CEO's wealth when there is more CEO deferred compensation (Jensen and Meckling, 1976). Consistent with this theory, Cassell *et al.* (2012) study the relationship between CEO deferred compensation and corporate risk taking and show that more CEO deferred compensation is associated with less risky investments and financial decisions. Also, Srivastav and Hagendorff (2016) highlight the important role of debt based compensation in mitigating excessive risk taking. Furthermore, another compensation variable that reflects the CEO's role and power in the top management team is the CEO Pay Slice by Bebchuk *et al.* (2011) calculated as the ratio of the CEO's compensation to the compensation of the top five executives. One can argue that the ratio of the CEO's compensation to the top Executives' compensation shows how much power the CEO has in influencing the decision-making process. Finally, Voulgaris *et al.* (2010) confess that the appointment of compensation advisors is an important element of the governance structure of corporations and that it has a positive impact on pay performance sensitivity. Their findings imply that the appointment of compensation advisors can eventually lead to having a subsequent impact on risk taking policies.

These discussions lead to the final hypothesis of this study, which is:

Hypothesis 8: Deferred and non-equity incentives have a negative effect on risk taking.

2.3. Research Methodology

2.3.1. Methodology

The first statistical tool used in this study is PCA which addresses the objective of studying several CG characteristics in a single model without the usage of indices. Dolan *et al.* (1999) stated that "PCA is often aimed at data description, or reduction", thus, PCA is used as a reduction tool for a large number of variables. Also, Jolliffe (2002) states that the main purpose of PCA is to reduce the dimensionality of a data set consisting of a large number of interrelated variables while retaining as much as possible of the variation present in the data set.

In this study, the PCA is used to identify factors that capture CG different dimensions and creates groups of CG variables that are associated with each other. In addititon, PCA converts correlated variables into uncorrelated factors, which accounts for the multicollinearity that exists in CG variables (Jolliffe, 2002). Another important benefit of using PCA as a replacement for indices is that it allows for individual interpretation of each variable within each factor, unlike the traditionally used indices which only show the total impact of each group. It allows for individual interpretation by showing factor loadings and signs for each individual variable within each factor (Beekes *et al.*, 2010; Bhat, 2008; Jolliffe, 2002). Studies that have used PCA to examine CG variables include Beekes *et al.* (2010), Bhat (2008), Black *et al.* (2017) and Enache and Hussainey (2020). However, none of these studies has been conducted in financial institutions, and none has used PCA to study CG in the context of risk taking.

The second methodological technique used in this study is SEM. Which is used to integrate several models into a single model. Researchers have supported the use of SEM as means of theory testing (Bhaduri and Selarka, 2016; Cliff, 1983; Dolan *et al.*, 1999; Freedman, 1987). In addition, Williams *et al.* (2018) show another benefit of using SEM which is that, for panel data, the maximum likelihood SEM is more efficient than the other methods for panel data used to control for unobserved confounders and to include lagged and endogenous regressors. They also show that SEM suffers less from finite sample biases.

Another benefit of using SEM is giving ease to regression-based assumptions, where it is more suitable when there is a presence of skewness in the data and when the sample size is relatively small (Mikulić and Ryan, 2018; do Valle and Assaker, 2016).

Finally, in incorporating PCA in an SEM, Dolan et al. (1999) state that there are two advantages, the integration of explanatory and confirmatory analysis, and the generalization and extension of PCA. In their study, they find that Multigroup extensions of models including PCA can be achieved easily with no posed problems in the addition of structured means.

2.3.2. Sample

This study explores a sample that covers the period from 2011 to 2018 including all financial institutions that are publicly listed in the US. The selection of financial institutions is based on the GICS, which includes banks, insurance, and diversified financial companies. The CG, accounting and market data are obtained from Bloomberg. The analysis includes 3,116 institution-year observations.

2.3.3. Risk Measurements

The study includes five measurements of risk taking that have been mostly used in prior literature. Appendix B provides the prior literature on measuring risk taking. Those measurements represent two classifications of risk, stand alone risk (specific risk) and market risk. This helps to test the effect of CG on risk taking on two levels: a firm's level and a firm's sensitivity to the market's risk.

Market risk includes two variables. The first one is the stock return volatility which is frequently used in the literature (Cain and McKeon, 2016; Christy *et al.*, 2013; Deyoung *et al.*, 2013; Erkens *et al.*, 2012; Ferris *et al.*, 2017; Guay, 1999; Hutchinson *et al.*, 2015; Nakano and Nguyen, 2012; Saunders *et al.*, 1990; Sheikh, 2019). In this study, the Stock Return Volatility is calculated as the annualised standard deviation of daily stock returns. The second is idiosyncratic risk measured as the standard deviation of the residuals derived from regressing daily stock return on market return in each year. Studies that examine CG impact on idiosyncratic risk include Cassell *et al.* (2012), Deyoung *et al.* (2013), Ferreira and Laux (2007), Sheikh (2019) and Wu (2016). Idiosyncratic risk is computed as the standard deviation of the residuals derived from the following model:

$$R_{id} = \beta_0 + \beta_1 R_{md} + \varepsilon_{id} \qquad (2.1)$$

Where R_{id} is the stock return of the firm i in the day d, R_{md} is the stock return of the market m in the day d, and ε is the residuals. To calculate the standard deviation of the residuals, the Idiosyncratic Risk is calculated as:

$$\textit{Idiosyncratic Risk} = \sqrt{\frac{\sum(R_{id} - \bar{R}_{id})^2}{n-1}} \qquad (2.2)$$

Next, stand alone risk includes three variables. The Z-score measures the distance to insolvency and is used in many studies to test the stability of a firm (Akbar *et al.*, 2017; Alhalabi *et al.*, 2020; Berger *et al.*, 2016; Hutchinson *et al.*, 2015; Laeven and Levine, 2009). A higher score indicates more stability and a lower probability of insolvency. Z-score is calculated as follows:

$$Z_{it} = \frac{ROA_{it} + \frac{E}{A_{it}}}{\sigma ROA_{it}} \qquad (2.3)$$

Where Z_{it} is Z-score for the institutions i year t, ROA is Return on Assets, E/A is the Equity to Assets ratio, and σROA is the standard deviation of Return on Assets.

In addition, there are two more risk measurements for stand alone risk, which are ROAV (Return On Assets Volatility) and leverage, calculated as the standard deviation of the returns on assets and the ratio of total debt to total assets respectively (Anginer *et al.*, 2018; Ferris *et al.*, 2017; Laeven and Levine, 2009; Mishra, 2011; Nakano and Nguyen, 2012).

2.3.4. Corporate Governance Variables

All CG in this study were obtained from the Bloomberg database. Initially, there were 72 variables, and then variables with very little or no data availability were omitted. In addition, variables in which almost all institutions have the same value were omitted (e.g., almost all committees were fully independent, and almost all institutions had shareholders authorized poison pill). The final set of variables is 24 CG variables for the US sample.

The first set of CG variables are related to the board's characteristics, they include board size, board independence, board meetings, board attendance, board average age, board tenure, CEO duality, and gender diversity which captures the female existence in the board. The second set of variables represents the ownership structure of the firm and includes institutional and Insider Ownership. The variable UVR represents the shareholder's rights and indicates the equality of the voting rights across different classes of shares. The last set of variables related to the compensation includes variables that have not received much attention empirically but are theoretically believed to be related to risk taking. The variable board stocks relates to the Board's compensation, while the variables related to the CEO and executives compensation include compensation advisor, CEO stocks, executives stocks, CEO options, executives options, CEO deferred, executives deferred, CEO non-equity incentives, and executives non-equity incentives. Also, CEO cash and executives cash represent the wealth available to executives that will enable them to diversify their investments. Finally, CPS is Bebchuk *et al.*

(2011) CEO Pay Slice calculated as the ratio of the CEO's total compensation to the executives' total compensation. Details of all variables and their definitions are represented in Appendix A.

2.3.5. Corporate Governance Factors

Previous studies have used the CG index to study the effect of governance on risk (Aggarwal *et al.*, 2009; Anginer *et al.*, 2018; Bebchuk *et al.*, 2009; Gompers *et al.*, 2003; Sheikh, 2019). However, prior literature suggests that not all CG characteristics have the same impact on risk; while some positively affect risk taking, other characteristics have a negative effect. This problem is addressed by replacing the governance index with PCA as a method of grouping different dimensions of CG with similar variances to capture their different effects.

The study follows prior literature in constructing the factors (Andreou *et al.*, 2016; Dey, 2008; Jolliffe, 2002; Larcker *et al.*, 2007). eigenvalues and the screen plot are used to determine the suitable number of factors; any factor with an eigenvalue that is greater than unity is retained. Then, to confirm the selection, the screen plot is used to identify factors that are plotted before the break of large and low eigenvalues. This resulted in seven factors that account for 63.25% of the total variance of the original 24 CG variables for the US sample. Jolliffe (2002) says that a sensible cutoff for the cumulative percentage ranges between 60% to 70%. Also, the retained percentage of the total variance (63.25%) is higher than in other studies that used PCA to study CG (Andreou *et al.*, 2016; Dey, 2008; Larcker *et al.*, 2007)

Next, the factors are rotated using Oblique rotation to produce more interpretable factors. an oblique rotation is performed following Larcker *et al.* (2007), instead of orthogonal rotation as performed by Andreou *et al.* (2016) and Dey (2008) because the latter resulted in cross-loadings where some of the variables were significantly loaded in more than one factor. Finally, as it's common in PCA, indicators that are significantly loaded in each factor are retained, the loading is considered significant when the absolute value of the component loadings exceeds 0.4. The factors and factor loadings resulting from the PCA are reported in table 2.1. They are referred to as the PCA factors hereinafter.

To test the reliability of using PCA as a replacement for indexing for CG variables, the Kaiser-Meyer-Olkin measure of sampling adequacy is used. The test for the US sample shows a score of 0.712 with very high significance. These results confirm the reliability of using PCA for the CG variables. Also, a correlation matrix for both the CG variables and the PCA factors shows that the CG variables have multicollinearity while the PCA factors showed no correlation. These findings further support the usage of PCA.

The main benefit of using PCA analysis as a replacement for indices, is that PCA not only creates different groups of variables as the indices do, but also creates groups that show the individual effect of each variable included in each group. This is an advantage that the PCA holds over the indices, where PCA not only creates factors including variables that will be analysed as a group, but it also allows for individual interpretation of each variable. Another advantage of the PCA analysis is that, unlike indices, the PCA factors include different loadings for each variable. The indices are usually developed in such a manner that includes equal loadings of all variables in the index.

For additional analysis, the PCA factors are replaced with governance scores created by ISS. the main score ISS Governance Score is compared with the four sub-scores ISS Board, ISS Shareholders, ISS Compensation and ISS Audit.

Table 2.1 Principal Component Analysis.

Factor	Significant Components	Loading	Cumulative Variance Explained
Gov 1	CEO Cash	0.861	22.47%
	Executive Cash	0.807	
	Executive Stocks	0.780	
	CEO Stocks	0.762	
	Institutional Ownership	0.671	
	Board Stocks	0.668	
	Compensation Advisor	0.442	
	Insider Ownership	-0.438	
Gov 2	Board Independence	0.661	32.89%
	Board Meetings	0.602	
	CEO Duality	-0.449	
	UVR	-0.424	
	Board Tenure	0.395	
Gov 3	Executive Deferred	0.937	40.29%
	CEO Deferred	0.937	
Gov 4	Executive Options	0.985	47.61%
	CEO Options	0.975	
Gov 5	CEO Non-equity Incentives	0.905	53.75%
	Executive Non-equity Incentives	0.898	
Gov 6	CPS	0.823	58.78%
	Gender Diversity	-0.562	
Gov 7	Board Meeting Attendance	-0.770	63.25%
	Board Size	0.406	
	Board Average Age	0.406	

Note: The table reports the factors resulting from the Principal Component Analysis, the components loaded in each factor, the component loadings and the cumulative variance explained. All factors with an eigenvalue greater than one are retained, and only components with an absolute value of loading exceeding 0.4 are reported. Components are reported in order of total variance explained.

2.3.6. Control Variables

The linear regression models include various control variables drawn from the literature. The most common control variables are the firm size and market to book (M-to-B) ratio to capture firm characteristics. Return On Equity (ROE) and capital ratio are also used to study the impact of CG on risk taking.

Also, year and industry fixed effects are included in all regressions to control for unobservable time or country variations. The results of the Hausman test show that random effects do not apply to the data.

2.3.7. Descriptive Statistics

Table 2.2 provides the descriptive statistics for all the CG, risk, and control variables. All variables are winsorised at a 1% level on both sides of the distribution to account for outliers and to avoid spurious inferences. The average leverage is 13.61 which confirms high risk taking policies in financial institutions. For CG variables, the board average age is about 62 years old, while the board size varies from a small board of four members only to a large board of 21 members. It is also noticeable that the existence of females on US boards is relatively low with only 12% average gender diversity. Appendix C includes the Pearson correlations for all the variables.

Table 2.2. Descriptive statistics.

Variable	N	Min.	Max.	Mean	Std. Deviation
ROAV	3856	0.04	23.27	1.45	3.17
Leverage	3856	0.00	91.88	13.61	17.20
Z-score	3856	-1.84	28.76	4.95	4.983
Stock Return Volatility	3856	0.13	45.48	2.96	4.82
Idiosyncratic Risk	3856	0.15	34.49	2.41	3.70
Institutional Ownership	3856	0.00	100.00	59.54	31.21
Insider Ownership	3856	0.00	60.51	8.13	10.16
Board Independence	3856	37.50	93.75	79.28	11.69
Board Meetings	3856	3	29	10.06	4.41
Board Attendance	3856	73.77	100.00	77.89	7.34
Gender Diversity	3856	0.00	41.67	12.80	9.73
Board Size	3856	4	21	10.41	2.99
Board Average Age	3856	50.11	74.77	62.75	4.10
Board Tenure	3856	1	4	1.99	1.00
CPS	3856	0.05	0.85	0.40	0.12
CEO Duality	3856	0	1	0.42	0.49
CEO Cash	3856	5.00	7.00	5.83	0.32
Executive Cash	3856	5.54	7.54	6.29	0.35
CEO Stocks	3856	0.00	7.28	4.00	2.77
CEO Options	3856	0.00	6.74	1.49	2.47
CEO Nonequity Incentives	3856	0.00	6.99	3.46	2.86
CEO Deferred	3856	0.00	6.81	1.99	2.54
Executive Stocks	3856	0.00	7.70	4.57	2.77
Executive Options	3856	0.00	7.09	1.85	2.71
Executive Non-equity Incentives	3856	0.00	7.37	3.93	2.96
Executive Deferred	3856	0.00	7.06	2.49	2.73
Board Stock	3856	0.00	100.00	28.25	24.95
Compensation Advisor	3856	0	1	0.65	0.47
UVR	3856	0	1	0.06	0.23
Firm Size	3856	7.68	12.29	9.59	0.83
ROE	3856	-54.49	66.45	9.04	11.12
M-to-B	3856	.22	13.83	1.60	1.60
Capital Ratio	3856	.04	0.96	0.19	0.17

2.4. Empirical Models and Findings

The study adopts Structural Equation Modelling (SEM) in examining the relationship between the PCA Factors generated that represent corporate governance and five risk measurements representing stand-alone and market risk. In the SEM, the latent variables stand alone risk and market risk represent the level of stand alone risk and market risk respectively. In the measurement model, the two latent variables are measured by relating them to five observable variables (Z-score, ROAV, leverage, idiosyncratic risk, and stock return volatility). The measurement models are specified as follows:

$$\boldsymbol{Z-score_{i,t}} = \boldsymbol{\alpha_1} + \boldsymbol{\beta_1 LV\ StandAlone\ Risk_{i,t}} + \boldsymbol{\varepsilon 2_{i,t}} \quad (2.4)$$

$$\boldsymbol{ROAV_{i,t}} = \boldsymbol{\alpha_2} + \boldsymbol{\beta_2 LV\ StandAlone\ Risk_{i,t}} + \boldsymbol{\varepsilon 3_{i,t}} \quad (2.5)$$

$$\boldsymbol{Leverage_{i,t}} = \boldsymbol{\alpha_3} + \boldsymbol{\beta_3 LV\ StandAlone\ Risk_{i,t}} + \boldsymbol{\varepsilon 4_{i,t}} \quad (2.6)$$

$$\boldsymbol{Stock\ Return\ Volatility_{i,t}} = \boldsymbol{\alpha_4} + \boldsymbol{\beta_4 LV\ Market\ Risk_{i,t}} + \boldsymbol{\varepsilon 6_{i,t}} \quad (2.7)$$

$$\boldsymbol{Idiosyncratic\ Risk_{i,t}} = \boldsymbol{\alpha_5} + \boldsymbol{\beta_5 LV\ Market\ Risk_{i,t}} + \boldsymbol{\varepsilon 7_{i,t}} \quad (2.8)$$

Where LV StandAlone $\text{Risk}_{i,t}$ and LV Market $\text{Risk}_{i,t}$ are the latent variables that represent the stand alone risk and market risk for the institution i in the year t. Z-score, ROAV, leverage, idiosyncratic risk and stock return volatility are the observed variables. β_1, β_2 β_3, β_4 and β_5 are the factor loadings that show how the observed indicators determine scores of latent variables. ε represents the residuals.

In the structural model, the PCA governance factors are the exogenous variables and the predictors of the latent variables defined in the measurement model. The structural model is specified as the following system of equations:

$$\boldsymbol{LV\ StandAlone\ Risk_{i,t}} = \boldsymbol{\alpha_6} + \boldsymbol{\lambda_1 Gov1_{i,t-1}} + \boldsymbol{\lambda_2 Gov2_{i,t-1}} + \boldsymbol{\lambda_3 Gov3_{i,t-1}} +$$

$$\boldsymbol{\lambda_4 Gov4_{i,t-1}} + \boldsymbol{\lambda_5 Gov5_{i,t-1}} + \boldsymbol{\lambda_6 Gov6_{i,t-1}} + \boldsymbol{\lambda_7 Gov7_{i,t-1}} + \boldsymbol{\varepsilon 1_{i,t}} \quad (2.9)$$

$$\boldsymbol{LV\ Market\ Risk_{i,t}} = \boldsymbol{\alpha_7} + \boldsymbol{\lambda_8 Gov1_{i,t-1}} + \boldsymbol{\lambda_9 Gov2_{i,t-1}} + \boldsymbol{\lambda_{10} Gov3_{i,t-1}} +$$

$$\boldsymbol{\lambda_{11} Gov4_{i,t-1}} + \boldsymbol{\lambda_{12} Gov5_{i,t-1}} + \boldsymbol{\lambda_{13} Gov6_{i,t-1}} + \boldsymbol{\lambda_{14} Gov7_{i,t-1}} + \boldsymbol{\varepsilon 5_{i,t}} \quad (2.10)$$

Where $\text{Gov1}_{i,t-1}$ to $\text{Gov7}_{i,t-1}$ are the PCA governance factors for the firm i in the year $t-1$. LV Stand Alone Risk and LV Market Risk are the latent variables defined in the measurement model. λ_1 to λ_{14} are the regression coefficients. The exogenous variables were lagged by one year (t-1) to account for the lagged effect of CG variables. The model was tested

using current PCA governance factors and lagged by one to three years. The results showed that one year lagged factors were the most significant and had the best model fit. The lagging of the independent and control variables will contribute to reducing endogeneity. To further alleviate endogeneity, year and industry fixed effects are added to control for possibly omitted variables caused by the different preferences of risk by different industries (banks vs insurance companies) that can affect both risk and CG. Panel data has been accounted for following Williams *et al.* (2018).

Table 2.3 and figure 2.2 show the results of the SEM. The model has a Root Mean Square Error of Approximation (RMSEA) with a P-value of 0.117, CFI value of 0.739, and NFI value of 0.735, which confirms the fitness of the model. Panel A reports the measurement model that shows the factor loadings of the risk measurements in the factor analysis. The variables ROAV and leverage are positively loaded on the latent variable stand alone risk, while the Z-score is negatively loaded, which accounts for its adverse effect (a higher Z-score indicates lower risk). Both idiosyncratic risk and stock return volatility are positively loaded on the latent variable market risk. This means that higher values of both latent variables indicate higher risk taking.

Panel B of table 2.3 shows the results of the structural model. The PCA governance factor GOV1 is positively related to both stand alone and market risk; a one-unit increase in GOV1 causes the stand alone risk to increase by 30.1% and the market risk to increase by 51.4%. This shows that the variables CEO cash, executive cash, CEO stocks, executive stocks, institutional ownership, board stocks, and compensation advisor positively and significantly affect risk taking, these results lead to partially accepting hypotheses 6 and 7. On the other hand, insider ownership has a negative effect which rejected the other part of hypothesis 6. These findings reaffirm that equity based compensation and institutional ownership positively affect risk. However, GOV4 which includes executives and CEO's option awards has a significant negative effect on stand alone risk, which rejects the other part of hypothesis 7. In addition, the debt based compensation (factors GOV3 and GOV5) shows a negative effect on risk which supports hypothesis 8.

The factors GOV2 and GOV7, which mostly include board characteristics, have a significant and negative effect on risk which means that these results reject hypothesis 2. On the other hand, CEO duality, UVR and board attendance have a positive effect on risk (due to their negative loadings on the factors). Therefore, the positive impact of CEO duality supports hypothesis 4, while the positive effect of UVR rejects hypothesis 5. However, the positive effect

of UVR on risk taking can be justified by the existence of controlling shareholders. The literature suggests that the presence of a controlling shareholder in a weak regulatory framework can lead to the abuse of other shareholders rights (Laeven and Levine, 2009; OECD, 2015)

Interestingly, the factor GOV6 (which loads on CPS positively and gender diversity negatively) has a positive coefficient when regressed on stand alone risk, but a negative coefficient when regressed on the market risk. The negative effect of gender diversity on risk taking accepts hypothesis 3. In addition, the positive effect of CPS and the negative effect of board independence both indicate that fewer independent directors take more risk, which again rejects hypothesis 1. Another noticeable finding is the negative effect of board average age on risk, which indicates that younger directors tend to take more risk.

Overall, the results support the idea that different CG variables have different impacts and not all CG variables positively affect risk. The predominant finding is that UVR, institutional shareholders and all compensation elements (except debt based) have a positive effect on risk, while most of the board characteristics and insider ownership have a negative effect on risk.

Figure 2.2: SEM CG and risk for US financial institutions

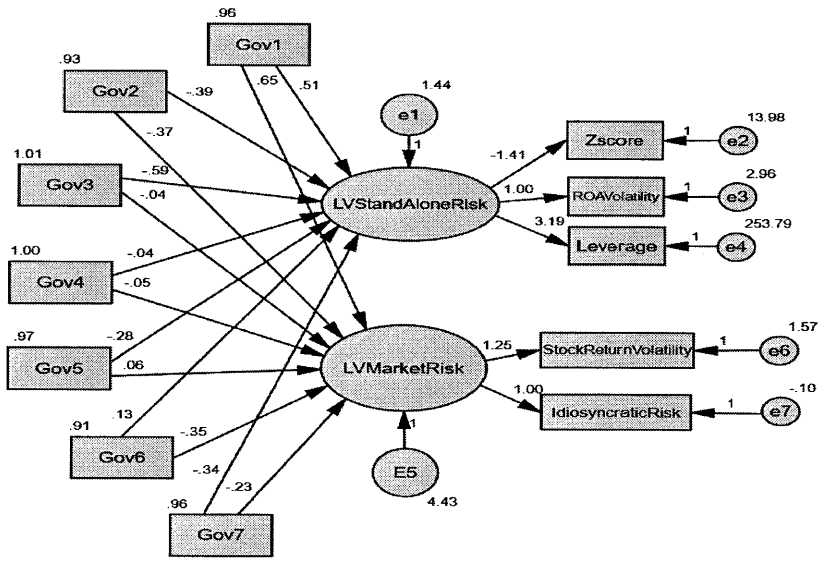


Table 2.3 SEM CG and risk for US financial institutions.

Panel A: Measurement Model		
	LV Stand Alone Risk	LV Market Risk
ROAV ←	1	
	(Constrained)	
Leverage ←	2.955***	
	(0.275)	
Z-score ←	-1.586***	
	(0.086)	
Idiosyncratic Risk ←		1
		(Constrained)
Stock Return Volatility ←		1.200***
		(0.027)
Panel B: Structural Model		
	LV Stand Alone Risk ←	LV Market Risk ←
Gov1	0.301***	0.514***
	(0.032)	(0.037)
Gov2	-0.153***	-0.279***
	(0.032)	(0.038)
Gov3	-0.500***	0.015
	(0.033)	(0.036)
Gov4	-0.092***	-0.047
	(0.031)	(0.036)
Gov5	-0.339***	0.005
	(0.032)	(0.037)
Gov6	0.098***	-0.324***
	(0.033)	(0.038)
Gov7	-0.253***	-0.223***
	(0.032)	(0.037)
R Squared	0.425	0.136
Observations	3116	3116

Note: This table represents the results of the SEM for the US sample to study the impact of PCA governance factors on stand alone and market risk. Components of the PCA governance factors are listed in table 2.1. Year and industry fixed effects are included in the models. Definitions and sources of all variables are detailed in Appendix A. Standard errors are provided in parentheses. Variables with arrows pointing towards them are the endogenous variables *, **, and *** denote significance at 10%, 5%, and 1% respectively.

2.5. Robustness Test

To test the robustness of the effect of PCA governance factors on risk taking, the following model is estimated:

$$Risk_{i,t} = \beta_0 + \beta_1 Gov1_{i,t-1} + \beta_2 Gov2_{i,t-1} +$$

$$\beta_3 Gov3_{i,t-1} + \beta_4 Gov4_{i,t-1} + \beta_5 Gov5_{i,t-1} + \beta_6 Gov6_{i,t-1} + \beta_7 Gov7_{i,t-1} +$$

$$\beta_8 Control_{i,t-1} + \gamma_t + \delta_i + \varepsilon_{i,t} \qquad (2.11)$$

Where $Risk_{i,t}$ is one risk measurement for the company i in the year t out of the five different measurements of risk. In all risk measurements, a higher value indicates a higher risk, except for the Z-score, where higher values indicate lower risk. $Gov1_{i,t-1}$ to $Gov7_{i,t-1}$ are the PCA governance factors. $Control_{i,t-1}$ is a set of four variables that control for firm level. γ_t is the year fixed effect and δ_i is the industry fixed effect. $\varepsilon_{i,t}$ is the residual. The descriptions and definitions of all variables are detailed in the variables list. As in the SEM analysis, the lagged independent and control variables, and the year and industry fixed effect help in alleviating endogeneity.

Table 2.4 provides the results of estimating equation (2.11) to study the effect of PCA governance factors on the five different risk measurements. The linear regression results of GOV2, GOV4, and GOV7 are consistent with the SEM results. However, GOV1 has a negative effect on market risk measurements in the linear regression, while positive in the SEM. Also, GOV6 has no significant coefficients for most of the regressions which differ from the SEM results, except for idiosyncratic risk with a negative coefficient that is consistent with the SEM. Finally, the coefficients of GOV3 and GOV5 show more significant and negative results, confirming the findings of the SEM. In terms of the control variables, Firm Size has a negative and significant effect on risk proxied by ROAV and Z-score, which suggests that bigger institutions have more stand alone risk. The positive effect of firm size on risk taking confirms the findings of Anginer *et al.* (2018) that big banks take higher risk due to their too big to fail status. Generally, a higher M-to-B ratio, ROE, and capital ratio result in higher risk.

The study includes restricted models in which each independent variable is the only regressor. The results of the restricted models confirm the results of the unrestricted models reported in Table 2.4. However, the restricted models remove the ambiguity in the factors GOV1 and GOV6. The restricted models show that GOV1 has a positive effect on stand alone risk and a negative effect on market risk. In addition, GOV6 shows more significance in the

restricted models with a positive effect on stand alone risk and a negative one on market risk, consistent with the results of the SEM. Overall, the linear regressions support and complement the results of SEM, which supports the usage of SEM to study the effect of PCA on various risk measurements in one model.

Table 2.4. Linear regression CG and risk.

	Dependent Variable: Five measures of risk				
	ROAV	Leverage	Z-score	Stock Return Volatility	Idiosyncratic Risk
Gov1	0.533***	3.023***	-0.504***	-0.233**	-0.126**
	(0.068)	(0.465)	(0.104)	(0.103)	(0.069)
Gov2	-0.041	-0.737***	-0.104	-0.147**	-0.119***
	(0.042)	(0.326)	(0.080)	(0.070)	(0.049)
Gov3	-0.019	-1.424***	0.319***	-0.184***	-0.111***
	(0.031)	(0.293)	(0.083)	(0.058)	(0.041)
Gov4	0.026	-0.796***	-0.023	-0.239***	-0.152***
	(0.032)	(0.296)	(0.076)	(0.056)	(0.038)
Gov5	-0.116***	-0.737***	0.741***	-0.175***	-0.084**
	(0.035)	(0.312)	(0.074)	(0.063)	(0.044)
Gov6	-0.013	0.024	0.106	-0.071	-0.072**
	(0.043)	(0.342)	(0.082)	(0.054)	(0.039)
Gov7	-0.122***	-1.484***	0.112*	-0.075	-0.113***
	(0.031)	(0.271)	(0.069)	(0.056)	(0.041)
Firm Size	-0.850***	-1.312**	0.802***	1.723***	1.176***
	(0.087)	(0.639)	(0.150)	(0.070)	(0.102)
M-To-B	0.353***	-2.229***	0.255***	0.546***	0.379***
	(0.065)	(0.453)	(0.067)	(7.543)	(0.046)
ROE	-0.19**	0.124**	0.094***	0.027***	0.025***
	(0.009)	(0.056)	(0.009)	(0.564)	(0.004)
Capital Ratio	5.398***	-9.876***	-0.523	3.259***	2.145***
	(0.504)	(2.997)	(0.645)	(6.788)	(0.396)
Observations	3116	3116	3116	3116	3116
R Squared	0.538	0.327	0.212	0.285	0.316

Note: This table represents the results of regressing five risk measurements (ROAV, Leverage, Z-score, Stock Return Volatility, and Idiosyncratic Risk) on PCA governance factors (Gov1, Gov 2, Gov 3, Gov 4, Gov 5, Gov 6, and Gov 7) for the US sample. Components of the PCA governance factors are listed in table 2.1. Definitions and sources of all variables are detailed in Appendix A. Year and industry fixed effects are included in all regressions. Robust standard errors are provided in parentheses. *, **, and *** denote significance at 10%, 5%, and 1% respectively. M-To-B is Market to Book.

In addition, another robustness test is included which extends the US sample to an international sample that includes 30 countries for the period of 2011 to 2017. The number of observations has increased from 3,116 to 4,633 firm-year observations. Extending the sample to other countries provides a larger sample that will serve as a robustness test and test the generalizability of the results to a global context following Anginer *et al.* (2018) and John *et al.* (2008). However, due to the lower data availability, the number of CG characteristics included in the analysis decreased from 23 to ten variables which are board size, board independence, board meetings, gender diversity, board tenure, CEO duality, compensation advisor, UVR, institutional ownership and insider ownership.

The PCA analysis of this sample results in four factors that accounted for 62.18% of the total variance. The SEM findings confirm the results using the US only sample and provide firm evidence of the positive effect of UVR and compensation advisor, and the negative effect of board independence and board size on risk taking. In addition, the results of the linear regression using this extended sample are consistent with the previous findings.

2.6. Additional Analysis

As an additional analysis, the PCA factors used in the previous models are replaced with governance scores created by ISS. The model is performed twice, once using the main governance score created, and another using the four sub-scores (Board, Audit, Shareholders and Compensation). The ISS governance scores are for the period from 2013 to 2018 with 2,504 observations.

To test the correlation between CG variables represented as ISS governance score and risk taking, the following model is estimated:

$$\boldsymbol{Risk_{i,t} = \beta_0 + \beta_1 ISS\ Governance\ Score_{i,t} + \beta_2 Control_{i,t} + \gamma_t + \delta_i + \varepsilon_{i,t}} \quad (2.12)$$

Where ISS Governance $\text{Score}_{i,t}$ is the governance score created by the ISS as reported in Bloomberg.

Next, the ISS Governance Score is replaced with the four sub-scores, by estimating the following model using univariate general linear regression:

$$\boldsymbol{Risk_{i,t} = \beta_0 + \beta_1 ISS\ Board_{i,t} + \beta_2 ISS\ Shareholders_{i,t} +}$$

$$\boldsymbol{\beta_3 ISS\ Audit_{i,t} + \beta_4 ISS\ Compensation_{i,t} + \beta_5 Control_{i,t} + \gamma_t + \delta_i + \varepsilon_{i,t}} \quad (2.13)$$

Where the independent variables are the governance sub-scores created by ISS, namely ISS $\text{Board}_{i,t}$, which accounts for board characteristics, ISS $\text{Shareholders}_{i,t}$, which accounts for shareholders' rights, ISS $\text{Audit}_{i,t}$, which accounts for Auditing practices and ISS $\text{Compensation}_{i,t}$, which accounts for compensation and remuneration.

Table 2.5 shows the results of regressing the ISS governance score and the ISS sub-scores on risk taking. Unlike the main analysis that did not include a variable showing the main score of governance, these results will allow addressing the research hypothesis 1. Panel A shows the positive and significant effect of ISS governance score on risk, which confirms that shareholder friendly CG has a positive effect on risk, which accepted the first research hypothesis. However, Panel B shows that, when CG variables are studied separately, not all have a positive effect on risk. ISS Board is negative but not always significant and ISS Shareholders has a negative effect on stand alone risk but a positive effect on market risk. Finally, both ISS Compensation and ISS Audit have a positive effect on risk, which suggests that the positive effect of CG on risk is mainly driven by compensation characteristics and auditing practices.

Table 2.5. ISS governance score vs. ISS sub-scores.

	Dependent Variable: Five measures of risk				
	ROAV	Leverage	Z-score	Stock Return Volatility	Idiosyncratic Risk
Panel A: ISS Governance Score					
ISS Governance Score	0.043***	0.271**	-0.043*	0.090***	0.092***
	(0.018)	(0.130)	(0.031)	(0.036)	(0.027)
Firm Size	-0.775***	-3.743***	0.471***	2.021***	1.462***
	(0.096)	(0.565)	(0.124)	(0.222)	(0.153)
M-To-B	0.612***	-2.363***	-0.087**	0.639***	0.473***
	(0.068)	(0.360)	(0.044)	(0.106)	(0.074)
ROE	-0.075***	0.042	0.142***	0.031**	0.039***
	(0.011)	(0.067)	(0.009)	(0.015)	(0.011)
Capital Ratio	5.598***	-41.916***	-0.530	5.074***	3.751***
	(0.617)	(3.229)	(0.680)	(0.970)	(0.722)
Observations	2504	2504	2504	2504	2504
R Squared	0.469	0.428	0.238	0.187	0.203
Panel B: ISS Governance Sub-scores					
ISS Board	-0.063***	-0.380***	-0.014	0.056	0.021
	(0.020)	(0.128)	(0.029)	(0.038)	(0.028)
ISS Shareholders	-0.031**	-0.142	0.078***	0.071***	0.061***
	(0.016)	(0.125)	(0.030)	(0.028)	(0.021)
ISS Compensation	0.072***	-0.161	-0.048**	0.043	0.068***
	(0.021)	(0.125)	(0.028)	(0.035)	(0.025)
ISS Audit	0.142***	0.180	-0.149***	0.002	0.003
	(0.030)	(0.178)	(0.031)	(0.034)	(0.028)
Firm Size	-0.824***	-4.000***	0.505***	2.068***	1.486***
	(0.094)	(0.574)	(0.125)	(0.230)	(0.159)
M-To-B	0.581***	-2.435***	-0.069*	0.649***	0.471***
	(0.068)	(0.367)	(0.045)	(0.107)	(0.075)
ROE	-0.073***	0.047	0.140***	0.030**	0.039***
	(0.011)	(0.067)	(0.009)	(0.015)	(0.011)
Capital Ratio	5.957***	-41.584***	-0.736	5.087***	3.845***
	(0.608)	(3.273)	(0.681)	(0.973)	(0.725)
Observations	2504	2504	2504	2504	2504
R Squared	0.485	0.430	0.248	0.189	0.204

Note: This table represents the results of regressing the five risk measurements on CG overall score (ISS Governance Score) and sub-scores (ISS Board, ISS Shareholders, ISS Compensation, and ISS Audit) as developed by ISS for the US sample. Definitions and sources of all variables are detailed in Appendix A. Year and industry fixed effects are included in all regressions. Robust standard errors are provided in parentheses. *, **, and *** denote significance at 10%, 5%, and 1% respectively. M-To-B is Market To Book.

2.7. Conclusion

This study contributes to the broader literature on the effect of CG on risk by showing how CG characteristics have different effects on risk taking. Findings confirm that CG as a whole positively affects risk. However, certain characteristics have a negative effect, but their effect is offset by other positive characteristics. The study reveals that the positive effect of CG on risk is mainly driven by executive compensation structures and auditing practices. However, insider ownership, debt based compensation and board characteristics including board independence and size have negative effects.

These results are also supported by the robustness test where the governance scores and sub-scores developed by ISS are used. ISS governance scores show that CG as a whole has a positive effect on risk, but some of the sub-scores have a negative effect, including board characteristics and shareholders' rights.

Table 2.6 provides the summary and the final view of the results for all the CG variables included in this study and the ISS scores. This table highlights the benefit of using PCA analysis as a replacement for indices. The results using ISS scores support the results using the PCA factors. However, the invalidity of using indices is highlighted when comparing the sum effect of one group to the individual effects of each variable within the same group. For example, the ISS board score shows that board characteristics have a negative impact on risk taking, but when compared to the induvial effects shown in by the PCA analysis, it can be noted that there are some variables related to the board that have a positive effect which are the board meeting attendance and CEO duality. The same example applies to the compensation elements.

The findings of this study highlight the importance of a granular study of CG rather than a broad overview using a single index. For example, the negative effect of board Independence on risk taking confirms the importance of requiring the majority of the board to be independent, and that more board independence does not cause excessive risk taking, thus contributing to the shareholder value maximisation literature (Anginer *et al.*, 2018; Ferreira and Laux, 2007; Ferris *et al.*, 2017; John *et al.*, 2008; Laeven and Levine, 2009; Saunders *et al.*, 1990).

Table 2.6. Summary of results.

Variable	Significant results*		Results from prior literature
	A	B	
Panel A: CG Variables			
Board independence	Negative	Negative	Positive (Anginer *et al.*, 2018; Ho *et al.*, 2013; Lu and Wang, 2018; Nakano and Nguyen, 2012; Sheikh, 2019)
Board meetings	Negative	Negative	Has not been investigated
Board size	Negative	Negative	Negative (Nakano and Nguyen, 2012; Wang and Hsu, 2013; Wu, 2016)
Board meeting attendance	Positive	Positive	Has not been investigated
Board Tenure	Negative	Negative	Has not been investigated
Board Average Age	Negative	Negative	Negative (Berger *et al.*, 2014)
CEO duality	Positive	Positive	Positive (Adams *et al.*, 2005; Deyoung *et al.*, 2013; Ho *et al.*, 2013; Sheikh, 2019; Switzer *et al.*, 2018; Wu, 2016)
Gender Diversity	Negative	Positive	Negative (Berger *et al.*, 2014; Wu, 2016)
UVR	Positive	Positive	Negative (Kieschnick and Moussawi, 2018; Mishra, 2011)
Institutional Ownership	Positive	Positive	Positive (Erkens *et al.*, 2012; Hutchinson *et al.*, 2015) Negative (Nakano and Nguyen, 2012; Switzer *et al.*, 2018)
Insider ownership	Negative	Negative	Positive (Laeven and Levine, 2009; Switzer *et al.*, 2018)
CPS	Positive	Negative	(Sheikh, 2019)
Compensation Advisor	Positive	Positive	Has not been investigated
Board Stocks	Positive	Positive	Positive (Anginer *et al.*, 2018; Ertugrul and Hegde, 2008)
CEO stocks	Positive	Positive	Positive (Cain and McKeon, 2016; Deyoung *et al.*, 2013; Guay, 1999; Nakano and Nguyen, 2012)
Executive stocks	Positive	Positive	Positive (Deyoung *et al.*, 2013; Guay, 1999; Nakano and Nguyen, 2012)
CEO options	Negative	Negative	Positive(Cain and McKeon, 2016; Deyoung *et al.*, 2013; Guay, 1999)
Executive options	Negative	Negative	Positive(Deyoung *et al.*, 2013; Guay, 1999)
CEO Cash	Positive	Positive	Positive(Cain and McKeon, 2016; Deyoung *et al.*, 2013; Guay, 1999; Jensen and Meckling, 1976)
Executive Cash	Positive	Positive	Positive(Deyoung *et al.*, 2013; Guay, 1999; Jensen and Meckling, 1976)
CEO Deferred	Negative	Negative	Negative(Cassell *et al.*, 2012; Edmans and Liu, 2011; Jensen and Meckling, 1976; Srivastav and Hagendorff, 2016)
Executive Deferred	Negative	Negative	Negative(Cassell *et al.*, 2012; Edmans and Liu, 2011; Jensen and Meckling, 1976; Srivastav and Hagendorff, 2016)

CEO non-equity	Negative	Negative	Has not been investigated (Edmans *et al.*, 2017)
Executive Non-equity	Negative	Negative	Has not been investigated (Edmans *et al.*, 2017)
Panel B: ISS Governance Score and Sub-Scores			
ISS Governance Score	Positive	Positive	Positive(Anginer *et al.*, 2018; Ferreira and Laux, 2007; John *et al.*, 2008; Laeven and Levine, 2009)
ISS Board	Negative	Negative	Positive (Anginer *et al.*, 2018; Lu and Wang, 2018; Wu, 2016)
ISS Shareholders	Negative	Positive	Positive(Anginer *et al.*, 2018; Ferreira and Laux, 2007; John *et al.*, 2008; Laeven and Levine, 2009)
ISS Compensation	Positive	Positive	Positive(Cain and McKeon, 2016; Deyoung *et al.*, 2013; Ertugrul and Hegde, 2008; Guay, 1999; Jensen and Meckling, 1976)
ISS Audit	Positive	Positive	Positive (Anginer *et al.*, 2018)

Note: *The columns represent the effect of CG on:
A) Stand alone risk for the US sample.
B) Market risk for the US sample.

2.7.1. Research Implications

Finally, the implications of these findings benefit managers and regulators as well as shareholders. CG frameworks should be developed by fully considering that not all aspects of CG behave similarly. For example, when designing a CG framework to address the excessive risk taking in financial institutions, the equity compensation requirement should be reduced (reflecting less shareholder friendly principles), and board independence requirements should be strengthened (reflecting more shareholder friendly principles). Although these principles have different directions, they all aim to minimise risk taking. In other words, granular analysis of CG characteristics matters more than it may initially seem.

2.7.2. Research Limitations

The first limitation was the data availability which results in having smaller samples than originally planned. The lack of data availability also resulted in eliminating the international sample and eliminating several CG variables.

Regarding the methodologies used, the main limitation of the PCA analysis is that it created governance factors that did not include variables from similar groups of CG. Therefore, it was not possible to name these factors based on the characteristics included. In addition, the Bloomberg database provided the ISS scores without details of their constructions, which would have been of benefit to the analysis.

2.7.3. Further Research Areas

There are many opportunities to direct this study for the future. First, creating PCA factors that have similar CG variables which will enable naming them according to their suitable group which will ease the difficult interpretation of the results caused by the anonymous naming. This will add a benefit to the generally used indices, which is the individual interpretation of each variable within each group. Finally, applying these studies to an international sample will increase the generalisability of the results.

In addition, extending the CG variables to cover more aspects would be a great benefit. Variables that could be incorporated include board committees, their independence, and the remuneration of directors sitting on these committees. Also, board diversity includes several aspects that could be included in this study other than gender and age which include ethnicity, educational background, and work experience.

3

Chapter 3: Bank Failure Prediction (Corporate Governance and Financial Indicators)

Abstract

This study reiterates the importance of CG in banks. Failure prediction studies have mainly relied on using financial ratios as predictors. The most suitable financial predictors for banks are financial ratios following the CAMEL rating system. Also, CG has been proven to be an important aspect of banks, especially after the financial crisis. Given its importance, the novelty of this study is to test the ability of CG to increase the accuracy and extend the time horizon of bank failure prediction in the US market.

Using DA, this study predicts the failure of banks insured by the FDIC from 2010 to 2018. Using financial and non-financial predictors, this study shows that combining CAMEL ratios with CG variables not only increases the accuracy of prediction but also extends the time horizon to three years before failure. The findings also show that adding non-financial variables to the financial ratios control for possible omitted variables.

The study also shows that the bank's earning is a more significant predictor than capital structure and asset quality. The results further reveal that CEO compensation, voting rights and institutional ownership are significant predictors. These results are robust when using LR and out of sample examination.

This study shows that CG plays a key role in the success or failure of banks. The regulatory implication of this study is that more attention needs to be directed to CG and earnings aspects of banks rather than focusing on capital structure.

Keywords: Corporate governance, CAMEL ratios, bank failure prediction.

3.1. Introduction

The latest financial crisis highlighted the importance of banks and the effects that their failure has on a wider economy (Basel Committee on Banking Supervision, 2010; Liang *et al.*, 2016). Banks play a key role in the financial systems Because of market integrity, the impact of one bank's failure extends to a wide range of institutions and has a more catastrophic effect than any other business failing (Liang *et al.*, 2016).

Failure prediction and CG are the two most important researched areas that contribute to the success of banks (du Jardin, 2017; Liang *et al.*, 2016; Manthoulis *et al.*, 2020). Failure of banks not only affects the banks themselves but also reaches the global economy (Liang *et al.*, 2016). The importance of failure prediction in banks has been highlighted by many researchers (Boyacioglu *et al.*, 2009; Liang *et al.*, 2016; López Iturriaga and Sanz, 2015; Ravi Kumar and Ravi, 2007; Wang *et al.*, 2014). It is also necessary for a bank to predict its failure as early as possible. The precautions and preventive procedures that need to be taken not only depend on the probability of the bank's failure, but also on the time horizon of the prediction (du Jardin, 2017; López Iturriaga and Sanz, 2015).

Failure prediction has been widely researched by using financial ratios. However, papers that study the failure of banks have not given much attention to other variables such as CG characteristics. There are many reasons to believe that incorporating CG characteristics in failure prediction will enhance the accuracy of prediction. First, CG is known for its importance and contribution to the success and failure of firms. Second, other research shows that incorporating non-financial variables has improved the accuracy of prediction models (Ioannidis *et al.*, 2010).

Therefore, this study contributes to the wide literature on failure prediction by investigating the role of CG variables as non-financial predictors in enhancing the prediction accuracy of US banks failure using financial ratios. There are empirical studies that use CG as non-financial predictors of failure (Brédart, 2014a, 2014b; Daily and Dalton, 1994; Jones, 2017; Lee and Yeh, 2004; Liang *et al.*, 2016; Wu, 2016). However, these studies were conducted on non-financial firms, and to the best of the author's knowledge, CG has not been examined before as non-financial predictors of the failure of US banks. In addition, the financial ratios are categorized into five categories, namely Capital, Assets, Management, Earnings and Liquidity (CAMEL) and identify the effects of each category on failure prediction. The study also shows which of these categories is the most significant for banks. These categories are in line with the rating system developed by the FDIC.

To study the bank failure prediction, this study uses DA and includes a robustness test using LR. The study also includes an additional analysis using out of sample examination to support the accuracy of the prediction model. The results show that adding CG variables to the traditionally used financial ratios enhances the accuracy rate and extends the time horizons. This is due to providing a broadened view of the banks' condition by adding the non-financial predictors. The findings also show that, amongst the CAMEL ratios, earnings and liquidity are the more significant predictors. On the other hand, amongst the CG variables, CEO pay slice, UVR and institutional shareholding are the most significant predictors.

This chapter is structured as follows: Section 2 contains the literature review on predicting bank failure. Section 3 includes the description of the methodology and samples used in the study. Section 4 includes the main analysis with a discussion of the results. Section 5 presents the robustness test. Section 6 represents the additional analysis. Finally, section 7 concludes.

3.2. Literature Review and Hypothesis Development

Researchers assert that bank failure prediction is a benefit to all shareholders, managers and stakeholders (Chauhan *et al.*, 2009; Ravi Kumar and Ravi, 2007; Wang *et al.*, 2014). Ravi Kumar and Ravi (2007) provide a review of different statistical and intelligent techniques used in failure prediction studies conducted during 1968 – 2005. Their review reveals that most studies were conducted on firms and not banks, and mainly focused on the period from 1980 to 2003. This, alongside other reasons, highlights the importance of studying failure prediction in banks. For example, bank failure affects the whole economic stability (Boyacioglu *et al.*, 2009), failure prediction enables banks to make appropriate lending decisions (Liang *et al.*, 2016) and bank failure could have been prevented if appropriate failure prediction tools had been used (Kao and Liu, 2004).

In addition, long term prediction of bank failure is a very important aspect as it affects the decision making, especially the lending decisions. Basel Committee on Banking Supervision (2009) recommended banks to estimate the risk of lending decisions over a long term period. du Jardin (2017) states that for this prudential reason, prediction exceeding one year is very important, especially for banks. The author provides a review of the time horizons of prediction in studies. The review shows that most studies provide predictions up to three years horizons, while fewer extend it to four or five year horizons. The review also shows that the optimal prediction accuracy is one year before failure, from that point the accuracy rates decrease, where the average rate for one year horizon is 85% and decreases to 69.5% for five

years horizons. Similarly, López Iturriaga and Sanz (2015) state that the reliability of failure prediction is a concern when the time horizon exceeds the short term.

3.2.1. Failure Prediction Methodologies

Both statistical and non-statistical models have been used to predict firms' failures. Among statistical methodologies, the most common is the DA, which was initially used by Altman (1968) and then developed and adopted by Boyacioglu *et al.* (2009), Canbas *et al.* (2005), Cielen *et al.* (2004), Cox and Wang (2014), du Jardin (2017), du Jardin (2016), Haslem *et al.* (1992), Kao and Liu (2004), Karels and Prakash (1987), Ohlson (1980) and Serrano-Cinca and Gutiérrez-Nieto (2013). Other methodologies include LR used by Boyacioglu *et al.* (2009), Brédart (2014a), Canbas *et al.* (2005), Daily and Dalton (1994), du Jardin (2017), du Jardin (2016), Kao and Liu (2004), Lee and Yeh (2004), Ohlson (1980), Serrano-Cinca and Gutiérrez-Nieto (2013), Wang *et al.* (2014), West (1985) and Wu (2016), PCA used by Boyacioglu *et al.* (2009), Canbas *et al.* (2005) and Kao and Liu (2004), and PLS-DA, used by Serrano-Cinca and Gutiérrez-Nieto (2013).

Among non-statistical models, artificial intelligence tools are widely used for failure prediction. In most studies, they have proven to be highly accurate. However, Boyacioglu *et al.* (2009) used both statistical and artificial intelligence techniques to predict the failure of Turkish banks during the crisis. Their findings show that, while artificial intelligence tools are superior prediction techniques, the other statistical techniques also provide satisfying results in prediction. Similarly, Jones *et al.* (2017) show that simple classifiers such as LR and DA perform reasonably well in bankruptcy prediction. In addition, Alaka *et al.* (2018) use several prediction tools including two statistical tools (DA and LR) and six artificial intelligence tools. They found that no single tool is predominantly better than other tools.

Other studies compare several statistical and intelligence methodologies. Boyacioglu *et al.* (2009) find that DA and LR analysis are better failure predicting models among other models including neural network, support vector machine, and cluster analysis. In assessing bank crisis, Davis and Karim (2008a) compare LR with signal extraction in early warning systems, and in another study, Davis and Karim (2008b) compared LR with binomial tree-based early warning systems. The results of both studies suggest that LR performs better than the rest of the techniques.

3.2.2. Financial Ratios

Pioneers in failure prediction have utilised financial ratios for the prediction of firm failure using statistical models (Altman, 1968; Beaver, 1966; Ohlson, 1980). Subsequently, studies have mainly incorporated the traditionally used financial ratios but with different feature selection techniques, including Boyacioglu *et al.* (2009), Chauhan *et al.* (2009), Cox and Wang (2014), du Jardin (2010, 2016, 2017), Feki *et al.* (2012), Hosaka (2019), Lin *et al.* (2011), López Iturriaga and Sanz (2015), Serrano-Cinca and Gutiérrez-Nieto (2013) and Wang *et al.* (2014).

The selection of the financial ratios is an important process in failure prediction (Wang *et al.*, 2014). du Jardin (2017) was able to have up to three years horizon prediction using variables selected based on prior literature. Because the financial structure and characteristics of banks differ from other sectors (Cielen *et al.*, 2004; Wu, 2016), common financial ratios used in non-financial sectors might not apply to banks. As a result, researchers have tried to adopt ratios in the CAMELS rating system as predictors.

CAMELS is a six part rating system to evaluate banks' overall condition based on their Capital adequacy, Asset quality, Management expertise, Earning strength, Liquidity, and Sensitivity to market risk. This rating system was developed by the Uniform Financial Institutions Rating System (UFIRS) in 1979 and is mandated by the Federal Deposit Insurance Corporation Improvement Act (FDICIA) of 1991 (Federal Deposit Insurance Corporation, 1997).

Initially, the rating system consisted of only five groups which are Capital, Assets, Management, Earnings and Liquidity. In 1995, an additional group was added which is the Sensitivity to market which formed the currently used CAMELS rating system. According to the review of prior literature on failure prediction, there is no variable in sensitivity to market that significantly contributes to failure prediction, except for one for which has no available data, which is the volatility of stock return. For this reason, this study incorporates the initial CAMEL rating system. Incorporating financial ratios that will test these five aspects of the rating system will enable us to have an overall coverage of the banks' financial conditions.

Studies that used CAMELS include Boyacioglu *et al.* (2009) and Feki *et al.* (2012) to predict failure in Turkish and Tunisian banks respectively. Similarly, López Iturriaga and Sanz (2015) declare that their variables selection approach is close to the CAMEL rating system in studying the failure prediction in banks. Their model shows that the three financial ratios that have the most predictive power are the provision ratio, the risk concentration in the construction industry, and the equity support to loans. Also, the Canbas *et al.* (2005) study aims to construct

an early warning system as a decision support tool in banks. In studying Turkish banks, they find that PCA can be used as an alternative or supportive tool to the CAMELS rating system.

Given the arguments discussed above, the following hypothesis is formulated:

Hypothesis 1: CAMEL ratios as financial ratios can prove accurate prediction of bank failure.

3.2.3. Non-Financial Ratios

Existing studies that have examined failure prediction of banks in the US include Serrano-Cinca and Gutiérrez-Nieto (2013) who use financial ratios to compare Partial Least Square Discriminant Analysis (PLS-DA) with eight other techniques. They assert that the US banking crisis is not over and that the FDIC recognizes that there are many banks at risk of failure. Also, López Iturriaga and Sanz (2015) predict the failure of US banks using a variables selection approach that is close to the CAMEL rating system. Other studies that have utilized financial ratios to study the failure prediction of US banks include Chauhan *et al.* (2009) and Cox and Wang (2014). However, none of these variables incorporates non-financial variables to predict bank failure.

In studying corporate bankruptcies, Jones (2017) finds that bankruptcy is better explained and predicted in a multi-dimensional setting. The author uses multiple non-financial and financial variables to predict bankruptcy and finds that non-traditional variables, such as ownership structure/concentration and CEO compensation, are among the strongest predictors. Also, Ioannidis *et al.* (2010) use several financial and non-financial variables to assess banks' soundness; they find that the accuracy of classification of the models that include only financial variables is poor. This gives enough reason to believe that adding non-financial variables, such as CG, to the CAMEL ratios will enhance the accuracy of predicting bank failure.

These arguments lead to the formulation of the hypothesis below:

Hypothesis 2: Adding non-financial variables to the CAMEL ratios leads to increasing the accuracy of failure prediction.

Some studies have incorporated non-financial variables such as market driven variables. Studies that use non-financial predictors include Cheng *et al.* (2018), Beaver *et al.* (2005), Jones (2017), Shumway (2001) and Charalambakis and Garrett (2016). CG is among the non-financial variables used in prediction (Brédart, 2014a, 2014b; Daily and Dalton, 1994; Jones, 2017; Lee and Yeh, 2004; Liang *et al.*, 2016; Wu, 2016). However, Liang *et al.* (2016) declare that, even though the importance of CG is well recognised in the literature, little effort has been

made to conduct empirical studies that test the contribution of CG indicators in failure prediction along with the financial ratios. They also declare that previously conducted studies have only used some selected features of CG, which suggests the need for a thorough examination of various CG indicators.

Similarly, Jones (2017) asserts that, despite having good theoretical reasons that relate CG indicators to failure, few studies examine them as alternative failure predictors. The Basel Committee on Banking Supervision states that the effectiveness of CG is critical to ensuring the proper functioning of the banking sector and the whole economy (Basel Committee on Banking Supervision, 2015). Lee and Yeh (2004) and Wu (2016) state that CG leads to corporate value reduction, but the question remains as to whether it also leads to financial distress. Also, Al-Faryan and Dockery (2021) find that the period following CG change of firms listed in Saudi Stock Markets shows sub-period improvement in market efficiency, and Enache and Hussainey (2020) find that CG has a positive effect on current and future firm performance up to two years ahead. These arguments and findings give us reasons to believe that CG plays an important role in the success of firms.

To study financial distress in listed firms, Lee and Yeh (2004) use both financial ratios and CG indicators including board and ownership. They assert that weak CG leads to economic downturns and increases the probability of falling into financial distress. Likewise, Wu (2016) studies the relationship between CG variables and the risk of bankruptcy in firms. The author finds that board size and board independence are most significantly related to bankruptcy risk. The results show that CG variables are strong predictors of failure, but their prediction accuracy increases only nearer the time of bankruptcy. On the other hand, Daily and Dalton (1994) study the characteristics of failed banks and find that less board independence and more CEO duality show significant association with failure three years before the bankruptcy event. Brédart (2014b, 2014a) finds that board size, CEO ownership, and CEO duality are significantly related to the financial distress of a firm.

One of the few studies that use CG as an alternative failure predictor is a study by Liang *et al.* (2016), who combine financial ratios with CG variables to predict failure. They conduct their study on non-financial firms in Taiwan by using statistical and artificial intelligence techniques. Their results suggest that CG enhances the accuracy of prediction and improves the performance of all models utilised in their study. They assert that their results may not apply to other markets due to the differences in the definition of distressed companies and CG indicators. They find that the most important CG indicators to predict failure are the ones related to the

board and ownership structure. Jones (2017) uses 91 different predictor variables, including financial and non-financial predictors. He finds that the most significant predictors are ownership structure and the CEO compensation, then market and accounting variables, and finally macro-economic variables. Also, Cheng *et al.* (2018) results show that specific types of institutional investors are able to determine which firms will file for bankruptcy among a set of equally distressed firms. These studies of failure prediction include few aspects of CG and do not include important characteristics such as CEO duality, board meetings and gender diversity.

Given the above discussion about the utilisation of CG in failure prediction, the final hypothesis can be expressed as follows:

Hypothesis 3: CG variables as non-financial variables can contribute to the accurate prediction of failure prediction.

3.3. Research Methodology

3.3.1. Methodology

Since the main objective of this study is the prediction of bank failure, the first adopted technique is the Mann-Whitney test which examines the discriminatory power of the variables and ratios. Mann-Whitney test is a non-parametric test that compares subsamples' distributions of variables to confirm their discrimination ability (Dupire and Slagmulder, 2019; du Jardin, 2016). In this study, many variables are not normally distributed. Therefore, the Mann–Whitney test is more suitable than the other tests to compare the differences between failed and non-failed banks (du Jardin, 2017; López Iturriaga and Sanz, 2015).

The second technique used to predict the failure of banks is the DA. The main rationale behind using DA as the main analysis of this study is that it uses variables and financial ratios that differentiate between failing and non-failing firms, which results in classifying the firms into failed or non-failed (Alaka *et al.*, 2018). The first to use DA in the field of business are Altman (1968) and Frydman *et al.* (1985) who build a z-score model that uses accounting data to discriminate between bankrupt and non-bankrupt firms.

Another statistical technique used for prediction is the LR. However, the DA is used in the main analysis of this study because its predictive capability is superior to logistic regression, and has the advantage of yielding a model with a relatively small number of selected measurements (Altman, 1968; Altman and Sametz, 1977).

Although DA is used in the main analysis due to its superiority, LR is also deployed in this study as a robustness test. LR has also been used by Ohlson (1980) for bankruptcy

prediction shortly after DA. In this study, LR is used as a robustness test because it has two advantages over DA; it does not require optimality of explanatory variables and allows the use of qualitative variables (du Jardin, 2016)

Finally, there are other prediction tools including machine learning that can be used, however, researchers found that DA and LR perform reasonably well in bankruptcy prediction (Boyacioglu *et al.*, 2009; Jones *et al.*, 2017). In addition, Alaka *et al.* (2018) find that no single tool, among six statistical and machine learning tools, is predominantly better than the other.

3.3.2. Data Sampling

This study includes samples of failed and non-failed banks that are insured by FDIC from 2010 to 2018. The financial data were obtained from the FDIC website and the CG data from the Bloomberg database. Failed banks in the FDIC database include institutions entering receivership, had their deposits assumed by others, and merged into others under federal assistance plans (Bell, 1997). However, in this study, failed banks are limited to either delisted or merged banks according to the Bloomberg database. The models are performed with five different datasets, as detailed in table 3.1, namely CAMEL, CG, ISS, CAMEL with CG, and CAMEL with ISS.

The analysis includes matched samples that were constructed following Altman (1968) and Beaver (1966) in pairing the datasets based on a stratified random sampling, in which a non-failed bank of similar size is matched for every failed bank for the corresponding year. Also, the F-test is shown in table 3.2. reveal that small banks and large banks have unequal variances, with a higher mean value for large banks. Therefore, the effect of the bank size is controlled for in constructing the sample.

The stratified random sampling technique has been recently used by Hartnett and Shamsuddin (2020), Islam *et al.* (2019) and Sarhan *et al.*)2018). This technique avoids a biased sample by ensuring that the samples for both the failed and non-failed banks include the best match. Beaver (1966) declares that this sampling technique controls for factors that might affect the relationship between ratios and failure prediction. In addition, this sampling technique accounts for the class imbalance problem caused by the difference between the number of failed and non-failed cases, which could lead to a degradation in the performance of the prediction (Liang *et al.*, 2016).

Table 3.1. The number of banks in the datasets.

No.	Dataset	Years	Lag	Failed banks	Non-failed banks
1	CAMEL	2010-2018	1	261	261
			2	242	242
			3	200	200
2	CG	2010-2018	1	99	99
			2	101	101
			3	96	96
3	CAMEL + CG	2010-2018	1	70	70
			2	64	64
			3	56	56
4	ISS	2013-2018	1	94	94
			2	82	82
			3	58	58
5	CAMEL + ISS	2013-2018	1	60	60
			2	54	54
			3	34	34

Note: This table describes the five datasets used in the analysis. All variables are defined in appendix D. CAMEL is the rating system that consists of five groups namely, Capital, Asset, Management, Earnings and Liquidity. CG is Corporate Governance.

Table 3.2. F-test of banks' size.

	Small banks	Big banks
Mean	0.624	0.798
Variance	0.236	0.162
F	1.455	
P(F<=f) one-tail	0.007	
F Critical one-tail	1.281	

Note: This table details the F-test of the size of banks measured by the log of total assets.

3.3.3. Variables Selection

The variable selection approach for the financial ratios includes two steps. First, prior literature is used to select the financial ratios which have been used to predict bankruptcy or failure in studies shown in appendix E, which resulted in 176 ratios. Next, ratios that were found to be significant are selected, which resulted in 43 ratios[1]. Then, 23 ratios were chosen out of the 43 based on the data availability. The second step is using the CAMEL rating system as a criterion for categorising the ratios into five groups, namely Capital, Assets, Management,

[1] (Altman, 1968; Beaver, 1966; Boyacioglu *et al.*, 2009; Canbas *et al.*, 2005; Chauhan *et al.*, 2009; Daily and Dalton, 1994; Demirgüç-Kunt *et al.*, 2008; Feki *et al.*, 2012; Gasbarro *et al.*, 2002; Hosaka, 2019; IMF, 2006; Ioannidis *et al.*, 2010; du Jardin, 2010, 2017; Jones, 2017; Kao and Liu, 2004; Liang *et al.*, 2016; Lin *et al.*, 2011; López Iturriaga and Sanz, 2015; Ohlson, 1980; Poon *et al.*, 1999; Serrano-Cinca and Gutiérrez-Nieto, 2013; Wang *et al.*, 2014; Wu, 2016).

Earnings, and Liquidity. It is worth mentioning that the review conducted for this study showed that the only significant variable in the sensitivity to market category which contributes to failure prediction is the volatility of stock return. This variable had no data availability; hence, the 1991 CAMEL rating system is incorporated in this study which excludes the Sensitivity to market category. The 23 CAMEL ratios are detailed in Panel B in appendix D.

As for CG variables, the selection process started with all variables that are related to CG and are available on the Bloomberg database. Initially, there were 72 variables, and then variables with low data availability were eliminated. This process resulted in 23 variables that represent board characteristics, compensation structure, voting rights and ownership structure. The CG variables are detailed in Panel C in appendix D.

To confirm the results of CG in predicting bank failure, the CG variables were replaced with another set of CG variables, which are the governance scores developed by the ISS. The ISS scores are detailed in Panel D in appendix D.

3.3.4. Discriminatory Power Test

This study uses a Mann-Whitney test to assess the discriminatory power of each variable and ratio by testing the discrepancies between failed and non-failed banks for one year before failure. Recent studies that have used the Mann-Whitney test include Elshandidy and Neri (2015) and Manthoulis *et al.* (2020).

Using the Mann-Whitney test, eight CAMEL ratios and three CG variables showed significant discrimination between failed and non-failed firms, as shown in table 3.3. The eight CAMEL ratios are Pre-Tax Income to Equity (PTItoE), Earnings Coverage of Net Charge-Offs (ECofNCO), and Assets per Employee (AperE), which represent the Capital, Assets and Management categories respectively. Non-Interest Expense to Total Income (NIEtoTI), Income Before Extraordinary Items to Assets (IBEItoA), and Retained Earnings to Total Assets (REtoTA) represent the Earnings category. Finally, Net Loans and Leases to Deposits (NLLtoD) and Gross Loans to Total Deposits (GLtoTD) represent the Liquidity category.

The three CG variables are the CPS, which represents the CEO's compensation in comparison to that of the other executives, UVR, which represents the voting rights of shareholders, and institutional ownership. These results show that none of the variables that represent board characteristics has discriminatory power.

Table 3.3. Mann-Whitney test.

Variable	P-Value		
Panel A: CAMEL ratios		Panel B: Corporate Governance	
TIEtoTA	0.613	BS	0.777
ECtoA	0.804	BM	0.131
TEtoGL	0.143	BA	0.369
PTItoE	**0.000**	GD	0.953
LtoE	0.391	BAA	0.508
LAtoL	0.358	BD	0.303
NCOtoL	0.959	CD	0.328
TEtoTA	0.110	**CPS**	**0.001**
TLtoTA	0.895	CEOS	0.929
NLLtoTA	0.077	ExecuS	0.753
DtoA	0.879	CEOO	0.788
LPtoNCO	0.379	ExecuO	0.572
ECofNCO	**0.001**	CEOD	0.894
AperE	**0.016**	ExecuD	0.870
NIEtoTI	**0.001**	CEONEI	0.673
IGR	0.284	ExecuNEI	0.467
IBEItoA	**0.000**	BStock	0.375
IEtoTE	0.708	CEOC	0.192
REtoTA	**0.000**	ExecuC	0.708
CtoTA	0.814	CA	0.553
CtoTL	0.814	**UVR**	**0.098**
NLLtoD	**0.040**	**Institutional Ownership**	**0.007**
GLtoTD	**0.037**	InsideO	0.942

Note: This table shows the P-value of Mann-Whitney test to assess the discriminatory power of each variable and ratio by testing the discrepancies between failed and non-failed firms for one year before failure. The ratios and variables are detailed in appendix D.

3.4. Empirical Models and Results

This study examines the prediction of bank failure using several types of predictors, which are financial ratios (CAMEL), non-financial variables (CG), and combinations of both. The aim is to find predictors that provide better accuracy rates. To predict bank failure, the study includes five datasets, namely CAMEL, CG, CAMEL with CG, ISS only and CAMEL with ISS. All models were performed three times where the explanatory variables are lagged by one, two and three years before failure.

3.4.1. Dataset 1: CAMEL Ratios

The study investigates the prediction accuracy using only CAMEL ratios; this will allow the comparison of the results with the other datasets when CG variables are added. The Mann-Whitney test resulted in eight significant ratios; the discriminant function for the CAMEL ratios is as follows:

$$D_1 = B_0 + B_1 PTItoE + B_2 ECofNCO + B_3 AperE + B_4 NIEtoTI + B_5 IBEItoA + B_6 REtoTA + B_7 NLLtoD + B_8 GLtoTD \quad (3.1)$$

where D_1 is a discriminant score, B_0 is the constant, B_1 to B_8 are the coefficients. $PTItoE$ is the Pre-Tax Income to Equity ratio, $ECofNCO$ is Earnings Coverage of Net Charge Offs, $AperE$ is the Assets per Employee, $NIEtoTI$ is the Non-Interest Expenses to Total Income ratio, $IBEItoA$ is the Income Before Extraordinary Items to Assets ratio, $REtoTA$ is the Retained Earnings to Total Assets ratio, $NLLtoD$ is the Net Loans and Leases to Deposits ratio, and $GLtoTD$ is the Gross Loans to Total Deposits ratio.

The result of measuring the accuracy of predicting failure by using the CAMEL ratios is reported in table 3.4. The Wilks' Lambda P-value shows that the discriminant function is significant for one, two and three years lags, which shows that the categorising power of the function is high. Also, the canonical correlation and the Chi-square show that the models have acceptable discriminant ability. Most importantly, the overall accuracy ranges from 60.3% for three years before failure to 61.1% for one year before failure. These results support the first hypothesis that CAMEL ratios can predict bank failure.

Table 3.4. Discriminant analysis CAMEL ratios.

	Standardised canonical discriminant function coefficients		
	1	2	3
PTItoE (Capital)	0.113	-0.117	0.198
ECOofNCO (Asset)	-0.005	0.083	0.340
AperE (Management)	0.308	-0.109	0.108
NIEtoTI (Earnings)	0.542***	-0.168*	0.059
IBEItoA (Earnings)	-0.220***	0.152***	-0.414***
REtoTA (Earnings)	-0.437***	0.748***	-0.586***
NLLtoD (Liquidity)	0.268**	3.329**	-2.294**
GLtoTD (Liquidity)	0.245**	-3.747**	2.731**
Model Statistics			
No. of failed banks	261	242	200
No. of non-failed banks	261	242	200
Eigenvalue	0.078	0.053	0.066
Canonical Correlation	0.268	0.224	0.248
Chi-square	38.576	27.715	25.075
Wilk's Lambda Sig.	0.000	0.002	0.002
Accuracy %	61.1%	61.2%	60.3%
Classification: % correct - failed	58.2%	58.3.0%	55.5%
Classification: % correct – non-failed	64.0%	64.0%	65.0%

Note: This table represents the results of Discriminant Analysis, equation (3.1). CAMEL ratios are lagged by one year before failure in model 1, by two years in model 2, and by three years in model 3. *, **, and *** denote significance at 10%, 5%, and 1% respectively according to Wilk's Lambda. PTItoE is Pre-tax income to equity, ECOofNCO is Earnings coverage of net charge-offs, AperE is Assets per employee, NIEtoTI is Non-interest expense to total income, IBEItoA is Income before extraordinary items to assets, REtoTA is Retained earnings to total assets, and NLLtoD is Net loans and leases to deposits.

The results show that IBEItoA and REtoTA are significant at 1% in all models, while NIEtoTI decreases from very significant in the one year lagged model to not significant in the three years lagged model. These ratios represent the earnings of a bank, and their coefficients illustrate those banks with lower earnings relative to assets are more likely to fail. Also, NLLtoD and GLtoTD, which represent liquidity, are significant at 5% in all models and show that failed banks are less liquid and have fewer deposits in relation to loans and leases three years before failure, but are more liquid one year before failure. It is worth mentioning that the coefficients of the aforementioned variables change signs across different lags, this might be due to the reason that CAMEL ratios represent financial ratios only without considering other

non-financial ratios, which means that the model with CAMEL ratios only does not account for omitted variables.

The other variables that represent the capital structure, asset quality, and management of banks are not significant across all models. These findings result in the conclusion that while the accuracy rates of prediction support the first hypothesis, the coefficients of the CAMEL ratios show that not all categories contribute to the prediction of failure.

These results are interesting and unexpected since they show that the earnings and liquidity of a bank are more significant than its capital structure and asset quality to predict failure. The prediction power of earnings that extends up to three years before failure indicates that the decisions related to earnings have a long term effect. Also, these results imply that the deterioration of earnings in failed banks starts early, which might be due to the provisioning for loan losses that have a direct impact on a bank's earnings (Gopalan, 2010). In addition, the increase of liquidity in failed banks implies that failed banks liquidate their assets nearer to their failure. The increase can also be due to the bailouts provided by the government for failing banks. On the other hand, the results related to the ratios of the capital structure and asset quality show that they are insignificant in comparison to the other aspects. This insignificance might be due to the banks' capability to increase their capital ratios by reducing lending or selling assets (Gopalan, 2010), which will result in concealing the capital deterioration in failed banks.

3.4.2. Dataset 2: CG Variables

This model investigates the prediction accuracy using CG variables. The discriminant function is as follows:

$$D_2 = B_0 + B_1 CPS + B_2 UVR + B_3 InstitutionalOwnership \qquad (3.2)$$

where $D_2$is a discriminant score, B_0 is the constant, B_1 to B_3 are the coefficients. CPS, UVR, and $InstitutO$ are the CG variables.

The results of the DA for the second dataset, which represents the CG variables, are reported in table 3.5. The eigenvalue, canonical correlation, and chi-square show that all models have a good discriminant ability, and Wilk's Lambda p-value shows that the discriminant function is statistically significant. The accuracy of predicting bank failure using CG variables is higher in comparison to the CAMEL ratios, where the percentage ranges from 62.4% one year before failure to 64.1% three years before failure. Above that, the accuracy increases as the lagging increases, which shows that CG is better than CAMEL for long term prediction. All variables are significant, notably the CPS, which is significant at 1% in all models. CPS is

associated with agency problems and banks are more likely to fail if their CEOs receive high compensation in comparison to their executive directors. These results are in line with the findings of Jones (2017): that the CEO compensation and ownership structure are among the strongest non-traditional predictors. Also, the CPS represents CEO power, which has been found to have a negative effect on the monitoring power of boards (Pathan, 2009), accounting profitability and stock returns (Bebchuk *et al.*, 2011).

In addition, the results show that UVR and institutional shareholding are the next significant non-financial predictors with positive effects. This is in line with the proposition that the potential costs of a dual class structure increase with time, while the potential benefits decrease, which indicates the importance of sunset provisioning (Bebchuk and Kastiel, 2017). Also, institutional shareholders pressurise management to deliver short run performance because they do not internalise the social costs and institutional arrangements of financial institutions' failures (Andreou *et al.*, 2016; Erkens *et al.*, 2012).

The above discussion including the accuracy rates of prediction and the coefficients of the variables indicates that these results accept hypothesis 3. However, similar to the first hypothesis with CAMEL ratios, not all CG variables contribute to the failure prediction.

Table 3.5. Discriminant analysis of CG variables.

	Standardized canonical discriminant function coefficients		
	1	2	3
CPS	0.768***	0.740***	0.820***
UVR	0.235*	0.428**	0.320*
Institutional Ownership	0.552***	0.588***	0.618**
Model Statistics			
No. of failed banks	99	101	96
No. of non-failed banks	99	101	96
Eigenvalue	0.111	0.136	0.111
Canonical Correlation	0.316	0.346	0.316
Chi-square	20.449	25.241	19.846
Wilk's Lambda Sig	0.000	0.000	0.000
Accuracy %	63.1%	62.4%	64.1%
Classification: % correct - failed	58.6%	55.4%	59.4%
Classification: % correct – non-failed	67.7%	69.3%	68.8%

Note: This table represents the results of Discriminant Analysis, equation (3.2). CG variables lagged by one year before failure in model 1, by two years in model 2, and by three years in model 3. *, **, and *** denote significance at 10%, 5%, and 1% respectively according to Wilk's Lambda. CPS is CEO Pay Slice and UVR is Unequal Voting Rights.

3.4.3. Dataset 3: CAMEL and CG

In this model, the prediction accuracy is investigated using CAMEL ratios with CG variables together. The discriminant function is as follows:

$$D_4 = B_0 + B_1 PTItoE + B_2 ECofNCO + B_3 AperE + B_4 NIEtoTI + B_5 IBEItoA + B_6 REtoTA + B_7 NLLtoD + B_8 GLtoTD + B_9 CPS + B_{10} UVR + B_{11} InstitutionalOwnership \quad (3.3)$$

where D_4 is a discriminant score, B_0 is the constant, B_1 to B_{11} are the coefficients. $PTItoE$, $ECofNCO$, $AperE$, $NIEtoTI$, $IBEItoA$, $REtoTA$, $NLLtoD$, and $GLtoTD$ are the CAMEL ratios. CPS, UVR, and $InstitutionalOwnership$ are the CG variables.

The results of the DA for both the CAMEL ratios with the CG variables are reported in table 3.6. Despite the decrease in the significance of the models, the eigenvalue, canonical correlation, and the chi-square show that the function has a better discriminant ability when combining the CAMEL ratios and the CG variables. Also, the accuracy percentages have increased significantly in comparison to using them individually. For example, the percentage for the three years lagged model has increased to 71.4% (from 60.3% using CAMEL ratios, and 64.1% using CG variables). Another notable finding is that the accuracy of prediction is increasing as the time horizon increases, comparing one and three years before failure. These results show that CG variables not only enhance the accuracy but also extend the time horizon of prediction. This finding accepts hypothesis 2 and confirms the crucial role of CG in assuring the proper functioning of banks, as suggested by the Basel Committee on Banking Supervision (Basel Committee on Banking Supervision, 2015). It also confirms that having a multi-dimensional setting by including different aspects of the bank provides a better prediction of failure (Jones, 2017).

Also, the coefficients and their significance confirm and complement the previous findings using the first and the second datasets. Regarding the CAMEL ratios, the REtoTA shows robust and significant findings across all models, which confirms that failed banks have fewer earnings relative to assets. The models also confirm that the capital structure, assets, and management of banks are not significant predictors, except for PTItoE, which is only significant one year before failure. On the other hand, these models show that liquidity ratios are not significant predictors, in contrast to the results using the first dataset. As for the CG variables, CPS shows robust significance and effects across all models, which confirms that in failed banks CEOs receive a higher percentage of remuneration. In addition, the UVR and institutional

ownership are less significant and have fewer impacts in comparison to the models using the CG variables only.

An additional notable finding is that all variables show robust sings across the different lags. This is an advantage that this model holds in comparison to the first model with CAMEL ratios only, which included variables with different signs across different lags. This implies that adding CG variables as non-financial ratios addresses the issue of omitted variables, while the model that included the CAMEL ratios as financial ratios suffered from this issue.

Table 3.6. Discriminant analysis of CAMEL ratios and CG variables.

	Standardised canonical discriminant function coefficients		
	1	2	3
PTItoE (Capital)	-0.238**	-0.342	0.371
ECOofNCO (Assets)	0.270	-0.297	0.155
AperE (Management)	0.147	-0.120	-0.289
NIEtoTI (Earnings)	0.322	-0.020	-0.194
IBEItoA (Earnings)	-0.029	0.257	-0.755**
REtoTA (Earnings)	-0.262***	-0.285***	-0.405***
NLLtoD (Liquidity)	2.519*	0.228	-0.895
GLtoTD (Liquidity)	-2.248	-0.155	1.114
CPS	0.644***	0.578***	0.435**
UVR	0.072	0.355**	0.308**
InsitutO	0.316**	0.470**	0.448
Model Statistics			
No. of failed banks	70	64	56
No. of non-failed banks	70	64	56
Eigenvalue	0.215	0.182	0.184
Canonical Correlation	0.421	0.392	0.394
Chi-square	25.791	20.118	17.662
Wilk's Lambda Sig.	0.007	0.044	0.090
Accuracy %	67.1%	64.1%	71.4%
Classification: % correct - failed	62.9%	54.7%	67.9%
Classification: % correct – non-failed	71.4%	73.4%	75.0%

Note: This table represents the results of Discriminant Analysis, equation (3.3). CAMEL ratios and CG variables are lagged by one year before failure in model 1, by two years in model 2, and by three years in model 3. *, **, and *** denote significance at 10%, 5%, and 1% respectively according to Wilk's Lambda. PTItoE is Pre-tax income to equity, ECOofNCO is Earnings coverage of net charge-offs, AperE is Assets per employee, NIEtoTI is Non-interest expense to total income, IBEItoA is Income before extraordinary items to assets, REtoTA is Retained earnings to total assets, NLLtoD is Net loans and leases to deposits, CPS is CEO pay slice, and UVR is Unequal voting rights.

3.4.4. Datasets 4 and 5: CAMEL and ISS

In the fourth dataset, ISS scores are used as an alternative measurement of CG, but the variables were not significant, and the accuracy was much lower. This might be due to combining many variables in four indices that are not suitable for the prediction of failure. Therefore, the results are excluded from the study.

Using the fifth dataset, the prediction accuracy is investigated using CAMEL ratios with the four ISS scores. The discriminant function is as follows:

$$D_5 = B_0 + B_1 PTItoE + B_2 ECofNCO + B_3 AperE + B_4 NIEtoTI + B_5 IBEItoA + B_6 REtoTA + B_7 NLLtoD + B_8 GLtoTD + B_9 ISSB + B_{10} ISSS + B_{11} ISSC + B_{12} ISSA \quad (3.4)$$

where D_5 is a discriminant score, B_0 is an estimated constant, B_1 to B_{12} are the estimated coefficients. $PTItoE, ECofNCO, AperE, NIEtoTI, IBEItoA, REtoTA, NLLtoD$, and $GLtoTD$ are the CAMEL ratios. $ISSB, ISSS, ISSC$, and $ISSA$ are the ISS scores that represent CG.

Replacing CG variables with ISS scores shows relatively the same results for the years 2013 to 2018 shown in table 3.7, which again confirms the early predictive power of CG.

Table 3.7. Discriminant analysis of CAMEL ratios and ISS scores.

	Standardized canonical discriminant function coefficients		
	1	2	3
PTItoE (Capital)	0.155	0.004**	0.409
ECOofNCO (Assets)	0.355	-0.393*	0.353
AperE (Management)	0.321	0.337	0.602
NIEtoTI (Earnings)	0.502	0.791**	1.469
IBEItoA (Earnings)	-0.196	0.309	0.503
REtoTA (Earnings)	-0.564**	-0.249**	-0.246
NLLtoD (Liquidity)	2.339*	-1.757**	0.631
GLtoTD (Liquidity)	-1.891*	2.572**	Excluded because of tolerance test failure
ISS Board	-0.203	-0.205	0.579
ISS Shareholders	-.361	0.092	0.535
ISS Compensation	-0.175	0.209	-0.263
ISS Audit	-0.164	0.111	0.101
Model Statistics			
No. of failed banks	60	54	34
No. of non-failed banks	60	54	34
Eigenvalue	0.118	0.226	0.388
Canonical Correlation	0.324	0.429	0.529
Chi-square	12.455	20.390	19.830
Wilk's Lambda Sig.	0.410	0.060	0.048
Accuracy %	60.8%	68.5%	75.0%
Classification: % correct - failed	60.0%	66.7%	73.5%
Classification: % correct – non-failed	61.7%	70.4%	76.5%

Note: This table represents the results of Discriminant Analysis, equation (3.4). CAMEL ratios are lagged by one year before failure in model 1, by two years in model 2, and by three years in model 3. *, **, and *** denote significance at 10%, 5%, and 1% respectively according to Wilk's Lambda. PTItoE is Pre-tax income to equity, ECOofNCO is Earnings coverage of net charge-offs, AperE is Assets per employee, NIEtoTI is Non-interest expense to total income, IBEItoA is Income before extraordinary items to assets, REtoTA is Retained earnings to total assets, and NLLtoD is Net loans and leases to deposits.

3.5. Robustness Test

It is worth mentioning that the compared models include different sizes of paired samples. Thus, the analysis is re-run using the same sample sizes for all models (CAMEL, CG, and CAMEL with CG) to test the robustness of the results. The results of the CG for both the DA and the LR in the section below are relatively similar to the analysis using different sizes of paired samples.

To test the robustness of the results, Logistic Regression (LR) is used to predict the failure of banks using CAMEL ratios and CG variables that were found to have a discriminatory power. The five datasets are run three times where the explanatory variables are lagged for one, two and three years before failure. The model fit for each dataset is measured using the log-likelihood ratio, chi-square, and Pseudo R squared tests.

3.5.1. Dataset 1: CAMEL Ratios

Using LR, this study examines the prediction of bank failure using the eight CAMEL ratios. The relationship between the CAMEL ratios and the bank failure is expressed with the following non-linear function:

$$P(Z_{1i}) = \frac{1}{1+e^{-Z_{1i}}} \tag{3.5}$$

where $P(Z_{1i})$ is the probability that takes the values between 0 and 1.

$$Z_{1i} = B_0 + B_1 PTItoE + B_2 ECofNCO + B_3 AperE + B_4 NIEtoTI + B_5 IBEItoA + B_6 REtoTA + B_7 NLLtoD + B_8 GLtoTD$$

B_0 is a constant, B_1 to B_8 are the coefficients. $PTItoE$, $ECofNCO$, $AperE$, $NIEtoTI$, $IBEItoA$, $REtoTA$, $NLLtoD$, and $GLtoTD$ are the CAMEL ratios.

The results of the LR using the CAMEL ratios are reported in table 3.8. The model statistics show good model fitness across all laggings. The results confirm the findings of the DA. However, the management ratio (AperE) is significant at 10% one year before failure and the liquidity ratios are not significant, contrary to the findings of the DA.

Table 3.8. Logit regression CAMEL ratios.

	Model 1 coefficient	**Model 2 coefficient**	**Model 3 coefficient**
Constant	3.004***	1.095	1.112
	(0.984)	(0.007)	(0.723)
PTItoE (Capital)	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)
ECOofNCO (Assets)	0.000	0.000	-0.002
	(0.001)	(0.000)	(0.001)
AperE (Management)	-0.063*	-0.018	-0.021
	(0.037)	(0.039)	(0.041)
NIEtoTI (Earnings)	-0.020**	-0.004	-0.001
	(0.009)	(0.005)	(0.005)
IBEItoA (Earnings)	0.115	0.052	0.184
	(0.094)	(0.084)	(0.112)
REtoTA (Earnings)	0.041**	0.060***	0.050**
	(0.020)	(0.019)	(0.022)
NLLtoD (Liquidity)	-0.009	0.111	0.093
	(0.084)	(0.083)	(0.103)
GLtoTD (Liquidity)	-0.010	-0.123	-0.107
	(0.084)	(0.677)	(0.103)
Model Statistics			
No. of failed banks	261	242	200
No. of non-failed banks	261	242	200
Log- Likelihood	682.335	645.101	527.986
Chi-square	41.310	25.866	26.531
Pseudo R squared	0.101	0.069	0.086
Prediction Accuracy %	61.5%	60.7%	60.3%
Classification: % correct - failed	59.0%	57.9%	55.5%
Classification: % correct – non-failed	64.0%	63.6%	65.0%

Note: This table represents the results of logistic regression, equation (3.5). CG factors are lagged by one year before failure in model 1, by two years in model 2, and by three years in model 3. Standard errors are provided in parentheses. *, **, and *** denote significance at 10%, 5%, and 1% respectively. The predicted probability is for non-failed banks. PTItoE is Pre-tax income to equity, ECOofNCO is Earnings coverage of net charge-offs, AperE is Assets per employee, NIEtoTI is Non-interest expense to total income, IBEItoA is Income before extraordinary items to assets, REtoTA is Retained earnings to total assets, and NLLtoD is Net loans and leases to deposits.

3.5.2. Dataset 2: CG Variables

In this model, the prediction of bank failure is examined using the three CG variables. The relationship between the CG variables and the bank failure is expressed with the following non-linear function:

$$P(Z_{2i}) = \frac{1}{1+e^{-Z_{2i}}} \tag{3.6}$$

where $P(Z_{2i})$ is the probability that takes the values between 0 and 1.

$$Z_{2i} = B_0 + B_1 CPS + B_2 UVR + B_3 InstitutO$$

where B_0 is a constant, B_1 to B_3 are the coefficients. CPS, UVR, and $InstitutO$ are the CG variables. The results of the LR using CG variables are reported in table 3.9. These models show better Pseudo R squared and accuracy rates compared to the LR using the CAMEL ratios. Consistent with the DA findings, the results show that CPS and Institutional Ownership are the CG variables with the most predictive powers, followed by UVR, which shows lower significance.

Table 3.9. Logit regression CG variables.

	Model 1 coefficient	**Model 2 coefficient**	**Model 3 coefficient**
Constant	2.069***	2.393***	0.790
	(0.535)	(0.589)	(1.268)
CPS	-0.033***	-0.037***	-0.034***
	(0.010)	(0.011)	(0.010)
UVR	-1.151	-21.029	1.407
	(1.135)	(17527.205)	(1.126)
Institutional Ownership	-0.012***	-0.015***	-0.014***
	(0.005)	(0.005)	(0.005)
Model Statistics			
No. of failed banks	99	101	96
No. of non-failed banks	99	101	96
Log- Likelihood	253.160	252.340	245.628
Chi-square	21.327	27.692	20.540
Pseudo R squared	0.136	0.171	0.135
Prediction Accuracy %	63.6%	62.9%	63.5%
Classification: % correct - failed	59.6%	57.4%	60.4%
Classification: % correct – non-failed	67.7%	68.3%	66.7%

Note: This table represents the results of logistic regression, equation (3.6). CG factors are lagged by one year before failure in model 1, by two years in model 2, and by three years in model 3. Standard errors are provided in parentheses. *, **, and *** denote significance at 10%, 5%, and 1% respectively. The predicted probability is for non-failed banks. CPS is CEO Pay Slice and UVR is Unequal Voting Rights.

3.5.3. Dataset 3: CAMEL and CG

In this logit model, bank failure is predicted using CAMEL ratios with CG variables. The relationship between CAMEL with CG and the bank failure is expressed with the following non-linear function:

$$P(Z_{4i}) = \frac{1}{1+e^{-Z_{4i}}} \tag{3.7}$$

where $P(Z_{4i})$ is the probability that takes the values between 0 and 1.

$$Z_{4i} = B_0 + B_1 PTItoE + B_2 ECofNCO + B_3 AperE + B_4 NIEtoTI + B_5 IBEItoA + B_6 REtoTA + B_7 NLLtoD + B_8 GLtoTD + B_9 CPS + B_{10} UVR + B_{11} InstitutO$$

where B_0 is a constant, B_1 to B_{11} are the coefficients. $PTItoE$, $ECofNCO$, $AperE$, $NIEtoTI$, $IBEItoA$, $REtoTA$, $NLLtoD$, and $GLtoTD$ are the CAMEL ratios. CPS, UVR, and $InstitutO$ are the CG variables.

The results of combining the CAMEL ratios with the CG variables are reported in table 3.10. The Pseudo R squared increased dramatically in these models compared to the LR using the first and the second datasets. Also, the prediction accuracy and the significance of the ratios and variables confirm the DA results.

Table 3.10. Logit regression CAMEL and CG variables.

	Model 1 coefficient	**Model 2 coefficient**	**Model 3 coefficient**
Constant	5.028*	2.551	0.554
	(3.074)	(2.485)	(3.057)
PTItoE (Capital)	0.040	0.084	-0.028
	(0.051)	(0.064)	(0.036)
ECOofNCO (Assets)	-0.003	0.002	-0.005
	(0.002)	(0.002)	(0.010)
AperE (Management)	-0.037	0.006	0.093
	(0.007)	(0.084)	(0.110)
NIEtoTI (Earnings)	-0.026	-0.008	0.012
	(0.025)	(0.022)	(0.027)
IBEItoA (Earnings)	0.080	-0.807	1.170
	(0.349)	(0.668)	(0.895)
REtoTA (Earnings)	0.056	-0.059	0.065
	(0.048)	(0.046)	(0.053)
NLLtoD (Liquidity)	-0.172	-0.021	0.058
	(0.193)	(0.183)	(0.161)
GLtoTD (Liquidity)	0.152	0.017	-0.069
	(0.192)	(0.180)	(0.158)
CPS	-0.040***	-0.034**	-0.026*
	(0.014)	(0.015)	(0.016)
UVR	-0.346	-20.624	-20.262
	(1.232)	(19566.337)	(19955.441)
Institutional Ownership	-0.010	-0.013	-0.013
	(0.008)	(0.008)	(0.009)
Model Statistics			
No. of failed banks	70	64	56
No. of non-failed banks	70	64	56
Log- Likelihood	166.286	153.283	134.866
Chi-square	27.796	24.163	20.399
Pseudo R squared	0.240	0.229	0.222
Prediction Accuracy %	67.1%	65.6%	70.5%
Classification: % correct - failed	61.4%	56.3%	67.9%
Classification: % correct – non-failed	72.9%	75.0%	73.2%

Note: This table represents the results of logistic regression, equation (3.7). CAMEL and CG factors are lagged by one year before failure in model 1, by two years in model 2, and by three years in model 3. Standard errors are provided in parentheses. *, **, and *** denote significance at 10%, 5%, and 1% respectively. The predicted probability is for non-failed banks. PTItoE is Pre-tax income to equity, ECOofNCO is Earnings coverage of net charge-offs, AperE is Assets per employee, NIEtoTI is Non-interest expense to total income, IBEItoA is Income before extraordinary items to assets, REtoTA is Retained earnings to total assets, NLLtoD is Net loans and leases to deposits, CPS is CEO pay slice, and UVR is unequal voting rights.

3.5.4. Datasets 4 and 5: CAMEL and ISS

For the same reasons as the DA, the results of the LR using the fourth dataset are excluded. Using the fifth dataset, the four ISS scores are added to the CAMEL ratios to examine the accuracy of predicting bank failure. The relationship between the CAMEL ratios with the ISS scores and the bank failure is expressed with the following non-linear function:

$$P(Z_{5i}) = \frac{1}{1+e^{-Z_{5i}}} \tag{3.8}$$

where $P(Z_{5i})$ is the probability that takes the values between 0 and 1.

$$Z_{5i} = B_0 + B_1 PTItoE + B_2 ECofNCO + B_3 AperE + B_4 NIEtoTI + B_5 IBEItoA + B_6 REtoTA + B_7 NLLtoD + B_8 GLtoTD + B_9 ISSB + B_{10} ISSS + B_{11} ISSC + B_{12} ISSA$$

where B_0 is a constant, B_1 to B_{12} are the coefficients. $PTItoE$, $ECofNCO$, $AperE$, $NIEtoTI$, $IBEItoA$, $REtoTA$, $NLLtoD$, and $GLtoTD$ are the CAMEL ratios. $ISSB$, $ISSS$, $ISSC$, and $ISSA$ are the ISS scores that represent CG.

The results of combining the CAMEL ratios with the ISS scores as a replacement for the CG variables are reported in table 3.11. Both the model fitness and accuracy confirm the previous findings.

Overall, the robustness test using the LR confirms the findings of the DA, where adding CG as a non-financial predictor to the financial ratios enhances the accuracy of failure prediction and extends the time horizon. These results are in line with the proposition that failure prediction can be improved by using a multi-dimensional setting. The robustness test also confirms that earnings and liquidity are the most significant aspects in CAMEL, while CPS and institutional shareholding are the most significant in CG.

Table 3.11. Logit regression CAMEL and ISS scores.

	Model 1 coefficient	**Model 2 coefficient**	**Model 3 coefficient**
Constant	2.671	11.022***	20.669***
	(3.498)	(4.301)	(7.074)
PTItoE (Capital)	0.031	0.027	-0.098
	(0.060)	(0.076)	(0.160)
ECOofNCO (Assets)	-0.002	0.002	-0.016
	(0.002)	(0.002)	(0.013)
AperE (Management)	-0.079	-0.135	-0.273*
	(0.078)	(0.093)	(0.174)
NIEtoTI (Earnings)	-0.022	-0.072**	-0.154***
	(0.028)	(0.034)	(0.061)
IBEItoA (Earnings)	0.287	-1.080	-1.664
	(0.537)	(1.077)	(2.594)
REtoTA (Earnings)	-0.081*	0.070	0.071
	(0.055)	(0.065)	(0.075)
NLLtoD (Liquidity)	-0.133	0.115	-0.054**
	(0.169)	(0.227)	(0.026)
GLtoTD (Liquidity)	0.112	-0.173	Excluded
	(0.169)	(0.225)	
ISS Board	0.046	0.080	-0.292**
	(0.093)	(0.105)	(0.147)
ISS Shareholders	-0.080	-0.029	-0.197*
	(0.076)	(0.079)	(0.111)
ISS Compensation	0.042	-0.080	0.120
	(0.087)	(0.092)	(0.128)
ISS Audit	0.058	-0.081	-0.081
	(0.111)	(0.129)	(0.182)
Model Statistics			
No. of failed banks	60	54	34
No. of non-failed banks	60	54	34
Log- Likelihood	151.581	125.630	71.061
Chi-square	14.775	24.090	23.207
Pseudo R squared	0.154	0.267	0.386
Prediction Accuracy %	64.2%	69.4%	77.9%
Classification: % correct - failed	63.3%	70.4%	82.4%
Classification: % correct – non-failed	65.0%	68.5%	73.5%

Note: This table represents the results of logistic regression, equation (3.8). CAMEL factors and ISS scores are lagged by one year before failure in model 1, by two years in model 2, and by three years in model 3. Standard errors are provided in parentheses. *, **, and *** denote significance at 10%, 5%, and 1% respectively. The predicted probability is for non-failed banks. PTItoE is Pre-tax income to equity, ECOofNCO is Earnings coverage of net charge-offs, AperE is Assets per employee, NIEtoTI is Non-interest expense to total income, IBEItoA is Income before extraordinary items to assets, REtoTA is Retained earnings to total assets, and NLLtoD is Net loans and leases to deposits.

3.6. Additional Analysis

The DA of combining both CAMEL ratios and CG variables showed the best performance in terms of prediction accuracy. To contend that the bank failure prediction models with CG variables outperform the ones without CG variables, an out of sample prediction examination is conducted. The whole sample period (2010-2018) is divided into two subperiods. The sample of the earlier subperiod (2010-2016) is used to create the in-sample dataset and develop the prediction model. The second subperiod (2017-2018) is used to create the out of sample dataset and examine the prediction accuracy by employing the developed prediction model based on the in-sample dataset.

In constructing the in and out samples which represent the training and testing samples respectively, it is taken into account the need for a large training sample in order to provide accurate prediction (Alaka *et al.*, 2018). Therefore, the last two years of the full period were chosen as the test samples following López Iturriaga and Sanz (2015). For one year before failure, the in-sample which represents the training sample consists of 104 banks (52 failed and 52 non-failed) and the out of sample which represents the test sample consists of 30 banks (15 failed and 15 non-failed). For two years before failure, the training sample consists of 96 banks (48 failed and 48 non-failed) firms and the test sample consists of 28 banks (14 failed and 14 non-failed). Finally, for three years before failure, the training sample consists of 76 banks (38 failed and 38 non-failed) firms and the test sample consists of 22 banks (11 failed and 11 non-failed)

The in-sample results are shown in table 3.12. The table provides the development of the prediction model based on the earlier subperiod. The results are similar to the main analysis findings shown in table 3.6, where the model shows that CG variables not only enhance the accuracy but also extend the time horizon of prediction to three years before failure. To examine the validity of this prediction model that includes eight CAMEL ratios and three CG variables, this model is employed on a new dataset that it has not been trained on, which is the latest subperiod that represents the out of sample dataset.

The out of sample results shown in table 3.13 indicates that the combination of CAMEL ratios and CG variables identifies a high number of failures. Therefore, the out of sample analysis confirm that the prediction model has a good predictive ability. It also confirms that adding CG variables to the model increases the prediction accuracy as the time horizon extends to three years (71.1% accuracy for three years before failure in comparison to 61.3% for one year before failure).

Table 3.12. The prediction model development.

	Standardised canonical discriminant function coefficients		
	1	2	3
PTItoE (Capital)	-0.004	-0.361	0.417
ECOofNCO (Assets)	0.029	-0.310	-0.015
AperE (Management)	0.101	-0.116	-0.167
NIEtoTI (Earnings)	0.439	-0.221	-0.077
IBEItoA (Earnings)	-0.096	0.283	-0.645**
REtoTA (Earnings)	-0.247**	-0.351**	-0.400**
NLLtoD (Liquidity)	0.365	7.026	4.244
GLtoTD (Liquidity)	0.342	-6.981	-4.077
CPS	0.716***	0.665***	0.607***
UVR	0.068	0.372*	0.313*
InsitutO	0.316**	0.196	0.215
Model Statistics			
No. of failed banks	52	48	38
No. of non-failed banks	52	48	38
Eigenvalue	0.240	0.225	0.257
Canonical Correlation	0.440	0.429	0.453
Chi-square	20.670	17.984	15.694
Wilk's Lambda Sig.	0.024	0.082	0.053
Accuracy %	67.0%	63.5%	71.1%
Classification: % correct - failed	60.8%	52.1%	60.5%
Classification: % correct – non-failed	73.1%	75.0%	81.6%

Note: This table represents the results of Discriminant Analysis using the first subperiod (2010-2016) to develop the prediction model. CAMEL ratios and CG variables are lagged by one year before failure in model 1, by two years in model 2, and by three years in model 3. *, **, and *** denote significance at 10%, 5%, and 1% respectively according to Wilk's Lambda. PTItoE is Pre-tax income to equity, ECOofNCO is Earnings coverage of net charge-offs, AperE is Assets per employee, NIEtoTI is Non-interest expense to total income, IBEItoA is Income before extraordinary items to assets, REtoTA is Retained earnings to total assets, NLLtoD is Net loans and leases to deposits, CPS is CEO pay slice, and UVR is Unequal Voting Rights.

Table 3.13. Out of sample examination.

	1	**2**	**3**
Accuracy %	61.3%	66.7%	72.4%
% Accuracy - failed	73.7%	75.0%	72.2%
% Accuracy – Non-failed	41.7%	54.6%	72.7%
No. of failed banks	15	14	11
No. of non-failed banks	15	14	11

Note: This table represents the accuracy rates of applying the earlier developed prediction model on the second subperiod (2017-2018). The first column shows the accuracy rates for failure prediction one year before failure, the second column is two years before failure, and the third column is three years before failure.

3.7. Conclusion

This study shows that adding CG variables (as non-financial predictors) to the traditional financial ratios not only enhances the accuracy of bank failure but also extends the time horizon of bank failure prediction. These findings imply that incorporating different aspects will give a better view of the bank's condition and hence improve the prediction accuracy. By combining financial and non-financial variables, this paper was able to not only prevent the accuracy rates from dropping dramatically but also, in some cases, improve them. Other studies suffered from decreasing accuracies as the time horizon of prediction increases using only financial ratios (du Jardin, 2017).

Furthermore, the study includes a Mann-Whitney test which identifies variables with significant discriminatory power. The test shows that board characteristics and most compensation characteristics have no discriminatory power. Then, DA and LR are employed with five datasets to compare prediction models that include CG variables and other models that don't. The results show that the earnings followed by the liquidity are the key determinants of bank failure, but capital, assets, and management are insignificant in failure prediction. In addition, the models with added CG variables have better prediction accuracies that increase up to three years before failure. These models also show that the CPS, UVR and institutional ownership structure serve as significant predictors of bank failure.

Also, the results show an additional advantage of adding non-financial variables to the financial ratios, which is accounting for omitted variables that the model with financial ratios only suffered from. These results are robust to the out of sample examination which confirms the validity of the prediction model.

3.7.1. Research Implications

This study has significant implications for shareholders, stakeholders, and regulators, where it provides guidelines related to the success of banks to predict failures and prevent them from happening. It shows that CG variables and the earnings of banks serve as strong predictors of bank failure. These findings provide important signals of bank failure that could serve in preventing future failures. The regulatory implications of this study suggest that regulators should pay more attention to the CG and earnings aspects of banks and not direct the entire focus on capital structure.

3.7.2. Research Limitations

The main limitation of this study is that it is performed on banks only and excluded other non-bank financial institutions. The non-bank financial institutions were excluded because the CAMEL ratios that were extracted from FDIC database were available to banks only. Also, the existing studies on bank failure showed that CAMEL ratios were the most suitable for prediction. However, there were no studies that showed such evidence for non-bank financial institutions.

Another limitation that this study along with the other ones suffered from which is data availability. First, an international sample could have been deployed. Second, the full CAMELS rating system which includes six parts could have been used by including the sensitivity to market part.

3.7.3. Further Research Areas

The first area in which research could go further is deploying the full parts of the CAMELS rating system including the sensitivity to market which was excluded due to lack of data availability. This would contribute to showing a larger image of the bank's condition and thus result in better prediction accuracies. Finally, other opportunities for this study include the utilisation of machine learning methodologies and including non-bank financial institutions for failure prediction.

4

Chapter 4: The Effect of Institutional Ownership on Corporate Governance Quality in Financial Institutions

Abstract

Institutional ownership is a significant characteristic of CG for financial institutions because institutional investors are the main players in financial markets. This study uses a two-steps system Generlazied Methods of Moments with an unbalanced sample of US financial institutions for the period from 2013 to 2018 to study the effect of institutional ownership on the governance score and sub-scores developed by Institutional Shareholder Services. The findings show that there is a high negative impact on the main score, shareholder's rights, and compensation structure. The negative impact on shareholders rights implies that institutional shareholders in financial institutions, who have the advantage of industry-specific knowledge, do not exercise their monitoring power effectively but exercise it to benefit at the expense of minority shareholders. This results in a principal-principal agency conflict with leads to a lower governance score.

On the other hand, the results show that while institutional ownership percentage has a negative effect on CG, the change of ownership has a positive effect on the governance score. To investigate this matter, the study includes both graphs and additional analysis in which the governance score is divided into high and low scores. The findings show that institutional ownership has a U-shaped effect on governance scores, where it has a negative effect on institutions with low scores, but a positive effect on institutions with high scores. This implies that institutions with high quality of governance have strong shareholders rights and are able to reduce the agency costs caused by controlling shareholders, hence resulting in a higher governance score.

Keywords: Corporate governance, Institutional ownership, Generalized methods of moments.

4.1. Introduction

The green report of the European Commission showed that financial institutions that failed during the crisis were mainly owned by institutional shareholders (European Commission, 2010). One of the very important aspects of CG is institutional ownership. Studies show that the presence of institutional investors is beneficial to the quality of CG. This benefit stems from their monitoring power and their aims to increase firm value. Their monitoring power also helps in mitigating agency problems (Choi *et al.*, 2020; Hartzell and Starks, 2003; Huddart, 1993). However, these studies were conducted on non-financial firms.

Previous studies have examined the effect of institutional ownership on firm performance (Guo and Platikanov, 2019; Sakawa and Watanabel, 2020), and other studies examined the effect of CG on institutional shareholders' preferences (Bushee *et al.*, 2014; Chung and Zhang, 2011; McCahery *et al.*, 2016). However, little has been done to examine the effect of institutional ownership on the quality of CG and its mechanisms in financial institutions.

This study examines the effect of institutional ownership on the quality of CG in financial institutions. It also examines the agency conflict where institutional shareholders as controlling shareholders are higher in financial institutions compared to the other sectors. To do so, the study examines the effect of the percentage of institutional ownership on the governance quality score developed by the ISS. Therefore, this study contributes to the literature by examining the financial sector in which very little has been done to study the effect of institutional ownership on the quality of CG.

This study includes a two-step system Generalized Methods of Moments (GMM) with an unbalanced sample of US financial institutions for the period from 2013 to 2018 to study the effect of the percentage change of institutional ownership on ISS governance score and sub-scores. This method addresses several issues including heterogeneity and endogeneity. It also eliminates the impact of time-invariant variables by instrumenting the lagged values of the dependent variable.

The results show that institutional ownership has a significant and negative effect on the main score of CG, shareholders rights and compensation structure. This implies that institutions use their power as large and controlling shareholders to benefit at the expense of minority shareholders, which eventually leads to reducing the quality of CG. These findings are confirmed using two robustness checks.

However, the results also show that while institutional ownership has a negative effect on governance score, the increase of ownership in comparison to the previous year has a positive effect. This implies that institutional ownership has a U-shaped relationship with governance. To further investigate this matter, graphs of the regression are included to showcase the relationship and re-run the GMM by separating institutions with high governance scores and low governance scores. The results of both analyses confirm the U-shape relationship, which indicates that high institutional ownership is not beneficial for financial institutions with low governance score, but is recommended for institutions with high scores. In addition, the study includes an additional analysis which shows that institutional ownership of banks has a more significant effect on board structure than the non-bank financial institutions.

The remainder of the chapter is organized as follows. Section 2 reviews related literature. Section 3 discusses the methodology, sample, and variables. Section 4 discusses the empirical models and results. Section 5 represents the robustness tests. Section 6 represents the additional analysis. Final, section 5 concludes.

4.2. Literature Review and Hypotheses Development

Institutional ownership is a key component of CG. However, many important issues related to the institutional environment remain unexplored despite their importance (Kumar and Zattoni, 2018). The main importance of studying CG and the institutional environment stems from their contribution to alleviating the agency problems associated with listed firms (Aslan and Kumar, 2014; Kumar and Zattoni, 2018; Schiehll *et al.*, 2014). Also, the number of institutional shareholdings in recent decades has grown rapidly due to financial globalization, which further highlights the importance of studying institutional ownership (Hartzell and Starks, 2003; Sakawa and Watanabel, 2020).

The most important role of institutional investors is their monitoring role which helps in reducing the agency problem. Choi *et al.*(2020) examined the relationships between institutional ownership and capital structure. They found that the level of debt decreased when the level of institutional ownership increased. This result implies that institutional investors help to reduce agency costs by substituting for the external debt monitoring role. Also, The monitoring power of institutional investors enables them to play increasingly important roles in corporate management (Choi *et al.*, 2020). Their monitoring power stems from their motivation to monitor corporate management because they benefit from monitoring by increasing firm value. The institutional shareholders exercise their monitoring power with the

aim to increase firm value (Huddart, 1993). Hartzell and Starks (2003) show that institutional ownership serves a monitoring role in mitigating the agency problem.

In addition, Sakawa and Watanabel (2020) found that the monitoring role of institutional shareholders functions effectively in Japanese corporations. They also show that institutional shareholders play an important role in enhancing firm performance and CG mechanisms. Also, McCahery *et al.* (2016) found that the investor horizon is an important aspect, where long term investors intervene more intensively than short term investors. This implies that the long term orientation of institutional investors provides them with stronger incentives to monitor.

Guo and Platikanov (2019) found that institutional ownership has a positive association with firm performance in China. They also found that this association enhanced after 2005 when the legal and institutional foundation of the capital markets in China has strengthened. They believe that this significant change suggests that the external legal and CG environment is important to enhance the monitoring role of institutional investors.

4.2.1 Institutional Ownership and CG

Researchers found that a small number of institutional investors can play a significant role in the quality of CG (Bushee *et al.*, 2014; Gillan and Starks, 2003). Aggarwal *et al.* (2011) found that institutional ownership leads to strong CG and firms with higher institutional ownership are more likely to terminate poorly performing CEO. They also show that institutional investors encourage good CG in their international portfolio.

However, Bushee *et al.* (2014) found that institutional investors prefer an alternative approach which is to invest in firms with existing good governance mechanisms. Similarly, Chung and Zhang (2011) found that shares held by institutions increase with the quality of governance. In addition, surveys by McCahery *et al.* (2016) and McKinsey and Company (2000) showed that institutional investors perceive CG as important as the financial indicators in evaluating investment decisions.

Institutional shareholders invest in a firm with good CG for at least three reasons: first, reducing monitoring costs (Bushee and Noe, 2000; Chung and Zhang, 2011). Second, decrease the risk of undiversified investments (Bushee *et al.*, 2014). Third, better transparency of disclosure (McCahery *et al.*, 2016).

Researchers believe that there are two ways in which institutional investors can exercise their monitoring role and affect CG. The first is a direct intervention which has the benefit of correcting managerial actions. Large shareholders (including institutional investors) have more

incentive to be involved in direct monitoring activities (McCahery *et al.*, 2016). Second, they can express their dissatisfaction with managerial behaviour by exercising the exit threat and selling their shares (Gillan and Starks, 2003; McCahery *et al.*, 2016). This gives institutions the benefit of disciplining the management. Therefore, institutional investors are believed to be able to improve CG practices and maintain the interests of shareholders in firms with low CG quality.

In addition, institutional shareholders (as large shareholders) might exercise their power at the expense of minority shareholders. The early literature on ownership concentration and CG focused on controlling shareholders and minority shareholders (Shleifer and Vishny, 1986). Previous studies that focused on the effect of large and controlling shareholders on tunnelling activities and leverage decisions include Buchuk *et al.* (2014), Liu and Tian (2012) and Qian and Yeung (2015). These studies found that firms with concentrated ownership give excess control rights to controlling shareholders, who in turn use high leverage to gain their own benefits from resources and facilitate tunnelling. On the other hand, Zhang *et al.* (2017) investigate how the trading activities of foreign institutional investors affect the tunnelling activities of controlling shareholders. They find an inverted U-shaped relationship between foreign institutional investors and tunnelling. Although large trading by institutional investors provides the market discipline to management which limits tunnelling, they may use their private knowledge to gain trading profit at the expense of uninformed investors and indirectly support tunnelling, which is the cause of the U-shape relationship. However, Solarino and Boyd (2020) find that institutional investors can mitigate the tunnelling activities in concentrated ownership.

On the other hand, Barroso Casado *et al.* (2016) examine the effect of the presence of more than one large shareholder. They find that having several large shareholders result in higher shareholder protection. Also, Lagasio (2018) study the CG of banks and find that controlling shareholders enhance the performance of banks.

4.2.2. Institutional Ownership of Financial Institutions

Financial institutions differ from nonfinancial firms because of the differences in regulation, the complexity of business, capital structure, and complexity of structure (de Haan and Vlahu, 2016). Also, the ownership structures and other governance characteristics differ in financial institutions in comparison to other industries.

Institutional investors are the main players in financial markets and thus play a significant role in the CG of financial institutions (Gillan and Starks, 2003). Erkens *et al.* (2012)

show that US financial institutions tend to have higher institutional ownership compared to European financial institutions. They also find that financial institutions with more institutional ownership took more risk before the crisis and suffered from larger losses during the crisis. Also, the green paper by the European Commission shows the same evidence in banks (European Commission, 2010). In addition, Dupire and Slagmulder (2019) find that financial institutions with powerful owners have a lower chief risk officer presence and lower risk committee presence.

The main benefit of institutional investors in the financial industry is that they have more industry specific knowledge than other shareholders. This information advantage enables low cost and effective monitoring (Sakawa and Watanabel, 2020). Gillan and Starks (2003) confirm that the lower monitoring cost caused by the presence of institutional investors result in better monitoring of managers. However, to the best of the author's knowledge, there are no existing studies that examine the effect of institutional ownership on the quality of corporate governance in financial institutions, despite their important role in this sector.

4.2.3. Principal-Principal Agency Conflict

The principal-agent conflict rises from the separation of management and owners (Fama and Jensen, 1983; Jensen and Meckling, 1976; Shleifer and Vishny, 1997). However, Ducassy and Guyot (2017) find that the usual principal-agency theory is debatable when the legal framework offers little protection of minority shareholders, and when the ownership structure is complex and heterogeneous in nature.

Institutional investors in financial institutions in specific have an advantage over the other types of investors, which is the industry-specific knowledge. Institutional shareholders being well informed investors might take advantage of less informed investors. This results in a different type of agency conflict which is the principal-principal agency conflict. This agency problem is the cause of conflict of interests between controlling and minority shareholders which has a potential negative impact on firm performance (Aslan and Kumar, 2012; Kumar and Zattoni, 2015).

The discussion above about institutional ownership and CG in financial institutions ultimately lead to the formulation of the following research hypothesis:

Hypothesis: Institutional ownership has a negative effect on CG in financial institutions.

4.3. Research Methodology

4.3.1. Methodology

To address the aims and objectives of this study, the techniques adopted include system GMM and linear regression. The GMM is a dynamic panel approach that introduces temporal dependency by lagging the dependent variable. The advantage that this estimator holds over other methods is that it addresses several issues including heterogeneity by having two equations that each one adopts instrumental variables to remove the correlation between explanatory variables and residuals. In addition, Wintoki *et al.* (2012) argue that system GMM is used in governance research because it accounts for endogeneity issues. GMM addresses endogeneity by drawing instrumental variables from the data itself, and eliminates the impact of time-invariant variables by instrumenting the lagged values of the dependent variable (Akbar *et al.*, 2017; Altunbas *et al.*, 2018; Pucheta-Martínez and Chiva-Ortells, 2019; Saeed *et al.*, 2019; Zona *et al.*, 2015). Finally, another technique that is used in this study as a robustness test is linear regression. Roodman (2009) suggest using alternative traditional estimators to get the best specifications for system GMM.

4.3.2 Sample

The data covers the period from 2013 to 2018. It includes publicly listed financial institutions in US markets. The data was collected from Bloomberg. The selection of financial institutions is based on the GICS, which includes banks, insurance, and diversified financial companies.

4.3.3. Corporate Governance Quality Score

The CG in this study is represented by the governance scores created by the ISS and the four sub-scores (Board, Audit, Shareholders and Compensation). The main governance score is assigned by ISS to the institution's governance practices and it ranges from 1 to 10. The main score is divided into four sub-scores which are: Board which represents the structure of the board of director, Audit which represents the audit process, Shareholders which represents the shareholder rights at the institution, and Compensation which represent the compensation practices. More details of all variables used in the analysis are included in Appendix F.

4.3.4 Institutional Ownership

The ownership of institutions is measured as the percentage of shares outstanding held by institutions in relation to the total shares outstanding. Other variables are included to represent institutional ownership which are the percentage change of ownership in comparison

to the last period, and the percentage ratio of float shares held by institutions to the number of float shares outstanding.

In addition, the study includes a variable to capture the controlling power of institutional ownership, which considered a shareholder as controlling when the ownership exceeds 20%. However, the descriptive statistics showed that 97% of institutional shareholders were controlling shareholders, and thus it was eliminated from the analysis.

4.3.5. Control Variables

The study includes various control variables drawn from the literature on institutional ownership. The most commonly used control variable is the firm size and leverage to capture firm characteristics. Other control variables are relevant and common to institutional ownership, which are sales growth, ROA, firm age, M-to-B ratio, and board size. This study includes three control variables which are leverage, sales growth, and M-to-B ratio. These variables are the most suitable according to the descriptive statistics and Pearson correlation. The other control variables (firm size, ROA, firm age, and board size) were excluded from the analysis because including them in the analysis decreased the model fitness.

In addition, the study includes year and industry fixed effects in the regressions. Also, the results of the Hausman test show that random effects do not apply to the data. The industry fixed effects were included to account for potential endogeneity.

4.3.6. Descriptive Statistics

The descriptive statistics of the variables used in the analysis are provided in table 4.1. All variables are winsorised at the 1% level on both sides of the distribution to account for outliers and to avoid spurious inferences. The table shows that all ISS scores (ranging from 1 to 10) have a mean average of around 5, except for the ISS score of audit practices which has an average score of 2. This suggests that US financial institutions suffer from relatively low scores of audit practices.

On average, the percentage of institutional ownership in financial institutions is 70.71%. This implies that most financial institutions own more than 50%, which confirms the proposition that they are mostly large and controlling shareholders. In respect to other variables, the percentage change of institutional ownership averages a 4% increase each year, and the percentage of float shares held by institutions averages 75% to total float shares. Appendix G includes the Pearson correlations for all the variables.

Table 4.1. Descriptive statistics.

	N	Min	Max	Mean	Std. Deviation	P25	P50	P75
ISS Gove	2103	1	10	5.42	2.703	3.00	5.00	8.00
ISS Shareholder	2103	1	10	5.37	2.880	3.00	5.00	8.00
ISS Board	2103	1	10	5.83	2.803	4.00	6.00	8.00
ISS Audit	2103	1	10	2.09	2.370	1.00	1.00	2.00
ISS Compensation	2103	1	10	5.25	2.912	3.00	5.00	8.00
Institutional Ownership	2103	0.55	100	70.71	24.028	53.98	74.47	90.91
Float Shares	2103	1.20	100	75.15	23.701	61.17	79.38	96.66
Ownership change	2103	-18.30	172.52	4.17	16.172	-0.79	1.05	4.34
Leverage	2103	.00	91.24	18.92	22.163	4.64	9.98	22.87
M-to-B	2103	-3.35	18.20	1.825	2.089	1.01	1.38	1.83
Sales Growth	2103	-73.09	346.78	11.984	34.014	0.58	6.88	15.64
Valid N (listwise)	2101							

Note: Definitions and sources of all variables are detailed in Appendix F. P25 refer to the 25th percentile, P50 to the 50th percentile, and P75 to the 75th percentile.

4.4. Empirical Models and Results

The study includes a two-steps system GMM to study the effect of the percentage change of institutional ownership on ISS governance score and sub-scores. Studies that used GMM to study institutional ownership include (Choi *et al.*, 2020; Pucheta-Martínez and Chiva-Ortells, 2019).

The study includes an unbalanced sample, therefore, system GMM is applied instead of difference GMM. Difference GMM subtracts the previous observation from the contemporaneous one thereby magnifying gaps in an unbalanced panel. Difference GMM was developed by Arellano and Bond (1991) and later improved to a system GMM by Arellano and Bover (1995) and Blundell and Bond (1998). System GMM uses orthogonal deviations. Instead of subtracting observations from the contemporaneous one, it subtracts the average of all future available observations of a variable, no matter how many gaps in is computable for all observations except the last for each individual, so it minimizes data loss.

The diagnostic tests employed to study the success of the GMM estimator in producing unbiased, consistent and efficient results include the Wald 2 test which shows the model fitness, the Arellano-Bond test AR (2) which shows whether a second-order serial correlation exists,

and the Hansen test of over identifying restrictions which examines the appropriateness of the employed instrumental variable.

The following model is estimated using a two-steps system GMM:

$$ISSGove_{i,t} = \beta_0 + \beta_1 InstitutionalOwnership_{i,t} + \beta_2 OwnershipChange_{i,t} + \beta_3 FloatShares_{i,t} + \beta_4 Leverage_{i,t} + \beta_5 SalesGrowth_{i,t} + \beta_6 MtoB_{i,t} + \gamma_t + \delta_i + \epsilon_{i,t} \quad (4.1)$$

Where $ISSGove_{i,t}$ is either the main governance score developed by ISS or one of the four sub-scores (Board structure, shareholder rights, audit practices and compensation structure). $InstitutionalOwnership_{i,t}$ is the institutional ownership percentage, $OwnershipChange$ is the percentage of the change in ownership in comparison to the previous period, and $FloatShares$ is the percentage of float shares held by institutions. $Leverage_{i,t}$, $SalesGrowth_{i,t}$, and $MtoB_{i,t}$ are the control variables. γ_t is the year fixed effect, δ_i is the industry fixed effect, and $\epsilon_{i,t}$ is the error term. The industry and year fixed effects are included to address endogeneity.

Table 4.2 reports the estimation results for the system GMM that studies the effect of institutional ownership on the main ISS score and four sub-scores. The results include three tests to check the validity and reliability of the GMM models. The Wald test statistics for all models are significant (P-value less than 0.001 level), which provides evidence that all explanatory variables included in the models are significant. The AR (2) tests of autocorrelation assess the validity of the lagged instruments. The results show that the AR (2) statistics are not significant in any model, which shows that there is no second-order serial correlation. Furthermore, the insignificant results of the Hansen test of over identification indicate that the instruments used in the analysis are valid. Overall, these tests support the validity and reliability of the instruments in the models and confirm the model fitness.

The results show that the level of institutional ownership is negatively and significantly related to the main ISS score that represents the quality of CG. This result accepts the research hypothesis. This implies that institutional investors of financial institutions do not play their monitoring role effectively. This finding is not in line with findings of some studies which show that institutional investors' monitoring power help in reducing agency costs (Choi *et al.*, 2020; Hartzell and Starks, 2003; Huddart, 1993). However, it is worth mentioning that these studies were conducted on non-financial firms. On the other hand, the evidence of this study supports the other studies conducted on financial institutions, which show that institutions with more

institutional ownership suffered the most during the crisis (Erkens *et al.*, 2012; European Commission, 2010). This might be justified by the institutional shareholders' behaviour in pressurising management to deliver short run performance (Andreou *et al.*, 2016; Erkens *et al.*, 2012).

When categorizing the governance score into four sub-scores that represent shareholders rights, board structure, audit practices and compensation structure, it becomes obvious that the significant negative coefficient of the main score is due primarily to the significantly negative effect that institutional investors have on shareholders rights. This might be a result of the institutions exercising their power as large shareholders at the expense of minority shareholders by performing tunnelling activities. Also, institutions are well informed investors of financial institutions and can take advantage of the less informed investors. The coefficients of the institutional ownership on the board and audit scores are not significant, while the compensation score is significant at 10%.

Table 4.2. GMM Institutional ownership and ISS governance scores.

	Dependent Variable: Institutional Ownership				
	Main Score	Shareholders Score	Board Score	Audit Score	Compensation Score
Ownership Percentage	-0.038***	-0.018**	-0.057	-0.003	-0.003*
	(0.005)	(0.006)	(0.005)	(0.005)	(0.005)
Ownership Change	0.113***	0.003	0.019*	0.005	0.005
	(0.004)	(0.048)	(0.004)	(0.003)	(0.003)
Float Shares	0.014*	-0.029*	0.020	0.004	0.004*
	(0.006)	(0.099)	(0.012)	(0.005)	(0.005)
Leverage	0.003*	-0.004	0.002	0.006***	0.006***
	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)
Sales Growth	-0.001*	-0.001	-0.001*	-0.002	-0.002*
	(0.002)	(0.002)	(0.001)	(0.002)	(0.001)
M-to-B	-0.034*	-0.055**	-0.014**	-0.047	-0.047*
	(0.028)	(0.030)	(0.028)	(0.025)	(0.025)
Wald Test	24.06	17.34	27.22	26.41	22.00
(P-value)	(0.000)	(0.008)	(0.000)	(0.000)	(0.001)
AR (2) Test (P-value)	0.541	0.225	0.445	0.340	0.195
Hansen Test (P-value)	0.212	0.154	0.445	0.623	0.393
No. of instruments	20	20	20	20	20
Observations	1,661	1,661	1,661	1,661	1,661

Note: This table represents the results of the System GMM that studies the effect of institutional ownership on the ISS governance main score and four sub-scores. Definitions and sources of all variables are detailed in Appendix F. Year and industry fixed effects are included in all regressions. Robust standard errors are provided in parentheses. *, **, and *** denote significance at 10%, 5%, and 1% respectively. M-To-B is Market to Book.

On the other hand, the ownership change has a positive and significant effect on the main governance, shareholders rights and compensation score. Also, the results show that the ratio of float shares held by institutional investors to the total outstanding float shares has a positive effect on the governance score. These results contradict the previous finding and reject the research hypothesis, which implies a non-linear relationship that calls for further investigation. Therefore, the study includes graphs and charts to further investigate the relationship.

Figure 4.1. shows the graph of the effect of institutional ownership on the main ISS score that represents the quality of CG. The graph shows that institutional ownership's effect on the governance score is a linear negative effect. However, it can be noted that the negative regression line reaches up to the governance score of 7. To further understand the proposed non-linear relationship between institutional ownership and the quality of governance, it is essential to study the relationship from a different perspective and to investigate the relationship when the governance score is higher than 7. Figure 4.2. includes a graph that shows the effect of CG on institutional ownership. The graph shows that indeed the relationship is negative, but there is a cut-off point when the governance score reaches 8. Therefore, figure 4.2. imply that the institutional ownership and the governance score have an inverted U-shaped relationship. In addition, figure 4.3. show the high, low and mean of institutional ownership in relation to the governance score. The mean in the chart confirms the U-shaped effect. Also, the low and high scores show that institutions with a low governance score have ownership percentages that range from 25% to 100%, while institutions with a high governance score have ownership percentages that range from 0% to 100%.

Figure 4.1.: Regression variable plots of the effect of Institutional ownership on CG

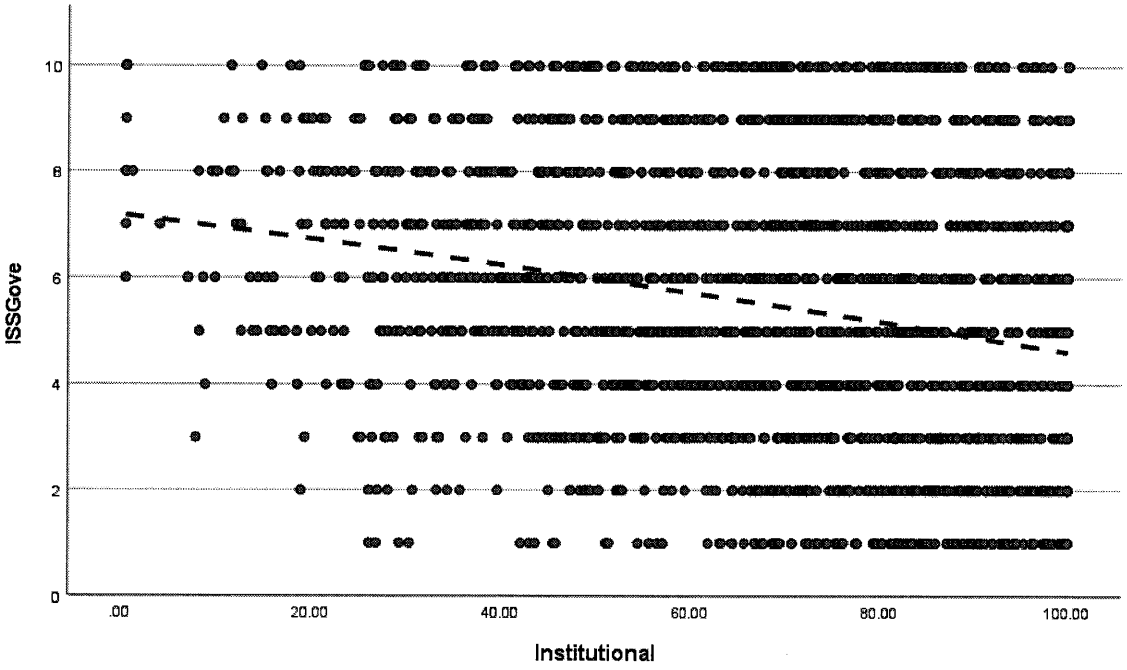


Figure 4.2.: Regression variable plots of the effect of CG Institutional ownership

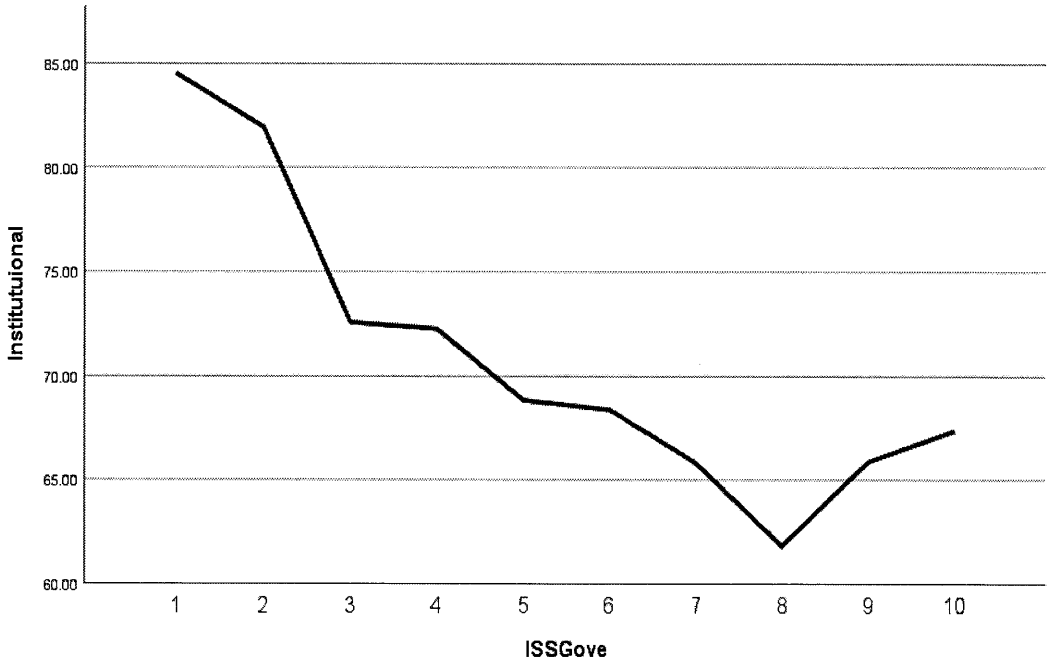


Figure 4.3.: High, low, and mean chart of institutional ownership in relation to the governance score



4.5. Robustness Tests

This section includes two tests to check the robustness of the results. The first test includes an extension of the previous analysis to test the possible nonlinear relationship between institutional ownership and the quality of CG. The findings of the main analysis and graphs suggest a non-linear relationship between institutional ownership and the quality of CG, where the cut-off point is above the score of 7 for the governance score. To test the nonlinearity of the relationship, a non-linear regression was performed with the addition of a squared version of the institutional ownership variable. However, the nonlinearity of the effect of institutional ownership on CG was not significant which confirmed the results of Figure 4.1. Therefore, the results of the non-linear regression were not reported. Instead, linear regression with an IF condition was performed to test the nature of the relationship beyond the point of a score of 7 for the governance score. Several conditions were tested, but the cut-off condition was the governance score of 8, where the relationship changes its course. This result is in line with Figure 4.1. which shows that the negative impact of institutional ownership on CG is robust until the ISS score reaches 7.

Table 4.3 reports the results of ordinary linear regression with an IF condition. The first condition is when the main governance score is equal to or larger than a score of 8. The results show that institutional ownership has a positive effect on the CG of this group, with a coefficient of 0.060 that is significant at 5%. The second condition is when the ISS score is less than 8. The results show that institutional ownership has a negative impact on the CG of this group, with a coefficient of -0,026 which is significant at 10%.

These results imply that the relationship between institutional ownership and the quality of CG is indeed U-shaped. This implies that institutional ownership is beneficial for institutions that have a strong CG framework but might further decrease the quality of the CG of institutions with a weak CG framework. These findings are in line with Zhang *et al.* (2017) who found that, although large trading by institutional investors provides market discipline to management, they may use their private knowledge to gain trading profit at the expense of uninformed investors, which causes a U-shape relationship between institutional investors and tunnelling.

In addition, the results imply that it is of benefit for institutional shareholders to invest in institutions with a good governance quality (a score of 8 and above). This finding supports and encourages the preference of institutional investors to invest in firms with a good CG framework (Bushee *et al.*, 2014; Chung and Zhang, 2011; McCahery *et al.*, 2016; McKinsey and Company, 2000).

Furthermore, The U-shaped effect can be justified by the low shareholders rights that financial institutions with low governance quality suffer from. Institutions with low quality of governance have low shareholders rights that allow institutional shareholders to exercise their powers as large and controlling shareholders to benefit at the expense of minority shareholders, hence causing a further reduction in the quality of governance. However, institutions with high quality of governance have a firm basis for shareholders rights and are able to reduce the agency costs caused by the controlling shareholders, hence resulting in a higher governance score.

Table 4.3. Linear regression with an IF condition: Institutional ownership and ISS governance scores

Dependent Variable: Institutional Ownership		
	IF Main Score >= 8	IF Main Score < 8
Ownership	0.060**	-0.026***
	(0.002)	(0.004)
Ownership Change	0.013*	0.005**
	(0.001)	(0.003)
Float Shares	0.003*	0.006
	(0.002)	(0.005)
Leverage	-0.001**	0.005**
	(0.002)	(0.002)
Sales Growth	-0.001	0.001
	(0.001)	(0.001)
M-to-B	-0.023*	-0.001*
	(0.018)	(0.022)
R Squared	0.096	0.112
Observations	565	1,538

Note: This table represents the results of the linear regression with an IF condition that studies the effect of the institutional ownership on the ISS governance main. Definitions and sources of all variables are detailed in Appendix F. Year and industry fixed effects are included in all regressions. Robust standard errors are provided in parentheses. *, **, and *** denote significance at 10%, 5%, and 1% respectively. M-To-B is Market to Book.

The second robustness test includes a linear regression when the independent and control variables are lagged by one year. The analysis has been also tested with two and three years lagging, but there are not reported because they show the same results as the one year lagged analysis. This robustness check is aimed to account for any lagged effect that institutional shareholders might have on CG. The R squared values are relatively low in all models, this might be due to the omitted variable issue that was accounted for in the system GMM.

The results of the linear regression in table 4.4 are mainly in line with the main analysis but with few differences. The main finding is confirmed in this analysis, which is that institutional ownership has a significant and negative effect on the main score, but the ownership change has a positive effect. However, the linear regression models show that institutional ownership has a negative and significant impact on the board score instead of the shareholders score. Another difference is that the float shares variable has no significant impact on the main governance score.

Table 4.4. Linear regression institutional ownership and CG (1 year lag).

	Dependent Variable: Institutional Ownership				
	Main Score	Shareholders Score	Board Score	Audit Score	Compensation Score
Ownership	-0.669***	-0.038	-0.912***	0.053	-0.607***
	(0.117)	(0.124)	(0.115)	(0.115)	(0.132)
Ownership Change	0.012***	0.003	0.018***	0.007	0.007*
	(0.003)	(0.004)	(0.003)	(0.005)	(0.004)
Float Shares	-0.001	-0.017***	-0.008**	0.002	0.015***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Leverage	-0.007**	-0.008**	-0.014***	0.005	0.001
	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)
Sales Growth	0.000	-0.001	-0.001	0.003	0.003
	(0.001)	(0.001)	(0.002)	(0.003)	(0.002)
M-to-B	-0.084**	-0.081**	-0.069**	-0.075**	-0.009
	(0.031)	(0.034)	(0.029)	(0.032)	(0.033)
R Squared	0.085	0.050	0.160	0.044	0.031
Observations	1756	1756	1756	1756	1756

Note: This table represents the results of the linear regression that studies the effect of institutional ownership on the ISS governance main score and four sub-scores. All independent variables are lagged for one year. Definitions and sources of all variables are detailed in Appendix F. Year and industry fixed effects are included in all regressions. Robust standard errors are provided in parentheses. *, **, and *** denote significance at 10%, 5%, and 1% respectively. M-To-B is Market to Book.

4.6. Additional Analyses

The results of the main analysis show that institutional ownership has a significantly negative impact on CG with a high coefficient of (-2.809), but the change of ownership has a positive effect. The main findings along with the graphs and the IF condition regression suggest that the institutional ownership and the governance score have an inverted U-shaped relationship. Thus, the additional analysis, includes the system GMM used in the main analysis, but the main governance score is replaced with two separate variables that represent low and high governance scores. This will assist in clarifying and understanding the effect of institutional ownership on the ISS governance main. The system GMM will also confirm the previous findings using the linear regression with the IF condition while accounting for issues that the linear regression does not account for, including heterogeneity, endogeneity and the impact of time-invariant variables.

According to figure 4.2 and the regression with the IF condition, the effect shifts when the governance score reaches 8. Therefore, the low score is defined as the ISS governance score for institutions with 0 to 7 scores. The high score is defined as the ISS governance score for

institutions with 8 to 10 scores. The independent and control variables used are the same as the main analysis.

Table 4.5 reports the estimation results for the system GMM that studies the effect of institutional ownership on low and high ISS scores. The Wald test, AR (2) and Hansen test of over identification support the validity and reliability of the instruments in the models and confirm the model fitness. The results show that institutional ownership has a negative effect on the low score, but a positive effect on the high score. The coefficient of the low score is significant at 10%, while the coefficient of the high score is significant at 5%. The findings of this analysis along with the previous graphs confirm the proposition that while institutional ownership has a negative effect on institutions with poor governance structure, it has a positive effect on institutions with high governance quality.

Table 4.5. GMM Institutional ownership and ISS governance scores (low and high).

	Dependent Variable: Institutional Ownership	
	High Main Score (=/>8)	Low Main Score (<8)
Ownership	0.174*	-0.389**
	(0.135)	(0.203)
Ownership Change	0.006	0.004
	(0.001)	(0.003)
Float Shares	-0.003	0.032***
	(0.009)	(0.011)
Leverage	0.017***	0.032**
	(0.006)	(0.017)
Sales Growth	0.001	-0.002
	(0.002)	(0.001)
M-to-B	-0.028	-0.217**
	(0.171)	(0.093)
Wald Test (P-value)	36.99	32.66
	(0.000)	(0.000)
AR (2) Test (P-value)	0.114	0.185
Hansen Test (P-value)	0.087	0.299
Number of Instruments	21	21
Observations	264	1,060

Note: This table represents the results of the System GMM that studies the effect of institutional ownership on the governance high and low scores. Definitions and sources of all variables are detailed in Appendix F. Year and industry fixed effects are included in all regressions. Robust standard errors are provided in parentheses. *, **, and *** denote significance at 10%, 5%, and 1% respectively. M-To-B is Market to Book.

The second additional analysis compares the effect of institutional ownership on CG between banks and non-banks financial institutions. This comparison is due to two reasons; first, more than 50% of the sample is banks (1,060 out of 2,103 observations). Second, the banking sector differs from other sectors in several ways; regulation and governance focused on banks more than the other sectors (Hopt, 2013), and the banking sector is more complex and has more stakeholders than the other sectors (Mehran *et al.*, 2011).

The system GMM is performed with the same variables as the main analysis, but the sample is replaced with banks only first and then with non-banks. Table 4.6. shows the results of the main governance score and sub-scores for non-bank financial institutions. The results are consistent with the main analysis, which shows that institutional ownership has a negative effect on CG which is driven by the negative effect on shareholders rights.

Table 4.7. shows the results of the main governance score and sub-scores for banks only. The results of the main score confirm the previous findings by showing that institutional ownership in banks has a negative effect on the main ISS score and the float shares, but a positive effect on the percentage change of institutional ownership. However, the results of the sub-scores differ slightly from the main analysis. Both analyses show that the negative effect is driven by the shareholders' rights.

On the other hand, the analysis of banks shows that institutional ownership has a negative effect on the board structure score as well. This might be due to the different nature of boards in banks than in the other sectors. In comparison to other sectors, the governance of bank boards has unique challenges due to the agency costs that rise from protecting diverse stakeholder interests (Abdelbadie and Salama, 2019). Also, bank boards have a fiduciary responsibility to ensure financial stability that serves the interests of shareholders (John *et al.*, 2016). The negative effect of institutional ownership on the board structure of banks is in line with Aebi *et al.* (2012) who find that institutional investors do not provide effective monitoring of boards in banks. Also, the significant effect might be due to the continuous and excessive pressure on boards in banks to show remarkable performance to shareholders (Jizi *et al.*, 2014).

Table 4.6. GMM Institutional ownership and ISS governance scores (non-banks).

	Dependent Variable: Institutional Ownership				
	Main Score	Shareholders Score	Board Score	Audit Score	Compensation Score
Ownership	-0.070***	-0.044***	-0.025	0.067*	-0.003
	(0.024)	(0.019)	(0.024)	(0.026)	(0.029)
Ownership Change	0.006*	0.007**	0.004	-0.004	-0.008
	(0.004)	(0.003)	(0.005)	(0.005)	(0.005)
Float Shares	0.070***	-0.008	0.001	-0.075*	0.088***
	(0.024)	(0.020)	(0.0263)	(0.027)	(0.027)
Leverage	0.001	0.026**	-0.051***	-0.090***	0.046**
	(0.011)	(0.012)	(0.015)	(0.017)	(0.017)
Sales Growth	-0.003*	0.003	0.001	-0.007***	-0.001
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
M-to-B	-0.213***	-0.094*	-0.485***	-0.467***	-0.097
	(0.104)	(0.083)	(0.112)	(0.113)	(0.127)
Wald Test (P-value)	24.95	65.30	37.25	54.45	63.12
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
AR (2) Test (P-value)	0.431	0.245	0.525	0.460	0.245
Hansen Test (P-value)	0.194	0.275	0.354	0.523	0.463
Number of Instruments	21	21	21	21	21
Observations	825	825	825	825	825

Note: This table represents the results of the System GMM that studies non-banks financial institutions only and excludes non-banks from the sample. Definitions and sources of all variables are detailed in Appendix F. Year and industry fixed effects are included in all regressions. Robust standard errors are provided in parentheses. *, **, and *** denote significance at 10%, 5%, and 1% respectively. M-To-B is Market to Book.

Table 4.7. GMM Institutional ownership and ISS governance scores (banks)

	Dependent Variable: Institutional Ownership				
	Main Score	Shareholders Score	Board Score	Audit Score	Compensation Score
Ownership	-0.052**	-0.022**	-0.049**	-0.069	-0.003
	(0.028)	(0.002)	(0.003)	(0.032)	(0.006)
Ownership Change	0.020***	0.008*	0.025***	-0.001	0.021***
	(0.006)	(0.004)	(0.007)	(0.007)	(0.007)
Float Shares	-0.032***	-0.028***	0.009	-0.010	-0.047***
	(0.012)	(0.009)	(0.015)	(0.014)	(0.016)
Leverage	0.070**	0.044**	-0.113***	-0.094***	0.090**
	(0.028)	(0.022)	(0.030)	(0.029)	(0.036)
Sales Growth	0.003	0.003	0.012*	0.004	-0.002
	(0.006)	(0.005)	(0.007)	(0.007)	(0.008)
M-to-B	-1.059***	-0.439***	-0.219	-0.117	-0.808***
	(0.182)	(0.151)	(0.222)	(0.205)	(0.245)
Wald Test (P-value)	95.20	53.39	50.93	23.88	52.04
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)
AR (2) Test (P-value)	0.285	0.185	0.482	0.106	0.285
Hansen Test (P-value)	0.538	0.099	0.173	0.037	0.482
Number of Instruments	21	21	21	21	21
Observations	836	836	836	836	836

Note: This table represents the results of the System GMM that studies banks only and excludes non-banks from the sample. Definitions and sources of all variables are detailed in Appendix F. Year and industry fixed effects are included in all regressions. Robust standard errors are provided in parentheses. *, **, and *** denote significance at 10%, 5%, and 1% respectively. M-To-B is Market to Book.

4.7. Conclusion

This study was conducted with the premise that institutional shareholders increase the quality of CG by performing their monitoring role to reduce agency costs. However, this study provides evidence that this proposition applies mainly to non-financial firms and may not apply to financial institutions.

Using system GMM to study the effect of institutional ownership on CG score and its four sub-scores developed by ISS, this study shows that there is a high negative impact on the main score. The subsiding models show that the negative impact is driven by the negative effect of institutional ownership on the scores of the shareholder's rights and compensation structure. This implies that institutional owners exercise their power as controlling and more informed shareholders to benefit at the expense of minority shareholders which eventually affects the governance score.

On the other hand, the results show that the increase in institutional ownership leads to better scores of corporate governance. These findings along with supporting graphs suggest that the effect of institutional ownership on the governance score is non-linear. These results are later supported by the robustness test and the additional analysis where the main governance score is divided into two separate variables that represent low and high scores. The findings of these analyses confirm that institutional ownership has a negative effect on institutions with low scores, but a positive effect on institutions with high scores. This implies that institutions with high quality of governance have strong shareholders rights and are able to reduce the agency costs caused by controlling shareholders, hence resulting in a higher governance score.

Furthermore, due to the different nature of banks from the other non-bank financial institutions, another additional analysis is performed with a banks only sample. The results confirm the negative effect on the main governance score and the shareholders' rights score but show that institutional ownership has a negative and significant effect on the board structure of banks.

4.7.1. Research Implications

The presence of institutional investors may enhance CG quality, especially for non-financial firms. However, very high ownership may worsen the quality of governance and increase agency issues for financial institutions, especially ones with less developed governance frameworks. Thus, regulators should be alert to the potential adverse effects of institutional

ownership on different sectors. Finally, the findings support and encourage the preference of institutional investors to invest in financial institutions with high quality CG.

4.7.2. Research Limitations

The main limitation of this study was the data availability which was due to limited access to databases. Like the previous studies, the aim was to include an international study for generalisation purposes. Also, the ISS governance score that represents the quality of CG in the study was extracted from the Bloomberg database, which only provided the final scores. Therefore, there was no access to the details and structure of these scores, which would have been utilized as an extension of the main analysis.

4.7.3. Further Research Areas

An opportunity for further research would be extending the sample to years before the financial crisis in order to examine whether the relationship between institutional investors and CG has been altered by the crisis. In addition, this study could be applied to an international sample to further understand the relationship in different contexts.

5

Chapter 5: Conclusion

This chapter recaps the findings of the three studies included in this thesis that study CG for financial institutions. Chapter 2, *Revisiting Corporate Governance and Financial Risk Taking*, examines the effect of CG represented by PCA factors on risk taking. Chapter 3, *Bank Failure prediction (corporate governance and financial indicators)*, studies the significance of adding CG variables as non-financial predictors to predict bank failure. And finally, chapter 4, *The Effect of Institutional Ownership on Corporate Governance Quality in Financial Institutions*, studies the effect of institutional ownership on the quality of CG.

5.1. Main findings

The review of the literature revealed the importance of CG in financial institutions and the research needed in this area. The review also revealed that there are major gaps in the literature including a detailed examination of the effect of CG on risk taking, the utilisation of CG in predicting failure, and the effect of institutional ownership on the quality of governance. Thus, this research includes three studies that aim to determine the important CG characteristics in order to develop a CG framework that is suitable for financial institutions.

The first study shows how different CG characteristics have different effects on risk taking by using PCA as a replacement for an index. The findings show that while CG has a significant and positive effect on risk taking, other variables have a negative effect on risk taking but their negative effect is not shown when these variables are included in a single index. The results show that compensation structure, institutional ownership and auditing practices have positive effects on risk which is what drives the positive effect of CG when using a single index. On the other hand, board characteristics, insider ownership, and debt based compensation have a negative effect on risk taking. These results are robust when replacing the PCA factors with governance scores developed by ISS. The robustness analysis using the ISS governance scores confirms that CG has a positive effect on risk when studied as a whole, but when divided

into sub-score, other variables including board characteristics and shareholders rights have a negative effect.

The second study develops a failure prediction model with a combination of financial ratios (CAMEL ratios) and non-financial variables (CG variables) with significant prediction accuracy percentages for one, two and three years before failure. The results show that when combing both the CAMEL ratios and CG variables, the accuracy increases significantly in comparison to using them separately. These findings imply that CG is a helpful tool in predicting failure when combined with financial ratios. This is because adding CG variables along with financial ratios provides a better view of the bank's condition leading to the improvement of the prediction accuracy. In addition, the results show that adding CG variables not only enhances the prediction accuracy but also extends the time horizon of prediction to three years before failure. This study was conducted using specific CG variables that were found to have significant discriminant power using the Mann-Whitney test, which helped in increasing the percentage of accuracy. In specific, the results show that liquidity, earnings, CPS, UVR and institutional shareholding are more important predictors than capital, board composition and compensation structure. The out of sample analysis was included in this study as an additional analysis, which confirms the previous findings.

The third study examines the effect of institutional ownership on the quality of governance. The existing literature on non-financial firms shows that institutional shareholders increase the quality of CG by performing their monitoring role. However, the findings of this study show that this proposition may not apply to financial institutions. Using the system GMM to study the effect of institutional ownership on CG score and its four sub-scores developed by ISS, the study shows that institutional shareholders have a U-shaped effect on CG in financial institutions. This shows that institutional ownership has a negative effect on institutions with low scores, but a positive effect on institutions with high scores. In addition, the results show that institutional ownership has a negative and significant effect on shareholders rights and compensation structure. This implies that institutional shareholders exercise their power to benefit at the expense of minority shareholders which eventually affects the governance score. These results are supported by two robustness tests.

5.2. Research Implications

This thesis includes principles and recommendations that a suitable CG framework should include for financial institutions in order to reflect effective protection of shareholders' rights. The main contribution of the thesis is that the three studies included allowing regulators, managers, investors, and stakeholders of financial institutions to better understand CG. The findings of the studies provide guidelines and a better understanding of risk regulation, failure prediction as well as institutional ownership for financial institutions.

The first study provides an insight into determining the suitable CG framework by showing the different impacts of different characteristics on risk taking. It questions the validity of using a single index to represent CG and shows that CG should be studied in detail. Thus, the implications of these findings benefit managers and regulators by showing that CG frameworks should be developed by fully considering that not all aspects of CG behave similarly. In other words, granular analysis of CG characteristics is very important due to its complexity.

The second study shows that CG variables and the earnings of banks serve as strong predictors of bank failure. These findings provide important signals of bank failure that could serve in preventing future failures. The regulatory implications of this study suggest that regulators should pay more attention to the CG and earnings aspects of banks and not direct the entire focus on capital structure.

The third study provides a better understanding of the role of institutional shareholders in CG. It shows that higher ownership may worsen the quality of governance and increase agency issues for financial institutions with less developed CG. This finding supports and encourages the preference of institutional investors to invest in financial institutions with a high quality CG. In addition, the findings of this study are contrary to the findings of the previous studies on non-financial firms which show that institutional investment enhances the CG of non-financial firms. This implies that regulators should be alert to the potential adverse effects of institutional ownership on different sectors.

Finally, some CG variables were commonly significant across the three studies. First, the institutional ownership results in higher risk taking, more probability of failure, worse quality of governance for institutions with a low CG score, and lower shareholders rights. These are important findings which suggest that high institutional ownership might not be suitable for financial institutions. In addition, equity-based compensation has a significant effect on risk taking, and CPS results in more probability of failure. This implies the importance of the

compensation structure. Finally, shareholders rights have a negative effect on risk taking in financial institutions, and UVR leads to more probability of failure. These findings highlight the importance of ensuring the protection of shareholders in financial institutions.

5.3. Research Limitations

The three studies in this thesis aim to provide an understanding of the significant CG characteristics and the suitable governance framework for the financial institutions that differ from the other sectors. However, there are a few research limitations that are outlined below:

1. There was a struggle with data availability which was due to limited access to databases. The aim was to include an international sample and to have large samples than the ones currently utilised in the thesis. However, due to the low data availability, fewer CG variables were included in the study with smaller samples than originally planned.
2. The governance factors resulting from the PCA in the first study did not include variables from similar groups of CG. Therefore, it was not possible to name these factors based on the characteristics included.
3. The ISS governance score used in the study was extracted from the Bloomberg database, which only provided the final scores. Therefore, there is no access to the details and structure of these scores.
4. The Second study is focused on banks only, this is due to two reasons. First, the existing studies on bank failure showed that CAMEL ratios were the most suitable for prediction. However, there were no studies that showed such evidence for non-bank financial institutions. Second, the CAMEL ratios that were extracted from the FDIC database were available to banks only. It was not possible to construct similar ratios for the non-bank financial institutions due to low data availability.

5.4. Further Research Areas

Finally, there are many ways in which this research could be directed for the future. First, incorporating non-bank financial institutions for failure prediction. Second, creating PCA factors that have similar CG variables which will enable naming them according to their suitable group (Board, compensation, ownership, etc.). This will ease the difficult interpretation of the results caused by the anonymous naming (GOV1, GOV2, GOV3, etc.). This will add a benefit to the generally used indices, which is the individual interpretation of each variable within each group.

Other opportunities for future research include applying these studies to an international sample will increase the generalisability of the results because increasing the number of countries may explore the extent to which the results generalize to these different and diverse countries. The diversity may take into consideration countries at different stages of market development and features of governance.

Also, future research could include a broader spectrum of variables related to the characteristics of the board of directors including qualification, ethnicity, experience, audit committee or other board committees. It can also be expanded by using qualitative aspects of the board such as the board decision-making process.

Finally, the studies included in this thesis were performed in a developed country which is the US. A promising research area would be to apply these studies to developing countries and include comparative studies.

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Appendix A Variables List (Chapter 2).

Variable	Definition	Database
	Risk Measurement	
Z-score	Return on assets plus equity to asset ratio divided by the standard deviation of the return on assets (High value = low risk).	Authors' Calculations
ROAV	The standard deviation of the returns on asset constructed for each year.	Authors' Calculations
Leverage	The ratio of total debt to total assets.	Bloomberg
Stock Return Volatility	Annualized standard deviation of daily stock returns.	Authors' Calculations
Idiosyncratic Risk	The standard deviation of the residuals derived from regressing daily stock return on market return in each year.	Authors' Calculations
LV Stand Alone Risk	A latent variable that represents the stand alone risk generated from the measurement model based on three risk measurements; *ROAV, Leverage* and *Z-score.*	SEM
LV Market Risk	A latent variable that represents market risk generated from the measurement model based on two risk measurements; *Stock Return Volatility* and *Idiosyncratic Risk.*	SEM
	Corporate Governance	
Board Size	Number of directors on the company's board.	Bloomberg
Board Independence	Independent directors as a percentage of total board membership.	Bloomberg
Board Meetings	Total number of corporate board meetings held in the past year.	Bloomberg
Board Attendance	Percentage of members in attendance at board meetings during the period.	Bloomberg
Gender Diversity	Percentage of women on the board of directors.	Bloomberg
Board Average Age	Average age of the members of the board.	Bloomberg
Board Tenure	Length of a board members' term, in years.	Bloomberg
CEO Duality	Indicates whether the company's Chief Executive Officer is currently also chairperson of the Board. Takes the value of 0 when the CEO and chairperson positions are separated and 1 otherwise.	Bloomberg
CPS	Bebchuk *et al.* (2011) CEO Pay Slice calculated as the ratio of the CEO total compensation to Executives' total compensation.	Authors' Calculations
CEO Stocks	The log of the total amount of stock the company awarded to the Chief Executive Officer.	Bloomberg
Executive Stocks	The log of the total amount of stock the company awarded to the executives.	Bloomberg

CEO Options	The log of the total amount of options the company awarded to the Chief Executive Officer.	Bloomberg
Executive Options	The log of the total amount of options the company awarded to the executives.	Bloomberg
CEO Deferred	The log of the total amount of pension and nonqualified deferred pension given to the Chief Executive Officer.	Bloomberg
Executive Deferred	The log of the total amount of pension and nonqualified deferred pension given to the executives.	Bloomberg
CEO Non-equity Incentives	The log of the total amount of non-equity incentives the company awarded to the Chief Executive Officer.	Bloomberg
Executive Non-equity Incentives	The log of the total amount of non-equity incentives the company awarded to the executives.	Bloomberg
Board Stocks	Stock awards given to directors compared to total director compensation as a percentage.	Bloomberg
CEO Cash	The log of the total salary and bonus amount the company paid to the Chief Executive Officer.	Bloomberg
Executive Cash	The log of the total salary and bonus amount the company paid to the executives.	Bloomberg
Compensation Advisor	Takes the value of 1 if the company appoints outside executive compensation advisors, and 0 otherwise.	Bloomberg
UVR	Indicates whether the company has unequal/restricted voting rights between common share classes (single, dual, or multiple classes of shares). Takes the value of 1 if voting rights are unequal and 0 otherwise.	Bloomberg
Institutional Ownership	Percentage of outstanding shares held by institutions.	Bloomberg
Insider Ownership	Percentage of outstanding shares currently held by insiders.	Bloomberg
ISS Governance Score	Overall score assigned by ISS to the company's governance practices. The score ranges from 1 to 10.	Bloomberg
ISS Board	Score assigned by ISS to the structure of the company's board of directors. The score ranges from 1 to 10 and is a component of ISS's Governance Score.	Bloomberg
ISS Shareholders	Score assigned by ISS to shareholder rights at the company. The score ranges from 1 to 10 and is a component of ISS's Governance Score.	Bloomberg
ISS Audit	Score assigned by ISS to the company's audit process. The score ranges from 1 to 10 and is a component of ISS's Governance Score.	Bloomberg
ISS Compensation	Score assigned by ISS to the company's compensation practices. The score ranges from 1 to 10 and is a component of ISS's Governance Score.	Bloomberg
	Firm Control Variables	

Firm size	the log of total assets in billion US dollars.	Bloomberg
M-to-B	Market capitalization to the book value of equity.	Authors' Calculations
ROE	Net income to total equity.	Bloomberg
Capital Ratio	Book value of equity to total book value of assets.	Authors' calculation

Appendix B Prior literature on measuring risk taking (Chapter 2).

Papers	Variable	Relationship to CG	CG	Sector	Country	Period
(Laeven and Levine, 2009)	Z-Score ROA Volatility Equity volatility	greater CF rights by a large owner is associated with greater risk.	Ownership	Banks	48 countries	1996-2001
	Earnings volatility	The results are somewhat weaker. But still negatively and significantly related to ownership even with this measure that can be subject to substantial manipulation by banks.				
(Anginer *et al.*, 2018)	Distance to Default	All six measurements of risk have a positive relationship to shareholder friendly CG, with more positive relationship in banks than non-financial firms	CG Index measuring shareholder protection	Banks and non-financial firms	US and 22 counties	1990-2014
	Leverage	Has the most significant in the relationship				
	Asset Volatility	least impact				
	Marginal Expected Shortfall	positive relationship				
	Systemic Risk	positive relationship				
	Conditional Value at Risk	least impact				
(John *et al.*, 2008)	Earnings volatility	Results show a positive relationship between risk taking and all three shareholder friendly CG variables.	Investor protections indicators (rule of law, anti-directors right index, disclosure)	Manufacturing Industry (SIC 2000-3999)	39 countries	1992-2002
(Lu and	Research and	Board independence is positively and	Board independence	Listed firms	US	1996-2007

Wang, 2018)	Development expenditure	significantly related to managerial risk taking, which means board independence helps to combat managerial conservatism. They chose R&D because it is a risky investment that implies innovation compared to property, plant, and equipment investments.				
(Berger *et al.*, 2016)	Nonperforming loans	larger shareholdings of lower-level management and non-CEO higher- level management significantly increase banks' risk taking. However, the shareholdings of the CEO appear to have no direct impact on a bank's risk taking. NPL is mostly related to outside directors' options	bank share and option ownership, compensation, and management structure	Commercial Banks	US	2007-2010
	Z-Score	mostly related to outside directors' options				
	noninterest income	most significance within the influence of lower management and non-CEO ownership effect on risk taking				
	capital ratio	little influence				
	ROA	Higher ratios indicate that this is the primary channel of risk taking by lower management and non-CEO				
(Erkens *et al.*, 2012)	Expected Default Frequency	greater institutional is related to more risk taking, but board independence is not related to risk taking	Board independence, institutional shareholders, and large shareholder	Financial Institutions	30 countries	2007-2008
	Stock Return Volatility	less significance				
(Sheikh, 2019)	Stock Return Volatility	CEO power is positively associated with risk	CEO Power (CPS, CEO duality, Board	Non-Financial firms	US	1992-2015

	Idiosyncratic Risk		independence, CEO tenure, founding family), Gompers et al. (2003) index			
(Pan *et al.*, 2017)	CDS spread Loan Spead Bond Yield Spread	CEO tenure is negatively related to default risk. CEO turnover is positively related to risk	CEO turnover and CEO tenure	Fama-French 48 industry classification	US	2001-2009
(Ferreira and Laux, 2007)	idiosyncratic volatility Relative idiosyncratic volatility Logistic idiosyncratic volatility	Strong negative relationship	Antitakeover provisions index. And shareholder friendly G-index as used in Gompers et al.2003	non-financial firms		1990-2001
(Ferris *et al.*, 2017)	Stock Return Volatility Volatility ROA Volatility ROE Research and Development expenditures corporate diversification Leverage Working Capital	Positive and significant relationship Negative and significant relation	CEO social Capital		Global and available on database	1999-2011
(Kim and Lu, 2011)	Research and Development investments	In weak external CG, CEO ownership is significantly and significantly related to risk	CEO ownership and external CG			1992-2006
(Calomiris	Real estate loans	Managerial ownership is negatively	Managerial	Banks	US	1892-1893

and Carlson, 2016)	to total loans Estimated losses to assets equity-to-asset ratio cash to assets ratio	related to estate loans, but positively related to G score Negative and significant relationship with G score. Most significant negative relationship with managerial ownership Managerial ownership is negatively related to default risk, as they prefer to use cash instead of equity	ownership, board meetings, board outsiders, managerial turnover, G score			
(Wu, 2016)	idiosyncratic risk	more volatility is related to higher probability of bankruptcy	Gender Diversity, CEO power (CEO duality and ownership), CEO tenure, turnover and age, audit committee independence, institutional shareholding, insider shareholding	non-financial firms	US	1996-2006
(Hutchinson *et al.*, 2015)	Stock deviation Risk management Z-score	Institutional shareholders are positively related to risk	Institutional shareholders	ASX listed companies	Australia	2006-2008
(Sharma *et al.*, 2008)	Inherent Risk Control environment risk	when auditors perceive stronger governance, they lower their assessment of control environment risk.	weak, moderate, or strong CG with respect to board and audit committee characteristics	Audit Managers	Singapore	2002
(Christy *et al.*, 2013)	Volatility of stock return	Shareholders' assessment of risk is lower for large firms whose boards are more independent and educated, and in small	Board independence, board qualification	ASX listed companies	Australia	2001-2007

		companies, it is not related to board independence but is greater in qualified board				
(Saunders *et al.*, 1990)	Total Return Risk Non-systematic risk Market risk interest rate risk	Stockholder controlled banks (manager with ownership) is positively related to risk taking in a deregulated environment.	Ownership	Banks		1979-1082
(Deyoung *et al.*, 2013)	Total Risk Systematic Risk Idiosyncratic risk	CEO pay-risk sensitivity is positively and significantly related to risk taking. AND CEO compensation and risk taking	CEO and executive Compensation	Banks	US	1994-2006
(Cain and McKeon, 2016)	Total Return Volatility	Corporate Risk behavior is significantly and positively related to risk taking in the firm	CEO risk taking measured by aircraft piloting to test risk behavior.			1991-1992
(Cassell *et al.*, 2012)	Volatility of future stock return	Negative relationship, more deferred compensation in CEO compensation structure is associated with less risk taking	CEO inside debt (deferred compensation)	Many industries	US	2006-2008
	Idiosyncratic risk	Negative relationship				
	Diversification (entropy)	positive relationship				
	Research and Development expenditure	Negative relationship				
	Total book leverage	Negative relationship				
	Working Capital	positive relationship				
(Guay, 1999)	Sensitivity of wealth to equity risk	Stock based compensation is positively related to risk taking	CEO wealth (stock options in compensation, and	Non-financial Firms	US	1988-1993

	Stock Return Volatility	same result	salary and bonus)			
(Nakano and Nguyen, 2012)	ROA Volatility Tobin's Q Sock Return Volatility	firms with larger boards exhibit lower performance volatility	Board size, inside directors, executives and directors' stocks, institutional investors	Non-Financial Firms	Japan	2003-2007
(Mishra, 2011)	ROA Volatility	The presence of Dominant Shareholder is associated with lower risk, while the voting rights of multiple large shareholders is associated with higher risk	Dominant Shareholders, Multiple Large Shareholders, voting rights	Non-Financial Firms	9 East Asia countries	1996-2005

Appendix C Pearson Correlations (Chapter 2).

Panel A: US-only Financial Institutions

	Gov1	Gov2	Gov3	Gov4	Gov5	Gov6	Gov7	Firm Size	M to B	ROE	Capital Ratio
Gov1	1	-.012	.133**	.184**	.288**	-.225**	-.138**	.661**	.170**	.144**	.133**
Gov2	-.012	1	.060**	.071**	.149**	.055**	.073**	.022	-.142**	-.127**	-.339**
Gov3	.133**	.060**	1	.143**	.069**	-.144**	.049**	.415**	-.146**	-.040*	-.272**
Gov4	.184**	.071**	.143**	1	.107**	-.025	-.111**	.251**	.045**	.008	-.012
Gov5	.288**	.149**	.069**	.107**	1	-.102**	-.057**	.258**	.055**	.103**	-.005
Gov6	-.225**	.055**	-.144**	-.025	-.102**	1	-.001	-.409**	-.081**	-.065**	.029
Gov7	-.138**	.073**	.049**	-.111**	-.057**	-.001	1	-.041*	-.146**	-.121**	-.200**
Firm Size	.661**	.022	.415**	.251**	.258**	-.409**	-.041*	1	-.147**	-.009	-.289**
M to B	.170**	-.142**	-.146**	.045**	.055**	-.081**	-.146**	-.147**	1	.494**	.398**
ROE	.144**	-.127**	-.040*	.008	.103**	-.065**	-.121**	-.009	.494**	1	.221**
Capital Ratio	.133**	-.339**	-.272**	-.012	-.005	.029	-.200**	-.289**	.398**	.221**	1

*, **, and *** denote significance at 10%, 5%, and 1% respectively.

Panel B: ISS Governance Score and Sub-scores.

	ISS Score	ISS Board	ISS Shareholders	ISS Audit	ISS Compensation	Firm Size	M to B	ROE	Capital Ratio
ISS Score	1	.513**	.588**	.232**	.645**	-.184**	-.050*	-.015	.021
ISS Board	.513**	1	.116**	.079**	.217**	-.243**	-.056*	-.025	.163**
ISS Shareholders	.588**	.116**	1	-.053*	.024	-.149**	-.080**	-.048*	-.003
ISS Audit	.232**	.079**	-.053*	1	.137**	.019	-.006	-.015	-.056*
ISS Compensation	.645**	.217**	.024	.137**	1	-.082**	.031	.040	-.066**
Firm Size	-.184**	-.243**	-.149**	.019	-.082**	1	-.227**	-.062**	-.492**
M to B	-.050*	-.056*	-.080**	-.006	.031	-.227**	1	.561**	.304**
ROE	-.015	-.025	-.048*	-.015	.040	-.062**	.561**	1	.197**
Capital Ratio	.021	.163**	-.003	-.056*	-.066**	-.492**	.304**	.197**	1

*, **, and *** denote significance at 10%, 5%, and 1% respectively.

Appendix D Variables list (Chapter 3).

Panel A: Dependent Variable

No	Variable	Definition	Database
1	Status	Takes the value of 1 if the institution is a non-failed institution, and 0 if failed.	Bloomberg

Panel B: Financial Ratios

No	Variable	Denoted by	FDIC definition	Category	Database	Prior literature
1	Total income and equity to total assets	TIEtoTA	(Equity + total income)/total assets	Capital	Author's calculations (FDIC)	(Canbas *et al.*, 2005; Chauhan *et al.*, 2009)
2	Equity capital to assets	ECtoA	Total equity capital as a percent of total assets.	Capital	FDIC	(Altman, 1968; Beaver, 1966; Boyacioglu *et al.*, 2009; Brédart, 2014b, 2014a; Demirgüç-Kunt *et al.*, 2008; Gasbarro *et al.*, 2002; Hosaka, 2019; IMF, 2006; Ioannidis *et al.*, 2010; du Jardin, 2010; Kao and Liu, 2004; Lin *et al.*, 2011; Serrano-Cinca and Gutiérrez-Nieto, 2013; Wang *et al.*, 2014)
3	Total equity to gross loans	TEtoGL	Total equity to gross loans and leases	Capital	Author's calculations (FDIC)	(Boyacioglu *et al.*, 2009; Feki *et al.*, 2012)
4	Pre-tax income to equity	PTItoE	Pre-tax income to equity	Capital	Author's calculations (FDIC)	(du Jardin, 2010; Liang *et al.*, 2016)
5	Liabilities to Equity	LtoE	Total liabilities to total equity	Capital	Author's calculations (FDIC)	(du Jardin, 2010; Jones, 2017; Liang *et al.*, 2016; Wang *et al.*, 2014)
6	Loss allowance to loans	LAtoL	Allowance for loan and lease losses as a percent of total loan and lease financing receivables, excluding unearned income.	Assets	FDIC	Ratio provided by FDIC
7	Net charge-offs	NCOtoL	Gross loan and lease	Assets	FDIC	Ratio provided by FDIC

	to loans		financing receivable charge-offs, less gross recoveries, (annualized) as a percent of average total loans and lease financing receivables			
8	Efficiency ratio	TEtoTA	Total expenses (interest + noninterest expenses) to total assets	Assets	Author's calculations (FDIC)	(Liang *et al.*, 2016; López Iturriaga and Sanz, 2015)
9	Debt Ratio	TLtoTA	Total liabilities to total assets	Assets	Author's calculations (FDIC)	(Beaver, 1966; du Jardin, 2010; Liang *et al.*, 2016; Lin *et al.*, 2011; Ohlson, 1980; Wang *et al.*, 2014; Wu, 2016)
10	Net loans and leases to total assets	NLLtoTA	Loan and lease financing receivables, net of unearned income, allowances, and reserves, as a percent of total assets.	Assets	Author's calculations (FDIC)	(López Iturriaga and Sanz, 2015) and Ratio provided by FDIC
11	Deposit to assets	DtoA	Total domestic office deposits as a percent of total assets.	Assets	Author's calculations (FDIC)	(López Iturriaga and Sanz, 2015) and Ratio provided by FDIC
12	Credit loss provision to net charge-offs	LPtoNCO	Provision for possible credit and allocated transfer risk as a percent of net charge-offs. If the denominator is less than or equal to zero, then the ratio is shown as 'NA.'	Assets	FDIC	Ratio provided by FDIC
13	Earnings coverage of net charge-offs	ECofNCO	Income before income taxes and extraordinary items and other adjustments, plus provisions for loan and lease losses and allocated transfer risk reserve, plus gains	Assets	Author's calculations (FDIC)	Ratio provided by FDIC

			(losses) on securities not held in trading accounts (annualized) divided by net loan and lease charge-offs (annualized).			
14	Assets per employee ($millions)	AperE	Total assets in millions of dollars as a percent of the number of full-time equivalent employees.	Management	Author's calculations (FDIC)	Ratio provided by FDIC
15	Non-interest expense to total income	NIEtoTI	Noninterest expense less amortization of intangible assets as a percent of net interest income plus noninterest income. This ratio measures the proportion of net operating revenues that are absorbed by overhead expenses, so that a lower value indicates greater efficiency.	Earnings	Author's calculations (FDIC)	(Serrano-Cinca and Gutiérrez-Nieto, 2013) and Ratio provided by FDIC
16	Net income growth rate	IGR	{(Net income of current period – Net income of previous period) / Net income of previous period} x 100	Earnings	Author's calculations (FDIC)	(Feki *et al.*, 2012; Jones, 2017)
17	Income before extraordinary items to assets	IBEItoA	Income before extraordinary items to total assets	Earnings	Author's calculations (FDIC)	(Altman, 1968; du Jardin, 2010, 2017; Wang *et al.*, 2014)
18	Interest expenses/total expenses	IEtoTE	Interest expense to total expense (interest +noninterest expense)	Earnings	Author's calculations (FDIC)	(Canbas *et al.*, 2005; Chauhan *et al.*, 2009)

19	Retained earnings to total assets	REtoTA	Retained earnings to total assets	Earnings	Author's calculations (FDIC)	(Altman, 1968; Liang *et al.*, 2016; Lin *et al.*, 2011)
20	Cash to Total assets	CtoTA	Cash to Total assets	Liquidity	Author's calculations (FDIC)	(Chauhan *et al.*, 2009; du Jardin, 2010, 2017; Liang *et al.*, 2016; Wang *et al.*, 2014)
21	Cash to Total liabilities	CtoTL	Cash to Total liabilities	Liquidity	Author's calculations (FDIC)	(Bebchuk *et al.*, 2014; du Jardin, 2010)
22	Net loans and leases to deposits	NLLtoD	Loans and lease financing receivables net of unearned income, allowances, and reserves as a percent of total deposits.	Liquidity	Author's calculations (FDIC)	(Serrano-Cinca and Gutiérrez-Nieto, 2013) and Ratio provided by FDIC
23	Gross loans to total deposits	GLtoTD	Gross loans and leases to total deposits	Liquidity	FDIC	Boyacioglu et al., 2009; Feki et al., 2012)

Panel C: Corporate Governance Variables

No	Variable	Denoted by	Definition	Category	Database
1	Board Size	BS	Number of Directors on the company's board	Board	Bloomberg
2	Board Meetings	BM	Total number of corporate board meetings held in the past year.	Board	Bloomberg
3	Board Attendance	BA	Percentage of members in attendance at board meetings during the period.	Board	Bloomberg
4	Gender Diversity	GD	Percentage of Women on the Board of Directors	Board	Bloomberg
5	Board Average Age	BAA	The average age of the members of the board.	Board	Bloomberg
6	Board Tenure	BD	Length of a board member's term, in years.	Board	Bloomberg
7	CEO Duality	CD	Indicates whether the company's Chief Executive Officer is currently also the chairperson of the Board. Takes the value of 0 when the CEO and chairperson positions are separated and 1 otherwise	Board	Bloomberg
8	CPS	CPS	(Bebchuk *et al.*, 2011) CEO Pay Slice calculated as the ratio of the CEO	Compensation	Author's

			total compensation to Executives' total compensation		Calculations
9	CEO Stocks	CEOS	The log of the total amount of stock the company awarded to the Chief Executive Officer (CEO)	Compensation	Bloomberg
10	Executives Stocks	ExecuS	The log of the total amount of stock the company awarded to the executives	Compensation	Bloomberg
11	CEO Options	CEOO	The log of the total amount of options the company awarded to the Chief Executive Officer (CEO)	Compensation	Bloomberg
12	Executives Options	ExecuO	The log of the total amount of options the company awarded to the executives	Compensation	Bloomberg
13	CEO Deferred	CEOD	The log of the total amount of pension and nonqualified deferred pension given to the Chief Executive Officer (CEO)	Compensation	Bloomberg
14	Executives Deferred	ExecuD	The log of the total amount of pension and nonqualified deferred pension given to the executives	Compensation	Bloomberg
15	CEO Non-equity Incentives	CEONEI	The log of the total amount of non-equity incentives the company awarded to the Chief Executive Officer (CEO)	Compensation	Bloomberg
16	Executives Non-equity Incentives	ExecuNEI	The log of the total amount of non-equity incentives the company awarded to the executives	Compensation	Bloomberg
17	Board Stocks	BStock	Stock awards given to directors compared to total director compensation as a percentage.	Compensation	Bloomberg
18	CEO Cash	CEOC	The log of the total salary and bonus amount the company paid to the Chief Executive Officer (CEO)	Compensation	Bloomberg
19	Executives Cash	ExecuC	The log of the total salary and bonus amount the company paid to the executives	Compensation	Bloomberg
20	Compensation Advisor	CA	Takes the value of 1 if the company appoints outside executive compensation advisors, and 0 otherwise.	Compensation	Bloomberg
21	UVR	UVR	Indicates whether the company has unequal/restricted voting rights between common share classes (single, dual, or multiple classes of shares). Takes the value of 1 if voting rights are unequal and 0 otherwise.	Voting Rights	Bloomberg
22	Institutional Ownership	-	Percentage of outstanding shares held by institutions.	Ownership	Bloomberg

23	Insider Ownership	InsideO	Percentage of outstanding shares currently held by insiders.	Ownership	Bloomberg
Panel D: ISS Variables					
No	Variable	Denoted by	Definition		Database
1	ISS Board	ISS Board	Score assigned by ISS to the structure of the company's board of directors. The score ranges from 1 to 10 and is a component of ISS's Governance Score.		Bloomberg
2	ISS Shareholders	ISS Shareholders	Score assigned by ISS to shareholder rights at the company. The score ranges from 1 to 10 and is a component of ISS's Governance Score.		Bloomberg
3	ISS Audit	ISS Audit	Score assigned by ISS to the company's audit process. The score ranges from 1 to 10 and is a component of ISS's Governance Score.		Bloomberg
4	ISS Compensation	ISS Compensation	Score assigned by ISS to the company's compensation practices. The score ranges from 1 to 10 and is a component of ISS's Governance Score.		Bloomberg

Appendix E Review of failure prediction studies (Chapter 3).

Authors	Sector	Country	Sample Size	Model	Period	Time-Horizon of Prediction	Categories
López Iturriaga and Sanz, (2015)	Commercial Banks only	US	Training: 386 failed banks - 386 non-failed randomly selected / Test: 52 failed - 52 non-failed	NN: MLP and SOM	training: 2002-2012 / Test: 2012-2013	1,2, and 3 years	5 sets: bank's earning, asset structure, loan portfolio, risk concentration, solvency
Wang *et al.* (2014)	Financial Institutions	Poland	240 (112 failed companies)	Feature Selection	1997-2001	-	Financial ratios
			132 (66 risk cases - 66 non-risk cases)	Boosting	1970-1982	-	Financial ratios
Serrano-Cinca and Gutiérrez-Nieto (2013)	Banks	US	Training: 140 failed banks, 140 non-failed banks - Test: 180 failed banks, 7833 non-failed banks	Partial Least Square - DA	training: 2009 - Test: 2010-2011	-	income and expense to asset, profitability, efficiency, assets, capital
Feki *et al.* (2012)	Commercial Banks	Tunisia	Training: 50. Test: 10	Bayes models and vector machine	2000-2006	-	CAMELS and Size
Chauhan *et al.* (2009)	Banks	US, Turkish, Spanish	Turkish: 22 bankrupt, 12 healthy / Spanish 37 bankruptcy, 29 healthy/ US: 65 bankrupt, 64 healthy	DEWNN	Spanish: 1982, US: 1975-1982	1 year	Financial ratios
Boyacioglu *et al.* (2009)	Banks	Turkey	21 bankrupts (14 training and 7 test)/ 44 non-failed (29 training and 15 test) (randomly selected double the failed)	T-test, PCA, DA and Artificial NN	1997-2004	-	CAMELS
Liang *et al.* (2016)	Non-	Taiwan	239 bankrupt, 239 non-	SVM, KNN,	1999-2009	3 years	7 categories of financial

	financial firms		bankrupt	NB, CART, and statistics			ratios and 5 categories of CG
Lee and Yeh (2004)	all listed firms	Taiwan	45 distressed, 88 healthy (double the failed sample)	logistic regression	1996-1999	1 year	2 categories of CG, profitability, R&D
Wu (2016)	Non-financial firms	US	217 bankrupts. 9,100 non-bankrupts	multi-period logit model	1996-2006	1 and 2 years	3 categories of CG, financial ratios
Daily and Dalton (1994)	listed firms in 1990	US	50 bankrupt, 50 healthy	logistic regression	1990	3 and 5 years	CG and financial ratios
Brédart (2014b)	listed in AMEX, Nasdaq, NYSE	US	312 firms	logit model	2007-2009	-	CG and financial ratios
Brédart (2014a)							
Jones (2017)	public firms	US	1115 bankrupt	Gradient Boosting Model	1987-2013	3 years	CG, market, accounting, macro-economic
Canbas *et al.* (2005)	Private banks	Turkey	21 failed, 19 non-failed	PCA, discriminant, logit, probit	1997-2003	1,2, and 3 years	Financial ratios
Kao and Liu (2004)	Commercial Banks	Taiwan	24 banks	Data envelopment analysis	2000	1 year	Financial ratios
du Jardin (2010)	Retail sector	France	Train: 250 bankrupt- 250 healthy / Test 260 Bankrupt / 260 Healthy	Neural Network	Train: 2006-2007 / Test: 2004-2005	-	Liquidity, Financial structure, Profitability, Efficiency, Rotation, Withdrawal, Contribution
Lin *et al.* (2011)	publicly listed	Taiwan	120 distressed and 120 non-distressed	Support Vector Machine	2000-2008	1,2,3 years	Financial ratios
du Jardin (2017)	firms	France	95,910 non-failed firms and 1920 failed firms	logistic regression, DA, NN, VM, boosting	1997-2003	5 years	liquidity, turnover, profitability, activity, solvency, and financial structure

Hosaka (2019)	publicly listed	Japanese	102 bankrupt, 2062 healthy	NN	2002-2016	up to 3 years	balance sheet, income statement
Beaver (1966)	Industrial publicly owned	US	79 failed firms, 79 non-failed firms	Profile Analysis	1949-1963	up to 5 years	6 groups
Altman (1968)	Manufacturers	US	66	Multiple Discriminant Analysis (MDA)	1946-1965		5 groups: liquidity, profitability, leverage, solvency, activity ratio
Ohlson (1980)	industrial	US	105 bankrupt, 2058 data vectors for non-bankrupt	Logit Analysis, MDA	1070-1976	1, 2 years	-
Poon, Firth, and Fung, (1999)	Banks	30 countries	130	Logistic	1996 1997	-	Financial ratios
Ioannidis *et al.* (2010)	Banks	78 countries	944	OLS and NN	2007-2008	-	Bank-level variables, regulatory variables, country-level variables
Demirgüç-Kunt, Detragiache, and Tressel (2008)	Banks	39 countries	304	regression	1999-2003	-	-
Gasbarro *et al.* (2002)	Banks	Indonesia	126	GLS	1993-1997	-	Camels
du Jardin (2016)	firms	France	16,240 observations per year	DT, DA, Logistic, NN	training 2002-2011 testing 2003-2012	1,2, and 3 years	Activity, Financial structure, Profitability, Turnover, liquidity, solvency
Cox and Wang (2014)	banks	US	322 failed banks	DA	2003-2008	1,2,3 and 4	

Appendix F List of Variables (Chapter 4).

Variable	Definition	Database
	Institutional Ownership	
Institutional Ownership	Percentage of Shares Outstanding held by institutions. Institutions include 13Fs, US and International Mutual Funds, Schedule Ds (US Insurance Companies) and Institutional stake holdings that appear on the aggregate level.	
Ownership change	Percentage change of shares held by institutional owners from the previous filing to the current filing.	Bloomberg
Floats shares held by institutions	Percentage ratio of freely traded shares held by institutions to the number of Float Shares Outstanding.	Bloomberg
	Corporate Governance Quality Scores	
ISS Governance Score	Overall score assigned by ISS to the company's governance practices. The score ranges from 1 to 10.	Bloomberg
ISS Board	Score assigned by ISS to the structure of the company's board of directors. The score ranges from 1 to 10 and is a component of ISS's Governance Score.	Bloomberg
ISS Shareholders	Score assigned by ISS to shareholder rights at the company. The score ranges from 1 to 10 and is a component of ISS's Governance Score.	Bloomberg
ISS Audit	Score assigned by ISS to the company's audit process. The score ranges from 1 to 10 and is a component of ISS's Governance Score.	Bloomberg
ISS Compensation	Score assigned by ISS to the company's compensation practices. The score ranges from 1 to 10 and is a component of ISS's Governance Score.	Bloomberg
Control Variables		
Firm Size	the log of total assets in billion US dollars.	Bloomberg
Leverage	The ratio of total debt to total assets.	Bloomberg
Sales Growth	The percentage increase or decrease of sales by comparing the current period with the same period the prior year. Calculated as {(Sales from Current Period - Sales from Same Period Prior Year) * 100 / Sales from Same Period Prior Year}	Bloomberg
ROA	The percentage of the firm's net income to its average total assets	Bloomberg
Firm Age	The time between the year of establishment of the firm and the present time.	Author's calculations

M-to-B	Market capitalization to the book value of equity.	Author's calculations
Board Size	Number of directors on the company's board, as reported by the company.	Bloomberg

Appendix G Pearson Correlation (Chapter 4).

	1	2	3	4	5	6	7	8	9	10	11	12
ISSGove	1	.623**	.560**	.225**	.616**	-.118**	-.196**	-.031	-.208**	.054*	-.105**	.005
ISSShareholder	.623**	1	.182**	-.055*	.030	-.012	-.190**	-.021	-.189**	.023	-.029	.003
ISSBoard	.560**	.182**	1	.080**	.203**	-.177**	-.297**	-.026	-.226**	.057*	-.128**	-.001
ISSAudit	.225**	-.055*	.080**	1	.159**	-.096**	-.017	-.013	-.001	.043	-.042	.003
ISSCompensation	.616**	.030	.203**	.159**	1	-.011	.005	-.046*	-.082**	.027	-.072**	.043
InstiutionalOwnership	-.225**	-.154**	-.335**	-.003	-.048*	.458**	.846**	.021	.400**	-.121**	.133**	-.014
FloatShares	-.196**	-.190**	-.297**	-.017	.005	.327**	1	.012	.356**	-.148**	.084**	-.029
IncreaseDecrease	-.031	-.021	-.026	-.013	-.046*	-.032	.012	1	.105**	.055*	-.069**	-.124**
PercentChange	.069**	.022	.097**	.036	.048*	.054*	-.056*	-.322**	-.117**	.051*	-.055*	.170**
Leverage	.054*	.023	.057*	.043	.027	.003	-.148**	.055*	-.075**	1	-.372**	.150**
M-to-B	-.069**	-.078**	-.065**	-.045	.005	.056*	.199**	.004	-.165**	-.131**	.008	.011
SalesGrowth	.005	.003	-.001	.003	.043	.065**	-.029	-.124**	-.038	.150**	-.029	1

Appendix H Literature Review (chapter 4).

Paper	sector	country	sample size	Methodology	Period	Institutional ownership measurement	Findings
(McCahery *et al.*, 2016)	Institutional Investors	International	143 print and online versions of surveys	Surveys and Ordered logit regressions	-	Voice index for institutional investors	Voice intensity is significantly negatively related to institutions' preferences for liquidity. Also, investors with longer holding periods use voice more intensively
(Choi *et al.*, 2020)	Listed firms excluding financial and utility sector	US	49,349 number of observations	Instrumental variables and two-step generalized method of moments. 3SLS	1985-2008	Institutional Ownership percentage	Firm's debt level was low if its institutional ownership level was high. the level of institutional ownership was high if a firm's debt level was high
(Ni *et al.*, 2017)	Firms listed in Taiwan Stock Exchange	Taiwan	4,277 firm-year observations	Censored panel data models and quantile regression models	2008-2013	Shareholders change of foreign institutions	CG and financial issues may not be related to the shareholding change of foreign institutions.

(Pucheta-Martínez and Chiva-Ortells, 2019)	Nonfinancial listed firms	Spain	553 firm year observations	Generalized methods of moments (GMM)\	2010-2014	Institutional investors percentage, pressure sensitive directors' percentage, and pressure resistant directors' percentage	Institutional and pressure-resistant directors increase fixed compensation and reduce variable pay.
(Sakawa and Watanabel, 2020)	large listed firms of the TOPIX	Japan	436 firms and 2924 firm year observations	Linear regression	2010-2016	Institutional Ownership percentage	Institutional investors enhance firm value. The monitoring role of institutional shareholders functions effectively in Japanese corporations.
(Guo and Platikanov, 2019)	Non-financial firms	China	10,180 firm year observations	Tobit model and linear regressions	1999-2010	Total institutional ownership, state owned financial institutions, privately owned financial institutions, pressure sensitive financial institutions, and pressure insensitive financial institutions	Institutional ownership is positively associated with company Tobin's Q, and the effect is mainly driven by the ownership of independent institutions.
(Bushee *et al.*, 2014)	S&P 500, S&P Mid Cap, S&P SmallCap	US	15,892 firm year observations	Linear regression	1995-2004	Board of directors' index including five variables related to	Little evidence of an association between total institutional ownership and governance

						board characteristics	mechanisms.
(Almazan *et al.*, 2005)	S&P 500 Index, S&P Midcap Index, and S&P Smallcap Index	US	1,914 firms	Tobit Regression	1992-1997	Institutional Ownership percentage, Active institutions percentage, and Passive institutions percentage	Pay-for-performance sensitivity of managerial compensation is increasing in the concentration of active institutions' ownership
(Hartzell and Starks, 2003)	S&P 500 Index, S&P Midcap Index, and S&P Small cap Index	US	1,914 firms	Tobit Regression	1992-1997	Institutional Holding, holdings of top five institutions, and Herfindahl Index of institutional holdings	Institutional ownership concentration is positively related to the pay-for-performance sensitivity of executive compensation and negatively related to the level of compensation
(Bebchuk *et al.*, 2015)	Hedge funds	US	2000 interventions	Linear regression	1994-2007	Hedge fund activism	Activist intervention is followed by improved operating performance during the five-year period following the intervention.
(Aslan and Kumar, 2014)	-	22 major European and Asian countries that	3,605 loan tranches (or facilities) from over 450 firms	GMM	1996-2007	Agency Cost of debt and control to cash flow	Strong NGFs in the CRDE and CIQ bundles have statistically and economically significant negative effects on the dominant shareholders' ownership choice and the firms' cost of debt
(Chung and Zhang, 2011)	Non-financial firms	US	12,093 firm-year observations	OLS and 2SLS	2001-2006	Institutional ownership ratio	The fraction of a company's shares that are held by institutional investors increases with the quality of its governance structure
(Dahlquist *et*	-	51 countries	50 firm-year	Linear regression	1997	Weight in US stocks	The world float portfolio has a

al., 2003)		observations				positive significant coefficient, but the world market portfolio has no additional explanatory power
(Bushee and Noe, 2000)	US	4,314 firm-year observations	Linear regression	1982-1996	Institutional ownership percentage	Firms with higher AIMR disclosure rankings have greater institutional ownership, but the particular types of institutional investors attracted to greater disclosure have no net impact on return volatility
(Fich *et al.*, 2015)	M&A	US	1,601 observations	logit	1984-2011	Monitoring institutions	Their measure of institutional holdings leads to greater bid completion rates, higher premiums, and lower acquirer returns.
(Aggarwal *et al.*, 2011)		23 countries	2,000 non-US firms and 5,000 US firms	Linear regression	2003-2008	Institutional ownership, domestic institutional ownership, foreign institutional ownership, and common institutional ownership	firm level governance is positively associated with international institutional investment.

(Frank and Ghosh, 2012)	Real Estate Investment Trust (REIT)	US	503 firm-years observations	linear regression and Quasi-maximum likelihood model	1998-2002	Institutional Investment	Institutional investment is greater when boards of directors are busier and less tenured, which supports a preference for well-connected yet less entrenched directors. Institutions prefer less equity ownership by the CEO, indicative of a preference for reduced CEO influence and increased governance.
(Dupire and Slagmulder, 2019)	Financial Institutions	Europe	54 banks and 33 insurance companies	OLS	2007 and 2014	Powerful owners	Financial institutions with powerful owners (i.e., those with >20% ownership) have a lower chief risk officer (CRO) presence and lower risk committee presence.