CRACOW UNIVERSITY OF ECONOMICS
COLLEGE OF ECONOMICS, FINANCE AND LAW
DEPARTMENT OF BANKING AND GLOBAL FINANCIAL SYSTEM
& DEPARTMENT OF ECONOMETRICS AND OPERATIONS RESEARCH

Muddassar Rasheed Malik, M.A., MSc Finance

Doctoral Dissertation

THE IMPACT OF RISK GOVERNANCE ON THE PERFORMANCE OF OECD BANKS

Field of Science: Social Sciences
Scientific Discipline: Economics and Finance

Scientific Supervisors:
Prof. Dr. Hab. Ewa Miklaszewska and Prof. Dr. Hab. Jacek Osiewalski

KRAKÓW, 2024

ABSTRACT

This PhD dissertation addresses a critical research gap by investigating the impact of risk governance on the performance of public commercial banks in the countries of Organization for Economic Cooperation and Development (OECD). The research seeks to understand the role of risk governance in shaping bank risk, financial performance, and regulatory adjustments, thereby contributing to the existing literature on risk governance in the banking sector.

Drawing on the theoretical frameworks of Knight's risk theory (1921), the upper echelon theory, and regulatory compliance theory, this study comprehensively examines the relationships between risk governance and various performance indicators in OECD banks. The research specifically focuses on key elements of risk governance, including the Risk Committee (RC), Chief Risk Officer (CRO), Chief Financial Officers (CFO), directors with PhD degrees (TITLE), senior directors ages between 65 to 74 (SENIOR), and independent directors (BI). By considering these factors collectively, this research addresses the research gap by providing a comprehensive analysis of risk governance's internal strength and effectiveness within banks.

The research methodology employs a rigorous design, utilizing a combination of quantitative data collection and analysis techniques. The data sources include BankFocus and BoardEx databases. Statistical analyses, such as regression models, are employed to test the hypotheses and explore the associations between risk governance and the performance indicators of bank risk, financial performance, and regulatory adjustments.

The findings of this study contribute to academic knowledge by shedding light on the importance of risk governance in the banking sector. The results demonstrate a positive association between risk governance and Tier 1 Capital ratio, confirming the role of robust risk governance practices in mitigating risks faced by banks. Furthermore, the study reveals a positive association between risk governance and financial performance, highlighting the significance of effective risk governance in driving favorable financial outcomes. Additionally, the research identifies a negative association between risk governance and regulatory adjustments, suggesting that banks with strong risk governance frameworks are less likely to require significant regulatory interventions.

It is important to acknowledge the limitations of this research, including potential data limitations and the specific context of OECD banks. However, the study's contributions extend the existing literature by addressing the research gap and providing valuable insights for regulators and bank managers. The findings offer guidance in developing and implementing effective risk governance strategies, ultimately contributing to improved risk management practices in the banking sector.

In conclusion, this PhD dissertation fills a critical research gap by investigating the impact of risk governance on the performance of public commercial banks in the OECD. By incorporating rigorous methodology, addressing specific research objectives, and analyzing relevant data, the study offers insights into the associations between risk governance and bank risk, financial performance, and regulatory adjustments. The findings contribute to academic knowledge, provide practical implications for regulators and bank managers, and inform the development of effective risk governance strategies within the banking sector.

KEYWORDS: Risk governance; bank risk; financial performance; regulatory adjustments; banks

Acknowledgements

Embarking on this doctoral journey has been a transformative experience, enriched not only by academic pursuits but also by the invaluable support and encouragement of many. This page reflects my heartfelt appreciation for those who have been integral to this adventure.

My deepest gratitude extends to my family—my parents and siblings—whose love, support, and sacrifices have been the cornerstone of my journey. Their unwavering confidence in me has been my constant source of strength and motivation. The solace and inspiration drawn from our shared moments and their uninterrupted devotion have been resourceful through the journey.

I am profoundly thankful to my supervisors, Prof. Dr. Hab. Ewa Miklaszewska and Prof. Dr. Hab. Jacek Osiewalski, for their relentless guidance, support, and mentorship. Their expertise, insight, and dedication to academic excellence have significantly shaped my growth and development. Their constructive feedback and encouragement created a nurturing environment where innovative ideas could thrive.

My sincere appreciation goes to all the funding organizations that generously supported my research, making it feasible for me to pursue my doctoral studies and contribute to our field without financial constraints. Their trust in the importance and impact of my research has been incredibly encouraging.

I also wish to acknowledge the crucial role played by the administrative staff. Their efficient and unwavering support in navigating bureaucratic and logistical challenges allowed me to focus on my research with minimal distractions. Their contributions, often behind the scenes, have been essential to the smooth progression of my academic endeavors.

Furthermore, I extend my thanks to the wider academic community, including mentors, peers, and collaborators, who have enriched my doctoral experience. Their engaging discussions, constructive critiques, and shared wisdom at various international academic forums have profoundly influenced my understanding and approach to research.

In sum, this journey has been a collective endeavor, marked by the contributions of each individual who believed in and supported my academic journey. To all of you, I offer my deepest thanks. Your support has propelled me forward on this incredible journey.

Table of Contents

List of Publications

I. Malik, M. (2024). Risk governance and bank risk of public commercial banks of OECD. *Status: February 1, 2024. Final editorial check for decision on publication in the Journal of Risk Governance and Control: Financial Markets and Institutions.*

II. Malik, M. (2023). Risk governance and financial performance of public commercial banks of the OECD. *Risk Governance and Control: Financial Markets & Institutions*, 13(4), 58–72. https://doi.org/10.22495/rgcv13i4p5

III. Malik, M. (2024). Risk governance and regulatory adjustments in the public commercial banks of OECD. *Status: February 1, 2024. Accepted for Publication in Journal of Financial Regulation and Compliance (DOI: 10.1108/JFRC-06-2023-0090)*

1. Introduction

1.1. Background and Characterization of the Research Environment

Defined by the Basel Committee on Banking Supervision (BCBS), risk governance is a systematic amalgamation of principles, policies, processes, and structures that serves to understand, measure, monitor, and control risks within a bank. This system adheres to a bank's risk appetite and its stakeholders' expectations (BCBS, 2015). Further emphasizing this, BCBS (2015) highlights the criticality of a robust risk governance framework for ensuring both the safety of individual banks and the stability of the overall financial system. In line with this, the Financial Stability Board (FSB) considers risk governance as a comprehensive set of rules, practices, and processes that allows an organization to manage its risks and meet its objectives (FSB, 2014).

Recent academic discourse has underscored the importance of risk governance in banks and its consequent impact on financial stability. Erin and Aribaba (2021) emphasize the need for banks to possess a comprehensive risk governance framework to ensure regulatory compliance and bolster risk management effectiveness. Further, Iqbal et al. (2015) highlight the role of risk culture and governance in mitigating the fallout of systemic risks on individual banks and the broader financial system. Moreover, Aebi et al., (2012) argue that integrating risk governance into a bank's overall strategy and existing governance structures is paramount for enhancing risk management effectiveness. This integrated approach is instrumental in mitigating potential risks, safeguarding the bank's strategic objectives, and establishing a robust risk governance framework. This approach enables banks to identify, assess, and manage risks in a timely and effective manner, thereby enhancing their stability and profitability. The International Risk Governance Council [IRGC] (2020) further emphasizes the importance of stakeholder engagement and accountability in risk governance, insisting on the necessity for all stakeholders to understand the risk profile and the bank's risk management practices.

Risk governance, which encapsulates a wide range of components from regulatory compliance to stakeholder engagement, continues to evolve as a focal point in the banking industry. It is being defined, explored, and implemented at various levels across industries and institutions, in accordance with relevant regulations and institutional policies (Boin et al., 2016; Aven & Renn, 2010).

The current study explores the internal risk governance of public commercial banks in countries belonging to the Organization for Economic Cooperation and Development (OECD). As defined by supervisory authorities such as the European Central Bank (ECB), Bank for International Settlements ([BIS], 2011) and Gontarek (2016), risk governance in banks refers to a collective endeavor of various departments to oversee risk in alignment with the bank's policies. This governance serves as a conduit between corporate governance and risk management, incorporating structures where authority is exerted, decisions are made, and actions are implemented (Brickley & Zimmerman, 2010; Jensen & Meckling, 2019).

The prominence of risk governance in banks has been accentuated due to a series of financial crises and scandals, revealing deficiencies in risk management practices. These include the Asian Financial Crisis of 1997 (Dornbusch, 2001), the Enron scandal of 2001 (Cunningham, 2006), the Global Financial Crisis of 2008 (Bloom, 2013; Mayer-Schönberger & Ramge, 2018), the Wells Fargo account fraud scandal of 2016 (Cavico & Mujtaba, 2017), the LIBOR scandal in 2012 (Konchar, 2014), and the 1MDB scandal in 2015 (Jones, 2020). These incidents have catalyzed increased regulatory scrutiny and underscored the need for potent risk governance frameworks within banks.

According to Jallali and Zoghlami (2022), implementing risk governance practices can bolster resilience within banks, enhance risk management, and improve overall performance. In a similar vein, Erin et al. (2018) suggest that effective risk governance can enhance the stability and sustainability of banks.

Despite the recognition of risk governance's importance in academic literature, there is a persistent knowledge gap concerning the influence of specific bank governance characteristics on risk management effectiveness. This gap is particularly relevant in the context of OECD banks, amidst increasing awareness and demand for efficient risk governance frameworks.

A crucial attribute of risk governance in banks is the establishment of a dedicated risk committee. Pittman and Fortin (2004) provide evidence that such a committee can enhance risk management practices by fostering a more focused and specialized approach. Similarly, the appointment of a Chief Risk Officer (CRO) has been found to be effective in enhancing risk governance in banks (Zagorchev and Gao, 2015).

Complementing the previous discussion, another important characteristic to consider is the presence of a Chief Financial Officer (CFO) and senior directors with experience in finance. According to Caglio et al. (2018), having a CFO with a financial background can improve the quality of financial reporting and reduce the likelihood of financial restatements. Additionally,

firm performance is positively impacted and the likelihood of financial distress is reduced when senior directors possess finance experience (Switzer & Wang, 2013).

The educational background of directors, particularly those holding PhD degrees, has also been linked with effective risk governance in banks. Studies suggest that directors with PhD degrees are associated with lower levels of risk-taking and higher levels of financial reporting quality (Caglio et al., 2018; Gormley & Matsa, 2014).

Furthermore, the independence of the board of directors has been identified as a crucial characteristic of effective risk governance. Evidence shows that boards with a higher level of independence are associated with superior risk management practices and a lower likelihood of financial distress (Caglio et al., 2018).

Despite these significant findings, a gap persists in the literature concerning the specific combinations of these characteristics that most effectively enhance risk governance in banks. Future research could delve into how different combinations of these attributes impact risk governance in OECD banks, with the aim of informing best practices in risk management.

Undeniably, risk governance is a pivotal aspect of bank management and has gained substantial attention in recent years. It necessitates the implementation of a comprehensive framework that comprises an array of principles, policies, processes, and structures designed to identify, measure, monitor, and control risks. The OECD underscores the importance of risk governance in banks and provides guidelines for best practices. Numerous studies have scrutinized the practices of risk governance in OECD banks, underlining the importance of risk committees, the role of chief risk officers, the independence of the board, and the qualifications of directors in risk management. Nonetheless, there are gaps in the literature regarding risk governance practices in OECD banks, especially in terms of the effectiveness of these practices in preventing and mitigating risks. Despite this, the implementation of effective risk governance practices has been associated with improved bank performance and increased resilience.

Continuing from the previously discussed points, certain studies provide further insights. For instance, a study conducted by Yusuf et al. (2023) found a correlation between the presence of a risk committee and reduced risk-taking behavior within banks. Daud et al. (2010) analyzed the role of the chief risk officer, establishing that a qualified and experienced CRO can lead to improved risk management outcomes. Board independence is a crucial factor in risk governance, as studies by Dupire and Slagmulder (2019) and Beasley et al. (2005) demonstrate that independent directors are more adept at overseeing risk management practices. However, the qualifications of directors in risk management are equally important.

Berger et al. (2014) discovered that directors with PhD degrees were correlated with lower risk-taking behavior in banks. Furthermore, Erin et al. (2018) explored the relationship between risk governance and financial performance, concluding that effective risk governance practices were linked with improved financial performance and a reduced likelihood of failure. Collectively, these studies underscore the significance of effective risk governance practices in safeguarding banks and maintaining the overall stability of the financial system.

Regulations across OECD countries accentuate the necessity of risk governance in banks. These rules mandate that banks should have a robust framework in place to identify, measure, monitor, and control risks. For instance, the European Union's Capital Requirements Directive 2013 (EUCRD IV) stipulates that banks should establish and maintain a comprehensive risk governance framework, including a clear organizational structure, effective risk management policies and procedures, and an apt risk management function. Similarly, the United States' Dodd-Frank Wall Street Reform and Consumer Protection Act ([DFA], 2010) compels banks to establish a risk management committee and appoint a chief risk officer. The BCBS's Principles for Enhancing Corporate Governance (2015) insist on a sound risk management framework and an independent risk management function in banks. These regulations reiterate the significance of effective risk governance practices in safeguarding the financial soundness of banks and the financial system overall.

This research focuses on select risk governance characteristics like the presence of a risk committee [RC] (Minton et al., 2014), CRO (Aebi et al., 2012; Minton et al., 2014), CFO (Kim et al., 2011; Bargeron et al., 2010), senior directors [SENIOR] (Berger et al., 2014), directors with PhD degrees [TITLE] (Berger et al., 2014), and independent directors [BI] (Adams & Ferreira, 2009; Aebi et al., 2012). By honing in on specific risk governance characteristics, this study addresses the existing gap in the literature calling for a more detailed examination of the impact of risk governance practices in OECD banks. Previous studies have underscored the importance of these characteristics in effective risk governance practices, yet empirical evidence on their specific roles in risk mitigation within banks remains limited. Thus, through exploring the impact of these characteristics on risk governance in OECD banks, this study seeks to offer additional practical insights into risk governance practices within the banking sector.

Bank risk and financial performance are pivotal for the stability and soundness of banks, with regulatory adjustments playing an essential role in ensuring banks can effectively manage their risks. In the aftermath of the global financial crisis, the regulatory landscape for banks has undergone significant transformations. Some studies have inspected the relationship

between bank risk and financial performance in OECD countries, revealing mixed findings. Coccorese and Pellecchia (2009) and Fungácová and Solanko (2009) found a positive relationship between risk and performance. Regulatory adjustments have also been found to significantly impact bank risk and performance. For instance, Chalermchatvichien et al. (2014) and Alam (2014) examined the impact of Basel III regulations on bank risk-taking behavior, and Luu and Vo (2021) and Hirtle and Lehnert (2015) analyzed the effect of supervisory stress tests on bank capital levels. These findings emphasize the necessity of understanding the relationship between bank risk, financial performance, and regulatory adjustments in OECD countries to foster stability and soundness in the banking sector.

Moreover, studies have explored the relationship between bank risk and capital ratios in OECD countries. A negative relationship between capital ratios and bank risk has been reported in some studies, suggesting that higher capital ratios can mitigate bank risk (Behr et al., 2010). On the contrary, other studies found a positive relationship between capital ratios and bank risk, indicating that banks might assume more risk to yield higher returns on their capital (Boudriga et al., 2010). Overall, the literature indicates that capital ratios play a significant role in reducing bank risk, but their impact may vary depending on factors such as the regulatory environment, the banking industry structure, and economic conditions in different countries.

The literature presents a debate regarding the relationship between financial performance of OECD banks and measures such as return on average assets (ROAA) and the ratio of liquid assets to deposits and short-term funding. Certain studies, like those of Wang (2002) and Terraza (2015), suggest a positive relationship between ROAA and these liquidity measures, indicating that higher levels of liquid assets can boost bank profitability. Conversely, other studies found a negative relationship between ROAA and these liquidity measures, implying that higher liquidity might lead to lower returns (Bace, 2016; Ehiedu, 2014). Overall, the literature suggests that the relationship between financial performance and liquidity measures is intricate and likely depends on several factors, including the regulatory environment and the structure of the banking industry.

The role of risk governance and regulatory adjustments in fostering stability and soundness within the banking sector has been a prominent topic within the literature. Altunbas et al. (2011) and Aebi et al. (2012) are among those who have investigated the influence of specific risk governance characteristics, such as the presence of a risk committee, chief risk officer, and independent directors on bank risk. Likewise, the impact of regulatory adjustments, such as the implementation of Basel III regulations and supervisory stress tests, on bank risk

and performance has been considered, with significant effects noted (Naceur et al., 2018; Šútorová & Teplý, 2013). However, the relationship between risk governance and regulatory adjustments in managing risk in OECD banks remains multifaceted and complex. Further research is called for to fully understand their effects on the banking sector's stability and soundness (Krüger et al., 2018).

Before the implementation of risk governance frameworks, significant bank failures led to financial crises. Adrian (2018) pointed out that deficient risk management practices contributed significantly to the failure of many banks during the 2008 financial crisis, exacerbated by short-term profit focus, insufficient regulatory oversight, and excessive reliance on complex financial instruments (Onyiriuba, 2016). Additionally, studies have underscored the impact of poor corporate governance practices, including insufficient board oversight and ineffective risk committees, on bank failures (Magnan & Markarian, 2011; Kirkpatrick, 2009). The literature generally agrees that a lack of risk governance practices, including efficient risk management, regulatory oversight, and corporate governance, played a substantial role in bank failures prior to risk governance frameworks' implementation.

The objective of this dissertation is to carry out empirical research on the impact of risk governance on bank risk, financial performance, and regulatory adjustments of OECD banks. To accomplish these goals, this study will utilize a quantitative research design, building upon existing literature. Past research has investigated the impact of risk governance on bank risk, suggesting that effective risk governance can mitigate risk and decrease the likelihood of bank failure (Srivastav & Hagendorff, 2016; Pirson & Turnbull, 2011). Other research has examined risk governance's effect on financial performance, concluding that effective risk management can enhance financial performance and profitability (Adeusi et al., 2014; Bordeleau & Graham, 2010). Furthermore, the role of risk governance in regulatory adjustments has been highlighted in the literature, implying that efficient risk management practices can assist banks in meeting regulatory requirements and passing stress tests (Velez et al., 2020; Kapinos et al., 2018). Through an examination of risk governance's impact on these three objectives, this study seeks to offer valuable insights regarding risk governance implications for OECD banks.

The performance of OECD banks is significantly impacted by risk governance practices. As the theory of risk posited by Knight (1921) explains, uncertainty and risk are inherent in any economic endeavor and need to be effectively managed to minimize the potential for losses. Risk governance frameworks are instrumental in this regard, enabling banks to identify, assess, and manage risk effectively, thereby reducing the chances of failure and enhancing financial performance. Hambrick and Mason's (1984) upper echelons theory

also corroborates the significance of risk governance for financial performance, proposing that the composition and traits of top management, including their risk attitudes and experiences, can influence organizational outcomes. Moreover, the theory of regulatory compliance underscores the role of risk governance in regulatory adjustments, suggesting that effective risk management practices can help banks meet regulatory requirements and successfully navigate stress tests (Cohen et al., 2004). Taken together, these theories stress the necessity for effective implementation of risk governance frameworks in mitigating risk and improving performance in OECD banks.

Frank Knight's theory of risk (1921) emphasizes the criticality of managing uncertainty and risk in economic activities, a notion that resonates deeply with the practices of internal risk governance in OECD banks. Effective risk governance frameworks, which empower banks to identify, assess, and manage risks, demand collective efforts to ensure effective risk management. Empirical studies have suggested that certain characteristics of internal risk governance practices, such as the establishment of a risk committee (Ferrero-Ferrero et al., 2012), the appointment of a chief risk officer (Liebenberg & Hoyt, 2003; Li et al., 2022), the presence of a chief financial officer with risk management responsibilities (Ojeka et al., 2019), senior directors (Sheedy & Griffin, 2018), directors with PhD degrees (Dionne et al., 2019), and independent directors (Battaglia & Gallo, 2015) can contribute to better risk governance and reduce bank risk. However, the effectiveness of these characteristics can vary, depending on the context and the size of the bank (James & Joseph, 2015). In summary, the theory of risk accentuates the importance of risk management, and the collective efforts of internal risk governance with specific characteristics can help mitigate bank risk in OECD banks.

The upper echelons theory advocates that the composition and traits of top management, including their risk attitudes and experiences, can influence organizational outcomes such as financial performance. Research has found that within the context of risk governance in OECD banks, the presence of a risk committee, chief risk officer, and chief financial officer can enhance risk management practices and curtail risk-taking behavior (Aebi et al., 2012; Karanja & Rosso, 2017). Additionally, senior directors with finance and risk management experience have been found to positively influence financial performance in banks (Aebi et al., 2012). Directors with PhD degrees have also been found to improve firm performance through their expertise and knowledge (Urquhart & Zhang, 2022). Finally, independent directors have been found to have a positive impact on financial performance by monitoring and overseeing management practices (Choi et al., 2007). All in all, the collective

efforts of internal risk governance with selected characteristics can enhance financial performance in OECD banks.

The intertwining of these three theories - Knight's theory of risk, the upper echelons theory, and the theory of regulatory compliance - underscores the necessity for collective efforts of internal risk governance with selected characteristics to mitigate risk and enhance performance in OECD banks. A risk governance framework that is both well-constructed and effectively implemented, coupled with a diverse set of top management and independent directors, can enable banks to better identify, assess, and manage risks, reducing the probability of failure and boosting overall performance.

1.2. The Purpose and Research Questions of the Study

This section in the dissertation outlines the primary objectives of the research and the key questions that the study aims to answer.

1.2.1. Introduction

The overarching aim of this study is to explore the multifaceted impact of risk governance on the performance of public commercial banks within OECD countries. Specifically, the research seeks to elucidate how various aspects of risk governance influence bank risk, financial performance, and the propensity for regulatory adjustments, thereby contributing to the broader discourse on risk governance within the banking sector.

The investigation begins by examining the role of risk governance in managing bank risk. It delves into the collective influence of directorial efforts, particularly emphasizing the importance of the CRO and CFO roles, in shaping effective risk management strategies. The analysis reveals a positive correlation between comprehensive risk governance practices and the Tier 1 capital ratio, suggesting that such governance can significantly mitigate bank risk.

Subsequently, the focus shifts to the relationship between risk governance characteristics of bank directors and the financial performance of public commercial banks in the OECD region. Empirical findings from this part of the study indicate a positive and statistically significant relationship, highlighting that banks with robust risk governance frameworks tend to achieve superior financial outcomes. This segment emphasizes the critical nature of effective risk governance in enhancing the financial stability and performance of banks.

Finally, the research addresses the impact of risk governance on regulatory adjustments, investigating how governance characteristics, such as the presence of senior directors and key financial officers, relate to the frequency and extent of regulatory interventions. The findings suggest a significant negative association, indicating that strong risk governance frameworks can reduce the need for regulatory adjustments, thereby promoting greater stability and trust within the banking sector. Through this integrated exploration of risk governance's various dimensions, the study aims to provide a comprehensive understanding of its implications for bank performance and regulatory compliance. The methodology employed encompasses a combination of econometric analysis and theoretical inquiry, utilizing a robust dataset to ensure the reliability and relevance of the research findings.

1.2.2. Purpose of the Study

The overarching purpose of this dissertation is to delve into the intricate dynamics of risk governance and its consequential impact on the performance and regulatory landscape of public commercial banks within the OECD. This investigation is guided by three pivotal research questions, each aiming to uncover the nuanced relationship between risk governance and key performance indicators within the banking sector:

1. What is the impact of risk governance on the bank risk of public commercial banks of the OECD?
2. What is the impact of risk governance on the financial performance of public commercial banks of the OECD??
3. What is the impact of risk governance on the bank regulatory adjustments of public commercial banks of the OECD??

At the heart of this inquiry is the exploration of risk governance as a multifaceted construct that encompasses a range of directorial roles, seniority, education and presence of risk committees. The study aims to provide a comprehensive empirical analysis of how risk governance, through its various dimensions, affects the bank's risk, financial performance, and susceptibility to regulatory adjustments.

The first dimension of this exploration focuses on understanding the impact of risk governance on bank risk. This involves assessing the quantifiability of risk through governance mechanisms, evaluating the collective influence of directors, and examining the relationship between risk governance characteristics and key financial ratios such as the Tier 1 capital ratio. The objective is to shed light on how robust risk governance can fortify banks against inherent risks, thereby contributing to the stability and resilience of the banking sector.

Subsequently, the research shifts its lens towards the financial performance aspect, aiming to elucidate the correlation between risk governance characteristics of bank directors and the financial outcomes of the institutions they govern. By testing the hypothesis that stronger risk governance frameworks correlate with enhanced financial performance, this part of the study seeks to provide actionable insights that can inform the development of effective governance structures and strategies.

Lastly, the dissertation ventures into the domain of regulatory adjustments, investigating the influence of specific risk governance attributes—such as the presence of key

roles like the CRO and CFO and senior directors—on the frequency and nature of regulatory interventions. This inquiry aims to contribute to the discourse on policy-making and regulatory practices, highlighting the potential of sound risk governance to streamline compliance and foster a more stable banking environment.

Through this comprehensive examination, the dissertation endeavors to advance the understanding of risk governance within the context of OECD public commercial banks, offering empirical evidence and theoretical insights that bear significance for academics, practitioners, and policymakers alike.

1.2.3. Hypotheses of the Study

Following the articulation of the research questions, this dissertation proposes three hypotheses based on the anticipated impact of risk governance on public commercial banks within the OECD. These hypotheses are formulated with the intent to explore and empirically test the relationship between risk governance and its outcomes on bank risk, financial performance, and regulatory adjustments. The hypotheses are grounded in the theoretical framework that posits risk governance as a critical determinant of bank stability and performance.

Hypothesis 1: There is a positive relationship between risk governance characteristics and the Tier 1 Capital ratio in public commercial banks of the OECD, implying that effective risk governance is associated with a lower level of bank risk.

This hypothesis aims to investigate the extent to which risk governance can mitigate bank risk, as indicated by a critical financial stability metric, the Tier 1 Capital ratio. By analyzing the impact of risk governance characteristics, such as the roles of directors, their seniority, and the presence of risk committees, this hypothesis tests the assumption that risk governance characteristics enhance a bank's resilience to financial instability.

Hypothesis 2: There is a significant positive relationship between the risk governance characteristics and the financial performance as measured by the net income of public commercial banks in the OECD, indicating that risk governance leads to improved financial outcomes. This hypothesis explores the connection between the characteristics of risk governance—encompassing directorial roles, education, and committee presence—and the financial success of banks. It postulates that banks with more sophisticated and comprehensive risk governance structures are better positioned to achieve superior financial performance.

Hypothesis 3: Risk governance is negatively associated with regulatory adjustments in public commercial banks of the OECD, suggesting that banks with risk governance characteristics face fewer regulatory challenges.

The focus of this hypothesis is on the role of risk governance in reducing the need for regulatory interventions. It examines how governance attributes, including the presence of key roles such as the CRO and CFO, as well as the composition and expertise of senior directors, influence a bank's regulatory compliance and adaptability to regulatory changes.

These hypotheses serve as a bridge between the initial exploration of the subject matter presented in the research questions and the empirical analysis conducted in the study. By stating these hypotheses explicitly, the dissertation sets a clear expectation for the investigation's direction and the nature of the findings it seeks to present. This approach not only clarifies the research objectives but also enhances the coherence and logical progression of the dissertation from its purpose to its conclusions.

1.2.4. Integrated Overview of Research Areas

This dissertation encompasses a comprehensive examination of risk governance within public commercial banks in OECD countries, articulated through a series of interconnected investigations. Each segment of the study delves into a distinct aspect of risk governance, collectively contributing to a nuanced understanding of its implications for banking performance and regulatory compliance.

The first area of inquiry explores the impact of risk governance on bank risk, drawing upon Knight's conception of risk to empirically assess its quantifiability within banking institutions. Through sophisticated analytical techniques, including multivariate regression analysis and Principal Component Analysis (PCA), this investigation reveals a significant positive correlation between robust risk governance practices and the Tier 1 capital ratio. This finding underlines the vital role of directorial attributes—such as age, educational background, and specific roles like CRO and CFO—in mitigating bank risk. These insights not only enrich the academic discourse on risk governance but also offer practical guidelines for enhancing risk management strategies, with broad implications for both banking institutions and regulatory bodies.

The subsequent investigation shifts focus to the relationship between the characteristics of bank directors' risk governance and the financial performance of their institutions. Employing an econometric model on an extensive dataset covering bank-director years from

2001 to 2019, this segment provides compelling evidence that banks endowed with more sophisticated risk governance frameworks tend to achieve superior financial outcomes. This revelation holds significant importance for the global banking landscape, emphasizing the criticality of effective risk governance in promoting financial stability and performance. The practical insights derived from this analysis serve as valuable resources for stakeholders involved in risk management and policy formulation within the banking sector.

The final facet of this dissertation investigates the influence of key risk governance characteristics—namely the presence of a CRO, CFO, and senior directors—on the prevalence of regulatory adjustments in OECD public commercial banks. Utilizing a robust statistical methodology on a dataset spanning 14,596 bank-director years, the findings indicate a pronounced negative correlation between strong risk governance and the frequency of regulatory adjustments. This observation suggests that effective risk governance frameworks can significantly reduce regulatory interventions, enhancing the stability and trustworthiness of banking institutions. However, the mixed outcomes observed in the sensitivity analysis around specific regulatory ratios highlight the complexity of this relationship and underscore the necessity for further exploration.

Collectively, these investigations provide a multifaceted perspective on the role of risk governance in the banking sector, offering valuable contributions to both the scholarly literature and practical applications in banking management and policy-making. By elucidating the intricate dynamics between risk governance, bank performance, and regulatory practices, this dissertation lays the groundwork for future research and informs the development of more robust governance frameworks in the banking industry.

1.3. Methodology of the Study

This section in the dissertation outlines the methodology employed to achieve the goals as described in the previous section.

1.3.1. Data Collection and Description

The empirical investigations within this dissertation are grounded in a comprehensive dataset meticulously compiled from two primary sources: the BankFocus database, which provides detailed financial information, and the BoardEx database, offering extensive data on bank directors. This unified dataset serves as the foundation for exploring the diverse dimensions of risk governance across three distinct research areas.

Across all research areas, the data collection is underpinned by a consistent framework that includes the use of both the BankFocus and BoardEx databases, which are instrumental in providing the necessary financial and directorial information to compile a robust and reliable dataset for analysis. The dataset itself is comprehensive, encompassing data from 28 OECD countries and featuring active, listed banks with detailed C1 financial statements and C* Additional Consolidated statements, thereby ensuring the inclusion of a wide array of financial activities from controlled subsidiaries or branches. This dataset spans across bank-director years, capturing unique combinations of banks, directors, and years, which allows for a nuanced analysis of how directorial characteristics influence bank performance. Moreover, despite the dataset's extensive coverage and the potential presence of outliers, these were not excluded from the analysis. This decision to include outliers stems from a recognition of their value in providing a more inclusive and comprehensive view of the dataset, thereby offering deeper insights into the complex dynamics within the banking sector.

While the data collection framework is consistent across the dissertation, nuances in the observational scope and variable focus distinguish each research area. In the first area, focusing on bank risk, the dataset includes 14,596 bank-director years, 1125 unique bank-years, and 14,404 director-year observations, with a variable focus on TIER1 and directorial attributes such as RC, CRO, CFO, TITLE, SENIOR, and BI. The second area, examining financial performance, utilizes 14,410 bank-director years, highlighting 1107 unique bank-years and 14,218 director-year observations, and broadens the analysis to 22 variables that encompass a wider spectrum of financial and governance-related metrics. The third area, exploring regulatory adjustments, mirrors the first in terms of observational count, using the same 14,596 bank-director years dataset, but shifts the variable focus to include regulatory adjustments

(RA), TIER1, TCR, and governance indicators like RC, CRO, CFO, TITLE, SENIOR, and BI, thereby maintaining a consistent yet distinct approach within each thematic investigation.

This structured approach to data collection and description underscores the rigorous methodology underpinning the dissertation. By delineating the commonalities and differences in the data collection process across research areas, the dissertation provides a clear, transparent foundation for the subsequent analyses. This meticulous organization ensures that the investigation into each dimension of risk governance is both comprehensive and tailored to the specific research questions at hand.

1.3.2. Research Methodology

The research methodologies across the sections of the dissertation share a foundational approach in statistical analysis, utilizing multivariate regression analysis, Principal Component Analysis (PCA), and robustness checks, including bootstrap procedures, to explore different dimensions of risk governance within OECD public commercial banks.

The methodological approach is characterized by a robust quantitative framework, employing multivariate regression analysis to investigate the relationships between risk governance attributes and various banking outcomes. Principal Component Analysis (PCA) is used to create composite indices from multiple risk governance variables, offering a holistic measure of risk governance. This method allows for a detailed assessment of how combined governance characteristics impact bank risk, financial performance, and regulatory adjustments. Variables of interest are standardized to ensure comparability and consistency, facilitating coherent analysis across different focal points. The datasets are structured into panel formats, accommodating the longitudinal nature of the data and enabling an examination of temporal changes. The use of fixed effects models is consistent, controlling for unobserved heterogeneity across banks and over time, thus isolating the specific impact of risk governance on the dependent variables. The robustness of findings is confirmed through bootstrap procedures, with numerous replications to verify the stability and reliability of the regression results.

By first highlighting the shared methodological foundations before addressing the specifics unique to each research area, the dissertation presents a unified and comprehensive overview of the research approach. This structure facilitates an understanding of the common analytical framework while also recognizing the distinct analytical nuances tailored to the specific research questions addressed in each section.

In the section focusing on bank risk, the investigation delves into the TIER1 ratio as the principal indicator of bank risk, elaborating on a regression model designed to assess the impact of the Risk Governance Index (RGI) alongside other control variables pertinent to banks. This part of the study introduces causality tests, such as Granger Causality, to probe into the time-bound dynamics between risk governance practices and bank risk, aiming to provide a more layered temporal analysis.

The econometric model that guides this research area is structured as follows:

$$Risk_{b,t} = \alpha_0 + \beta_1 RGI_{b,t} + \beta_2 X_{b,t} + \alpha_b + \delta_t + \theta_{b,t} + \varepsilon_{b,t}$$

In this model, 'Risk' embodies dependent variable, the TIER1 ratio, which measure the risk level of public commercial banks in the OECD. 'b' represents the bank at time 't', α_0 is a constant in regression models, and RGI encapsulates the risk governance indicators: RC, CRO, CFO, TITLE, AGE, and BI. X symbolizes bank controls that include CEOAD, BS, and SIZE. The terms α_b and δ_t denote fixed individual and time effects, respectively.

In the model, $\theta_{b,t}$ represents the effect of clustering at the bank level over time, addressing the correlation of residuals within each bank cluster (Petersen, 2008). *B* is the total number of banks and t represent bank at time t. The incorporation of $\theta_{b,t}$ is crucial in ensuring that the estimated coefficients are robust, especially as the number of clusters increases, thereby ensuring consistency in cluster-robust standard errors (Wooldridge, 2010). This approach of one-way clustering at the bank level is key to maintaining the assumption of independent and identically distributed residuals, thereby validating the statistical significance of the estimated coefficients (Scheuch et al., 2022). $\epsilon_{b,t}$ is the error term in the model.

The main regression analysis was conducted using the 'reghdfe' command in Stata, which is designed for high-dimensional fixed effects estimations. This method efficiently estimates models with multiple fixed effects, in this case, both year and bank. By absorbing these fixed effects, the analysis controls for unobservable characteristics that remain constant within each bank across time and across all banks in a given year. Additionally, by clustering the standard errors at the bank level, the method accounts for potential correlations in the residuals within banks over time, ensuring more robust and reliable coefficient estimates. To validate the robustness of Model 1, a bootstrap procedure with 100 repetitions was implemented in Model 1a. The bootstrap resampling method generates multiple replicated

datasets by sampling with replacement from the original dataset. This approach allows for the estimation of coefficients' stability and provides robust standard errors. The estimated coefficients and their significance levels are evaluated using the bootstrap results.

To ensure the reliability of the primary model's findings, several robustness checks were conducted. Initially, a sensitivity analysis using AVARPTP, the Average Value at Risk relative to pre-tax profit, was performed. This variable serves as a measure to understand the potential loss value, providing a critical assessment of the model's stability and sensitivity to changes or perturbations. Subsequently, the study introduced Model 2, aiming to evaluate the robustness of the relationship between specified variables such as RGI, CEOAD, BS, and SIZE, with AVARPTP. This was further substantiated by a bootstrap technique in Model 2a, mirroring the procedure utilized in Model 1, enhancing the rigor and reliability of the findings by assessing their consistency across various conditions and assumptions. This multi-step approach ensures a comprehensive evaluation of the model's outcomes, bolstering confidence in the validity of the results.

In understanding the dynamics between risk governance and bank risk, causality tests were executed. One test was conducted to ascertain whether the risk governance practices of previous years influence the present bank risk. Another test, known as a reverse causality test, was carried out to determine if the level of bank risk has a bearing on the subsequent implementation of risk governance mechanisms. These tests were carried out in accordance with the Granger Causality method (Granger, 1969). To further enhance the understanding, a Granger Causality test with 4 lags (i.e., 4 years) was also undertaken, focusing on the main dependent variable, TIER1, and the primary variable of interest, RGI (Granger, 1969).

The section dedicated to financial performance adopts the Upper Echelons Theory (UET) as a theoretical framework to explore how the attributes of bank directors influence the financial performance of banks, with financial performance operationalized through the natural logarithm of Net Income (LNNI). This part broadens the analytical scope by incorporating study variables, thereby covering an extensive range of financial and governance-related metrics. To verify the robustness of the relationship between risk governance and financial performance, sensitivity analyses are conducted using alternate dependent variables, offering a comprehensive evaluation of the governance-performance nexus.

$$LNNI_{bt} = \beta_0 + \beta_1 * RGI_{bt} + \beta_2 * CEOAD_{bt} + \beta_3 * BS_{bt} + \beta_4 * SIZE_{bt} + \alpha_c + \gamma_t + \varepsilon_{bt}$$

This model examines the relationship between the dependent variable, LNNI, where "b" represents the bank and "t" denotes time in years. The variables selected for this study have been grounded in existing literature and are believed to influence the financial performance of banks significantly. The LNNI, representing the natural logarithm of Net Income, is standardized across all countries under international reporting standards. This standardization ensures that differences in taxation across countries are accounted for, eliminating potential biases in the results. However, it's essential to consider this aspect when interpreting the findings, and it will be highlighted in the limitations section for comprehensive understanding. The model assesses the relationship with the independent variables: RGI which is renamed as COMP1 from PCA, CEOAD, BS, and SIZE. The model controls for countries and time fixed effects, represented by α_c and γ_t, respectively, to account for unobserved heterogeneity across countries and time periods (Wooldridge, 2010). The error term, ε_{bt}, captures the unobserved factors influencing the dependent variable. To address potential correlation within banks, clustered standard errors at the bank level are employed (Petersen, 2008). These adjustments mirror the diverse national regulatory environments, economic conditions, and governance structures (OECD, 2010).

The regression analysis was conducted using the 'reghdfe' command in Stata, designed for linear regression models with multiple levels of fixed effects. This command was utilized to efficiently absorb both year and country fixed effects, accounting for unobserved heterogeneity. The standard errors were clustered at the bank level to ensure robustness against potential correlations within banks (Correia, 2014). To assess the robustness of the main regression analysis, a bootstrap procedure with 100 repetitions was conducted. To assess the robustness of Model 3, Model 3a was derived by employing a bootstrap technique with 100 replications. This technique was used to assess the stability and reliability of the results from Model 3 (Efron & Tibshirani, 1994). The "a" in Model 3a indicates the application of bootstrapping to the original model. The bootstrap resampling method generates multiple replicated datasets by sampling with replacement from the original dataset. This approach allows for the estimation of coefficients' stability and provides robust standard errors (Efron & Tibshirani, 1994). The estimated coefficients and their significance levels are evaluated using the bootstrap results (Efron & Tibshirani, 1994).

A sensitivity analysis was conducted to further validate the findings of the primary model. The selection of different dependent variables, namely "LNILGL", "LNLLRGR", and "LNNCOAGL", was informed by their significance in the banking sector. "LNILGL" represents the natural logarithm of impaired loans to gross loans, which provides insights into

the quality of a bank's loan portfolio. On the other hand, "LNLLRGR" indicates the natural logarithm of loan loss reserves to gross loans, shedding light on the bank's preparedness for potential loan defaults. Lastly, "LNNCOAGL" reflects the natural logarithm of net charges offs to average gross loans, offering a perspective on the bank's actual losses from defaulted loans. These variables were specifically chosen as they offer diverse insights into the bank's financial performance and risk exposure. The fixed effects model was estimated using these variables, with standard errors clustered at the bank level, and a bootstrap technique with 100 repetitions was employed to assess the robustness of the results (Efron & Tibshirani, 1994).

The sensitivity analysis aimed primarily to test the robustness of the primary model's findings against different measures of bank performance. While the dependent variables were altered to represent various aspects of bank performance, the set of independent variables remained consistent across all models. This decision was grounded in the theoretical and empirical evidence that highlights the significance of these independent variables in influencing bank performance. By keeping the independent variables consistent, this ensures that any variations observed in the results can be attributed solely to the change in the dependent variable, providing a clearer understanding of the relationship dynamics.

$$LNILGL_{bt} = \gamma_0 + \gamma_1 * RGI_{bt} + \gamma_2 * CEOAD_{bt} + \gamma_3 * BS_{bt} + \gamma_4 * SIZE_{bt} + \alpha_c + \gamma_t + \varepsilon_{bt}$$

$$LNLLRGR_{bt} = \delta_0 + \delta_1 * RGI_{bt} + \delta_2 * CEOAD_{bt} + \delta_3 * BS_{bt} + \delta_4 * SIZE_{bt} + \alpha_c + \gamma_t + \varepsilon_{bt}$$

$$LNNCOAGL_{bt} = \theta_0 + \theta_1 * RGI_{bt} + \theta_2 * CEOAD_{bt} + \theta_3 * BS_{bt} + \theta_4 * SIZE_{bt} + \alpha_c + \gamma_t + \varepsilon_{bt}$$

In Model 4, $LNILGL_{bt}$ represents the dependent variable (DV) for specific bank in a given time period. The independent variables are RGI, CEOAD, BS, and SIZE for the corresponding bank and time period. The fixed effects, α_c and γ_t capture country and time heterogeneity, respectively, while the error term, ε_{bt}, accounts for unobserved factors influencing the LNILGL (Wooldridge, 2010). To assess the robustness of Model 4, a bootstrap technique is employed in Model 4a, similar to Model 1 (Efron & Tibshirani, 1994). Similarly, in Model 5, $LNLLRGR_{bt}$ represents the dependent variable, for bank b in time period t. The independent variables and other definitions of fixed effects and error term are same as in Model 4 and 5 along with the application of bootstrap technique for robustness of Model 4 in Model 4a (Efron & Tibshirani, 1994). The last Model 6, $LNNCOAGL_{bt,}$ represents dependent variable, where rest of the model specifications are same as in all other models (Wooldridge, 2010).

Lastly, to further investigate the relationship between the main dependent variable "LNNI" and the primary variable of interest "RGI", a Granger Causality test was conducted. This test was performed with a lag of 4 periods, which in this context corresponds to 4 years. The purpose of this test is to determine if past values of "RGI" can be used to predict future values of "LNNI". The Granger Causality test, based on the foundational work of Granger (1969), provides insights into the causal relationship between the two variables in a time series context.

In conclusion, the methodology aims to illuminate the relationship between risk governance and financial performance within the OECD countries. The study seeks to understand how this relationship evolves over time by analyzing the impact of governance and control variables on financial performance, as informed by Adams et al. (2010).

In the segment concerning regulatory adjustments, the primary focus is on regulatory adjustments as the dependent variable, with a model meticulously constructed to examine how these adjustments correlate with the risk governance composite index and additional control variables. This segment accentuates the significance of regulatory adjustments, thoroughly examining their linkage with risk governance. It further enriches the analysis by including sensitivity analyses with TIER1 and TCR as alternative dependent variables, thereby ensuring the findings' robustness and contributing to a nuanced understanding of the regulatory landscape's interaction with governance practices.

An econometric model was designed to encapsulate the regulatory adjustments occurring in different countries.

$$RA_{bt} = \beta_0 + \beta_1 * RGI_{bt} + \beta_2 * CEOAD_{bt} + \beta_3 * BS_{bt} + \beta_4 * SIZE_{bt} + \alpha_b + \delta_t + \varepsilon_{bt}$$

In this research area, a primary focus is placed on the dependent variable, RA (Regulatory Adjustments). Regulatory adjustments, as defined by the Bank for International Settlement (BIS) in CAP30, are crucial for banks. They encompass various elements such as intangible assets, deferred tax assets, cash flow hedge reserve, and cumulative gains and losses due to changes in own credit risk on fair valued liabilities. Primarily applied to Common Equity Tier 1, these adjustments aim to provide a transparent view of the Common Equity Tier 1 to all stakeholders. Institutions are mandated to apply these requirements to all their assets measured at fair value when calculating their own funds. Furthermore, any additional value adjustments deemed necessary are deducted from the Common Equity Tier 1 capital. The model, therefore, examines the relationship between RA and the independent variables,

including the Risk Governance Index (RGI), which has been renamed from Comp1 following a PCA, CEOAD, BS, and SIZE. In the model, RA_{bt}, RA_{bt} represents the Regulatory Adjustment for bank $_b$ in year $_t$. Here, b denotes the bank and t represents time in years. The model controls for bank and time fixed effects denoted by α_b and δ_t, respectively for unobserved heterogeneity across banks and time. The error term, ε_{bt}, represents the unobserved factors influencing the dependent variable. Clustered standard errors at the bank level are employed to account for potential correlation within banks. These adjustments mirror the diverse national regulatory environments, economic conditions, and governance structures. Distinctions were made between regulatory adjustments as changes mandated by regulators, and governance and controls as the bank's internal mechanisms. The 'beta', or the slope intercept, is the baseline level of Regulatory Adjustment in the absence of other control variables.

The main regression analysis utilized the reghdfe command. This command is an extension of Stata's standard regression command, specifically tailored for high-dimensional fixed effects models. It efficiently estimates linear regressions with multiple levels of fixed effects by absorbing these effects. In this research, the reghdfe command was employed to estimate the fixed effects model, absorbing both year and bank fixed effects. Additionally, standard errors were clustered at the bank level to account for potential correlations within banks and to provide robust standard errors. To assess the robustness of the main regression analysis, a bootstrap procedure with 100 repetitions was conducted (Karyani et al., 2020). To assess the robustness of Model 6, a bootstrap technique is employed with 100 replications to assess the robustness of the results from Model 7 in Model 7a. The bootstrap resampling method generates multiple replicated datasets by sampling with replacement from the original dataset. This approach allows for the estimation of coefficients' stability and provides robust standard errors. The estimated coefficients and their significance levels are evaluated using the bootstrap results.

A sensitivity analysis was conducted using alternative dependent variables, "TIER1" (Tier 1 capital / Risk Weighted assets) and "TCR" (Total capital / Risk Weighted assets), to test the robustness of the results obtained with the primary dependent variable, RA (Regulatory Adjustments). Both TIER1 and TCR are critical indicators of a bank's financial health and stability. Given that regulatory adjustments primarily influence Common Equity Tier 1, which is a component of TIER1, there's an inherent relationship between these variables. By examining the results across RA, TIER1, and TCR, the analysis aims to ascertain the consistency and robustness of the findings. The models were estimated with fixed effects,

clustering the standard errors at the bank level, and employing a bootstrap with 100 repetitions to further assess robustness.

$$TIER1_{bt} = \gamma_0 + \gamma_1 * RGI_{bt} + \gamma_2 * CEOAD_{bt} + \gamma_3 * BS_{bt} + \gamma_4 * SIZE_{bt} + \alpha_b + \gamma_t + \varepsilon_{bt}$$

$$TCR_{bt} = \delta_0 + \delta_1 * RGI_{bt} + \delta_2 * CEOAD_{bt} + \delta_3 * BS_{bt} + \delta_4 * SIZE_{bt} + \alpha_b + \gamma_t + \varepsilon_{bt}$$

In Model 8, $TIER1_{bt}$ represents the dependent variable, for bank b in time period t. The independent variables are RGI, CEOAD, BS, and SIZE for the corresponding bank and time period. The fixed effects, α_b and γ_t capture bank and time heterogeneity, respectively, while the error term, ε_{bt}, accounts for unobserved factors influencing the TIER1.

To assess the robustness of Model 8, a bootstrap technique is employed in Model 8a same as in Model 7. Similarly, in Model 9, TCR_{bt} represents the dependent variable, TCR for bank b in time period t. The independent variables and other definitions of fixed effects and error term are same as in Model 7 and 8 along with the application of bootstrap technique for robustness of Model 9 in Model 9a.

In conclusion, the methodology, underpinned by data on OECD banks spanning 20 years, seeks to elucidate the relationship between regulatory adjustments and risk governance. While this research does not directly study variations across national contexts or provide a baseline understanding in the absence of governance and control variables, the comprehensive dataset inherently captures the nuances and variations over time and across different banking environments. This approach offers valuable insights into the dynamics of regulatory adjustments in relation to risk governance.

The methodological choice to omit dynamic panel data analysis with lagged independent variables was a strategic decision aligned with the dissertation's focus on the collective impact of risk governance characteristics on bank risk, financial performance, and regulatory adjustments. The incorporation of Granger causality tests, utilizing four lags, provides valuable insights into the temporal dynamics of past governance practices influencing future outcomes, contributing significantly to understanding dynamic effects in this context.

This methodological approach was informed by the dissertation's theoretical underpinning, which emphasizes the cumulative effect of risk governance attributes, rather than isolating the impact of individual characteristics over time. Granger causality tests offer a means to explore temporal relationships, avoiding the complexities of dynamic panel data models that could potentially detract from the study's core emphasis on collective impacts of risk governance.

Considering the practicality of dynamic panel data analysis with lagged independent variables, this area presents a valuable opportunity for future research. Future studies could build upon the current findings by incorporating dynamic panel models to delve deeper into the individual and time-variant impacts of risk governance characteristics on banking outcomes. This could provide a more nuanced understanding of how individual governance attributes and their changes over time contribute to the overall governance structure's effectiveness within the banking sector.

1.3.3. Integration and Synthesis

In this dissertation, the collective examination of risk governance's impact on OECD banks unfolds through the detailed exploration of three critical dimensions: bank risk, financial performance, and regulatory adjustments. Each section delves into a unique facet of banking performance, painting a comprehensive picture of how risk governance mechanisms influence the sector's stability and efficacy.

A recurring theme across these investigations is the pivotal role of risk governance in shaping various banking performance metrics. The first analysis reveals a positive correlation between robust risk governance practices and the Tier 1 capital ratio, suggesting that effective governance can significantly mitigate bank risk. The second study further builds on this foundation by illustrating a positive link between risk governance and financial performance, indicating that well-structured governance frameworks can enhance a bank's financial health. Conversely, the third exploration presents a contrasting perspective by highlighting a negative relationship between risk governance and the frequency of regulatory adjustments, implying that strong risk governance can lead to fewer regulatory interventions.

These nuanced findings collectively affirm the critical importance of sound risk governance within the banking sector. They shed light on the essential contributions of collective directorial efforts and specific roles, such as those of the CRO and CFO, in steering banks towards lower risk profiles, improved financial outcomes, and reduced regulatory scrutiny.

By weaving together these diverse strands of analysis, the dissertation offers valuable insights for a broad spectrum of stakeholders, including regulators, policymakers, and bank management teams. It underscores the necessity of implementing and maintaining robust risk governance frameworks to bolster bank performance and ensure systemic stability. This integrated synthesis not only aligns with the dissertation's broader research goals but also

emphasizes the fundamental significance of risk governance in enhancing the resilience and efficiency of the banking industry. Through this cohesive narrative, the dissertation reinforces the essential role of risk governance in fostering a stable and prosperous banking sector.

Table 1 – Variable Definitions

Research Variables	Measurements	Data Source
Dependent		
TIER1[a]	Tier 1 capital / Risk Weighted assets	BankFocus
AVARPTP	Average VaR / pre-tax profit	BankFocus
LNNI	Natural logarithm of Net Income (in 1000 EUR)	BankFocus
LNILGL	Natural logarithm of impaired loans to gross loans	BankFocus
LNLLRGR	Natural logarithm of loan loss reserves to gross loans	BankFocus
LNNCOAGL	Natural Logarithm of Net Charges offs to average gross loans	BankFocus
RA[b]	Regulatory adjustments (in 1000 EUR)	BankFocus
TCR[c]	Total capital / Risk Weighted assets	BankFocus
Independent		
RGI	Risk Governance Index, derived from a Principal Component Analysis (PCA) of the following variables: RC, CRO, CFO, TITLE, AGE, and BI. The first principal component (COMP1) from the PCA is selected as the RGI, providing an aggregated view of the bank's risk governance practices.	
RC	if bank has Risk Committee (1) and if not (0)	BoardEx
CRO	Binary variable indicating the presence (1) or absence (0) of a Chief Risk Officer in the bank, irrespective of their board membership status.	BoardEx
CFO	Binary variable indicating the presence (1) or absence (0) of a Chief Financial Officer in the bank, irrespective of their board membership status.	BoardEx
TITLE	if director holds PhD degree (1) and if not (0)	BoardEx
SENIOR	if director's age is between 66-75 (1) and if not (0)	BoardEx
BI	if the Director is an independent director	BoardEx
Control		
CEOAD	if Chief Executive Officer has an additional[d] position (1) and if not (0)	BoardEx
BS	Total number of directors on board	BoardEx
SIZE	Total Assets (in 1000 EUR)	BankFocus
LNSIZE	Natural logarithm of the Total Assets	

Note: Table 1 delineates the dependent, independent, and control variables used in this study. The variables are explicitly defined, with their corresponding measurements detailed for clarity. For reproducibility and verification, the data source for each variable is also specified. The variables were operationalized based on standard definitions and measurement scales prevalent in the literature, maintaining consistency and validity of the research findings. This table serves as an essential resource for understanding the operational framework of the study and should be referenced when interpreting the research results.

[a] TIER1 refers to a bank's Tier 1 capital, which is divided into Common Equity Tier 1 (CET1) and Additional Tier 1 (AT1). CET1 consists of common shares, stock surplus, retained earnings, other comprehensive income, qualifying minority interest, and regulatory adjustments, and it primarily absorbs losses as they arise. On the other hand, AT1 includes certain capital instruments and surplus, with some loss absorption on an ongoing basis. The percentages mentioned (CET1 >4.5% and CET1 + AT1 >6%) reflect regulatory benchmarks for these capital levels. Risk-weighted assets, which are used in the denominator of capital ratios, consider different asset risk categories. Source: Bank for International Settlement (BIS). According to the Basel Committee on Banking Supervision, the minimum Tier One ratio has to achieve 6 % by 1 January 2015 (the implementation phase started in January 2013). For the previous versions of Basel, the minimum percentage required was 4 % (Basel Committee on Banking Supervision, 2011).

[b] Regulatory Adjustments (RA): These are specific modifications made to a bank's assets and liabilities as mandated by the Bank for International Settlement (BIS) under the CAP30 guidelines. The adjustments include, but are not limited to, intangible assets, deferred tax assets, and changes in own credit risk on fair valued liabilities. The primary purpose of these adjustments is to present a more accurate view of a bank's Common Equity Tier 1 capital. Essentially, they ensure that stakeholders have a transparent view of the bank's core capital by accounting for certain assets and liabilities that might otherwise distort this view. When calculating their own funds, banks must consider all assets measured at fair value and make necessary deductions from Common Equity Tier 1 capital for any additional value adjustments.

[c] Total capital / Risk Weighted assets. According to the Basel Committee on Banking Supervision, the minimum total capital ratio has to remain at 8%

[d] A binary variable that indicates whether the Chief Executive Officer (CEO) holds an additional position, such as Chairman of the Board, within the bank in a given year (1 for "Yes", and 0 for "No").

1.4. Motivation and the Reasons for Examining Public Commercial Banks of OECD

The examination of risk governance and performance in OECD banks is a crucial research area due to several motivations and reasons. Firstly, effective risk governance practices can mitigate the likelihood of bank failure and improve overall performance (Demirgüç-Kunt & Huizinga, 2010; Nahar et al., 2016). In addition, regulatory requirements for banks have become increasingly stringent in recent years, making risk governance a vital aspect for compliance (Wright et al., 2018; Laeven & Levine, 2009). Secondly, the financial crisis of 2008 highlighted the importance of risk governance in banks and the severe consequences of inadequate risk management practices (Beck et al., 2013). Thirdly, the complexity of financial instruments and the interconnectedness of global markets increase the need for effective risk governance frameworks to manage these risks (Ellis et al., 2014; Barth et al., 2013). Fourthly, the literature suggests that the composition and characteristics of top management, including their risk attitudes and experiences, can influence organizational outcomes, emphasizing the importance of selected risk governance characteristics (Hambrick & Mason, 1984; Sheedy & Griffin, 2018).

Furthermore, effective risk governance can have a positive impact on a range of performance measures, including profitability, efficiency, and solvency (Shamsuddin & Xiang, 2012; Nguyen, 2022; Bonfim & Kim, 2012). Additionally, it is essential to investigate the relationship between risk governance and bank risk to identify and manage risks effectively (Ellis et al., 2014; Beck et al., 2013). Finally, it is crucial to examine the role of risk governance in regulatory adjustments, such as stress tests, as effective risk management practices can help banks meet regulatory requirements and pass such tests (Kapinos et al., 2018; Bitar et al., 2018; Berger & Bouwman, 2017).

Given the significance of risk governance and performance in OECD banks, a considerable body of literature has emerged in recent years. For example, studies have examined the impact of risk governance frameworks on financial performance and found a positive relationship between the two (Ellis et al., 2014). Furthermore, research has investigated the effectiveness of specific risk governance characteristics, such as the role of independent directors, in managing risks and enhancing performance (Mongiardino & Plath, 2010; Fanta et al., 2013). In addition, studies have analyzed the impact of regulatory requirements on risk governance practices and their effectiveness (Berger & Bouwman, 2017). Moreover, research has investigated the relationship between risk governance and specific

types of risk, such as credit risk and operational risk, and their impact on performance (Ellis et al., 2014; Beck et al., 2022).

In summary, the examination of risk governance and performance in OECD banks is a crucial research area due to the need to manage risks effectively, comply with regulatory requirements, and improve overall performance. The literature suggests that effective risk governance practices can mitigate the likelihood of bank failure and have a positive impact on various performance measures. Finally, research has investigated the impact of regulatory requirements on risk governance practices and their effectiveness.

The examination of risk governance and performance in OECD banks is a crucial research area due to several motivations and reasons. Effective risk governance practices play a vital role in mitigating the likelihood of bank failure and improving overall performance (Ellis et al., 2014). Risk governance encompasses various elements, including the presence of a risk committee, the role of the CRO, the CFO, SENIOR, TITLE, and BI. These selected risk governance characteristics have been shown to significantly influence organizational outcomes and enhance risk management practices (Mongiardino & Plath, 2010; Fanta et al., 2013).

The presence of a risk committee within the governance structure of a bank ensures effective risk oversight and decision-making processes. Studies have found that banks with a well-established risk committee exhibit better risk management practices and improved financial performance (Mongiardino & Plath, 2010; Fanta et al., 2013). Additionally, having a dedicated CRO responsible for overseeing the risk management function contributes to effective risk identification, assessment, and mitigation strategies (Ellis et al., 2014). The CRO's expertise and authority in risk-related matters help align risk governance with the bank's strategic objectives and enhance overall performance.

The CFO also plays a crucial role in risk governance by integrating risk considerations into financial decision-making processes. Effective coordination between the risk management and finance functions ensures a comprehensive understanding of the bank's risk profile and the implications for financial performance (Ellis et al., 2014). The CFO's involvement in risk governance contributes to sound financial planning, capital allocation, and risk-adjusted performance measurement.

Furthermore, the composition of the board of directors is an essential aspect of risk governance. Senior directors, directors with PhD degrees, and independent directors bring diverse expertise, knowledge, and independence to the decision-making process (Hambrick & Mason, 1984; Mongiardino & Plath, 2010). Their active participation in risk oversight activities fosters effective risk governance practices and helps identify and address emerging risks.

The impact of effective risk governance on bank risk, financial performance, and regulatory adjustments is a critical area of research. Studies have examined the relationship between risk governance characteristics and bank risk, including credit risk and operational risk (Ellis et al., 2014; Beck et al., 2022). Findings suggest that robust risk governance frameworks are associated with lower risk levels and improved risk management outcomes.

Furthermore, effective risk governance has a positive impact on financial performance measures such as profitability, efficiency, and solvency (Shamsuddin & Xiang, 2012; Bikker & Vervliet, 2018; Bonfim & Kim, 2012). Banks with strong risk governance practices tend to achieve better financial results, as they can effectively manage risks and capitalize on opportunities.

Finally, the examination of risk governance is essential in the context of regulatory adjustments, such as stress tests. Effective risk management practices and robust risk governance frameworks enable banks to meet regulatory requirements and successfully navigate stress tests (Bonfim & Kim, 2012; Berger & Bouwman, 2017). By doing so, banks can demonstrate their ability to withstand adverse scenarios and maintain financial stability.

In summary, the examination of risk governance and performance in OECD banks is motivated by the need to manage risks effectively, comply with regulatory requirements, and improve overall performance. Effective risk governance practices, including the presence of a RC, CRO, CFO, SENIOR, TITLE, and BI, are associated with enhanced risk management outcomes. These risk governance characteristics contribute to better risk.

2. Theoretical Background

2.1. Introduction

The examination of risk governance and performance in OECD banks is a critical area of research that seeks to understand the impact of risk governance practices on various aspects of bank operations. This theoretical background section aims to provide a comprehensive overview of the three research questions pertaining to the relationship between risk governance and bank risk, financial performance, and regulatory adjustments. Each research question is grounded in a specific theoretical framework, enabling a deeper understanding of the underlying mechanisms at play. The theories of risk by Knight (1921), upper echelons, and regulatory compliance will be discussed in relation to their relevance and applicability to the respective research questions.

The first research question explores the impact of risk governance on the bank risk of public commercial banks of OECD. Knight's (1921) theory of risk provides a solid foundation for understanding risk governance within this context. According to Knight, risk is characterized by uncertainty and the potential for both gains and losses. Within the banking sector, risk governance plays a crucial role in identifying, assessing, and managing risks to ensure the stability and sustainability of financial institutions (Demirgüç-Kunt & Huizinga, 2010; Ellis et al., 2014). By adopting a risk governance framework that aligns with Knight's theory, OECD banks can develop robust risk management practices, enhance risk mitigation strategies, and ultimately reduce their exposure to various types of risks, such as credit risk and operational risk (Ellis et al., 2014; Beck et al., 2022).

The second research question focuses on the impact of risk governance on the financial performance of public commercial banks of OECD. The theory of upper echelons, as proposed by Hambrick & Mason (1984), offers valuable insights into the relationship between risk governance and financial performance. This theory posits that the characteristics and decision-making processes of top management significantly influence organizational outcomes. In the context of risk governance, the composition of the board of directors, including the presence of senior directors, directors with PhD degrees, and independent directors, becomes crucial. These individuals bring diverse expertise, knowledge, and independence to the decision-making process, enabling effective risk oversight and enhancing risk management practices (Srivastav & Hagendorff, 2016). By integrating risk considerations into strategic decision-

making, OECD banks can achieve improved financial performance, as evidenced by measures such as profitability, efficiency, and solvency (Karyani et al., 2020; Gontarek, 2016).

The third research question delves into the impact of risk governance on the regulatory adjustments of public commercial banks of OECD. The theory of regulatory compliance provides a relevant lens to understand the relationship between risk governance and regulatory requirements. This theory focuses on how organizations navigate and comply with regulatory frameworks. In the context of risk governance in OECD banks, effective risk management practices and robust risk governance frameworks are essential for meeting regulatory requirements and successfully navigating regulatory adjustments, such as stress tests (Gontarek, 2016; Gropp et al., 2019). By implementing comprehensive risk governance frameworks, banks can demonstrate their ability to manage risks effectively, ensure regulatory compliance, and maintain financial stability.

By examining these research questions through the lens of the respective theories, this study aims to contribute to the existing body of knowledge on risk governance and its impact on bank risk, financial performance, and regulatory adjustments in OECD banks. The insights gained from this research will provide valuable guidance for policymakers, regulators, and banking institutions in enhancing their risk governance practices and improving overall performance in the challenging and dynamic banking landscape.

2.2. Corporate Governance

The origin and development of corporate governance in the banking industry have been influenced by historical events, financial crises, and regulatory initiatives. The establishment of regulatory frameworks and industry best practices has underscored the importance of strong governance structures, risk management practices, and accountability mechanisms. Effective corporate governance in the banking industry is associated with improved performance and risk management outcomes, benefiting banks, stakeholders, and the broader financial system.

Corporate governance, as defined in banking literature, encompasses a set of principles, practices, and mechanisms that govern the relationships between different stakeholders within a financial institution (Aguilera et al., 2015). It provides a framework for effective oversight, accountability, and decision-making, with the aim of safeguarding the interests of shareholders, depositors, borrowers, employees, and other stakeholders (Strange et al., 2009).

The OECD defines corporate governance as "the system by which business corporations are directed and controlled" (OECD, 2019). According to the OECD Principles

of Corporate Governance, the objective of corporate governance is to enhance corporate performance, facilitate effective risk management, and ensure the fairness and transparency of business operations (OECD, 2015). It emphasizes the importance of the board of directors, shareholders' rights, and disclosure and transparency in promoting accountability and responsible corporate behavior.

The BCBS defines corporate governance in the banking industry as "the system of rules, practices, and processes by which a bank is directed and controlled" (BCBS, 2015). It focuses on the governance arrangements specific to banks, considering their unique characteristics and risks. This definition emphasizes the role of the board of directors, senior management, and risk management functions in ensuring the soundness and stability of banks. It also recognizes the importance of regulatory frameworks and supervisory oversight in promoting effective corporate governance.

Academic literature provides further insights into the definitions of corporate governance in the banking industry. Scholars highlight various dimensions and components of corporate governance, emphasizing different aspects depending on their research focus. Some scholars define corporate governance in banks as the mechanisms and practices that align the interests of shareholders, management, and other stakeholders (Bhagat & Bolton, 2008). Others emphasize the role of internal controls, risk management, and ethical conduct in mitigating agency problems and ensuring the integrity of banking operations (Macey, 2008).

In summary, corporate governance in the banking industry encompasses a range of definitions and perspectives. It emphasizes the systems, principles, and mechanisms that ensure effective oversight, accountability, risk management, and responsible decision-making within financial institutions. The definitions provided by organizations such as the OECD and the Basel Committee on Banking Supervision, along with academic literature, contribute to a comprehensive understanding of corporate governance in the banking sector.

Corporate governance in the banking industry plays a crucial role in ensuring the effective management and oversight of financial institutions (Aguilera et al., 2015). The evolution of corporate governance practices in the banking sector has been shaped by various historical and regulatory factors (Baele et al., 2014; Claessens & Yurtoglu, 2013).

The concept of corporate governance originated in the broader context of corporate law and business practices. The principles of corporate governance aim to establish a framework for decision-making, accountability, and the protection of stakeholders' interests (Tricker & Tricker, 2015). In the banking industry, the need for effective corporate governance emerged

from the recognition of the unique characteristics and risks associated with financial institutions (Mallin, 2016).

One of the early events that emphasized the importance of corporate governance in banking was the financial crisis of the late 1920s and early 1930s. The collapse of numerous banks during this period highlighted the significance of robust governance structures, risk management practices, and accountability mechanisms (Huizinga et al., 2011). Subsequent financial crises, such as the Savings and Loan Crisis in the 1980s (Calomiris & Mason, 2003) and the Global Financial Crisis in 2008 [GFC] (Brunnermeier, 2009), further underscored the importance of strong corporate governance in the banking sector.

The development of corporate governance in the banking industry has been influenced by various regulatory initiatives and industry best practices. In many countries, regulatory authorities and central banks have played a key role in establishing and enforcing corporate governance standards for banks.

One of the notable frameworks that have shaped corporate governance in the banking industry is the BCBS. The BCBS introduced the Basel Core Principles for Effective Banking Supervision, which emphasize the importance of sound corporate governance practices as a fundamental element of bank supervision (BCBS, 2015). These principles provide guidelines for banks to enhance board oversight, risk management, and transparency.

Furthermore, regulatory authorities in different countries have introduced governance codes or guidelines specific to the banking industry. For instance, the UK's Financial Conduct Authority (FCA) issued the Senior Managers and Certification Regime (SMCR) to enhance individual accountability and improve governance practices in banks (Financial Conduct Authority, 2019). Similarly, the Dodd-Frank Wall Street Reform and Consumer Protection Act in the United States introduced reforms aimed at strengthening corporate governance in financial institutions (DFA, 2010).

Effective corporate governance in the banking industry is closely associated with improved performance and risk management outcomes. Research has highlighted that sound corporate governance practices enhance the stability, resilience, and long-term profitability of banks (Beltratti & Stulz, 2012).

Studies have shown that banks with strong governance structures, including independent and knowledgeable boards of directors, exhibit better risk management practices and financial performance. For example, a study by Beltratti & Stulz (2012) found that banks with more independent boards and higher levels of monitoring and risk oversight experienced lower risk levels and higher profitability.

Additionally, robust corporate governance practices contribute to the effective identification, assessment, and mitigation of risks, such as credit risk, market risk, and operational risk (Bonaimé et al., 2014; Ellul & Yerramilli, 2013). Through appropriate risk management frameworks and board oversight, banks can navigate challenges and maintain financial stability.

2.2.1. Risk

The concept of "risk" has a rich history that can be traced back to various disciplines and time periods. The origin of the term can be attributed to the field of finance and insurance, where risk is associated with the potential for uncertain outcomes and losses. The study of risk has evolved over time, with notable contributions from scholars and researchers. For instance, Frank Knight's work in 1921 on the distinction between "risk" and "uncertainty" laid the foundation for understanding risk in decision-making processes (Knight, 1921). Additionally, the concept of risk gained prominence in the field of economics through the groundbreaking works of Harry Markowitz on portfolio theory and Nobel laureate Robert C. Merton's contributions to option pricing theory (Markowitz, 1952; Merton, 1973). These seminal works have greatly influenced the understanding and analysis of risk in various fields, including banking and finance.

The references provided highlight key contributions to the understanding of risk in different disciplines, from Knight's exploration of risk and uncertainty to Markowitz's portfolio theory and Merton's option pricing theory. These works have significantly shaped our understanding of risk and have become foundational in the study and practice of risk management in fields like banking.

In general, risk refers to the probability of an adverse event occurring and the potential negative consequences associated with it. It encompasses uncertainties that can impact the achievement of objectives, whether they are financial, operational, or strategic, and involves the consideration of both the likelihood and magnitude of potential losses or outcomes (BCBS, 2010; Jorion, 2007).

In the context of the banking industry, risk encompasses various dimensions that banks face in their operations. The dimensions of risk in banking include credit risk (Bluhm et al., 2016), market risk (Saunders & Cornett, 2008), operational risk (BCBS, 2010), liquidity risk (BCBS, 2010), and legal and regulatory risk (FSB, 2013). Each dimension represents specific

types of uncertainties and potential negative consequences that banks need to identify, assess, and manage effectively to safeguard their financial stability, reputation, and overall viability.

These references provide insights into the dimensions of risk in the banking industry and the principles for managing these risks. The Basel Committee's publications offer guidelines for the sound management of operational risk, effective risk data aggregation and risk reporting, and the importance of resolution regimes. Jorion's book on value at risk explores risk management benchmarks. Saunders and Cornett's book on financial institutions management covers a comprehensive risk management approach. Wong's book on credit risk modeling offers a comprehensive introduction to the topic. These references contribute to a deeper understanding of risk management practices and the importance of effectively managing risks in the banking industry.

2.2.2. Risk Management

In the banking industry, risk management plays a crucial role in ensuring the stability and sustainability of financial institutions. It involves identifying, assessing, and managing risks to protect the bank's assets, maintain regulatory compliance, and safeguard the interests of stakeholders.

An integrated risk management framework tailored for the banking industry is essential. This framework considers various types of risks faced by banks, such as credit risk, market risk, liquidity risk, operational risk, and regulatory compliance risk. It provides a holistic approach to managing these risks and ensures that they are adequately addressed (BCBS, 2017).

The implementation of enterprise risk management (ERM) in banks requires a comprehensive understanding of the factors influencing its adoption. This includes organizational culture, risk appetite, governance structures, and risk management frameworks (Lam, 2014). Successful implementation of ERM helps banks to proactively identify and manage risks, enabling them to make informed decisions and optimize their risk-return profile.

In the banking sector, project risk management is crucial for the successful execution of strategic initiatives, such as mergers and acquisitions, system upgrades, or new product launches. Utilizing methodologies like Analytic Hierarchy Process (AHP) and Decision Tree (DT) can aid in identifying, evaluating, and managing project risks effectively (Dey, 2002). This approach helps banks to minimize potential disruptions and ensure project success while considering the unique challenges of the banking industry.

Operational risk management holds significant importance in the banking industry, as operational failures can result in financial losses, reputational damage, and regulatory penalties. Leveraging intelligent data analysis techniques, including statistical methods and machine learning algorithms, allows banks to analyze large volumes of operational data to identify potential risks, predict future incidents, and enhance risk mitigation strategies (Wiley et al., 2010).

The banking industry must also remain vigilant about regulatory compliance risks. Adhering to regulatory requirements and maintaining effective internal controls are paramount for banks to mitigate compliance-related risks. Robust risk management frameworks and constant monitoring ensure that banks meet regulatory expectations and maintain a strong compliance culture (Chapelle, 2019).

In summary, risk management in the banking industry encompasses the identification, assessment, and management of various risks. An integrated risk management framework, coupled with the implementation of ERM, project risk management, operational risk management, and compliance risk management, helps banks proactively navigate risks and ensure long-term stability and success.

2.2.3. Risk Governance

The concept of "risk governance" emerged as a response to the growing recognition of the importance of effectively managing risks in various domains, such as finance, environment, health, and technology. It encompasses the processes, structures, and institutions that guide decision-making and actions regarding risks (Renn, 2017). The origins of risk governance can be traced back to several influential events and developments.

One of the key milestones in the development of risk governance was the Three Mile Island nuclear accident in 1979. This incident raised concerns about the safety of nuclear energy and highlighted the need for a systematic approach to assessing and managing risks (Pidgeon, 1997). As a result, the field of risk analysis and management began to gain prominence, focusing on identifying and mitigating potential hazards.

The concept of risk governance further evolved with the increasing complexity and interconnectedness of global systems. The Bhopal gas tragedy in 1984, where a chemical leak caused significant human and environmental harm, underscored the need for a broader perspective on risk management. It emphasized the importance of considering social, economic, and political dimensions in addition to technical aspects (Fraser et al., 2021).

In the early 2000s, a series of high-profile corporate scandals, such as Enron and WorldCom, exposed weaknesses in traditional risk management approaches. These events led to calls for improved corporate governance and risk oversight. The need for a holistic and integrated approach to risk management gained traction, with a focus on aligning risk management practices with strategic objectives and fostering a risk-aware culture (CSOTC, 2017).

The term "risk governance" gained prominence through various academic and policy-oriented publications. Notably, the OECD has been instrumental in advancing the concept of risk governance. The OECD published a seminal report in 2003 titled "Guidance for Managing the Risks of Chemicals," which emphasized the importance of involving multiple stakeholders, enhancing transparency, and integrating risk assessment and risk management (OECD, 2015).

Moreover, the United Nations International Strategy for Disaster Reduction (UNISDR) has played a crucial role in promoting risk governance in the context of disaster risk reduction. The UNISDR's Hyogo Framework for Action (2005-2015) called for the establishment of risk governance systems that involve all relevant stakeholders and integrate risk reduction into development planning (UNISDR, 2005).

By building upon the lessons learned from significant incidents and embracing a multidimensional perspective, risk governance has evolved into a comprehensive framework for addressing risks across various sectors and contexts.

The development of risk governance in the banking industry is closely intertwined with the broader evolution of risk management practices. Banks, as crucial players in the financial system, require effective risk governance to ensure stability and mitigate systemic risks (BCBS, 2010). The following academic references provide valuable insights into this development:

The BCBS has outlined "Principles for enhancing corporate governance" (2010), which provides guidelines for strengthening corporate governance practices within banks. These principles play a significant role in shaping risk governance frameworks.

In their book "An introduction to credit risk management," Bluhm et al. (2016) offer an in-depth analysis of credit risk management strategies specific to the banking industry. Their work contributes to understanding risk governance approaches for managing credit-related risks.

The book "The essentials of risk management" by Crouhy et al. (2006) provides a comprehensive overview of risk management principles, including those applicable to the banking sector. It offers insights into various risk governance aspects relevant to banks.

Haldane (2009) discusses the importance of rethinking the financial network and its implications for risk governance in a speech delivered at the Financial Student Association. His insights highlight the need for a systemic approach to risk management within the banking industry.

Renn (2020) explores the role of risk regulation in reinforcing the rule of law within the banking industry. This analysis sheds light on the interplay between risk governance and legal frameworks, contributing to discussions on effective risk management practices.

Additionally, PwC's "Risk in Review: Global risk management survey" (2016) presents findings from a global survey on risk management practices, offering industry perspectives on risk governance in the banking sector. This survey contributes to understanding current trends and practices in risk governance.

These academic references collectively provide valuable insights into the development and current state of risk governance in the banking industry. They cover topics such as corporate governance, credit risk management, regulatory reforms, legal frameworks, and industry perspectives, enhancing our understanding of effective risk management practices within banks.

Risk governance in banks plays a crucial role in bridging the gap between risk and risk management (Stein et al., 2019). It serves as a comprehensive framework that integrates risk awareness, oversight, and control mechanisms, enabling banks to identify, assess, monitor, and mitigate various types of risks they face (Power, 2007).

Risk governance ensures that banks have a systematic process in place to identify and assess potential risks. It involves understanding the bank's risk appetite, setting risk tolerance levels, and establishing risk assessment methodologies. By aligning risk identification and assessment with the bank's overall objectives, risk governance provides a holistic view of risks and enables effective risk management strategies (Jallali & Zoghlami, 2022).

A strong risk governance framework promotes a robust risk culture within the bank (Kaplan & Mikes, 2020). It emphasizes the importance of risk awareness and encourages proactive risk management practices across all levels of the organization (Stulz, 2016). This involves fostering a risk-aware mindset, promoting ethical behavior, and ensuring employees understand their roles and responsibilities in managing risks (Beasley et al., 2008). By creating a risk-conscious environment, risk governance bridges the gap between risk and risk management by integrating risk considerations into day-to-day operations (CSOTC, 2017).

Effective risk governance requires active involvement from the board of directors and senior management (Hillson, 2003). The board plays a crucial role in overseeing the bank's risk

profile, strategy, and risk management practices (Mikes & Kaplan, 2013). It sets the tone at the top by defining risk appetite and ensuring alignment with business objectives (Rittenberg et al., 2012). The board also holds management accountable for implementing adequate risk management processes, monitoring risk exposures, and making informed risk-related decisions (Agarwal & Taffler, 2008). Through this oversight, risk governance provides a bridge between the identification of risks and their effective management (Woods, 2009).

Risk governance establishes clear policies, frameworks, and procedures for managing risks within the bank (BCBS, 2015). These frameworks encompass risk identification, measurement, and mitigation techniques specific to different types of risks, such as credit risk (Calem & Rob, 1999), market risk (Jorion, 2000), liquidity risk (Diamond & Dybvig, 1983), operational risk (Chernobai et al., 2008), and compliance risk (Arnone & Gambini, 2007). By standardizing risk management practices, risk governance ensures consistent and effective risk management across the organization (Power, 2007), thereby bridging the gap between identifying risks and implementing risk mitigation strategies (Buehler et al., 2008).

Risk governance enables continuous monitoring and reporting of risks to relevant stakeholders, including the board, senior management, and regulators (Power, 2009). It establishes mechanisms to measure and assess risk exposures in real-time, enabling prompt action to address emerging risks (Aven, 2012). Risk governance also ensures the timely and accurate reporting of risks to stakeholders, facilitating informed decision-making and enabling proactive risk management measures (Renn, 2017).

Banks operate within a highly complex and stringent regulatory environment (Barth et al., 2004). Risk governance plays a critical role in this context by establishing a linkage between risk and risk management, ensuring adherence to relevant laws, industry standards, and regulations (Pfleeger & Caputo, 2012). This structured approach is instrumental in managing various regulatory risks, which include regulatory reporting requirements, maintaining adequate capital, and implementing anti-money laundering measures (Bessis, 2011). Consequently, risk governance facilitates banks in remaining updated with regulatory changes, evaluating their impact on the risk profile, and making necessary adjustments to their risk management strategies (Dionne, 2013).

In summary, risk governance in banks bridges the gap between risk and risk management by providing a comprehensive framework that integrates risk identification, assessment, oversight, and control mechanisms (Mikes, 2011). It promotes a risk-aware culture, ensures board accountability, establishes risk policies and frameworks (Power, 2007), facilitates risk monitoring and reporting, and ensures compliance with regulatory requirements

(BCBS, 2015). By adopting a robust risk governance framework, banks can effectively bridge the gap between identifying risks and implementing proactive risk management strategies to safeguard their financial stability and enhance their long-term resilience (Borio, 2011).

2.3. Knightian Risk

Knightian risk, also known as uncertainty or ambiguity, has important implications for risk governance and management within the banking industry (Gigerenzer & Gaissmaier, 2011). As an inherent characteristic of certain events or outcomes where the probability distribution is unknown or difficult to estimate, Knightian risk poses challenges for banks in understanding and effectively managing risks.

In the context of risk governance, Knightian risk highlights the limitations of relying solely on quantitative risk models and measures. Traditional risk management frameworks often assume that probability distributions are known or can be estimated accurately based on historical data. However, Knightian risk suggests that there are situations where the underlying probability distribution is uncertain, making it difficult to rely solely on historical data for risk assessments (Kroszner & Rajan, 1994). This calls for a more nuanced and comprehensive approach to risk governance that recognizes and incorporates the presence of Knightian risk.

Effective risk governance in the face of Knightian risk requires a combination of qualitative and quantitative risk assessment techniques. Banks should embrace scenario analysis and stress testing as valuable tools to assess the potential impact of rare and unforeseen events. These techniques help banks explore a range of plausible scenarios and evaluate their resilience under different conditions, including those that fall outside historical norms (Crouhy et al., 2006).

Moreover, the governance of Knightian risk requires a culture of risk awareness and a robust risk appetite framework. Banks should foster an environment where risk identification and assessment are encouraged, and where employees at all levels are empowered to voice concerns and raise potential risks associated with uncertainty. A clear risk appetite statement and risk limits framework can provide guidance to management and employees in navigating uncertain situations and making risk-informed decisions (CSOTC, 2017).

Incorporating Knightian risk into risk governance also highlights the importance of effective risk communication. Banks need to communicate the nature and implications of Knightian risk to stakeholders, including shareholders, regulators, and customers. Transparent and timely communication about the uncertainties and limitations associated with certain risks

can help build trust and confidence in the bank's risk management practices (Schrand & Zechman, 2012).

Furthermore, the oversight role of boards of directors and risk committees becomes crucial in addressing Knightian risk. These governing bodies should ensure that risk management frameworks are adaptive and responsive to emerging risks, including those associated with Knightian risk. Regular assessments of risk governance practices and the effectiveness of risk management frameworks can help identify areas for improvement and enable timely adjustments (Battiston et al., 2021).

In summary, Knightian risk poses significant challenges to risk governance and management in the banking industry. Acknowledging the presence of uncertainty and ambiguity, banks need to adopt a more comprehensive and adaptive approach to risk governance. This includes integrating qualitative and quantitative risk assessment techniques, fostering a risk-aware culture, promoting effective risk communication, and enhancing the oversight role of boards and risk committees. By addressing Knightian risk within their risk governance frameworks, banks can enhance their resilience and better navigate uncertain environments.

2.4. Upper Echelon Theory

The Upper Echelon Theory is a concept in organizational and management studies that focuses on the impact of executive characteristics, such as their demographics, values, and experiences, on organizational outcomes (Hambrick & Mason, 1984). When applied to the context of risk governance and financial performance of banks, the UET suggests that the characteristics and decision-making behaviors of top-level executives can significantly influence a bank's risk management practices and overall financial performance.

In the banking sector, effective risk governance is crucial for maintaining financial stability and mitigating potential risks. The UET posits that executives' attributes, such as their risk-taking propensity, cognitive biases, and expertise, can shape the risk governance practices within a bank (Finkelstein & Hambrick, 1996).

The UET emphasizes that executives' demographics, such as age, education, and tenure, can influence their risk attitudes and decision-making (Carpenter et al., 2004). For instance, younger executives might have a higher risk appetite, while more experienced executives might adopt a more conservative approach to risk.

Executives' personal values, beliefs, and past experiences play a significant role in shaping their perception of risk and influencing risk management practices (Barnett & King, 2008). Those who have experienced financial crises may be more risk-averse and implement stricter risk management protocols.

The UET recognizes that cognitive biases, such as overconfidence or confirmation bias, can impact executives' decision-making regarding risk (Kahneman et al., 1982). These biases can lead to inadequate risk assessments and poor risk management strategies, ultimately impacting the financial performance of banks.

Executives' expertise and knowledge in risk management are critical in shaping a bank's risk governance framework (Petersen & Rajan, 1994). Executives with a deep understanding of financial markets and risk management techniques are more likely to implement effective risk management practices, enhancing a bank's financial performance.

To maximize risk governance and financial performance, banks should consider the implications of the UET. They can focus on selecting executives with diverse backgrounds, experiences, and risk perspectives. Encouraging ongoing professional development and training programs can enhance executives' risk management expertise and decision-making skills. Furthermore, fostering a culture of open communication and challenge within the organization can help mitigate cognitive biases and improve risk governance practices (Kaplan & Mikes, 2012).

By recognizing the influence of executive characteristics on risk governance and financial performance, banks can aim to create a leadership team that promotes effective risk management strategies, ultimately contributing to the long-term success and stability of the organization.

2.5. Theory of Regulatory Compliance

The theory of regulatory compliance in reference to risk governance and regulatory adjustments in banks revolves around the framework and principles that govern compliance processes and risk management practices within the banking industry. This theory posits that adherence to regulatory requirements and the maintenance of effective risk management strategies are crucial to safeguard the stability and integrity of the financial system (BCBS, 2017).

Regulatory compliance encompasses various areas such as financial reporting (Tarullo, 2008), consumer protection (Cizel et al., 2019), anti-money laundering (Takats, 2011), risk

management, and capital adequacy (Blundell-Wignall & Atkinson, 2010). The theory underscores the necessity of banks maintaining a robust compliance culture, implementing appropriate controls, and vigilantly monitoring their activities to ensure adherence to regulatory standards (Arnone & Gambini, 2007).

Risk governance is an integral part of this theory, encompassing the systems, processes, and structures through which banks identify, assess, monitor, and manage risks (Mikes, 2011). It involves the establishment of risk appetite, the creation of risk management frameworks, and the allocation of responsibilities for risk oversight (Power, 2009). Effective risk governance ensures that banks have the appropriate mechanisms in place to identify and mitigate risks, thus minimizing the likelihood of financial crises and safeguarding stakeholders' interests (Rochet, 2009).

Regulatory adjustments refer to changes in regulatory requirements and guidelines to adapt to evolving market conditions, emerging risks, and lessons learned from previous financial crises (Laeven et al., 2014). Regulatory authorities continuously monitor the banking industry and make adjustments to enhance prudential standards, improve risk management practices, and address potential vulnerabilities (Buchak et al., 2018). The theory acknowledges that banks must proactively adjust their policies, procedures, and risk management frameworks to align with new regulatory expectations and maintain compliance (Ellul & Yerramilli, 2013).

The theory of regulatory compliance in reference to risk governance and regulatory adjustments in banks is guided by several key principles. Firstly, banks should adopt a proactive approach to compliance by actively monitoring regulatory changes, conducting regular risk assessments, and making necessary adjustments to policies and processes (Rosen, 2003). This ensures that they stay ahead of evolving requirements and maintain compliance (BCBS, 2017).

Secondly, a risk-based approach is crucial in compliance efforts (Ellul & Yerramilli, 2013). Banks need to tailor their compliance strategies to the specific risks they face (BCBS, 2017). By doing so, they can allocate resources effectively to manage and mitigate those risks, reducing potential vulnerabilities (Borio et al., 2001).

Establishing and maintaining robust internal controls is another essential principle (BCBS, 2005). Banks should put in place strong internal mechanisms, such as clear policies, well-defined procedures, and monitoring systems (BCBS, 2005). These controls enable banks to detect and address any deviations from established standards, ensuring compliance with regulatory requirements (Borio et al., 2001).

Fostering a compliance culture is vital. Banks should create an environment where all employees understand the importance of regulatory compliance and are committed to upholding ethical and legal standards (PWC, 2016). Regular training and effective communication about compliance expectations help reinforce this culture throughout the organization.

Maintaining a proactive and constructive relationship with regulatory authorities is another key principle (BCBS, 2017). Banks should engage in open dialogue with regulators, provide timely and accurate reporting, and seek clarification when needed (Buchak et al., 2018). This engagement fosters transparency, cooperation, and mutual understanding between banks and regulatory authorities (BCBS, 2017).

Lastly, continuous improvement is emphasized in the theory of regulatory compliance (BCBS, 2017). Banks should regularly assess their risk governance and compliance practices, conduct policy reviews, and incorporate lessons learned from internal and external sources (Buchak et al., 2018). This iterative process enables banks to enhance their compliance frameworks and adapt to changing regulatory expectations (BCBS, 2017).

By adhering to these key principles, banks can effectively navigate the regulatory landscape, mitigate risks, and maintain compliance, thereby promoting financial stability and protecting the interests of their customers and stakeholders.

2.6. Conclusion

The linkage between risk, risk governance, and risk management in corporate governance is complex and dynamic. The theories of Knightian risk, Upper Echelon Theory, and Theory of Regulatory Compliance shed light on this relationship. Risk governance is crucial in identifying and managing uncertainties and risks in the banking sector. The composition of a bank's board and executive team influences risk management practices. Effective risk governance ensures regulatory compliance and enhances transparency, accountability, and stakeholder confidence. It also impacts bank risk, financial performance, and regulatory adjustments. Sound risk governance reduces financial losses, improves performance, and contributes to sector stability. Overall, robust risk governance frameworks help banks navigate risks, meet regulatory expectations, and promote sustainable growth and stability.

3. Risk Governance in the Banking Industry

3.1. Introduction

Risk governance, over the past three decades, has significantly transitioned from a focus on natural hazards to the banking industry. This paradigm shift owes its momentum to an increasingly mature understanding of environmental risks and their potent impact on financial stability. A key element of this transformation is a robust body of academic research and regulatory initiatives that have collaborated in integrating environmental risk management into banking practices.

Initially, risk governance was primarily aimed at understanding and managing natural hazards, subsequently expanding to incorporate environmental risks, including those related to climate change. A broadened risk governance scope encompasses not just the physical risks associated with natural hazards but also the transition risks arising from market volatility, policy shifts, and societal attitudes towards environmental issues.

Regulatory initiatives and guidelines have played an instrumental role in reshaping risk governance within the banking industry. These guidelines, focusing on incorporating climate risk assessments and stress testing methodologies, strive to enhance the resilience of banks to climate-related risks. Additionally, these requirements also underscore the necessity of sustainable lending practices and the integration of Environmental, Social, and Governance (ESG) criteria into banking decision-making processes.

Collaboration among stakeholders—banks, government agencies, research institutions, and industry associations—is a vital aspect of advancing risk governance. Such partnerships facilitate knowledge sharing and a concerted effort in addressing environmental risks, thereby fostering a comprehensive understanding of natural hazards and climate-related risks.

The regulation and supervision of risk governance in banks involve a comprehensive framework encompassing capital requirements, risk-based supervision, stress testing, corporate governance, risk reporting, and disclosure. These measures aim to enhance the resilience of banks, promote stability in the financial system, and protect the interests of various stakeholders.

Risk governance in public commercial banks, particularly in OECD countries, is vital for maintaining stability and resilience. These banks serve as intermediaries between savers and borrowers, fostering economic growth and financial stability. Effective risk governance practices are thus essential to mitigate risks and protect stakeholders' interests. This includes

formulating and implementing strategies, policies, and structures to identify, measure, manage, and monitor risks. Boards of these banks bear the responsibility of overseeing risk governance, establishing risk appetite, and monitoring risk management activities.

In conclusion, risk governance's evolution in the banking industry over the past three decades reflects the growing recognition of environmental risks and their impact on financial stability. By effectively managing these risks, the banking industry can enhance resilience and contribute to a sustainable and stable financial system.

3.2. Risk Governance from Natural Hazards to Banking Industry

Over the past three decades, risk governance has undergone a significant evolution, transitioning from its initial focus on natural hazards to encompassing the banking industry. This transformation has been driven by a deeper understanding of environmental risks and their impact on financial stability. The evolution of risk governance has been influenced by a growing body of academic research, regulatory initiatives, collaborative efforts, and the integration of environmental risk management into banking practices. This section explores the key developments in risk governance during this period, citing relevant academic references.

Initially, risk governance primarily focused on understanding and managing natural hazards, with efforts made to establish robust monitoring systems, enhance early warning capabilities, and improve disaster response plans (Platt, 2012). As the understanding of environmental risks expanded, including those related to climate change, the focus shifted to incorporating these risks into risk governance frameworks (Adger et al., 2005). This broader perspective encompassed both physical risks associated with natural hazards and transition risks arising from policy shifts, market volatility, and changing societal attitudes toward environmental issues (Berkhout, 2012).

Regulatory initiatives played a vital role in shaping risk governance in the banking industry. Guidelines and requirements were introduced to incorporate climate risk assessments, stress testing methodologies, and disclosure practices, aiming to assess banks' resilience to climate-related risks, including those linked to natural hazards (Dietz et al., 2016).

The integration of risk management frameworks emerged as a key aspect of risk governance in recent years. Banks started incorporating climate risk assessments, scenario analysis, and stress testing into their risk management practices (Batten et al., 2016). Additionally, sustainable lending practices and the consideration of ESG criteria in decision-making processes gained prominence (Schoenmaker & Schramade, 2019).

Collaboration among stakeholders has been instrumental in advancing risk governance. Partnerships were formed between banks, government agencies, research institutions, and industry associations to facilitate knowledge sharing and collective efforts in addressing environmental risks. These collaborations aim to foster a comprehensive understanding of natural hazards and climate-related risks (Biermann et al., 2009).

In conclusion, the evolution of risk governance from natural hazards to the banking industry over the past three decades reflects a growing recognition of environmental risks and their impact on financial stability. Academic research, regulatory initiatives, collaborative efforts, and the integration of environmental risk management into banking practices have been key drivers of this transformation. By effectively managing these risks, the banking industry can enhance resilience and contribute to a sustainable and stable financial system.

3.3. Regulation and Supervision of Risk Governance in Banks

Regulation and supervision of risk governance in banks are crucial for maintaining financial stability and safeguarding the financial system. The objective of risk governance is to effectively identify, assess, and manage risks within banks, ensuring their soundness and protecting the interests of depositors, shareholders, and the overall economy. A comprehensive framework is in place to mitigate potential risks and prevent financial crises. Let's explore the regulatory and supervisory measures governing risk management in banks.

The BCBS plays a significant role in developing and promoting banking regulations. The Basel II framework focuses on minimum capital requirements, supervisory review, and market discipline, while Basel III extends the framework to strengthen capital and liquidity requirements, enhance risk coverage, and promote macroprudential oversight (BCBS, 2006; BCBS, 2010).

Regulatory authorities employ risk-based supervision to assess and monitor banks' risk governance practices. This approach involves evaluating banks' risk management systems, capital adequacy, liquidity positions, and compliance with regulations. It aims to identify potential vulnerabilities and areas requiring improvement. A research by Llewellyn (1999) highlights the importance of risk-based supervision in maintaining the stability of the financial system.

Strong risk governance is an integral part of corporate governance in banks. Regulators emphasize the role of the board of directors in overseeing risk management practices and setting the risk appetite of banks. This includes establishing clear risk management policies,

ensuring effective risk reporting and internal controls, and promoting a risk-aware culture throughout the organization. A study by De Andres et al. (2005) emphasize the significance of robust corporate governance in managing risks in banks.

Regulatory authorities conduct stress tests to assess the resilience of banks under adverse scenarios. Stress tests involve subjecting banks' balance sheets to severe economic and financial shocks to evaluate their ability to withstand such pressures. By conducting stress tests, regulators can identify potential risks and vulnerabilities and take appropriate actions to ensure banks have adequate capital buffers and risk management measures in place. Studies by Drehmann and Tsatsaronis (2014) and Merrouche and Nier (2017) discuss the importance of stress tests in managing systemic risks in banks.

Banks are required to provide regular risk reports and disclosures to regulators, investors, and the public. These reports offer detailed information on the bank's risk profile, capital adequacy, liquidity position, and risk management practices. Enhanced transparency and disclosure requirements aim to promote market discipline, ensure informed decision-making, and facilitate effective oversight of banks' risk governance. Research by Barth et al. (2013) and Laeven and Levine (2009) emphasize the role of risk reporting and disclosure in enhancing market discipline and reducing information asymmetry.

Regulators impose minimum capital requirements to ensure banks maintain sufficient capital to absorb losses and withstand adverse events. Capital adequacy ratios, such as the Basel III common equity tier 1 (CET1) ratio, are used to assess a bank's capital adequacy. Higher capital requirements for riskier assets and activities act as a buffer against potential losses, reducing the probability of financial distress. A research by Acharya et al. (2016) and Demirgüç-Kunt and Huizinga (2010) discusses the importance of capital requirements in mitigating risks in banks.

In conclusion, the regulation and supervision of risk governance in banks involve a comprehensive framework encompassing capital requirements, risk-based supervision, stress testing, corporate governance, risk reporting, and disclosure. These measures aim to enhance the resilience of banks, promote stability in the financial system, and protect the interests of various stakeholders.

3.4. Risk Governance in the Public Commercial Banks of OECD Countries

Risk governance plays a critical role in maintaining the stability and resilience of public commercial banks in OECD countries. These banks act as intermediaries between savers and borrowers, fostering economic growth and financial stability. Effective risk governance practices are essential to mitigate risks and protect stakeholders' interests (Lam, 2014). This section explores the significance of risk governance in public commercial banks of OECD countries, examining relevant frameworks, practices, challenges, and potential improvements.

Risk governance involves formulating and implementing strategies, policies, and structures to identify, measure, manage, and monitor risks (IAIS, 2011). Robust risk governance is particularly important for public commercial banks due to their systemic significance and impact on the broader economy (Banco de España, 2017). Effective risk identification is essential, encompassing credit risk, market risk, liquidity risk, operational risk, and strategic risk (Bank for International Settlements [BIS], 2013). Public commercial banks need to establish appropriate risk measurement methodologies and allocate sufficient resources for risk management (CSOTC, 2017). Comprehensive risk management strategies, including risk mitigation and contingency plans, should be developed (Bessis, 2011).

The protection of stakeholders' interests is a key objective of risk governance in public commercial banks (FSB, 2014). Stakeholders, including depositors, borrowers, shareholders, and the broader public, should be safeguarded (ECB, 2019). This involves ensuring the safety of customer deposits, maintaining adequate capital buffers, and minimizing systemic risks (Bank of England, 2020).

Public commercial banks in OECD countries adopt various risk governance frameworks and practices. Boards of these banks have the responsibility of overseeing risk governance, establishing risk appetite and tolerance levels, approving risk management policies, and monitoring risk management activities (OECD, 2015). Specialized committees, such as the Risk Committee or Audit Committee, provide additional oversight and expertise in risk-related matters (Hull, 2012).

Banks establish dedicated risk management units staffed with skilled professionals responsible for identifying, assessing, and managing risks (BCBS, 2013). Risk management tools, including risk registers, scenario analyses, stress testing, and risk reporting frameworks, are employed to facilitate effective risk management and decision-making (BGFRS, 2019). Regulatory requirements in OECD countries enforce prudent risk management practices,

prescribing minimum capital requirements, stress testing exercises, and risk management guidelines (FSB, 2020).

Fostering a strong risk culture is crucial within public commercial banks (Merna & Thani, 2008). Banks strive to promote risk awareness and provide comprehensive training programs to enhance risk management capabilities (Frigo & Anderson, 2009). Open communication channels are encouraged to promptly report and address risks (IOSC, 2017).

Public commercial banks face challenges in managing risks effectively. Complexity and interconnectedness pose difficulties, requiring integrated risk management frameworks (BIS, 2011). Emerging risks, such as technological advancements, cybersecurity threats, climate change, and geopolitical risks, necessitate adaptive risk management approaches (WEF, 2019). Inadequate incentive structures can incentivize excessive risk-taking behavior, highlighting the need for appropriate incentive alignment.

3.5. Conclusion

In conclusion, the evolution of risk governance from natural hazards to the banking industry over the past three decades demonstrates a growing recognition of environmental risks and their impact on financial stability. Academic research, regulatory initiatives, collaborative efforts, and the integration of environmental risk management into banking practices have been key drivers of this transformation. By effectively managing these risks, the banking industry can enhance resilience and contribute to a sustainable and stable financial system.

In the banking sector, the regulation and supervision of risk governance are crucial for maintaining financial stability and safeguarding the financial system. Regulatory authorities have implemented comprehensive frameworks to mitigate potential risks and prevent financial crises. These frameworks include capital requirements, risk-based supervision, stress testing, corporate governance, risk reporting, and disclosure. Through these measures, regulators aim to assess banks' risk management practices, identify vulnerabilities, and ensure they have adequate capital buffers and risk management measures in place.

Public commercial banks in OECD countries face unique challenges in risk governance due to their systemic significance and impact on the broader economy. Robust risk governance practices are essential to protect stakeholders' interests, maintain adequate capital buffers, and minimize systemic risks. These banks adopt various risk governance frameworks and practices, with boards and specialized committees providing oversight and expertise. Risk management units and tools are employed to facilitate effective risk management and decision-making. The

fostering of a strong risk culture and addressing emerging risks are crucial elements in managing risks effectively.

While progress has been made in risk governance, challenges such as complexity, interconnectedness, emerging risks, and incentive alignment remain. Ongoing efforts are needed to further enhance risk governance practices, adapt to evolving risks, and promote a robust risk management culture within the banking industry.

By continuously improving risk governance frameworks and practices, the banking industry can strengthen its resilience, contribute to financial stability, and fulfill its role in supporting sustainable economic growth. The collaboration between stakeholders, including regulators, banks, government agencies, research institutions, and industry associations, will be vital in addressing these challenges and promoting effective risk governance in the future.

4. The Role and Functions of Risk Governance in Banks

4.1. Introduction

Risk governance plays a critical role in banks by providing a structured framework to identify, assess, and manage risks effectively. It involves establishing policies, procedures, and mechanisms to ensure alignment of risk-taking activities with the bank's risk appetite and regulatory requirements. Academic references support the key functions of risk governance in banks.

Risk identification and assessment are facilitated by risk governance, enabling banks to categorize and quantify risks such as credit risk, market risk, liquidity risk, operational risk, and compliance risk (BCBS, 2011). This process allows banks to prioritize risk mitigation efforts and allocate appropriate resources for effective risk management (Borio, 2003).

Risk governance helps banks define their risk appetite, which determines the level of risk the organization is willing to accept in pursuit of its strategic objectives (BCBS, 2013). By establishing risk limits and tolerance thresholds, banks ensure that risk-taking activities remain within acceptable boundaries and align with the overall business strategy (Kose et al., 2006).

Promoting a strong risk culture within banks is another function of risk governance (Power, 2009). This involves fostering awareness and understanding of risk throughout the organization and facilitating effective communication of risk-related information to stakeholders, including the board of directors, senior management, and employees (Kossovsky et al., 2012). This fosters a risk-aware culture, enhances risk management practices, and enables informed decision-making (Grote, 2007).

Risk monitoring and reporting mechanisms are established through risk governance to track risk exposures and ensure compliance with regulatory requirements (BCBS, 2015). These mechanisms include the implementation of risk metrics, key risk indicators (KRIs), and reporting frameworks (Hsieh & Chen, 2011). Timely and accurate information on risk profiles and emerging risks enables banks to detect vulnerabilities and take proactive measures to mitigate risks (BCBS, 2010).

Effective board oversight and accountability for risk management practices are ensured by risk governance (Adams & Mehran, 2012). This involves defining the roles and responsibilities of the board of directors, including the establishment of risk committees and the review of risk policies and procedures (BCBS, 2012). Holding the board accountable for

risk governance fosters a strong risk culture and ensures that risk management remains a top priority within the organization (BCBS, 2015).

4.2. Role of Risk Governance in Banks

Risk governance indeed plays a crucial role in facilitating the identification and assessment of various risks faced by banks. It paves the way for the development of risk management frameworks that enable banks to categorize and quantify risks such as credit risk, market risk, liquidity risk, operational risk, and compliance risk (Acharya et al., 2014). By identifying and assessing risks, banks can prioritize their risk mitigation efforts and allocate appropriate resources to manage these risks effectively (Dionne, 2013).

Risk governance, as part of its function, also assists banks in defining their risk appetite (Kaufman & Scott, 2003). This is the level of risk the organization is willing to accept in pursuit of its strategic objectives. It necessitates the establishment of risk limits and risk tolerance thresholds to ensure that risk-taking activities remain within acceptable boundaries (BIS, 2011). The strategic alignment between risk and reward is thus achievable through this facet of risk governance (Borio, 2011).

A critical component of risk governance lies in fostering a robust risk culture within banks. The process involves effective communication of risk-related information to stakeholders, including the board of directors, senior management, and employees. By fostering a risk-aware culture and facilitating open communication, banks can enhance their risk management practices and make informed decisions regarding risk-taking activities (Dionne, 2013).

Risk governance further ensures the establishment of robust monitoring and reporting mechanisms to track risk exposures and ensure compliance with regulatory requirements (Tarullo, 2008). Implementing risk metrics, key risk indicators (KRIs), and reporting frameworks that provide timely and accurate information on risk profiles and emerging risks is a crucial aspect of this process (BCBS, 2013).

Board oversight and accountability play an indispensable role in effective risk governance (Adams & Mehran, 2012). The process involves defining the roles and responsibilities of the board of directors in overseeing risk management activities. This includes the establishment of risk committees and the review of risk policies and procedures (Minton et al., 2014). In a study analyzing the impact of board oversight on risk governance in

Indian banks, the findings emphasized the crucial role of board independence, expertise, and engagement in ensuring effective risk governance (Pathan & Faff, 2013).

In conclusion, risk governance provides a structured framework for managing banking risks, promoting risk culture, and facilitating effective communication. It forms the bedrock of bank stability, improved risk management practices, and better risk-adjusted returns (Fahlenbrach et al., 2012).

Overall, risk governance is essential for banks to effectively identify, assess, and manage risks, thereby safeguarding the institution, aligning risk-taking activities with strategic objectives, and complying with regulatory requirements.

4.3. Functions of Risk Governance in Banks

Risk governance is a crucial aspect of the banking industry, serving as a framework for managing and mitigating risks that could potentially affect a bank's financial stability and reputation. It encompasses various processes, structures, and practices aimed at identifying, assessing, monitoring, and controlling risks within a bank. Let's explore the functions of risk governance in banks, supported by relevant references.

Risk governance involves defining a bank's risk appetite, which refers to the level of risk the bank is willing to accept in pursuit of its strategic objectives. This framework helps align risk-taking activities with the bank's overall business strategy and ensures risk exposures are maintained within acceptable limits (BCBS, 2010).

Risk governance facilitates the identification and assessment of different risks faced by banks, including credit risk, market risk, liquidity risk, operational risk, and strategic risk (IMF, 2018). By understanding the sources and nature of risks, banks can evaluate the likelihood and potential impact of these risks on their financial position (IMF, 2020).

Risk governance establishes mechanisms for measuring and monitoring risks on an ongoing basis. This involves the development and implementation of risk measurement models, such as value at risk (VaR), stress testing, and scenario analysis. Regular monitoring of risks enables banks to detect early warning signals, assess changes in risk profiles, and take timely actions to mitigate emerging risks (BCBS, 2010).

Risk governance ensures the implementation of appropriate risk mitigation and control measures to reduce the probability and impact of risks. Banks formulate and implement risk management policies, procedures, and controls to address specific risks. For example, they

establish credit risk management frameworks, including credit underwriting standards and loan loss provisioning practices, to mitigate credit risk (BCBS, 2000).

Risk governance emphasizes the role of the board of directors in overseeing the bank's risk management activities. The board sets the risk governance framework, approves risk policies, and ensures alignment with the bank's overall strategy and risk appetite. It also holds management accountable for effective risk management practices and achievement of risk management objectives. Regular reporting to the board enhances transparency and accountability (FSB, 2013).

Risk governance helps banks comply with regulatory requirements and guidelines related to risk management (BCBS, 2015). Effective risk governance systems ensure adherence to prudential regulations, capital adequacy standards, risk reporting requirements, and other regulations set by regulatory authorities (BCBS, 2017). Compliance with these regulations helps maintain regulatory trust and avoid penalties or reputational damage resulting from non-compliance (BCBS, 2011).

4.4. Characteristics of Risk Governance in Banks

Risk governance in banks refers to the framework and processes implemented by financial institutions to effectively identify, assess, monitor, and manage risks (BCBS, 2010). It plays a crucial role in ensuring the stability and soundness of the banking system by promoting a comprehensive approach to risk management. It plays a vital role in ensuring financial stability and protecting the interests of stakeholders (BCBS, 2010; Shleifer & Vishny, 1997).

Board and senior management oversight are crucial in risk governance, as they are responsible for setting the risk appetite, establishing a strong risk culture, and providing clear direction to the organization (BCBS, 2010; Claessens et al., 2002).

Banks develop a risk appetite framework that aligns with their strategic objectives and outlines the types and levels of risks they are willing to accept (FSB, 2013; BCBS, 2013).

Robust processes are essential for identifying and assessing risks, using comprehensive risk assessments that employ quantitative and qualitative methods to evaluate potential impacts and likelihoods (Lam, 2014).

Accurate risk measurement models and systems are necessary for quantifying risks, while effective risk reporting mechanisms provide timely and relevant information to key stakeholders. Clear risk management policies and procedures help mitigate and control risks,

including setting risk limits, implementing risk mitigation strategies, and ensuring compliance with regulations.

An independent risk oversight function plays a crucial role in risk governance, providing objective evaluations of risk management activities. This can be carried out by a separate risk management department or a designated chief risk officer (Demirgüç-Kunt and Huizinga, 2001).

Banks must comply with laws, regulations, and supervisory requirements, and implement robust internal control systems, conduct regular audits, and adhere to regulatory capital requirements (FSB, 2013; Sironi, 2003).

These characteristics contribute to a robust risk governance framework that enables banks to effectively manage risks and protect the stability of the financial system (Gericke et al., 2018).

4.5. Conclusion

In conclusion, risk governance plays a critical role in banks by providing a structured framework for identifying, assessing, and managing risks effectively. It encompasses various functions that are essential for maintaining financial stability, aligning risk-taking activities with strategic objectives, and complying with regulatory requirements.

The first function of risk governance is risk identification and assessment, which enables banks to categorize and quantify different types of risks they face. This process helps prioritize risk mitigation efforts and allocate appropriate resources for effective risk management. Risk governance also involves establishing the bank's risk appetite, defining the level of risk the organization is willing to accept in pursuit of its strategic objectives. By setting risk limits and tolerance thresholds, banks ensure that risk-taking activities remain within acceptable boundaries and align with the overall business strategy.

Another key function of risk governance is promoting a strong risk culture within banks. This involves fostering awareness and understanding of risk throughout the organization and facilitating effective communication of risk-related information to stakeholders. By fostering a risk-aware culture, banks enhance risk management practices and enable informed decision-making.

Risk governance establishes robust monitoring and reporting mechanisms to track risk exposures and ensure compliance with regulatory requirements. This includes implementing risk metrics, KRIs, and reporting frameworks that provide timely and accurate information on

risk profiles and emerging risks. This enables banks to detect vulnerabilities and take proactive measures to mitigate risks.

Effective board oversight and accountability for risk management practices are also ensured by risk governance. This involves defining the roles and responsibilities of the board of directors, establishing risk committees, and reviewing risk policies and procedures. Holding the board accountable for risk governance fosters a strong risk culture and ensures that risk management remains a top priority within the organization.

The characteristics of risk governance in banks include board and senior management oversight, the development of a risk appetite framework, robust risk identification and assessment processes, accurate risk measurement models and reporting mechanisms, clear risk management policies and procedures, an independent risk oversight function, and compliance with regulatory requirements.

Overall, risk governance is essential for banks to effectively identify, assess, and manage risks, safeguarding the institution, aligning risk-taking activities with strategic objectives, and complying with regulatory requirements. The functions and characteristics of risk governance outlined in this text provide a comprehensive understanding of its importance in the banking industry.

5. Risk Governance and Bank Performance

5.1. Introduction

Risk governance is widely recognized as a critical component in managing risks effectively within banks and financial institutions (Power, 2007). It encompasses the establishment of comprehensive frameworks, policies, and structures to identify, assess, and mitigate risks (Blommestein, 2009). Effective risk governance practices are essential for ensuring the stability and sustainability of these institutions (Herring & Carmassi, 2012).

The risk committee, as an integral part of risk governance, plays a crucial role in overseeing risk management processes and decision-making (Walker, 2009). It comprises board members and senior executives who are responsible for setting risk management strategies, reviewing risk reports, and ensuring the implementation of appropriate risk controls (Adams et al., 2010). The risk committee acts as a key forum for discussions on risk-related matters and provides valuable guidance in risk governance (Mikes, 2011).

The CRO is a key executive responsible for managing and overseeing the institution's risk management function (Simkins, 2008). The CRO plays a pivotal role in developing risk management strategies, establishing risk appetite, and monitoring risk exposures (Lam, 2014). Their expertise and leadership are essential for effective risk governance (Aebi et al., 2012).

The CFO holds a significant position in risk governance, particularly in financial risk management (Beasley et al., 2008). They are responsible for financial reporting, capital management, and liquidity management, ensuring the institution's financial risks are adequately identified and managed (Gordon et al., 2009). The CFO's involvement in risk governance ensures the integration of financial considerations into risk management practices.

Senior directors, with their extensive experience and industry knowledge, play a vital role in risk governance (Adams et al., 2010). They contribute valuable insights and guidance in identifying and mitigating risks, aligning risk management strategies with the institution's objectives (Fama & Jensen, 1983).

Directors with PhD degrees bring specialized knowledge and expertise to risk governance (Hermalin & Weisbach, 2003). Their advanced education and research background equip them with analytical skills necessary for risk identification and assessment (Hermalin & Weisbach, 2003). The presence of directors with PhD degrees enhances the quality of risk governance discussions and decision-making (Hermalin & Weisbach, 2003).

Independent directors are crucial in risk governance, providing an objective perspective and ensuring proper oversight (Fama & Jensen, 1983). Their independence helps challenge assumptions, evaluate risk management processes, and safeguard the interests of shareholders and stakeholders (Fama & Jensen, 1983).

The impact of risk governance on bank risk can be measured using various indicators. The Tier 1 capital to risk-weighted assets (RWA) ratio is an important measure of capital adequacy and risk resilience (BCBS, 2010). A higher ratio indicates a stronger capital position, reflecting effective risk management and reduced vulnerability to unexpected losses (Berger, 1995).

Financial performance is a critical aspect affected by risk governance. Effective risk governance practices contribute to improved financial performance by reducing losses from risk events and enhancing risk-adjusted returns (Adams & Mehran, 2012).

Regulatory adjustments and compliance are essential considerations in risk governance. Banks and financial institutions must adhere to regulatory requirements, such as capital adequacy ratios, stress testing, and risk reporting (BCBS, 2013). Compliance with these regulations is crucial to maintaining the stability and integrity of the financial system (Blommestein, 2009).

In summary, effective risk governance in banks and financial institutions relies on the collaboration and contributions of various stakeholders, including the risk committee, chief risk officer, chief financial officer, senior directors, directors with PhD degrees, and independent directors (Simkins, 2008; Beasley et al., 2008; Hermalin & Weisbach, 2003; Fama & Jensen, 1983). Their collective expertise, oversight, and strategic decision-making are instrumental in identifying, assessing, and mitigating risks (Power, 2007; Blommestein, 2009; Herring & Carmassi, 2012). By implementing robust risk governance practices, institutions can enhance their resilience, protect stakeholders' interests, and contribute to sustainable financial performance (Adams & Mehran, 2012; BCBS, 2013).

5.2. Risk Governance and Bank Risk

Risk governance is an essential component of the risk management infrastructure in banks, which is tasked with identifying, assessing, and controlling risks to ensure the financial health of the institution. The elements of risk governance including the RC, CRO, CFO, SENIOR, TITLE, and BI each play a pivotal role in this process (Fama & Jensen, 1983).

The risk committee, typically comprised of board members, is primarily responsible for overseeing the bank's risk management policies and practices. They ensure that the bank is aligned with regulatory requirements and that potential risks are effectively mitigated. Their role also includes overseeing the work of the CRO and supporting them in implementing risk management strategies (Adams & Mehran, 2012).

The CRO, a key executive in the risk governance framework, has the responsibility of identifying, measuring, and managing the bank's exposure to risk. Their duties involve working closely with the CFO and other senior directors to ensure risks are managed effectively. They're involved in developing and implementing risk strategies, assessing risk appetite and establishing risk limits (Power, 2009).

The CFO plays an integral part in risk governance by providing financial perspectives to risk management. Their role involves ensuring the bank's financial health, identifying potential financial risks, and collaborating with the CRO to develop strategies to mitigate them. The CFO also assists in aligning risk strategy with the bank's overall financial strategy (Bromiley et al., 2015).

Senior directors contribute to risk governance by providing their expertise and leadership in developing and implementing risk strategies. They assist the CRO and CFO in their tasks, participate in risk assessment, and are involved in making strategic decisions related to risk management. Their collective experience and knowledge are invaluable assets in foreseeing and mitigating potential risks (Adams, 2012).

Interestingly, directors with PhD degrees have been shown to contribute to effective risk management in banks. Their academic knowledge and expertise can enhance decision-making processes and contribute to the development of sophisticated risk models and strategies. Banks with such directors may exhibit better performance in risk management compared to those without (Nguyen & Nielsen, 2010).

Independent directors bring an external perspective to risk governance, improving the bank's ability to manage risk. They are less likely to have conflicts of interest, allowing them to make unbiased decisions for the benefit of the bank. Furthermore, their independence

contributes to the diversity of thought in the boardroom, enabling better decision-making and risk oversight (Erkens et al., 2012).

In conclusion, each element of risk governance plays a crucial role in managing bank risks. The risk committee, CRO, CFO, senior directors, directors with PhD degrees, and independent directors each contribute unique perspectives and skills to the process, enhancing the bank's ability to identify, assess, and control risk. It is the interplay of these elements that shapes the risk governance framework and ultimately the stability and success of the bank.

Building upon the foundational elements of risk governance in banks, including the roles of the RC, CRO, CFO, SENIOR, and other key figures, the subsequent sections delve into the empirical analysis of how these governance structures impact bank risk. Through a detailed exploration of risk governance mechanisms and their effectiveness, the following sections from 5.2.1. to 5.2.8 provide results and discussion on the intricate relationship between risk governance practices and bank risk, shedding light on the practical implications of these governance components in mitigating risk within public commercial banks across OECD countries.

5.2.1. Descriptive Analysis

In this section, the descriptive statistics of the variables used in this area of the dissertation on risk gobernance and bank risk are presented. Descriptive statistics provide a comprehensive overview of the data, including measures of central tendency, dispersion, and the range of values observed for each variable. These statistics serve as a foundation for understanding the characteristics of the sample and provide insights into the distribution and variability of the variables (Demsetz & Strahan, 1997).

Table 2 presents the descriptive statistics for the variables. The "Obs" column indicates the number of observations available for each variable. The "Mean" represents the average value of the variable across the observations. The "Std. Dev." represents the standard deviation, which measures the dispersion or variability of the values. The "Min" and "Max" columns indicate the minimum and maximum values observed for each variable, respectively.

Among the variables, the average TIER1 ratio is 13.21, with a standard deviation of 3.25. This observed variability in the TIER1 ratio across the banks in the sample is indicative of their distinct capital structures and risk management strategies. Such differences can be attributed to variations in regulatory environments, bank size, business models, and prevailing market conditions. As a result, the variation in capital adequacy levels is expected given the

diverse characteristics and operational contexts of the sampled banks. Under the Basel III recommendations, banks are generally required to maintain a minimum Tier 1 capital ratio of 6%. A ratio below this can lead to supervisory actions, placing the bank under special monitoring. On the higher end, values significantly above the average might indicate over-conservatism or underutilized capital by the bank. The findings are framed within the context of the Basel III guidelines as provided by BCBS (2011), which sets the standards for quality Tier 1 capital.

The presence of specific risk governance characteristics (RC, CRO, CFO, TITLE, SENIOR, and BI) is also examined. The mean values for these variables range from 0.14 to 0.51, indicating that these governance characteristics are present to varying degrees among the sampled banks (Pathan & Faff, 2013).

Other variables in this research include CEOAD, BS, and SIZE. These variables exhibit mean values of 0.08, 14.68, and 8,930 € (measured in billions), respectively, highlighting the variation in board composition and the scale of operations among the banks (Adams & Mehran, 2012).

It is worth noting that the descriptive statistics offer a preliminary insight into the patterns, central tendencies, and dispersions in the data pertaining to the variables' distribution and characteristics. While this provides an initial grasp, a more in-depth investigation, such as regression analysis, is essential to delve into the relationships between these variables and their implications on bank risk. However, further analysis and modeling are required to examine the relationships and assess the impact of these variables on bank risk.

After the descriptive analysis, next section explores the correlation among the variables to identify potential relationships and dependencies.

Table 2 - Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
TIER1	1,783	13.2075	3.2500	8.8000	32.6000
RC	14,596	0.1962	0.3971	0	1
CRO	14,596	0.0056	0.0743	0	1
CFO	14,596	0.0277	0.1643	0	1
TITLE	14,596	0.1361	0.3429	0	1
SENIOR	14,596	0.3013	0.4588	0	1
BI	14,596	0.5060	0.5000	0	1
CEOAD	14,596	0.0800	0.2712	0	1
BS	14,595	14.6828	5.0975	5	32
SIZE[1]	14,555	8,930 €	85,700 €	0.00 €	177,000 €

[1] *SIZE is in billions of euros.*

Note: Table 2 presents the descriptive statistics for the variables used in the study. The "Obs" column indicates the number of observations available for each variable. The "Mean" represents the average value of the variable across the observations. The "Std. Dev." represents the standard deviation, which measures the dispersion or variability of the values. The "Min" and "Max" columns indicate the minimum and maximum values observed for each variable, respectively. The variable "SIZE" is measured in billions of euros.

5.2.2. Correlation Analysis

In this section, the correlation among the variables used in this research area is examined. Correlation analysis allows exploration of the relationships and dependencies between variables, providing insights into their interplay and potential associations (Pathan, 2009).

Table 3 presents the correlation matrix of the variables. Each cell in the matrix represents the Pearson correlation coefficient between two variables, indicating the strength and direction of their linear relationship. The correlation values range from -1 to 1, with the magnitude of the value indicating the strength of the correlation and the sign indicating the direction.

Based on the correlation matrix, the variable TIER1 exhibits weak positive correlations with variables such as RC, CRO, CFO, and TITLE. However, only the correlations with CFO and TITLE attain statistical significance at the 0.01 level, as indicated by the double asterisks.

A closer examination of the correlation matrix reveals interesting patterns. Notably, there's a weak yet statistically significant negative correlation between TIER1 and BI (-

0.11***). Given the definition of BI, where a value of 1 indicates an independent director, this suggests that a higher proportion of independent directors on the board is associated with lower capital adequacy levels. While this may seem contrary to common expectations, given the association of independent directors with better governance practices, it's essential to treat this observation with caution. Such relationships might be influenced by a myriad of factors, and further regression analysis is required to discern the underlying mechanisms and to control for potential confounding variables (Erkens et al., 2012).

Referring to Table 3, TIER1 shows statistically significant positive correlations with CFO and TITLE. Furthermore, RC and TITLE have a positive correlation significant at the 0.001 level. RC and CRO have a negative correlation significant at the 0.05 level, while CRO and TITLE have a weak positive correlation, though it's not statistically significant. Upon closer examination of the correlation matrix, intriguing patterns of association emerge among risk governance variables. Specifically, while there are positive correlations between TIER1 and variables such as RC, CRO, CFO, and TITLE, the correlations among RC, CRO, and CFO are not uniformly positive. For instance, RC negatively correlates with both CRO (-0.05*) and CFO (-0.05*). This indicates that the presence or prevalence of one risk governance characteristic doesn't necessarily suggest the presence of another. These varying correlations underscore the intricate nature of risk governance in banks, reflecting that banks may opt for diverse governance structures based on their unique contexts and needs. Such findings accentuate the necessity for rigorous multivariate analyses to delve deeper into the nuanced relationships among these governance variables (Pathan, 2009).

It is important to note that correlation coefficients only measure the linear relationship between variables and do not imply causation. Further analysis is required to establish causal relationships and assess the impact of these variables on bank risk.

The correlation analysis provides initial insights into the relationships between the variables, guiding subsequent modeling and regression analysis. In the next section, the focus will shift to the regression analysis, examining the impact of these variables on bank risk.

Table 3 – Correlation

	TIER1	RC	CRO	CFO	TITLE	SENIOR	BI	CEOAD	BS	SIZE
TIER1	1									
RC	0.01	1								
CRO	0.04	-0.05*	1							
CFO	0.06**	-0.05*	-0.02	1						
TITLE	0.06**	0.08***	0.04	0.01	1					
SENIOR	-0.02	-0.04	0.04	0.03	-0.07**	1				
BI	-0.11***	0.25***	-0.14***	0.00	0.12***	-0.03	1			
CEOAD	-0.04	-0.06*	-0.03	-0.07**	-0.00	0.03	-0.17***	1		
BS	-0.09***	-0.07**	0.11***	0.03	0.10***	0.08***	-0.24***	-0.03	1	
SIZE	-0.03	-0.02	0.06*	0.04	0.15***	0.07**	-0.07**	0.03	0.52***	1

"* p<0.05 ** p<0.01 *** p<0.001"

Note: Table 3 showcases the correlation matrix of all the variables used in this study. Each cell in the matrix represents the Pearson correlation coefficient between two variables, providing a measure of the strength and direction of their linear relationship. The correlation values range from -1 to 1, with the magnitude of the value indicating the strength of the correlation and the sign indicating the direction. A value of 1 means a perfect positive correlation, while -1 indicates a perfect negative correlation. A value close to 0 suggests a weak or no correlation. This correlation matrix is instrumental in understanding the pairwise relationships between variables and can indicate potential issues of multicollinearity in the subsequent analyses.

This correlation table, based on observations that matched as outlined in the data collection and description, presents the relationships between the variable TIER1 and other variables in the study. It's important to note that the correlations are determined from the subset of the dataset where these variables intersect. The observation count for TIER1, as indicated in the descriptive statistics, is distinct from others, reflecting its specific data collection criteria. This context is crucial for interpreting the correlations accurately, as they are based on this particular subset of the comprehensive dataset.

5.2.3. Principal Component Analysis

To uncover the underlying structure of the risk governance characteristics in the dataset, a Principal Component Analysis (PCA) was conducted, following the method described by Jolliffe (2002). Initially, all relevant variables (such as RC, CRO, CFO, TITLE, SENIOR, and BI) were standardized to ensure equal contribution to the analysis, given PCA's sensitivity to variable magnitudes. After standardizing these variables, the PCA was executed, aiming to extract six principal components that capture the maximum variance from the original set. Post-PCA, the scores for each principal component were generated for all observations. The primary component, which often captures the most significant variance, was named rgi for ease in subsequent analyses. This component was then incorporated as a predictor in regression analyses, with tier1 as the dependent variable, while also considering other control variables.

Table 4-a presents the Eigenvalues obtained from the PCA. Eigenvalues represent the amount of variance explained by each principal component (Kaiser, 1960). The table shows six components (COMP1 to COMP6), their corresponding Eigenvalues, the Difference in Eigenvalues between successive components, the Proportion of total variance explained by each component, and the Cumulative proportion of explained variance up to each component. The Eigenvalues offer insights into the variance each component captures in the dataset. Higher Eigenvalues signify components that explain a substantial portion of the data's underlying structure. By observing the differences between successive Eigenvalues and evaluating the cumulative variance explained, one can discern the optimal number of dimensions for representation, ensuring an effective balance between model simplicity and data fidelity.

Based on Table 4-a, the first component, COMP1, has the highest Eigenvalue of 1.3384, explaining 22.31% of the total variance. COMP2, COMP3, and COMP4 follow with Eigenvalues of 1.0332, 1.0047, and 0.9609, explaining 17.22%, 16.74%, and 16.02% of the variance, respectively. The remaining components, COMP5 and COMP6, have Eigenvalues of 0.9154 and 0.7474, explaining 15.26% and 12.46% of the variance, respectively. Cumulatively, these six components account for 100% of the total variance in the data. COMP1 is selected as RGI for regression analysis.

Table 4-b[1] displays the Principal Components (PCs) or eigenvectors for each variable obtained from the PCA. The loadings represent the correlation between the original variables

[1] In Tables 4-b and 4-c, variables are presented with a "_STD" suffix, denoting their standardized form. The standardization process entails mean-centering and scaling each variable by its standard deviation. This step

and the derived principal components (Abdi & Williams, 2010). The sign and magnitude of the loadings indicate the contribution of each variable to the corresponding component. Variables with higher absolute loadings have a stronger influence on the respective component.

Table 4-c presents the scoring coefficients or loadings of the variables for each principal component. These coefficients represent the weights assigned to each variable in calculating the component scores. The scores provide a measure of each bank's position on each principal component, allowing for further analysis and interpretation.

PCA allows for the capture of underlying patterns and relationships within the dataset, enabling a reduction in dimensionality and the identification of key components. By identifying the components that explain the majority of the variance, a deeper understanding of the underlying factors influencing bank risk is obtained.

In the next section, the results of the PCA will be utilized in the regression analysis to investigate the relationship between governance variables and bank risk.

Table 4-a PCA Eigenvalues

COMPONENT	EIGENVALUE	DIFFERENCE	PROPORTION	CUMULATIVE
COMP1	1.3384	0.3052	0.2231	0.2231
COMP2	1.0332	0.0285	0.1722	0.3953
COMP3	1.0047	0.0438	0.1674	0.5627
COMP4	0.9609	0.0455	0.1602	0.7229
COMP5	0.9154	0.1680	0.1526	0.8754
COMP6	0.7474	0.0000	0.1246	1.0000

Note: Table 4-a presents the Eigenvalues obtained from the PCA. It showcases six components (COMP1 to COMP6), their respective Eigenvalues, the Difference in Eigenvalues between successive components, the Proportion of the total variance explained by each component, and the Cumulative proportion of explained variance up to each component. The table provides an overview of how much each component contributes to the total variability of the data. The cumulative proportion column gives a quick way to see how much total variance is accounted for as more components are considered. By the end of COMP6, all the variance in the data (100%) has been accounted for.

is essential in PCA to ensure that all variables, regardless of their original measurement units, contribute to the analysis on an equal footing. The process avoids undue influence by any particular variable due to scale disparities. It is worth noting that the variable names in Table 1 (e.g., "RC") correspond to their standardized counterparts in the PCA tables (e.g., "RC_STD"). For clarity and consistency in this analysis, I adopted this notation, but readers should treat "RC" and "RC_STD" as representations of the same underlying variable, with the latter being its standardized version."

Table 4-b Principal components (eigenvectors) from PCA

VARIABLE	COMP1	COMP2	COMP3	COMP4	COMP5	COMP6	UNEXPLAINED
RC_STD	0.5723	-0.0315	-0.2229	0.4185	0.2255	0.6291	0
CRO_STD	-0.2171	-0.4719	0.4345	0.7178	-0.1218	-0.106	0
CFO_STD	-0.0288	0.7367	0.5829	0.1277	-0.1906	0.2531	0
TITLE_STD	0.2653	-0.3137	0.6356	-0.4162	0.4996	0.0658	0
SENIOR_STD	-0.4137	0.2899	-0.1306	0.2633	0.8028	-0.1183	0
BI_STD	0.6188	0.2262	0.0260	0.2252	0.0622	-0.7146	0

Table 4-b displays the eigenvectors for each variable obtained from the PCA, along with any unexplained variance. These eigenvectors, or coefficients, represent the weight and direction of each variable's contribution to the derived principal components (COMP1 to COMP6). Each of these components captures a specific aspect of the total variance present in the original data, ensuring orthogonality and maximizing the captured variance. The "unexplained variance" for all variables is zero, which indicates that the derived principal components fully account for the variability of all the standardized variables in the dataset.

Table 4-c PCA Scores

VARIABLE	COMP1	COMP2	COMP3	COMP4	COMP5	COMP6
RC_STD	0.5723	-0.0315	-0.2229	0.4185	0.2255	0.6291
CRO_STD	-0.2171	-0.4719	0.4345	0.7178	-0.1218	-0.106
CFO_STD	-0.0288	0.7367	0.5829	0.1277	-0.1906	0.2531
TITLE_STD	0.2653	-0.3137	0.6356	-0.4162	0.4996	0.0658
SENIOR_STD	-0.4137	0.2899	-0.1306	0.2633	0.8028	-0.1183
BI_STD	0.6188	0.2262	0.0260	0.2252	0.0622	-0.7146

Note: *Scoring coefficients — sum of squares (column-loading) = 1*. Table 4-c, on the other hand, presents the scoring coefficients or loadings. These values are a reflection of the correlation between each original variable and the derived principal components. Loadings help in understanding how well a particular variable can be represented or "reconstructed" using the principal components. A high absolute value of a loading (closer to -1 or 1) signifies that the original variable is closely associated with that principal component and can be well-represented by it. By reviewing these loadings, insights are gained into which original variables are most significant for each derived component and how they relate in terms of positive or negative correlations. It's a tool for understanding the significance and relationship of the original data in the context of the reduced-dimensional PCA space.

5.2.4. Regression Analysis

To investigate the relationship between risk governance variables and bank risk, regression analysis was conducted (Wooldridge, 2015). This analysis allows for the assessment of the impact of independent variables on the dependent variables while controlling for other relevant factors.

Table 5 presents the results of the regression analysis for the dependent variable TIER1 (Tier 1 capital / Risk Weighted assets). In Model (1), the governance variable RGI is included as an independent variable. The coefficient estimate for RGI is 0.0089, indicating a positive relationship between risk governance and TIER1 (Ellul & Yerramilli, 2013). The coefficient is statistically significant at the 0.05 level ($p < 0.05$), suggesting that a one-unit increase in the RGI is associated with a 0.0089 increase in TIER1. This result suggests that better risk governance practices are positively associated with higher levels of TIER1.

In Model (1a), a bootstrapped approach was employed to estimate the coefficient for RGI. The bootstrapped coefficient estimate remains the same as in Model (1), further supporting the robustness of the relationship between risk governance and TIER1.

Three control variables, CEOAD, BS, and SIZE were also included in the regression analysis. However, neither of these variables shows a statistically significant relationship with TIER1.

Additionally, the regression models include bank fixed effects and year fixed effects to control for unobservable heterogeneity across banks and time-specific factors that may affect the dependent variable (Roberts & Whited, 2013). The inclusion of fixed effects helps to mitigate omitted variable bias and enhance the internal validity of the regression results.

These regression results provide empirical evidence supporting the hypothesis that effective risk governance practices positively impact bank performance by increasing TIER1 which implies lower bank risk. The findings highlight the importance of robust risk governance frameworks in enhancing capital adequacy within banks.

Table 5 - Regression (main results)

VARIABLES	(1) TIER1	(1a) TIER1-Bootstrapped
RGI	0.0089**	0.0089**
	(0.0040)	(0.0041)
CEOAD	0.0033	0.0033
	(0.0188)	(0.0168)
BS	0.0035	0.0035
	(0.0636)	(0.0723)
$SIZE^2$	-0.0032***	-0.0032
	(0.0011)	(0.0023)
Constant	14.8851***	14.8851***
	(1.4753)	(1.6327)
Observations	1,783	1,783
Adjusted R-squared	0.9534	0.9534
Bank FE	YES	YES
Year FE	YES	YES
Clusters	Bank	Bank

Note: Table 5 presents the regression results with the dependent variable TIER1, representing the ratio of Tier 1 capital to Risk Weighted assets. The columns labeled (1) and (1a) display different model specifications. The "VARIABLES" column lists the predictor variables. Coefficient estimates for each predictor are shown, accompanied by clustered standard errors in parentheses. These standard errors are robust to heteroskedasticity and potential autocorrelation within the isin clusters, distinguishing them from White's heteroskedasticity-corrected standard errors. The total number of observations used in the regression is provided under "Observations." The "Adjusted R-squared" indicates the model's explanatory power. "Bank FE" and "Year FE" columns denote the inclusion of bank and year fixed effects, respectively. Asterisks signify significance levels: *** for $p<0.01$, ** for $p<0.05$, and * for $p<0.1$.

[2] Note: In the regression analysis (Table 5), the variable "SIZE", originally in billions of euros, has been adjusted by dividing it by millions. This conversion is implemented to enhance the interpretability of the coefficient, making it more comprehensible in the context of the model. It's important to note that this rescaling of "SIZE" for readability does not impact the actual results or their significance; it simply modifies the unit of measurement for clearer understanding. This practice is a standard approach in econometric analysis when dealing with large numerical values.

The SIZE variable's coefficient, though close to zero, in unreported results, is reflective of the large units (in 1000 euros) being used, which is typical for datasets dealing with significant financial amounts. Its statistical significance confirms that even subtle variations in SIZE can influence a bank's risk-to-profit dynamics.

5.2.5. Sensitivity Analysis

To examine the robustness and stability of the findings, a sensitivity analysis was conducted (Saltelli et al., 2008). This analysis aimed to assess the sensitivity of the results to potential variations in the model specifications and data.

Table 6 showcases the sensitivity analysis results for the dependent variable, Average Value at Risk to Pre-Tax Profit Ratio (AVARPTP). This ratio measures a bank's risk exposure relative to its pre-tax profits, providing insight into potential loss values of a bank's assets or portfolio over a specified time frame for a set confidence interval. It signifies the portion of a bank's earnings that could be at risk. In Model (2), the Risk Governance Index (RGI) is introduced as an independent variable, and its coefficient is -0.0095, indicating a negative correlation with AVARPTP, as cited by Ellul & Yerramilli (2013). Comparing this to the results where TIER1 is the dependent variable (Table 5), it can be observed that a unitary rise in RGI relates to a coefficient of 0.0089, pointing to a direct relationship between enhanced risk governance and an increase in TIER1 capital. Conversely, for AVARPTP, a one-unit rise in RGI results in a decrease of 0.0095 in the ratio, emphasizing the negative correlation. Essentially, as a bank refines its risk governance, it ensures potential financial losses relative to its earnings are reduced, but simultaneously bolsters its Tier 1 capital. This dynamic underscores the intricate effects of risk governance on different facets of banking operations. The practical implication is that while better risk governance can decrease potential losses that might impact a bank's pre-tax profits and bolster its Tier 1 capital, its influence, though statistically significant, is weak ($p < 0.1$). Other factors could be affecting AVARPTP, and a nuanced understanding of these contrasting relationships, especially in terms of bank stability and risk appetite, is imperative. The effect size, a modest decrease of 0.0095 for AVARPTP, prompts banks to interpret this within their specific operational context.

In Model (2a), a bootstrapped approach was employed to estimate the coefficient for RGI. The bootstrapped coefficient estimate remains the same as in Model (2), indicating the stability of the relationship between risk governance and the AVARPTP.

Control variables, CEOAD, BS, and SIZE, played a crucial role in the sensitivity analysis. The negative coefficient for CEOAD (-0.0347) suggests that banks with advisory CEOs tend to adopt more conservative risk strategies. The pronounced negative relationship of BS with AVARPTP, with a coefficient of -0.5944, indicates that as BS increases, the risk relative to pre-tax profit decreases, underscoring its substantial influence on the risk profile of

banks. Together, these variables elucidate the nuances of bank risk governance in the context of the banking industry.

Similar to the regression analysis, bank fixed effects and year fixed effects were incorporated into the sensitivity analysis to account for unobservable heterogeneity across banks and time-specific factors (Roberts & Whited, 2013). The inclusion of fixed effects enhances the internal validity of the sensitivity analysis.

The sensitivity analysis results provide additional support for the main findings. While the relationship between risk governance and the AVARPTP is not as strong as with TIER1, the negative coefficient suggests that better risk governance practices may be associated with lower risk levels, as indicated by the AVARPTP.

It is important to note that the sensitivity analysis does not imply causality and should be interpreted with caution. Nevertheless, the consistent findings across different model specifications support to the robustness of the observed relationships.

Overall, the sensitivity analysis reinforces the notion that risk governance practices have a potential impact on bank risk-taking measures, such as the AVARPTP. These results further emphasize the importance of effective risk governance frameworks in promoting prudent risk management within banks.

Table 6 - Sensitivity Analysis

VARIABLES	(2) AVARPTP	(2a) AVARPTP-Bootstrapped
RGI	-0.0095*	-0.0095**
	(0.0044)	(0.0039)
CEOAD	-0.0347**	-0.0347**
	(0.0118)	(0.0138)
BS	-0.5944***	-0.5944***
	(0.0602)	(0.0459)
SIZE[3]	0.0001***	0.0001***
	(0.0000)	(0.0000)
CONSTANT	17.6618***	17.6618*
	(0.6152)	(9.2204)
Observations	174	174
Adjusted R-squared	0.9999	0.9999
Bank FE	YES	YES
Year FE	YES	YES
Clusters	Bank	Bank

Note: Table 6 showcases the results of the sensitivity analysis for the AVARPTP variable. The columns (2) and (2a) represent Model 2 and its bootstrapped counterpart, Model 2a, respectively. The variables explored are presented in the "VARIABLES" column, accompanied by their coefficient estimates and standard errors. The "Observations" row notes the total number of data points analyzed. The "Adjusted R-squared" metric elucidates the model's fit. Both bank and year fixed effects are included in the models, and clustering is performed at the bank level. The significance levels, represented by asterisks, indicate the varying levels of confidence in the results.

5.2.6. Causality Analysis

The Granger causality Wald tests, inspired by the work of economist Sir Clive Granger, function as a method to see if one time series can predict another. In this research, these tests aim to discover if historical risk governance data can forecast future bank risk indicators. If risk governance factors "Granger cause" the bank risk variables, it indicates that these

[3] Note: In the sensitivity analysis (Table 6), the variable "SIZE", originally in billions of euros, has been adjusted by dividing it by millions. This conversion is implemented to enhance the interpretability of the coefficient, making it more comprehensible in the context of the model. It's important to note that this rescaling of "SIZE" for readability does not impact the actual results or their significance; it simply modifies the unit of measurement for clearer understanding. This practice is a standard approach in econometric analysis when dealing with large numerical values.

The SIZE variable's coefficient, though close to zero, in unreported results, is reflective of the large units (in 1000 euros) being used, which is typical for datasets dealing with significant financial amounts. Its statistical significance confirms that even subtle variations in SIZE can influence a bank's risk-to-profit dynamics.

governance elements carry significant predictive information about future bank risks beyond what is provided by the bank risk's own history. While the term "causality" is utilized, it doesn't denote a direct cause-and-effect relationship in the conventional sense. Rather, it signifies a predictive association, meaning fluctuations in risk governance might foreshadow changes in bank risk. In summary, the Granger causality Wald tests are applied to determine if there's a directional link between risk governance practices and subsequent bank risk, and whether risk governance can act as a precursor to bank risk.

Table 7 presents the results of the Granger causality Wald tests. In the first equation, the test was conducted to determine if the RGI Granger causes TIER1. The test yielded a chi-square statistic of 0.02332 with 1 degree of freedom, resulting in a p-value of 0.879. The high p-value suggests that there is no evidence of Granger causality from RGI to TIER1 (Ellul & Yerramilli, 2013). Similarly, when all control variables were included in the equation, the test yielded the same results, indicating no significant causal relationship between risk governance and TIER1.

In the second equation, the causality was reversed to test if TIER1 Granger causes the RGI. The chi-square statistic for this test was 3.1646 with 1 degree of freedom, resulting in a p-value of 0.075. Although the p-value is below the conventional significance level of 0.05, it does not provide strong evidence of Granger causality from TIER1 to RGI (Pathan, 2009).

The causality analysis results suggest that there is no strong evidence of a causal relationship between risk governance, as measured by the RGI, and TIER1 in either direction. These findings indicate that the relationship between risk governance and Tier 1 capital may be driven by other factors or may be influenced by bidirectional causality, rather than a clear causal link.

It is important to underscore that while the Granger causality tests indicate temporal precedence and correlation between variables, they do not conclusively determine causal relationships. The results should be interpreted with caution, as other unobserved factors or omitted variables might influence the observed relationships. Although the current study provides valuable insights, it acknowledges that comprehensive exploration of the underlying mechanisms and potential causal pathways requires further in-depth research.

The results of the causality analysis contribute to the understanding of the relationship between risk governance and bank risk-taking. While risk governance and TIER1 are correlated, the causality analysis suggests that the relationship is not driven by a unidirectional causal effect. This implies that risk governance practices and TIER1 may mutually influence each other or may be influenced by common factors.

These findings highlight the complexity of the relationship between risk governance and bank risk and underscore the need for comprehensive risk management frameworks that integrate risk governance practices with other risk management mechanisms.

Table 7 - Causality

Granger causality Wald tests

Equation	Excluded	chi2	df	Prob > chi2
TIER1	RGI	0.02332	1	0.879
TIER1	ALL	0.02332	1	0.879
RGI	TIER1	3.1646	1	0.075
RGI	ALL	3.1646	1	0.075

Note: Table 7 presents the results of Granger causality Wald tests conducted for the specified equations. The "Equation" column indicates the equation under consideration. The "Excluded" column shows the variable excluded from the equation. The "chi2" column displays the chi-square test statistic value. The "df" column represents the degrees of freedom associated with the test. The "Prob > chi2" column indicates the p-value associated with the chi-square test, which assesses the statistical significance of the causality relationship.

5.2.7. Discussion

The discussion of findings and implications delves deep into the insights derived from the empirical analysis, emphasizing their relevance for regulators, policymakers, and practitioners within the banking sector. This research area of the dissertation investigated the link between risk governance and bank risk by analyzing a set of specific risk governance indicators, control variables, and distinct measures of bank risk, using data from banks situated in OECD countries during a defined timeframe.

The findings offer insights into the relationship between risk governance and bank risk. The main findings can be summarized as follows:

There was a positive and significant association between risk governance, as measured by the RGI, and TIER1. This suggests that banks with stronger risk governance practices tend to maintain higher levels of capital, acting as a buffer against potential losses (Minton et al., 2014). Contrarily, for the AVARPTP, a negative coefficient was observed, indicating that better risk governance practices might be associated with lower risk levels. However, it's important to note that while this relationship is statistically significant, it may not be as strong as the relationship with TIER1.

Among the individual risk governance variables examined, the presence of a Chief Risk Officer (CRO) was explored to discern its influence on TIER1 capital ratios. While the regression analysis indicates a positive association, suggesting that having a CRO might be an asset in managing risk effectively, it is crucial to note that this relationship was not found to be statistically significant. This is further corroborated by the correlation matrix presented in Table 3, where the correlation between TIER1 and the presence of a CRO is a modest 0.04, emphasizing a very weak linear relationship. Consequently, despite the suggestive positive association in the regression analysis, the presence of a CRO, while potentially beneficial, does not conclusively imply a strong enhancement of the TIER1 capital ratio based on the dataset and analyses employed in this study. (Ellul & Yerramilli, 2013).

SIZE was negatively related to TIER1, suggesting that larger banks tend to maintain relatively lower capital levels (Laeven & Levine, 2009). However, SIZE have a significant and positive impact on the AVARPTP ratio suggesting that larger banks maintain higher AVARPTP. The results from the analysis highlight differing implications of the BS on bank risk metrics. Specifically, in Table 5, BS does not demonstrate a statistically significant relationship with the TIER1 capital ratio. However, as evidenced in Table 6, there is a notable negative association between BS and the Average Value at Risk to Pre-Tax Profit ratio (AVARPTP). This suggests that banks with larger boards tend to exhibit a reduced Value at Risk in relation to their Pre-Tax Profits. This might imply that institutions with large boards could potentially be benefiting from enhanced risk management practices, resulting in minimized potential losses as a percentage of their profits.

These findings have several implications for regulators, policymakers, and practitioners in the banking industry. The positive association between risk governance and TIER1 emphasizes the importance of robust risk governance practices in maintaining adequate capital levels. Regulators and policymakers should encourage banks to adopt effective risk governance frameworks that encompass clear risk management policies, strong oversight mechanisms, and appropriate board composition.

In the correlation matrix presented in Table 3, it can be observed that the correlation between TIER1 and CRO is 0.04, which is quite close to zero and indicates a very weak linear relationship between the two variables. This correlation is not statistically significant at conventional levels (as it lacks asterisks), suggesting that the linear association between TIER1 and CRO might not be substantial in the context of this study. This observation should be taken into consideration when interpreting results related to these variables.

The conclusions about the board of directors' composition stem from the methodological approach using the 'risk governance index' constructed through PCA. This index captures the collective risk governance attributes of directors, emphasizing the board's unified decisions and strategies over individual director profiles. Insights from Table 3's correlation matrix also support this, indicating weak correlations between individual director attributes and risk-related variables. While the terms 'expertise', 'experience', and 'diverse' were not directly tested, it is widely acknowledged in risk governance literature that a board comprising members with relevant expertise is beneficial. The study thus suggests that banks prioritize a holistic approach to risk governance by focusing on the collective efforts of the board rather than specific director characteristics.

Regulators and policymakers should carefully monitor the capital adequacy of larger banks to ensure they have sufficient buffers to absorb potential losses.

The Granger causality tests suggest that the relationship between risk governance and TIER1 may be influenced by bidirectional causality or other factors, rather than a clear causal link (Pathan, 2009).

These findings highlight the complexity of the relationship between risk governance and bank risk-taking and underscore the need for comprehensive risk management frameworks that integrate risk governance practices with other risk management mechanisms (Adams & Mehran, 2012).

The findings from this research shed light on specific aspects of risk governance that can enhance current frameworks. Specifically, the positive correlation between risk governance and TIER1 highlights the significance of capital buffers, aligning with Basel III's emphasis on increased capital prerequisites (BCBS, 2011). The limited correlation between TIER1 and the presence of a Chief Risk Officer indicates that risk management processes' functionality might be more impactful than individual presence, reflecting insights from Adams and Mehran (2012). Moreover, while insights on bank size can be informative, it's crucial to note that size does not necessarily correlate with the intricacy of bank operations. Any recommendations for tailored governance guidelines should consider this distinction and be approached with caution. These nuanced findings can steer policymakers and regulators in refining governance frameworks to better fit the practicalities of bank risk management.

5.2.8. Limitations

This research area of the dissertation offers significant insights into the interplay between risk governance and bank risk, notably highlighting the pronounced positive correlation between the Risk Governance Index (RGI) and Tier 1 capital. Additionally, the study illuminates the nuanced dynamics encapsulated by the marked negative relationship between risk governance and the Average Value at Risk to Pre-Tax Profit ratio (AVARPTP). The potential for bidirectional causality further enriches the complexity of these results. These findings are instrumental for both scholarly discussions and have profound implications for regulators and banking institutions. Yet, it remains essential to recognize the study's limitations, emphasizing the need for discerning interpretation of the results. First, the study focused on a OECD countries and a particular time period, which may limit the generalizability of the findings to other contexts. The banking industry is influenced by various factors, including legal and regulatory frameworks, cultural norms, and macroeconomic conditions, which can differ across countries and time periods. Therefore, caution should be exercised when applying the findings of this study to different jurisdictions or time periods.

Second, the analysis relied on publicly available data from BankFocus and BoardEx. While these databases provide comprehensive information on banks and their governance practices, there may be limitations or inaccuracies in the data. The use of alternative data sources or access to proprietary data could provide more detailed and accurate insights into risk governance practices and their impact on bank risk-taking.

Third, the study focused on specific risk governance indicators, such as the presence of risk committees, the presence of a CRO, and board composition. While these indicators capture important aspects of risk governance, they may not fully capture the complexity and nuances of risk governance frameworks in banks. Future research could explore additional dimensions of risk governance, such as the effectiveness of risk management processes, the quality of risk reporting, and the alignment of risk culture within banks.

Fourth, the study's panel design limits the ability to establish causal relationships between risk governance and bank risk-taking. The observed associations may be influenced by endogeneity issues, where unobserved factors or reverse causality could affect the results. To address this limitation, future research could employ longitudinal or experimental designs that allow for a more robust causal analysis.

Fifth, while the study included various control variables such as bank size, there may be other factors that influence bank risk which were not considered in the analysis. Future

research could explore additional variables that may affect bank risk-taking, such as market conditions, regulatory environment, or specific characteristics of the banking sector.

Lastly, the study focused on quantitative analysis and did not capture the qualitative aspects of risk governance, such as the organizational culture, decision-making processes, or the quality of risk communication within banks. Incorporating qualitative methods, such as interviews or case studies, could provide deeper insights into the mechanisms through which risk governance practices influence bank risk.

Despite these limitations, the study contributes to the existing literature by examining the relationship between risk governance and bank risk-taking. The findings provide valuable insights for regulators, policymakers, and practitioners in enhancing risk governance and fostering a stable and resilient banking sector. Further research addressing these limitations can advance the understanding of risk governance and its implications for bank performance and stability.

5.3. Risk Governance and Financial Performance

Risk governance, an essential aspect of the overall governance structure in banks, significantly affects their financial performance. Its key components, such as the RC, CRO, CFO, senior directors, directors with PhD degrees, and independent directors, play vital roles in ensuring effective risk management, which consequently impacts the bank's financial outcomes.

The Risk Committee is responsible for overseeing the bank's risk management framework, thus significantly influencing the bank's financial performance. By monitoring and evaluating risk exposures, the Committee ensures that these are within the bank's risk appetite. A study by Minton et al. (2014) found that Risk Committees reduce financial distress and improve bank stability, highlighting their importance in enhancing bank financial performance.

The CRO's role involves identifying, measuring, and managing risks that the bank faces, including credit, operational, and market risks. Studies have shown that the presence of a CRO improves the bank's risk management quality, leading to better financial performance. Pathan (2009) found that a bank's total risk is lower when a CRO is part of the executive management team. This finding suggests that having a CRO can indeed help banks achieve better financial outcomes.

The CFO's role is also crucial in risk governance. The CFO oversees the bank's financial planning, record-keeping, and financial reporting, hence influencing the bank's financial performance. It is in the CFO's interest to ensure that the bank's risk profile aligns with its strategic goals. This can result in improved financial performance, as suggested by Bushman and Smith (2001), who found that the CFO's role in the risk management process significantly impacts the bank's value.

Senior directors bring their experience and knowledge to the risk governance process. They provide a broad view of the risks, their interconnections, and their potential impacts, thereby contributing to the bank's financial stability. Research has shown that experienced directors are more likely to have a deep understanding of the business and can provide better oversight (Fahlenbrach et al., 2012).

Directors with PhD degrees may contribute to improved risk governance due to their higher analytical and research skills. These directors can utilize their research skills to scrutinize the bank's risk management policies, contributing to more effective decision-making processes. However, there's little empirical evidence directly linking directors with PhD degrees to better bank financial performance. Hence, more research is needed to substantiate this claim.

Independent directors are not part of the bank's management and, as such, can provide a balanced perspective on risk governance. They can challenge management's decisions and push for better risk management practices. Adams and Mehran (2012) found that banks with a higher proportion of independent directors perform better financially.

In conclusion, elements of risk governance play a significant role in determining bank financial performance. While some roles are more directly linked to financial outcomes, each plays an essential part in maintaining the bank's overall financial health and stability.

Building on the understanding of how risk governance influences financial performance in banks, the subsequent sections delve deeper into this relationship through various analytical approaches. Section 5.3.1 presents a descriptive analysis, offering an initial overview of the data. This is followed by a correlation analysis in Section 5.3.2, shedding light on the relationships between risk governance elements and financial performance. Section 5.3.3 utilizes Principal Component Analysis to discern underlying patterns within the data, while Section 5.3.4 conducts a regression analysis to test the strength and direction of these relationships. The analysis is further refined in Section 5.3.5 through sensitivity tests, ensuring the robustness of the findings. Causality analysis in Section 5.3.6 explores the directional influences among variables, and Section 5.3.7 discusses these results in a broader context. Finally, Section 5.3.8 acknowledges the limitations of the study, providing a complete and comprehensive examination of risk governance's impact on financial performance in banks.

5.3.1. Descriptive Analysis

This section provides a comprehensive overview of the variables employed in this research area of the dissertation through descriptive statistics. Table 8 showcases the descriptive statistics, including the mean, standard deviation, minimum, and maximum values for each variable, offering a snapshot of the data's distribution and characteristics.

For instance, the variable LNNI has a mean value of 13.4055 and a standard deviation of 2.5546, indicating the central tendency and dispersion of net income values across the dataset. Similarly, 'LNILGL' (natural logarithm of impaired loans to gross loans) has a mean of 0.4454, suggesting that impaired loans, on average, constitute a small fraction of gross loans.

The governance attributes, measured on a bank-director year basis, provide insights into the board composition and governance practices over time. For example, the RC attribute has a mean of 0.1987, indicating that in approximately 20% of the bank-director years, a RC was present. Similarly, attributes such as 'CFO', 'TITLE', and 'SENIOR' reflect the characteristics

of directors during their tenure. Around 2.8% of the bank-director years had a CFO, 13.8% had TITLE, and approximately 30% featured SENIOR.

The "SIZE" variable, representing total assets, has a vast range, indicating the inclusion of both small and large banks in the dataset. This diversity ensures a comprehensive understanding of the relationship between risk governance and financial performance across various bank sizes within the OECD countries.

Table 8 - Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
LNNI	13,296	13.4055	2.5546	-1.5606	21.7152
LNILGL	13,751	0.4454	1.9563	-7.4186	3.9757
LNLLRGR	13,800	0.1755	1.7944	-6.5293	3.2722
LNNCOAGL	5,793	-1.7138	1.9336	-9.2103	1.8197
RC	14,410	0.1987	0.3990	0	1
CRO	14,410	0.0056	0.0748	0	1
CFO	14,410	0.0280	0.1651	0	1
TITLE	14,410	0.1376	0.3445	0	1
SENIOR	14,410	0.2982	0.4575	0	1
BI	14,410	0.5079	0.5000	0	1
CEOAD	14,410	0.0806	0.2722	0	1
BS	14,409	14.7276	5.1033	5	32
SIZE	14,369	6760000000	69200000000	8	1680000000000

Note: Table 8 presents the descriptive statistics for the variables used in the study. The table provides key statistical measures, including the number of observations (Obs), mean, standard deviation (Std. Dev.), and the minimum (Min) and maximum (Max) values, for each variable, offering insights into the data distribution. The variables include both financial ratios (in natural logarithm form) and governance attributes, sourced respectively from BankFocus and BoardEx. Variables LNNI, LNILGL, LNLLRGR, and LNNCOAGL are continuous, whereas variables RC, CRO, CFO, TITLE, SENIOR, BI, CEOAD, and BS are discrete, with values ranging between 0 and 1, indicating their binary nature. The SIZE variable, a continuous variable, denotes total assets measured in 1000 EUR. This summary table enables readers to quickly grasp the central tendency and dispersion of the data for each variable, as well as the range of values that each variable can take. It serves as an essential reference for interpreting the empirical analyses in this study.

5.3.2. Correlation Analysis

The correlation analysis presented in Table 9 offers a detailed perspective on the pairwise relationships between the variables. Each cell in the matrix displays the Pearson correlation coefficient, which quantifies the linear relationship between two variables. The values range from -1 (perfect negative correlation) to 1 (perfect positive correlation). A value close to 0 indicates a weak or negligible correlation. For instance, the positive correlation of 0.08 between 'LNNI' and 'RC' suggests that banks with a risk committee tend to have higher net incomes. Conversely, the negative correlation of -0.06 between 'LNNI' and 'LNLLRGR' implies that as loan loss reserves to gross loans increase, net income tends to decrease. It is crucial to note that while correlations offer an understanding of the associations between variables, they do not establish causative relationships. The term 'insights' here refers to the knowledge acquired through the analysis of correlation coefficients, revealing the strength and direction of linear relationships between variable pairs. These insights are valuable for forming hypotheses, guiding subsequent analyses, and interpreting outcomes. Nonetheless, it's imperative to recognize that a correlation, regardless of its magnitude, does not inherently indicate that one variable is the cause of changes in another. Additionally, high correlations between independent variables might hint at multicollinearity, potentially affecting the reliability of regression coefficients in subsequent analyses. This matrix serves as a foundational tool in understanding the interrelationships between variables and guiding further empirical investigations.

Table 9 – Correlation

	LNNI	LNILGL	LNLLRGR	LNNCOAGL	RC	CRO	CFO	TITLE	SENIOR	BI	CEOAD	BS	SIZE
LNNI	1												
LNILGL	0.02	1											
LNLLRGR	-0.06***	0.96***	1										
LNNCOAGL	-0.09***	0.81***	0.85***	1									
RC	0.08***	-0.01	-0.01	0.02	1								
CRO	0.03*	0.05***	0.03*	0.02	-0.04**	1							
CFO	0.02	0.04**	0.03*	0.05***	-0.08***	-0.01	1						
TITLE	0.08***	0.09***	0.07***	0.06***	0.02	-0.03	0.01	1					
SENIOR	0.12***	0.04**	0.01	-0.03*	-0.09***	0.01	0.02	-0.09***	1				
BI	-0.04**	-0.08***	-0.03	0.02	0.21***	-0.08***	0.01	0.07***	-0.08***	1			
CEOAD	-0.01	0.02	0.05**	0.05***	-0.11***	-0.02	-0.05***	0.03*	0.02	-0.15***	1		
BS	0.06***	0.44***	0.40***	0.37***	-0.10***	0.06***	0.06***	0.10***	-0.02	-0.19***	-0.03	1	
SIZE	0.50***	0.02	-0.03*	-0.06***	-0.08***	0.01	-0.02	-0.01	0.14***	-0.05***	0.02	-0.14***	1

"* p<0.05 ** p<0.01 *** p<0.001"

Note: Table 9 showcases the correlation matrix of all the variables used in this study. Each cell in the matrix represents the Pearson correlation coefficient between two variables, indicating the strength and direction of their linear relationship. Correlation values range from -1 to 1, where the magnitude indicates the strength of the correlation, and the sign indicates its direction. A value of 1 signifies a perfect positive correlation, while -1 denotes a perfect negative correlation. A value near 0 suggests a weak or negligible correlation. This correlation matrix is crucial for understanding the pairwise relationships between variables and can highlight potential multicollinearity issues in subsequent analyses.

This correlation table, based on observations that matched as outlined in the data collection and description, presents the relationships between the variable e.g., LNNI and other variables in the study. It's important to note that the correlations are determined from the subset of the dataset where these variables intersect. The observation count for LNNI, as indicated in the descriptive statistics, is distinct from others, reflecting its specific data collection criteria. This context is crucial for interpreting the correlations accurately, as they are based on this particular subset of the comprehensive dataset.

5.3.3. Principal Component Analysis

To capture the underlying dimensions of the governance attributes, Principal Component Analysis (PCA) was conducted on six standardized variables: RC, CRO, CFO, TITLE, SENIOR, and BI (Jolliffe & Cadima, 2016). Standardization ensured equal variance across these variables (Hair et al., 2010). PCA results, presented in Tables 4-a, 4-b, and 4-c, provide a tool for dimensionality reduction and intrinsic insights into relationships among the governance attributes. For instance, the first principal component (COMP1) explains a significant portion of the variance and is used as the Risk Governance Index (RGI) in the regression analysis. Besides its utility for regression, PCA offers a deeper understanding of the data structure, validating the robustness of our variable selection and offering insights into interrelationships among the governance attributes.

The PCA results are presented in Tables 10-a, 10-b, and 10-c. Table 10-a presents the eigenvalues, demonstrating the amount of variance explained by each principal component (Jolliffe & Cadima, 2016). For instance, the first component (COMP1) explains 22.21% of the total variance, while the second component (COMP2) explains 17.24%. As the components increase, the cumulative proportion column illustrates the total variance explained, reaching 100% at the sixth component (COMP6).

Table 10-b displays the principal components (eigenvectors) obtained from the PCA. These components, linear combinations of the original variables, indicate each variable's contributions to each component. For example, the loading of 'RC_STD' on 'COMP1' is 0.5775, suggesting a positive relationship between the risk committee variable and the first principal component. These loadings provide insights into the direction and magnitude of each variable's influence on the principal components (Jolliffe & Cadima, 2016).

Lastly, Table 10-c presents the scoring coefficients (loadings) derived from the PCA. These coefficients represent the correlation between the original variables and the principal components. Higher absolute values of loadings signify a stronger association between the variables and the corresponding components. For example, "RC_STD" has high loadings on COMP1 and COMP6, indicating strong associations with these components. The sum of squares of column-loadings equals 1, confirming that the components fully account for the variance in the data (Jolliffe & Cadima, 2016). The PCA outcomes present comprehensive insights into the major components underlying the variation within the data, contributing

significantly to understanding the relationship among the variables. In regression analysis, COMP1 is considered as the RGI.

Table 10-a PCA Eigenvalues

Component	Eigenvalue	Difference	Proportion	Cumulative
COMP1	1.3323	0.2978	0.2221	0.2221
COMP2	1.0346	0.0302	0.1724	0.3945
COMP3	1.0044	0.0416	0.1674	0.5619
COMP4	0.9627	0.0445	0.1605	0.7223
COMP5	0.9182	0.1704	0.1530	0.8754
COMP6	0.7478	0.0000	0.1246	1.0000

Note: Table 10-a presents the Eigenvalues obtained from the PCA. This table displays six components (COMP1 to COMP6), each with its respective Eigenvalue, and the difference in Eigenvalues between successive components. It also indicates the proportion of total variance explained by each component and the cumulative proportion of explained variance up to each component. This table offers an overview of the contribution of each component to the total variability of the data. The cumulative proportion column provides a quick reference for the total variance accounted for as more components are included. By the end of COMP6, all the variance in the data (100%) has been accounted for. Overall, Table 4-a is crucial for understanding the distribution of variance across the principal components and the overall significance of each component in explaining the data's variance.

Table 10-b Principal components (eigenvectors) from PCA

Variable	COMP1	COMP2	COMP3	COMP4	COMP5	COMP6	Unexplained
RC_STD	0.5775	-0.0299	-0.2251	0.4170	0.1965	0.6343	0
CRO_STD	-0.2248	-0.4543	0.4149	0.7335	-0.1466	-0.1064	0
CFO_STD	-0.0316	0.7390	0.5732	0.1183	-0.2126	0.2552	0
TITLE_STD	0.2593	-0.3151	0.6553	-0.3745	0.5088	0.0703	0
SENIOR_STD	-0.4034	0.3060	-0.1358	0.2869	0.7953	-0.1016	0
BI_STD	0.6205	0.2315	0.0270	0.2266	0.0576	-0.7113	0

Note: Table 10-b displays the Principal Components (PCs) or eigenvectors for each variable obtained from the PCA. It also details any unexplained variance. This table illustrates the direction and magnitude of each variable's contribution to each principal component (COMP1 to COMP6). These components, as linear combinations of the original variables, each represent a specific aspect of the total variance in the original data. The zero unexplained variance for all variables indicates that the PCA model comprehensively captures the variability of all standardized variables. This table is instrumental in identifying which variables most strongly influence each principal component, thereby aiding in interpreting the results of the PCA.

Table 10-c PCA Scores

Variable	COMP1	COMP2	COMP3	COMP4	COMP5	COMP6
RC_STD	0.5775	-0.0299	-0.2251	0.4170	0.1965	0.6343
CRO_STD	-0.2248	-0.4543	0.4149	0.7335	-0.1466	-0.1064
CFO_STD	-0.0316	0.7390	0.5732	0.1183	-0.2126	0.2552
TITLE_STD	0.2593	-0.3151	0.6553	-0.3745	0.5088	0.0703
SENIOR_STD	-0.4034	0.3060	-0.1358	0.2869	0.7953	-0.1016
BI_STD	0.6205	0.2315	0.0270	0.2266	0.0576	-0.7113

Note: *Scoring coefficients — sum of squares (column-loading) = 1.* Table 10-c details the scoring coefficients, or loadings, derived from the PCA. These loadings represent the correlations between the original variables (from RC_STD to BI_STD) and the principal components (COMP1 to COMP6) derived from the PCA. High absolute values of loadings, approaching -1 or 1, suggest a significant contribution of the respective variable to the corresponding component. For example, RC_STD shows a high loading of 0.5775 on COMP1, indicating a significant positive correlation between the two. Negative loadings reflect an inverse relationship between the variables and the components. The sum of the squares of the column-loadings equals 1, demonstrating that the components collectively account for the entire variance in the data. Overall, Table 4-c is critical for understanding how each original variable relates to the principal components, providing valuable insights for the subsequent analyses.

5.3.4. Regression Analysis

To examine the relationship between risk governance and financial performance, specifically in public commercial banks, a regression analysis was conducted (Adams et al., 2010). The standard regression and bootstrapped regression results are presented in Table 11 (Efron & Tibshirani, 1994; Veeramoothoo & Hammoudeh, 2022). The dependent variable in these models is LNNI.

The independent variables include RGI, CEOAD, BS, and SIZE. The coefficients and standard errors of these variables reveal their respective impacts on LNNI, assuming all other factors are held constant (Wooldridge, 2010).

In the regression analysis of Model (3), RGI, CEOAD, and BS exhibit statistically significant positive coefficients with LNNI, suggesting that robust risk governance, additional roles of CEOs, and larger board sizes positively correlate with bank financial performance. The coefficient for the bank size variable, represented by total assets in thousands of euros, is statistically significant but near zero. This phenomenon is attributable to the large scale of the variable; even a small change in a variable measured in such large numbers can result in a negligible coefficient. However, this does not negate the variable's influence on financial

performance. This reflects the proportionality of the effect relative to the scale of the variable being measured. Thus, while the coefficient for bank size is close to zero, its positive and statistically significant nature suggests a modest positive association with financial performance. This aligns with theoretical expectations that larger banks may experience benefits from economies of scale or a more diversified risk profile, which can positively impact financial outcomes, even if the magnitude of this effect is small when viewed through the lens of regression analysis (Adams et al., 2010).

The models account for unobserved country-specific and global trends through Country and Year Fixed Effects (Wooldridge, 2010). Observations are clustered at the bank level to handle potential intra-group correlation (Petersen, 2008). The adjusted R-squared values from Model (3) indicate that approximately 79.21% of the variance in LNNI can be explained by the independent variables in the model (Wooldridge, 2010). A considerable portion of this explanatory power is attributed to the inclusion of RGI, derived from the first principal component (COMP1) of the PCA. As seen in Table 4-a, COMP1 alone accounts for 22.21% of the total variance, emphasizing the importance of the variables it represents in explaining the variance in LNNI.

However, while regression models establish associations between risk governance variables and financial performance, causation is not definitively proven (Wooldridge, 2010). Even with the control variables and fixed effects, other unobservable or external variables might influence the observed relationships (Wooldridge, 2010).

In conclusion, this analysis provides empirical evidence of a positive association between risk governance and financial performance in public commercial banks. These findings underscore the role of risk governance in enhancing financial performance and provide valuable insights for policymakers, regulators, and bank management (Adams et al., 2010).

Table 11 Regression (main results)

VARIABLES	(3) LNNI	(3a) LNNI-Bootstrapped
RGI	0.0778**	0.0778**
	(0.0321)	(0.0329)
CEOAD	0.2043**	0.2043***
	(0.0846)	(0.0788)
BS	0.1468***	0.1468***
	(0.0309)	(0.0383)
SIZE[4]	0.0015***	0.0015
	(0.0002)	(0.0165)
Constant	11.2534***	11.2534***
	(0.4683)	(0.6037)
Observations	13,255	13,255
Adjusted R-squared	0.7921	0.7921
Country FE	YES	YES
Year FE	YES	YES
Clusters	Bank	Bank

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Table 11 displays the main results of the regression analyses conducted in this study. It presents two models: Model (3) showing the results of the standard regression, and Model (3a) indicating the results of the bootstrapped regression. The dependent variable in both models is LNNI. For each model, regression coefficients are reported alongside their corresponding robust standard errors enclosed in parentheses. These coefficients indicate the impact of each independent variable on the dependent variable, with all other variables held constant. The regression models incorporate country and year fixed effects (Country FE and Year FE) to capture unobserved, consistent country-specific characteristics and annual variations. Observations are clustered by bank to address potential intra-group correlation. The table also reports the number of observations and the adjusted R-squared for each model. The adjusted R-squared value signifies the proportion of variance in the dependent variable that is predictable from the independent variables, adjusted for the quantity of predictors in the model.

[4] Note: In the regression analysis (Table 11), the variable "SIZE", originally in 1000 of euros, has been adjusted by dividing it by billions. This conversion is implemented to enhance the interpretability of the coefficient, making it more comprehensible in the context of the model. It's important to note that this rescaling of "SIZE" for readability does not impact the actual results or their significance; it simply modifies the unit of measurement for clearer understanding. This practice is a standard approach in econometric analysis when dealing with large numerical values.

The SIZE variable's coefficient, though close to zero, in unreported results, is reflective of the large units (in 1000 euros) being used, which is typical for datasets dealing with significant financial amounts. Its statistical significance confirms that even subtle variations in SIZE can influence a bank's risk-to-profit dynamics.

5.3.5. Sensitivity Analysis

A sensitivity analysis was conducted to validate the robustness of the findings, and the results are detailed in Table 12. This analysis utilized different dependent variables (LNILGL, LNLLRGR, LNNCOAGL), as previously defined and justified in section 3.2, along with their bootstrapped counterparts in six distinct models (Efron & Tibshirani, 1994). The coefficients and standard errors for each variable are reported.

The sensitivity analysis consistently affirmed a positive and statistically significant relationship between the risk governance index (RGI) and various performance measures across all models (Adams et al., 2010). This suggests that strong risk governance practices correspond to lower levels of impaired loans, higher loan loss reserves, and lower net charge-offs. Even with the application of bootstrapped estimates, the coefficients retained their stability and statistical significance, underscoring the findings' robustness (Efron & Tibshirani, 1994).

The variable CEOAD demonstrated a positive and significant relationship with the different performance measures (Adams et al., 2010). This suggests that CEOs with additional roles might indirectly influence risk governance, which encompasses risk management practices. The variable BS was found to be statistically insignificant across all models presented in Table 6. This suggests that, within the context of this study, the size of the board does not have a statistically significant association with the financial performance measures considered.

Notably, the sensitivity analysis strengthened the robustness of the findings by testing multiple dependent variables and applying bootstrapping techniques (Efron & Tibshirani, 1994). The consistent results across different performance measures validate the relationship between risk governance and bank performance (Adams et al., 2010).

Lastly, it is assumed in the sensitivity analysis that the variables (RGI, CEOAD, BS, SIZE) adequately represent risk governance practices and their effect on performance. However, unobserved factors or alternative risk governance measures could influence the results. Future research might further validate these findings by incorporating additional dimensions of risk governance and employing alternative measurement methodologies (Adams et al., 2010). Despite these limitations, the sensitivity analysis enhances the findings' robustness and reliability, confirming a consistent relationship between risk governance and bank performance across different measures. This understanding underscores the significance of

effective risk governance in enhancing sound risk management practices and overall financial performance in public commercial banks (Adams et al., 2010).

Table 12 Sensitivity Analysis

VARIABLES	(4) LNILGL	(4a) LNILGL-Bootstrapped	(5) LNLLRGR	(5a) LNLLRGR-Bootstrapped	(6) LNNCOAGL	(6a) LNNCOAGL-Bootstrapped
RGI	0.0366**	0.0366**	0.0320**	0.0320**	0.0610***	0.0610***
	(0.0153)	(0.0160)	(0.0132)	(0.0142)	(0.0213)	(0.0205)
CEOAD	0.1086***	0.1086**	0.0879***	0.0879***	0.1208**	0.1208**
	(0.0391)	(0.0422)	(0.0316)	(0.0313)	(0.0461)	(0.0471)
BS	-0.0004	-0.0004	0.0137	0.0137	-0.0189	-0.0189
	(0.0177)	(0.0224)	(0.0151)	(0.0161)	(0.0362)	(0.0430)
SIZE[5]	0.0178*	0.0178	-0.0022***	-0.0022	-0.0056	-0.0056
	(0.0105)	(0.0139)	(0.0001)	(0.0050)	(0.0134)	(0.0256)
Constant	0.3680	0.3680	-0.0182	-0.0182	-1.4348***	-1.4348**
	(0.2655)	(0.3752)	(0.2333)	(0.2899)	(0.5120)	(0.7049)
Observations	13,750	13,750	13,799	13,799	5,793	5,793
Adjusted R-squared	0.8818	0.8818	0.9172	0.9172	0.7956	0.7956
Country FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Clusters	Bank	Bank	Bank	Bank	Bank	Bank

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Table 12 showcases the outcomes of the sensitivity analyses conducted in this study. This table includes six distinct models, each utilizing a different dependent variable: LNILGL, LNILGL-Bootstrapped, LNLLRGR, LNLLRGR-Bootstrapped, LNNCOAGL, and LNNCOAGL-Bootstrapped. The table details the coefficients for each variable, along with their robust standard errors enclosed in parentheses. These models are instrumental in verifying the robustness of the results, employing different outcome measures and a bootstrapping method for more accurate inference, particularly when the estimator distributions are unknown or complex. Additionally, the table includes the number of observations and the adjusted R-squared values for each model. Consistent with the main regression results, these models control for country and year fixed effects (Country FE and Year FE), thus accounting for unobserved country-specific factors and temporal trends. Observations are clustered at the bank level to address potential correlations within banks. This table is critical for confirming the reliability and robustness of the study's main findings.

[5] Note: In the sensitivity analysis (Table 12), the variable "SIZE", originally in 1000 of euros, has been adjusted by dividing it by billions. This conversion is implemented to enhance the interpretability of the coefficient, making it more comprehensible in the context of the model. It's important to note that this rescaling of "SIZE" for readability does not impact the actual results or their significance; it simply modifies the unit of measurement for clearer understanding. This practice is a standard approach in econometric analysis when dealing with large numerical values.

The SIZE variable's coefficient, though close to zero, in unreported results, is reflective of the large units (in 1000 euros) being used, which is typical for datasets dealing with significant financial amounts. Its statistical significance confirms that even subtle variations in SIZE can influence a bank's risk-to-profit dynamics.

5.3.6. Causality Analysis

This research incorporates both Granger causality and Vector Autoregression (VAR) model analyses. The VAR model, a multivariate time series framework, captures linear relationships between past and present values of multiple variables. This model facilitates the examination of how variations in one variable may influence changes in another over time. Specifically, the VAR model in this study explores the dynamic interactions between risk governance (RGI) and financial performance (LNNI) over the examined period (Granger, 1969; Greene, 2003). This approach aligns with the methodology used by Gontarek and Belghitar (2018) in their examination of risk governance's impact on bank performance and risk-taking.

Two sets of Granger causality tests were executed. Table 13 presents results suggesting a dynamic relationship between RGI and LNNI. Specifically, the findings indicate that risk governance practices (RGI) can precede and potentially influence changes in financial performance (LNNI). Additionally, fluctuations in a bank's net income (LNNI) might serve as indicators of potential future adjustments in the bank's risk governance strategies (RGI). However, it's pivotal to note that Granger causality doesn't confirm causation in a strict sense; other unobserved factors may still influence this observed relationship (Greene, 2003).

For the causality analysis, both Granger causality and Vector Autoregression (VAR) methods were utilized. However, only the Granger causality results are tabulated and included in the paper. The LNNI, representing the natural logarithm of Net Income, is standardized across all countries under international reporting standards, ensuring that differences in taxation across countries are accounted for. The results indicated that LNNI from four years prior (Greene, 2003) significantly predicts its current value ($p<0.001$), emphasizing the predictive power of past financial performance on present risk governance practices. Conversely, past RGI values did not significantly forecast present LNNI ($chi2=0.01924$, $p<0.890$). This unidirectional relationship suggests that while historical financial performance can influence current risk governance decisions, past risk governance practices do not necessarily predict current financial outcomes. This distinction underscores the stable nature of financial performance over time, compared to the more dynamic nature of risk governance practices. These findings are consistent with the broader literature, emphasizing the importance of past data in forecasting future financial outcomes and the dynamic nature of risk governance practices.

These results provide a deeper understanding of the complex relationships between LNNI and RGI. Consistent with the findings of Gontarek and Belghitar (2018), a significant relationship between risk governance and bank performance is evident. More specifically, the study sheds light on how RGI and financial performance (LNNI) evolve and potentially influence each other over time, highlighting their temporal dynamics. Furthermore, the observed ability of past values of one variable to predict current values of the other underscores the predictive nature of these variables. This suggests that understanding past trends in risk governance and financial performance can provide valuable insights into future outcomes, hinting at potential causal links between the two (Granger, 1969). These insights shed light on the variables' temporal dynamics and predictive nature, suggesting a potential causal link where past financial performance (LNNI) influences current risk governance practices (RGI). This direction of causality is supported by the Granger causality tests (Granger, 1969). Future studies could benefit from further investigation of these relationships, potentially incorporating additional control variables or exploring different time lags (Greene, 2003). This is in line with the recommendations of Gontarek and Belghitar (2018), who also emphasized the need for further research in this field of risk governance and its impact on financial performance.

Table 13 Causality

Granger causality Wald tests

Equation	Excluded	chi2	df	Prob > chi2
LNNI	RGI	0.01924	1	0.890
LNNI	ALL	0.01924	1	0.890
RGI	LNNI	13.526	1	0.000
RGI	ALL	13.526	1	0.000

Table 13 showcases the results from the Granger causality Wald tests conducted in this study. This test aims to establish if one time series is useful in forecasting another. Specifically, these tests determine if the coefficients on the lagged (4 years) values of the proposed causal variable significantly differ from zero. In this table, two sets of tests are reported. Initially, the tests ascertain if 'RGI' Granger-causes 'LNNI', followed by tests assessing if 'LNNI' Granger-causes 'RGI'. For each test, the null hypothesis asserts that the excluded variable does not Granger-cause the variable mentioned in the 'Equation' column. The table displays the chi-squared statistic, degrees of freedom (df), and the probability (Prob > chi2) of obtaining the observed statistic or a more extreme value under the null hypothesis. A low p-value (Prob > chi2) indicates that the null hypothesis of no Granger-causality may be rejected. These tests yield insights into potential causal relationships between variables, thus deepening the understanding of correlations identified in the regression analyses.

5.3.7. Discussion

This research area of the dissertation provides a deeper understanding of the relationship between risk governance and financial performance in OECD public commercial banks. Specifically, the findings shed light on how risk governance practices influence bank performance metrics, the temporal dynamics of these relationships, and the potential causal links between governance measures and financial outcomes (Adams et al., 2010). Through comprehensive analyses, such as PCA, regression, sensitivity, and causality, the study elucidates how risk governance practices influence financial outcomes (Elkington, 2006). This is in line with the findings of Gontarek and Belghitar (2018), who also examined the impact of risk governance on bank performance and risk-taking. These findings align with Almashhadani and Almashhadani (2022), who also explored the broader implications of corporate governance as an internal control mechanism on performance, reaffirming the significance of governance structures.

The descriptive analysis set the foundation for the investigation by providing an overview of the distribution and characteristics of the variables (Hair et al., 2010). Meanwhile, the correlation analysis highlighted potential associations among variables, emphasizing the significance of risk governance in shaping financial performance.

The PCA analysis identified key components that explain the variance in the data, providing a deeper understanding of the relationships between risk governance and financial performance (Jolliffe & Cadima, 2016). The regression analysis further solidified these relationships, showing a significant impact of risk governance on net income (Draper & Smith, 1998). This significant relationship is in line with findings from Almashhadani and Almashhadani (2022), who also highlight the impact of corporate governance, viewed as an internal control mechanism, on corporate performance. Effective risk governance practices, as indicated by a favorable Risk Governance Index (RGI) score, were associated with better financial performance (Eisenhardt, 1989). However, the direction of this association, whether RGI influences financial performance or vice versa, requires further investigation (Eisenhardt, 1989). The variables RGI, CEOAD, and BS were found to have statistically significant associations with net income. Specifically, RGI and CEOAD were significant at the 0.05 level, while BS was significant at the 0.01 level. The variable SIZE showed a significant association with net income at the 0.01 level in the standard regression but was not significant in the bootstrapped regression (Adams et al., 2010). These findings are consistent with Gontarek & Belghitar (2018), who also found that risk governance significantly impacts bank performance.

The robustness of the findings was confirmed by the sensitivity analysis, which showed consistent results across different outcome measures and bootstrapping techniques (Efron & Tibshirani, 1994). This not only strengthens the validity of the observed relationships but also enhances confidence in the study's conclusions (Sijtsma, 2009).

The Granger causality tests indicated a causal relationship where LNNI Granger-causes changes in RGI (Granger, 1969). However, the reverse relationship, in which risk governance influences net income, did not exhibit statistical significance. The Granger causality tests underlined the importance of directional influence in the relationship between risk governance and financial performance. Specifically, LNNI was found to Granger-cause changes in RGI (Granger, 1969). In contrast, the influence of risk governance on net income was not statistically supported (Engle & Granger, 1987).

These findings collectively suggest that effective risk governance practices, characterized by a high-risk governance index and CEO additional positions, contribute to better financial performance (Eisenhardt, 1989). While the number of directors is deemed most suitable, the bank size, as measured by total assets, showed a statistically significant influence on financial performance in the regression analysis. However, due to the large scale of the bank size variable, its coefficient appears near zero, reflecting the scale rather than diminishing its importance. This has important implications for policymakers, regulators, and bank management, who can leverage these insights to enhance risk governance frameworks and promote financial stability in the banking sector (BCBS, 2015). The insights provided by Almashhadani and Almashhadani (2022) on corporate governance as an internal control mechanism further substantiate the importance of these governance frameworks in impacting corporate performance. This aligns with the conclusions of Gontarek and Belghitar (2018), who also emphasized the importance of effective risk governance in enhancing bank performance.

This study contributes to the existing literature by providing empirical evidence of the positive relationship between risk governance and financial performance in public commercial banks. The study's results emphasize the significance of comprehensive risk governance measures in bolstering financial performance and profitability. These measures encompass activities such as identifying potential risks, assessing their impact, implementing mitigation strategies, and fostering a culture of risk awareness. By adopting such thorough approaches, banks can better navigate uncertainties and challenges, ensuring sustained financial health.

In conclusion, this study underscores the significant influence of effective risk governance on the financial performance of public commercial banks in OECD countries

(Adams et al., 2010). This is consistent with the findings of Gontarek and Belghitar (2018), further emphasizing the importance of risk governance in the banking sector.

5.3.8. Limitations

While the regression analysis and Granger causality tests provide valuable insights into the relationship between risk governance and financial performance in public commercial banks, it is essential to acknowledge the limitations of this study. These limitations highlight areas for future research and caution against drawing definitive conclusions.

First, although the study incorporates panel data with Year Fixed Effects to control for time-specific variations, it is important to note that this approach does not definitively establish causal relationships. Longitudinal data with panel regression techniques could provide stronger evidence of causality by capturing changes in risk governance and financial performance over time.

Second, the study's focus on public commercial banks within specific countries or regions may limit the generalizability of the findings to other contexts or types of financial institutions. Replicating the study with data from countries outside the current sample, and including various types of banks, would further enhance the external validity of the findings.

Third, the reliance on standardized variables and composite indices in the study might introduce measurement errors and potential biases. Exploring individual risk governance metrics or incorporating insights from interviews, focus groups, or content analysis could offer a deeper perspective on the relationship between specific risk governance practices and financial performance.

Fourth, although the study accounts for a range of observable variables, other unobserved factors could still influence the relationship between risk governance and financial performance. This represents a potential omitted variable concern, often referred to as the "omitted variables problem." However, the analysis was conducted using the best available data and methodologies, striving for a comprehensive understanding within the scope and constraints of the study. Future research could explore additional control variables or employ advanced econometric techniques to further address these concerns.

Fifth, the study focuses on a specific set of risk governance variables and financial performance indicators. Including a broader range of risk governance dimensions and financial measures, such as risk-adjusted profitability ratios or capital adequacy ratios, would provide a more comprehensive assessment of the relationship.

Finally, although the study controls for bank size through the 'SIZE' variable, it operates under the assumption that the impact of risk governance practices on financial performance is consistent across all banks. It's worth noting that the intricacies of how risk governance practices are implemented and their effectiveness might still vary based on other factors such as a bank's specific business model. Additionally, while the study controls for country-level differences, there might be variations within countries due to specific regulatory frameworks, changes in regulations over time, or local and regional regulatory policies. Further research could investigate the moderating effects of these contextual factors on the risk governance-performance relationship.

5.4. Risk Governance and Regulatory Adjustments

The multi-faceted nature of risk governance necessitates a complex network of personnel to manage, analyze, and respond to the variety of risks that an organization, like a bank, can face. Risk governance includes structures, individuals, and mechanisms, such as the risk committee, the CRO, the CFO, SENIOR, TITLE, and BI.

The risk committee, comprising of directors and executives, often sets the overall risk appetite for the bank. This committee guides strategic decision-making and facilitates adjustments to regulatory requirements. It is central in translating regulatory changes into operational strategies and defining the risk culture. For instance, in response to the Basel III regulatory adjustments, the risk committee determines the capital and liquidity buffers maintained above the mandated minimum (BIS, 2011).

The role of the CRO in managing regulatory adjustments is pivotal. As the executive responsible for identifying, assessing, and mitigating risks, the CRO ensures that the bank complies with evolving regulatory norms (Fraser et al., 2021). A proactive CRO can anticipate changes in regulations and guide the bank in meeting these requirements without disrupting operations or sacrificing strategic objectives. For example, the CRO played a crucial role in the implementation of stress testing requirements as outlined in the Dodd-Frank Act (U.S. GAO, 2013).

The CFO, responsible for the financial health and stability of a bank, has a significant role in implementing regulatory adjustments, particularly in areas relating to capital adequacy and financial reporting (André et al., 2014). A CFO often works closely with the CRO and the risk committee to ensure regulatory compliance while maintaining the financial sustainability of the bank.

Senior directors' experience and knowledge are indispensable in the face of regulatory adjustments. Their wisdom is essential in identifying opportunities amidst regulatory changes and navigating the organization through potential pitfalls (Hermalin & Weisbach, 2012). This was particularly evident during the transition to IFRS 9, where senior directors' involvement was crucial in mitigating the potential impacts of the new expected credit loss model on banks' financial statements (Casta et al., 2019).

Directors with PhD degrees bring unique expertise to the boardroom, especially when interpreting and implementing complex regulatory adjustments. Their in-depth knowledge aids in understanding the implications of regulatory changes and can lead to more robust compliance mechanisms (Nguyen & Nielsen, 2010). Furthermore, directors with PhDs in fields like finance, economics, or law often provide innovative approaches to maintaining compliance, as witnessed during the implementation of the Volcker Rule (Kress, 2018).

Finally, the independent directors bring an external perspective to the bank's risk governance. They can offer unbiased judgments on the bank's regulatory adjustments and protect the interests of all stakeholders, including minority shareholders (Fama and Jensen, 1983). In the context of bank regulation, their role is crucial to ensure compliance and maintain the trust of regulators and the public. For instance, their neutrality was instrumental in restoring public confidence during the 2008 financial crisis when public trust in banks was significantly damaged (Erkens et al., 2012).

In summary, each element of risk governance plays a unique role in implementing bank regulatory adjustments. Their collective expertise and oversight capabilities ensure that the bank navigates regulatory landscapes effectively, mitigates potential risks, and continues to serve its stakeholders diligently.

The exploration of risk governance in the context of regulatory adjustments in banks continues in the subsequent sections, each delving into specific aspects of this intricate relationship. Section 5.4.1 provides descriptive statistics, offering an initial quantitative perspective. Following this, Section 5.4.2 presents a correlation analysis, examining the interrelationships between risk governance components and regulatory adjustments. Section 5.4.3 utilizes Principal Component Analysis to discern underlying patterns, while Section 5.4.4 conducts a regression analysis to probe the nature of these relationships further. Sensitivity analysis in Section 5.4.5 tests the findings' stability, and Section 5.4.6 discusses the broader implications. Each section contributes to a holistic understanding of how risk governance shapes regulatory adjustments in banks.

5.4.1. Descriptive Analysis

This section presents a detailed overview of the descriptive statistics for key variables in the dataset. The dataset encompasses 14,596 bank-director years from 2001 to 2020, providing a comprehensive view of the banking landscape within this period.

Each variable is selected for its relevance to the study's focus on regulatory compliance and risk governance. The RA variable, with a mean value of 548,608 € and a standard deviation of 4,100,070 €, is central to understanding the scope and frequency of adjustments made by banks in response to regulatory changes. TIER1 and TCR offer insights into banks' capital adequacy, while variables like RC, CRO, CFO, TITLE, SENIOR, and BI provide a nuanced view of the composition and characteristics of bank boards. This section not only presents these statistics but also contextualizes them within the broader framework of regulatory compliance and risk governance, crucial for accurately interpreting the data and understanding its larger research implications.

Table 14 presents the descriptive statistics for the variables in the dataset. The variable RA, with a mean value of 548,607.9 and a standard deviation of 4,100,070. The variable TIER1, with a mean value of 13.24027 and a standard deviation of 3.202067. The variable TCR, with a mean value of 15.23164 and a standard deviation of 3.44537. Other variables such as RC, CRO, CFO, SENIOR, and BI are also included in the table. These descriptive statistics provide an overview of the distribution and variation of the variables in the dataset. The descriptive statistics in this study, particularly in relation to RA, TIER1, and TCR, resonate with trends observed in the seminal work of Francis and Osborne (2012). Their investigation into the impact of capital requirements on bank behavior provides essential context for understanding how regulatory frameworks influence banking operations. The variable RA, characterized by a significant mean and standard deviation, indicates substantial variability in banks' responses to regulatory changes. This aspect of the findings can be contrasted with the research by Francis and Osborne (2012), who explored the impact of capital requirements on bank behavior. While their study provides a broad overview of the regulatory impacts, the current analysis extends these insights by highlighting specific variances in key variables, thereby contributing to a more nuanced understanding of banks' behaviors under different regulatory environments. This study extends these insights by showcasing the specific variances in key variables within the dataset, thereby contributing to a more nuanced understanding of bank behaviors under different regulatory environments.

Table 14 Descriptive Statistics

VARIABLE	OBS	MEAN	STD. DEV.	MIN	MAX
RA	2,740	548,608 €	4,100,070 €	-6,601,000 €	27,400,000 €
TIER1	1,872	13.24027	3.202067	8.8	32.6
TCR	14,596	15.23164	3.44537	9.89	20.9
RC	14,596	0.1961496	0.3970967	0	1
CRO	14,596	0.0055495	0.0742903	0	1
CFO	14,596	0.0277473	0.1642537	0	1
TITLE	14,596	0.1361332	0.3429417	0	1
SENIOR	14,596	0.3013154	0.4588451	0	1
BI	14,596	0.5059605	0.4999816	0	1
CEOAD	14,596	0.0799534	0.2712304	0	1
BS	14,595	14.68284	5.097506	5	32
SIZE	14,555	8,930,000,000 €	85,700,000,000 €	4,760 €	1,770,000,000,000 €
LNSIZE	14,555	18.64115	2.606162	8.468085	28.20256

Table 14 presents the descriptive statistics for the variables used in the study, including the number of observations (Obs), mean, standard deviation (Std. Dev.), minimum (Min), and maximum (Max) values for each. The variables encompass key aspects of the research, such as Regulatory Adjustments (ra, in 1000 EUR), TIER1, TCR, RC, CRO, CFO, TITLE, SENIOR, BI, CEOAD, BS, SIZE (in 1000 EUR), and LNSIZE. These statistics illustrate the data spread and central tendencies, providing a comprehensive understanding of the dataset.

The dataset, comprising 14,596 bank-director years from 2001 to 2020, reflects individual directors' experiences within banks over this period, offering a detailed "bank-director years" level of analysis. This approach enhances the understanding of the interplay between risk governance characteristics and regulatory adjustments.

Notably, the RGI (Risk Governance Index) is not included in this table. The RGI, derived through PCA, is a composite measure aggregating individual risk governance characteristics. It captures the shared variance of these characteristics, providing a consolidated measure of a bank's overall risk governance strength. As a derived measure, the RGI is crucial in regression analysis for assessing the collective impact of risk governance characteristics on regulatory adjustments.

The inclusion of both size and lnsize (natural logarithm of size) in the analysis serves distinct purposes. Size represents the actual size of the bank, assessing the direct linear relationship with the dependent variables. In contrast, lnsize captures non-linear relationships and the percentage change in the dependent variable for a 1% change in the bank's size. This dual approach ensures a comprehensive understanding of the impact of bank size on the dependent variables, capturing both linear and non-linear relationships and reinforcing the robustness of the findings.

5.4.2. Correlation Analysis

In this section, the correlation matrix is used to explore the relationships between different variables, particularly focusing on risk governance characteristics and their influence on regulatory adjustments. This matrix is a crucial statistical tool that helps in understanding how variables are interrelated within the dataset. The correlations provide insights into potential associations but do not imply causation. For instance, a negative correlation between RA and TIER1 suggests an inverse relationship, but it's important to consider other factors that might be influencing these variables.

To address concerns about multicollinearity, which arises when independent variables in a regression model are highly correlated, this study has conducted careful variable selection and analysis. While some degree of correlation is expected due to the nature of the variables studied, the impact on the regression models is mitigated through the use of advanced statistical techniques and the interpretation of results in the context of existing literature. This approach helps ensure that the findings are robust and reliable.

The correlation matrix presents the relationships among the variables in the study, focusing on risk governance characteristics and their association with regulatory adjustments. Among these characteristics, only the CRO shows a small negative correlation with regulatory adjustments, while the CFO and TITLE do not exhibit significant negative correlations with regulatory adjustments. Conversely, the presence of a RC shows a positive correlation, and BI exhibits a significant positive correlation with RA. These findings suggest that while certain risk governance characteristics may influence regulatory adjustments, their impact varies. The observed correlations in this study, particularly those related to risk governance characteristics such as the presence of a CRO and their impact on regulatory adjustments, offer noteworthy insights. These findings are in line with the research conducted by Erin et al. (2018) on the Nigerian banking sector, which also underscored the influence of risk governance on bank performance. Furthermore, the relationship between risk governance characteristics and regulatory adjustments resonates with the findings of Srivastav and Hagendorff (2016), who emphasized the significance of these factors in the banking sector. The current analysis enriches this discourse by providing empirical evidence from the OECD public commercial banks, thereby contributing to a more comprehensive understanding of risk governance within diverse regulatory contexts. This study's findings, particularly the correlation between risk governance characteristics and regulatory adjustments, align with Erin et al. (2018). Their research on the Nigerian banking sector similarly highlighted the influence of risk governance

on bank performance, underscoring the relevance of these correlations in understanding bank behavior within regulatory frameworks. The correlation matrix provides clear evidence of specific relationships between risk governance characteristics and regulatory adjustments, underscoring the need for careful interpretation and consideration of broader research implications, as discussed in Srivastav and Hagendorff (2016). Further analysis is needed to assess the statistical significance and strength of these associations.

Table 15 Correlation

	RA	TIER1	TCR	RC	CRO	CFO	TITLE	SENIOR	BI	CEOAD	BS	SIZE
RA	1											
TIER1	-0.21***	1										
TCR	-0.16***	0.54***	1									
RC	0.09**	0.04	0.06*	1								
CRO	-0.06*	0.08*	0.02	-0.07*	1							
CFO	-0.01	0.13***	0.11***	-0.07*	-0.03	1						
TITLE	-0.05	0.15***	0.10**	0.08**	0.05	-0.02	1					
SENIOR	0.00	-0.05	0.00	-0.06	0.03	0.05	-0.07*	1				
BI	0.29***	-0.16***	-0.04	0.28***	-0.16***	0.00	0.11***	-0.05	1			
CEOAD	0.03	-0.09**	-0.02	-0.04	-0.04	-0.09**	-0.02	0.00	-0.11***	1		
BS	-0.32***	0.11***	-0.04	-0.14***	0.12***	-0.01	0.05	0.07*	-0.38***	-0.07*	1	
SIZE	-0.22***	0.24***	0.14***	-0.09**	0.04	-0.02	0.08*	0.06	-0.12***	0.01	0.41***	1

Note: Table 15 presents the correlation matrix of the variables utilized in the study. Each cell shows the Pearson correlation coefficient between pairs of variables, with significance levels marked as follows: * for $p<0.05$, ** for $p<0.01$, and *** for $p<0.001$. A negative correlation indicates an inverse relationship, while a positive correlation signifies a direct relationship. For instance, RA and TIER1 share a significant negative correlation of -0.21, suggesting that as RA increase, TIER1 tends to decrease, and vice versa. Understanding these correlations assists in the interpretation of the relationship dynamics among the various factors considered in this study.

This correlation table, based on observations that matched as outlined in the data collection and description, presents the relationships between the variable e.g., RA and other variables in the study. It's important to note that the correlations are determined from the subset of the dataset where these variables intersect. The observation count for RA, as indicated in the descriptive statistics, is distinct from others, reflecting its specific data collection criteria. This context is crucial for interpreting the correlations accurately, as they are based on this particular subset of the comprehensive dataset.

5.4.3. Principal Component Analysis

Building on the foundational understanding of risk governance practices highlighted in the previous work such as Karyani et al. (2020), this study conducts a PCA to explore the underlying structure and dimensionality of specific risk governance characteristics. The variables of interest, namely RC, CRO, CFO, TITLE, SENIOR, and BI, were included in the analysis to further investigate their interrelationships and potential impact on regulatory adjustments. The PCA analysis identified six principal components based on the variance in the dataset. The first component, labeled as Comp1, captured the most variance with an eigenvalue of 1.33838. Comp1 explained 22.31% of the total variance, indicating its significance in capturing the variability in the risk governance characteristics. The subsequent components, Comp2 to Comp6, accounted for decreasing proportions of the variance.

The loadings of the variables on the principal components provide insights into their contribution to the overall structure. Comp1 has a negative loading for CRO, CFO, and SENIOR. Specifically, SENIOR has a pronounced negative loading of -0.4137 on Comp1, suggesting a significant inverse relationship. CRO also has a negative relationship with Comp1, indicated by its loading of -0.2171. However, CFO's contribution to Comp1 is minimal, as evidenced by its loading of -0.0288. This makes Comp1 a suitable representative of the risk governance characteristics in the subsequent regression analysis. The PCA findings in this study, particularly regarding the significant variance captured by Comp1 and its loadings on CRO, CFO, and SENIOR, align with the methodologies employed by Karyani et al. (2020) in their study on the ASEAN-5 banking sector. They also utilized PCA to dissect risk governance characteristics, finding key components that influence bank operations. The similarity in the use of PCA and the identification of influential risk governance factors in both studies not only validates the methodology but also reinforces the importance of these characteristics in risk governance analysis within the banking sector.

Including Comp1 as an explanatory variable in the regression analysis facilitates the examination of its relationship with RA, offering insights into the potential association between risk governance characteristics and regulatory adjustments (Drake et al., 2006). By utilizing Comp1, which emerged from the PCA as a comprehensive measure of risk governance characteristics, the study can effectively capture the collective impact of CRO, CFO, and SENIOR on regulatory adjustments. This approach, grounded in the PCA findings, enhances the interpretability and efficiency of the regression model. It provides a nuanced evaluation of

the role played by risk governance characteristics in potentially influencing regulatory adjustments, aligning with the broader research context highlighted by Srivastav and Hagendorff (2016).

The PCA methodology in this study not only aligns with the approach taken by Karyani et al. (2020) but also extends it by offering unique insights into the role of senior directors in risk governance. While Karyani et al. (2020) laid the groundwork for understanding risk governance in the ASEAN-5 banking sector, this study further explores how specific components like senior director roles uniquely contribute to the dynamics of risk governance in OECD public commercial banks. This distinction highlights the study's contribution to the broader discourse on risk governance, enhancing the understanding of its multifaceted nature in different banking contexts.

Table 16-a PCA Eigenvalues

COMPONENT	EIGENVALUE	DIFFERENCE	PROPORTION	CUMULATIVE
COMP1	1.3384	0.3052	0.2231	0.2231
COMP2	1.0332	0.0285	0.1722	0.3953
COMP3	1.0047	0.0438	0.1674	0.5627
COMP4	0.9609	0.0455	0.1602	0.7229
COMP5	0.9154	0.1680	0.1526	0.8754
COMP6	0.7474	0.0000	0.1246	1

Note: Table 16-a presents the Eigenvalues obtained from the PCA. It showcases six components (COMP1 to COMP6), their respective Eigenvalues, the Difference in Eigenvalues between successive components, the Proportion of the total variance explained by each component, and the Cumulative proportion of explained variance up to each component. The table provides an overview of how much each component contributes to the total variability of the data. The cumulative proportion column gives a quick way to see how much total variance is accounted for as we consider more components. By the end of COMP6, all the variance in the data (100%) has been accounted for.

Table 16-b Principal components (eigenvectors) from PCA

VARIABLE	COMP1	COMP2	COMP3	COMP4	COMP5	COMP6	UNEXPLAINED
RC_STD	0.5723	-0.0315	-0.2229	0.4185	0.2255	0.6291	0
CRO_STD	0.2171	-0.4719	0.4345	0.7178	-0.1218	-0.106	0
CFO_STD	0.0288	0.7367	0.5829	0.1277	-0.1906	0.2531	0
TITLE_STD	0.2653	-0.3137	0.6356	-0.4162	0.4996	0.0658	0
SENIOR_STD	0.4137	0.2899	-0.1306	0.2633	0.8028	-0.1183	0
BI_STD	0.6188	0.2262	0.0260	0.2252	0.0622	-0.7146	0

Note: Table 16-b displays the Principal Components (PCs) or eigenvectors[6] for each variable obtained from the PCA, along with any unexplained variance. The table depicts the direction and magnitude of each variable's contribution to each component (COMP1 to COMP6). These components are linear combinations of the original variables, and each represents a specific aspect of the total variance present in the original data. The unexplained variance for all variables is zero, indicating that the PCA model fully represents the variability of all standardized variables.

[6] Note on the Similarity Between Table 16-b and Table 16-c:

Tables 16-b and 16-c both stem from the PCA process, and their values are intrinsically linked:

PCA Overview: PCA is employed to transform the original data variables into a set of new orthogonal variables, termed principal components. These components encapsulate the variance in the data, with the aim of reducing dimensionality while retaining as much information as possible.

Eigenvectors vs. Loadings: Table 16-b delineates the eigenvectors of each variable, reflecting the direction and magnitude of each variable's contribution to the principal components. Conversely, Table IV-c displays the loadings, signifying the correlation between the original variables and the principal components. Due to the nature of PCA, especially when standardized variables are utilized, the eigenvectors and loadings often coincide, leading to the observed similarity in values across the two tables.

Incorporating Unexplained Variance: A distinguishing feature of Table 16-b is the 'Unexplained' column, which sheds light on any variance not captured by the principal components. In this dataset, the unexplained variance for all variables is zero, indicating that the PCA has comprehensively represented the variability of the standardized variables.

In essence, the congruence between Tables 16-b and 16-c is anticipated and aligns with standard PCA outputs. The addition of the 'Unexplained' column in Table 16-b provides an extra layer of understanding, ensuring that readers grasp the full scope of the data's dimensionality reduction.

In the context of the table "Table 16-b PCA Principal components (eigenvectors)," the value "0.5723" under "COMP1" for the variable "RC_STD" represents the eigenvector coefficient for that specific variable in relation to the first principal component (COMP1).

Table 16-c PCA Scores

VARIABLE	COMP1	COMP2	COMP3	COMP4	COMP5	COMP6
RC_STD	0.5723	-0.0315	-0.2229	0.4185	0.2255	0.6291
CRO_STD	-0.2171	-0.4719	0.4345	0.7178	-0.1218	-0.106
CFO_STD	-0.0288	0.7367	0.5829	0.1277	-0.1906	0.2531
TITLE_STD	0.2653	-0.3137	0.6356	-0.4162	0.4996	0.0658
SENIOR_STD	-0.4137	0.2899	-0.1306	0.2633	0.8028	-0.1183
BI_STD	0.6188	0.2262	0.0260	0.2252	0.0622	-0.7146

Note: *ring coefficients — sum of squares (column-loading) = 1*. Table 16-c presents the scoring coefficients, also known as loadings, obtained from the PCA. These loadings signify the correlation between the original variables (RC_STD to BI_STD) and the derived principal components (COMP1 to COMP6). High absolute values of loadings (closer to -1 or 1) indicate that the respective variable contributes significantly to the corresponding component. For instance, RC_STD has a high loading of 0.5723 on COMP1, suggesting a significant positive relationship between these. Negative loadings indicate an inverse relationship. The sum of squares of column-loadings equals 1, indicating that the components fully account for the variance in the data.

5.4.4. Regression Analysis

The main regression analysis results provide important insights into the relationship between the Risk Governance Index (RGI), represented by COMP1, and regulatory adjustments. The regression model incorporated the RGI, capturing the collective influence of risk governance characteristics, along with control variables such as CEOAD, BS, and SIZE. The coefficient for RGI was statistically significant and negative (-18,760.77, $p < 0.05$), indicating that a higher score on RGI, reflecting stronger risk governance practices associated with CRO, CFO, and SENIOR, is linked to lower levels of regulatory adjustments. This association remains robust even when controlling for CEOAD, BS, and SIZE, suggesting that risk governance characteristics, as represented by RGI, are associated with lower levels of regulatory adjustments, even after accounting for other control variables (Srivastav and Hagendorff, 2016). The negative relationship between the RGI and regulatory adjustments, as indicated by the significant coefficient in the regression analysis, resonates with the findings of Srivastav and Hagendorff (2016). They explored similar dynamics in the context of bank risk-taking behaviors and governance. The alignment of these results with their study provides a broader validation of the hypothesis that stronger risk governance practices, particularly those characterized by CRO, CFO, and SENIOR roles, are instrumental in reducing the need for

regulatory adjustments. This study extends these insights by demonstrating how such governance characteristics specifically impact regulatory adjustments in the context of OECD public commercial banks, thereby contributing to the ongoing discourse on effective risk governance and regulatory compliance.

These findings offer empirical evidence supporting the hypothesis that risk governance characteristics, as represented by the RGI, are associated with regulatory adjustments. This study carefully considers the fixed-effects modeling approach to address potential endogeneity. This method controls for unobserved heterogeneity that could bias estimates. Incorporating fixed effects for banks and time, the model accounts for unobserved, bank-specific factors and time-related effects that could influence the dependent variable, enhancing the credibility of the findings. Such methodological consideration ensures the robustness of results and mitigates the risk of endogeneity. The negative coefficient for RGI suggests that strong risk governance practices, particularly those characterized by the presence of a CRO, CFO, and SENIOR, are linked with fewer regulatory adjustments. This association underscores the importance of effective risk governance in aligning financial statements with regulatory standards and potentially reducing the frequency of adjustments required by regulatory bodies like the Bank for International Settlements (BIS). The specific mention of CRO, CFO, and SENIOR is due to their significant loadings in the PCA, indicating their pivotal role in the overall risk governance framework and its impact on regulatory compliance.

Table 17 Regression (main results)

VARIABLES	(7) RA	(7a) RA-Bootstrapped
RGI	-18,760.7750**	-18,760.7750**
	(9,097.2082)	(8,448.8366)
CEOAD	-1,101.3568	-1,101.3568
	(29,493.7221)	(28,696.5639)
BS	-12,491.6684	-12,491.6684
	(101,654.2046)	(104,146.9859)
SIZE	0.0044**	0.0044*
	(0.0016)	(0.0026)
CONSTANT	-3.5066e+06*	-3.5066e+06
	(2040512.1295)	(3586194.8452)
Observations	2,740	2,740
Adjusted R-squared	0.8951	0.8951
Bank FE	YES	YES
Year FE	YES	YES
Clusters	Bank	Bank

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Table 17 showcases the primary outcomes of the regression analysis for this study. Two models, (7) and (7a), are presented, both using RA as the dependent variable and RGI as a key independent variable. Model (1) utilizes a standard regression method, while Model (7a) employs bootstrapped estimates for robustness verification.

The negative coefficient for RGI indicates a statistical association where higher values of risk governance (RGI) correspond with decreased regulatory adjustments. This association is statistically significant at the 5% level in both models. However, it's crucial to understand that this association does not imply that improving risk governance directly causes a reduction in regulatory adjustments. The relationship merely suggests that the two variables move in opposite directions.

The SIZE variable's positive coefficient suggests that larger banks tend to have increased regulatory adjustments. This finding is significant at the 5% level in Model 1 and the 10% level in Model 1a. Other variables, such as CEOAD and BS, do not show statistically significant coefficients, indicating their potential limited impact on regulatory adjustments.

The models account for bank and year fixed effects, controlling for unobserved bank-specific attributes and common time-related effects. Robust standard errors, clustered by bank, are used to mitigate potential issues with heteroskedasticity and autocorrelation. The models' adjusted R-squared value of 0.8951 indicates that the included variables account for approximately 89.51% of the variability in regulatory adjustments. The high adjusted R-squared value in the regression models is influenced by the inclusion of the RGI variable, derived from COMP1 of the PCA analysis. COMP1 captures a significant portion of the variance from the original dataset, contributing to the model's explanatory power. However, the overall model specification and other variables also play a role in achieving this high R-squared value.

5.4.5. Sensitivity Analysis

The results of the sensitivity analysis, robust to heteroskedasticity using bootstrap replication, provide additional insights into the relationship between risk governance characteristics and regulatory adjustments. The analysis focused on TIER1 as the dependent variable. The coefficient for RGI remains positive (0.0074) in the sensitivity analysis, but it does not achieve statistical significance at the conventional level ($p < 0.05$). However, the coefficient is marginally significant at a 10% significance level ($p < 0.10$). While the bootstrap results do not strongly confirm the main regression findings, they suggest a consistent positive association between RGI and TIER1. The statistical significance of this association is not firmly established based on the available data, but the consistent direction of the coefficient across the bootstrap replications suggests a tendency towards a positive relationship. These findings indicate an association between risk governance characteristics, as represented by RGI, and the TIER1 for banks. However, it's important to note that this does not imply a direct causal relationship. In the sensitivity analysis, the positive coefficient for Comp1 suggests a potential association between TIER1 and the risk governance characteristics. Specifically, while the RC shows a positive influence on TIER1, the roles of CRO, CFO, and Senior Directors might have inverse effects. However, given the nature of sensitivity analyses, these findings should be interpreted with caution, as they are meant to test the robustness of our main regression results rather than establish definitive relationships. Caution is exercised in interpreting these results, as the statistical significance of the association is not firmly established. Further research with a larger sample size may be necessary to obtain more conclusive evidence on the relationship between risk governance characteristics and the regulatory capital ratio. It's pertinent to note that while this study delves into the relationship between risk governance characteristics and regulatory adjustments.

The sensitivity analysis, robust to heteroskedasticity using bootstrap replication, provides additional insights into the relationship between risk governance characteristics and the TCR. The coefficient for RGI in the main regression analysis remains statistically significant and negative (-0.0585, $p < 0.05$) even after accounting for potential variations in the estimation.

The negative association between RGI and TCR suggests that there's a correlation between risk governance characteristics, as captured by RGI, and the overall capital adequacy of banks, as reflected by the total capital ratio. This indicates that while risk governance characteristics may be associated with higher tier 1 capital, which primarily consists of a bank's

core capital, they may not necessarily correlate with tier 2 capital, which includes supplementary capital like subordinated debt and loan-loss reserves, or other components of the total capital.

The bootstrap results further support the main regression findings, confirming the stability of the negative coefficient for RGI across the bootstrap replications. This consistency strengthens the evidence that risk governance characteristics have a limited influence on the TCR of banks.

These findings suggest that risk governance characteristics may play a more significant role in enhancing the core capital component (tier 1 capital) of banks, while their impact on other components, such as tier 2 capital, may be limited. It is essential to consider additional factors that influence the TCR beyond risk governance characteristics, as they may contribute to a more comprehensive understanding of the bank's overall capital structure.

In the sensitivity analysis, the exploration of the relationship between risk governance characteristics and regulatory capital ratios, as seen through the lens of RGI's impact on TIER1 and TCR, offers a nuanced perspective on governance practices. This aligns with and extends the findings of Karyani et al. (2020), who examined the influence of risk governance and market competition on banks' operational risk disclosure quality in the ASEAN-5 banking sector. Their study underscores the broad significance of risk governance in banking and the interplay between governance and market factors, a theme that resonates with the current study's focus on regulatory capital ratios.

Table 18 Sensitivity Analysis

VARIABLES	(8) TIER1	(8a) TIER1-Bootstrapped	(9) TCR	(9a) TCR-Bootstrapped
RGI	0.0074*	0.0074*	-0.0585**	-0.0585**
	(0.0043)	(0.0041)	(0.0284)	(0.0272)
CEOAD	0.0075	0.0075	-0.1094*	-0.1094*
	(0.0180)	(0.0174)	(0.0620)	(0.0593)
BS	0.0176	0.0176	0.0127	0.0127
	(0.0583)	(0.0802)	(0.0545)	(0.0508)
SIZE[7]	-3.2131***	-3.2131		
	(1.0979)	(1.9548)		
LNSIZE			-2.1427***	-2.1427***
			(0.6558)	(0.6391)
CONSTANT	14.6206***	14.6206***	54.9984***	54.9984***
	(1.3686)	(1.4343)	(12.1721)	(11.9407)
Observations	1,872	1,872	14,554	14,554
Adjusted R-squared	0.9526	0.9526	0.6406	0.6406
Bank FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Clusters	Bank	Bank	Bank	Bank

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Table 18 displays the results of the sensitivity analysis, with four models presented. The first two models have TIER1 as the dependent variable while the next two use TCR. Each pair includes a conventional regression model and a bootstrapped model for robustness checking. Models (8) and (8a) have 1,872 observations, while models (9) and (9a) have 14,554. This variation in sample size is a result of merging data with the BoardEx database and reflects the differing availability of overlapping data points. Such differences in sample sizes across models are typical in regression analysis, underscoring the importance of understanding the data sources and the rationale behind each model's construction.

For the models with TIER1 as the dependent variable, the RGI variable shows a positive association, indicating that higher values of risk governance (RGI) are correlated with higher TIER1 values. It's important to note that this is an observed association and does not imply that changes in risk governance directly cause changes in TIER1. This association is statistically significant at the 10% level in Model 1. The SIZE variable is negatively associated with TIER1

[7] Note: In the sensitivity analysis (Table 18), the variable "SIZE", originally in 1000 of euros, has been adjusted by dividing it by billions. This conversion is implemented to enhance the interpretability of the coefficient, making it more comprehensible in the context of the model. It's important to note that this rescaling of "SIZE" for readability does not impact the actual results or their significance; it simply modifies the unit of measurement for clearer understanding. This practice is a standard approach in econometric analysis when dealing with large numerical values.

The SIZE variable's coefficient, though close to zero, in unreported results, is reflective of the large units (in 1000 euros) being used, which is typical for datasets dealing with significant financial amounts. Its statistical significance confirms that even subtle variations in SIZE can influence a bank's risk-to-profit dynamics.

and is significant at the 1% level, suggesting that, on average, larger banks have lower TIER1 values. The CEOAD and BS variables are not statistically significant.

For the models with TIER1 as the dependent variable, the RGI variable has a positive association, suggesting that an improvement in risk governance is correlated with a higher TIER1. However, this result is only significant at the 10% level in Model 1. The SIZE variable has a negative association with TIER1 and is significant at the 1% level. This implies that larger banks may tend to have a lower TIER1. The CEOAD and BS variables are not statistically significant.

In the models with TCR as the dependent variable, the RGI variable shows a negative association. This suggests that higher values of risk governance (RGI) are correlated with lower total capital ratios (TCR). It's important to clarify that this is an observed correlation and does not imply that changes in risk governance directly cause changes in the total capital ratio. This relationship is statistically significant at the 5% level. The CEOAD variable is negative and significant at the 10% level, suggesting that banks with a CEO who is also the chair of the board may have a lower total capital ratio. The LNSIZE variable, representing the natural logarithm of the bank's size, has a negative coefficient and is significant at the 1% level. This suggests that larger banks have a lower total capital ratio. The BS variable is not statistically significant in these models.

All models include bank and year fixed effects, and the standard errors are clustered at the bank level.

5.4.6. Discussion

The results of the regression analysis and sensitivity analysis provide valuable insights into the relationship between risk governance characteristics and regulatory adjustments in public commercial banks within the OECD. The findings suggest that risk governance characteristics, particularly those represented by CRO, CFO, and SENIOR, play a crucial role in mitigating regulatory adjustments and ensuring regulatory compliance. The negative associations observed in the correlation analysis (Section 4.2, Table III) and regression analysis indicate that a stronger presence of these risk governance characteristics is associated with lower levels of regulatory adjustments. This supports the hypothesis that effective risk governance practices contribute to the stability and reputation of public commercial banks within the OECD. While the direct impact on stability and reputation is beyond the scope of this study, it's evident that effective risk governance practices can influence regulatory adjustments in public commercial banks within the OECD. As highlighted by Srivastav and Hagendorff (2016), governance mechanisms play a crucial role in shaping bank risk-taking behaviors, emphasizing the need for internal governance mechanisms that reflect the needs of various stakeholders to ensure financial stability.

These findings are consistent with the earlier discussion emphasizing the significance of risk governance roles, particularly the roles of CRO, CFO, and SENIOR, in influencing

regulatory adjustments. This alignment with previous research, such as that by Stolz et al. (2003), further underscores the importance of these roles in enhancing risk management practices within public commercial banks. The results also align with the principles set out in regulatory frameworks that emphasize risk governance and regulatory compliance. Specifically, the Basel III framework, introduced by the Basel Committee on Banking Supervision, focuses on strengthening bank capital requirements and introducing new regulatory requirements on bank liquidity and bank leverage. These measures are designed to enhance the resilience of the banking sector and reduce the risk of systemic failures. While this study does not directly address the concept of "stability," the findings do shed light on the relationship between risk governance characteristics and regulatory adjustments in public commercial banks.

The sensitivity analysis, as presented in Table 18, was conducted to assess how the main results with the RA variable might change if the dependent variable is altered to TIER1 or TCR. For the models with TIER1 as the dependent variable, there's a positive association with the RGI variable, indicating that an enhancement in risk governance correlates with an increase in TIER1. However, this association is significant at the 10% level in Model 1. Additionally, the SIZE variable shows a negative relationship with TIER1, significant at the 1% level, suggesting that larger banks might have a lower TIER1. The CEOAD and BS variables do not exhibit statistical significance in these models. It's essential to interpret these findings in the context of the broader research and consider the implications for risk governance practices in public commercial banks within the OECD. Future research, especially studies like that of Ekawati et al. (2021) which delve into the interplay between risk management, capital structure, and corporate governance, can offer deeper insights into the influence of risk governance characteristics on banks' financial performance and capital structure.

While the main regression results, as presented in Table 17, indicate a negative association between RGI and RA, the sensitivity analysis for TCR, robust to heteroskedasticity using bootstrap replication, also reveals a negative association between RGI and TCR. This contrast with the positive association observed for TIER1 underscores the nuanced impact of risk governance on different components of banks' capital structure and regulatory adjustments. This suggests that risk governance characteristics, as represented by RGI, may have a differential impact on different components of the bank's capital structure. Further research is necessary to explore the specific reasons behind this negative association and its implications for bank risk management and capital adequacy.

Overall, the results of this study contribute to the existing literature on risk governance, regulatory compliance, and their relationship with regulatory adjustments in public commercial banks within the OECD. The findings highlight the importance of effective risk governance practices in mitigating regulatory adjustments and maintaining financial stability. In line with the insights from Francis and Osborne (2012), who examined the effects of regulatory capital requirements on bank behavior in the UK, policymakers and bank regulators can use these findings to inform their efforts in strengthening risk governance frameworks and promoting regulatory compliance in the banking sector. This is especially pertinent given the ongoing debates surrounding the design and calibration of international capital standards.

6. Conclusions: Integration of Findings and Contributions

6.1. Integration of Findings

Integrating findings from the sections on risk governance's impact on bank risk, financial performance, and regulatory compliance offers a comprehensive view of the multifaceted role of risk governance in banking institutions. This integration highlights how effective risk governance mechanisms not only contribute to mitigating inherent banking risks but also enhance financial performance and ensure adherence to regulatory standards, thereby bolstering the overall stability and integrity of financial institutions.

Effective risk governance plays a pivotal role in managing bank risk by establishing robust frameworks that facilitate the identification, assessment, and mitigation of various risks. The presence of specialized structures such as risk committees, along with key roles including the CRO and senior directors, ensures a concerted approach towards managing and mitigating risks. These governance mechanisms are instrumental in embedding risk management into the bank's strategic and operational processes, thereby enhancing its resilience to financial uncertainties and market volatility.

Beyond risk mitigation, the impact of risk governance extends to the financial performance of banks. Strong governance frameworks contribute to improved financial outcomes by fostering a risk-aware culture that aligns risk-taking activities with the bank's strategic objectives and risk appetite. This alignment ensures that risk-taking decisions are made judiciously, with a clear understanding of their potential impact on the bank's financial health. Moreover, effective risk governance supports financial performance by promoting transparency, accountability, and effective communication within the organization, which are crucial for informed decision-making and operational efficiency.

In the realm of regulatory compliance, risk governance assumes a critical role in ensuring that banks adhere to the evolving landscape of financial regulations. The regulatory environment for banks has become increasingly complex, with stringent requirements aimed at enhancing financial stability and protecting consumer interests. Risk governance structures facilitate a proactive approach to compliance, enabling banks to anticipate regulatory changes and integrate them seamlessly into their operational and strategic frameworks. This proactive

stance not only minimizes the risk of regulatory breaches and associated penalties but also positions the bank favorably in the eyes of regulators, investors, and other stakeholders.

The integration of findings across these three areas underscores the interconnectedness of risk governance, bank risk, financial performance, and regulatory compliance. Effective risk governance serves as the cornerstone of a bank's ability to manage risks, achieve sustainable financial performance, and maintain regulatory compliance. These aspects are interdependent, with each contributing to the overall stability, reputation, and success of banking institutions. As such, the role of risk governance extends beyond mere compliance or risk mitigation; it is fundamental to the strategic positioning and long-term sustainability of banks in the competitive and regulatory landscape of the financial sector.

6.2. Hypothesis Verification

This dissertation rigorously tests three key hypotheses, aligning with its purpose to examine the impact of risk governance on public commercial banks within the OECD. The first hypothesis explores the impact of risk governance on bank risk, revealing a notable positive association between risk governance characteristics and a Tier 1 Capital ratio which implies the lower level of bank risk in the presence of risk governance characteristics. The second hypothesis assesses the impact of risk governance on financial performance, finding a significant positive relationship, indicating that stronger risk governance leads to enhanced financial outcomes. The third hypothesis investigates the impact of risk governance on regulatory adjustments, where a clear negative association is observed, suggesting that effective risk governance results in fewer regulatory adjustments. These findings collectively validate the hypotheses, confirming that risk governance plays a crucial role in managing bank risk, improving financial performance, and ensuring regulatory compliance in OECD public commercial banks.

Building on the robust hypothesis verification in this dissertation, it becomes evident that risk governance is not just a regulatory necessity but a strategic cornerstone in the banking sector. The interplay between various governance roles – the Risk Committee, Chief Risk Officer, Chief Financial Officer, and other key personnel – showcases a holistic approach towards managing risk, enhancing financial performance, and navigating regulatory landscapes. This comprehensive approach underpins the essential nature of risk governance in steering banks through complex operational, financial, and regulatory challenges, affirming its critical role in the banking sector's overall resilience and success.

The risk committee provides pivotal oversight of risk management policies and practices, ensuring compliance with regulatory requirements and effective risk mitigation. This high-level supervision has shown positive impacts on the bank's financial performance, notably reducing financial distress and improving stability. Similarly, the CRO's role in identifying, measuring, and managing risk exposure demonstrates a direct correlation with better financial performance by improving risk management quality.

The CFO plays a dual role, bridging risk management with the bank's overall financial strategy. They contribute significantly to maintaining the financial health of the bank and aligning its risk profile with strategic goals. This role impacts both the immediate risk scenario and the bank's broader financial outcomes.

SENIOR, TITLE, and BI each bring unique benefits to risk governance. SENIOR provide experience and a broad view of potential risks and their impacts. TITLE bring enhanced analytical and research skills, contributing to sophisticated risk models and strategies. BI add an external perspective that bolsters the bank's ability to manage risk and ensures a diverse boardroom thought process.

The roles of these key components become increasingly significant during regulatory adjustments. The RC, CRO, and CFO are critical to translate regulatory changes into operational strategies, ensure regulatory compliance, and maintain the financial sustainability of the bank. SENIOR and TITLE contribute their wisdom and unique expertise to navigate and implement complex regulatory adjustments. BI offer unbiased judgments, protect stakeholders' interests, and are vital in maintaining public trust in compliance with banking regulations.

In conclusion, risk governance is a multifaceted domain that deeply impacts a bank's risk management, financial performance, and regulatory adaptations. The collective insights and expertise of the RC, CRO, CFO, and directors ensure that risks are effectively identified, assessed, and mitigated. Their efforts not only bolster the bank's stability but also directly contribute to its financial success and the steadfast navigation of evolving regulatory landscapes. These aspects of risk governance underscore its crucial role in the banking sector's resilient operations.

6.3. Summary and Contributions

The dissertation offers a comprehensive examination of risk governance's impact on bank risk, financial performance, and regulatory compliance within public commercial banks across OECD countries. This work delves into how risk governance mechanisms, particularly those involving board directors' characteristics and executive roles such as the Chief Risk Officer (CRO) and Chief Financial Officer (CFO), influence the management of bank risk, enhance financial outcomes, and align with regulatory standards.

In the first part, dissertation explores the relationship between risk governance and bank risk, presenting empirical evidence that highlights the quantifiability of risk through governance practices. Basing on Knightian Risk and utilizing multivariate regression and Principal Component Analysis (PCA), the study finds a significant association between robust risk governance and a higher Tier 1 capital ratio, indicative of reduced bank risk. This section underscores the collective influence of directors' attributes and executive roles in mitigating risk, suggesting pathways for more effective risk management strategies in the banking sector.

The second part investigates the nexus between risk governance characteristics and financial performance, employing the Upper Echelons Theory (UET) as a theoretical lens. The analysis reveals a positive correlation between strong risk governance structures and enhanced financial performance, emphasizing the strategic importance of risk governance in banking operations. These insights offer practical guidance for developing governance frameworks that bolster financial performance and stability.

In the final part, the focus shifts to risk governance's role in regulatory compliance, particularly examining how governance characteristics impact regulatory adjustments. The findings suggest a negative association, indicating that effective risk governance can reduce the need for regulatory adjustments, thereby fostering a more stable and compliant banking environment.

This dissertation contributes significantly to the field by providing empirical evidence of risk governance's multifaceted impact on banking performance. It extends the theoretical and practical understanding of how governance mechanisms influence bank risk, financial performance, and regulatory compliance. Furthermore, by identifying areas for future research, such as addressing endogeneity concerns, exploring additional variables influencing bank risk-taking, and considering the practicality of dynamic panel data analysis with lagged independent variables, this dissertation sets the stage for subsequent inquiries into the complex dynamics of risk governance in banking.

The implications of this work are manifold, offering valuable insights for bank directors, regulators, policymakers, and academics. By elucidating the critical role of risk governance in enhancing banking operations' stability and performance, this dissertation underscores the need for well-structured governance frameworks. These frameworks not only mitigate risks and enhance financial outcomes but also ensure adherence to evolving regulatory standards, contributing to the broader stability and integrity of the financial system.

Abbreviations

AHP	Analytic Hierarchy Process
AVARPTP	Average Value at Risk to Pre-Tax Profit
BCBS	Basel Committee on Banking Supervision
BGFRS	Board of Governors of the Federal Reserve System
BI	Independent Directors
BIS	Bank for International Settlements
BS	Board Size
CEOAD	if Chief Executive Officer holds an addition position
CET1	Common Equity Tier 1
CFO	Chief Financial Officer
CRO	Chief Risk Officer
CSOTC	Committee of Sponsoring Organizations of the Treadway Commission
DFA	Dodd-Frank Wall Street Reform and Consumer Protection Act
DT	Decision Tree
ECB	European Central Bank
ERM	Enterprise Risk Management
ESG	Environmental, Social, and Governance
FCA	Financial Conduct Authority
FSB	Financial Stability Board
GAO	Government Accountability Office
GFC	Global Financial Crisis
IAIS	International Association of Insurance Supervisors
IFRS 9	International Financial Reporting Standard 9
IMF	International Monetary Fund
IOSC	International Organization of Securities Commissions
IRGC	International Risk Governance Council
ISIN	International Securities Identification Number
KRIs	Key Risk Indicators
OECD	Organization for Economic Cooperation and Development
PCA	Principal Component Analysis
PhD	Doctor of Philosophy
PwC	PricewaterhouseCoopers
RA	Regulatory Adjustments
RC	Risk Committee
RGI	Risk Governance Index
ROAA	Return On Average Assets
RWA	Risk-Weighted Assets
SENIOR	Senior directors ages between 65 to 74
SIZE	Size of the bank by total assets
SMCR	Senior Managers and Certification Regime
TCR	Total Capital Ratio
TIER1	Tier 1 Capital Ratio
TITLE	Directors with PhD degrees
UET	Upper Echelons Theory
UNISDR	United Nations International Strategy for Disaster Reduction
VaR	Value at Risk
WEF	World Economic Forum

List of References

[1] Acharya, V. V., Engle, R., & Pierret, D. (2014). Testing Macroprudential Stress Tests: The Risk of Regulatory Risk Weights. *Journal of Monetary Economics*, 65, 36-53.

[2] Acharya, V. V., Mehran, H., & Thakor, A. V. (2016). Caught between Scylla and Charybdis? Regulating bank leverage when there is rent seeking and risk shifting. *The Review of Corporate Finance Studies*, 5(1), 36-75.

[3] Adams, R. B. (2012). Governance and the financial crisis. *International Review of Finance,* 12(1), 7-38.

[4] Adams, R. B., & Mehran, H. (2012). Bank Board Structure and Performance: Evidence for Large Bank Holding Companies. *Journal of Financial Intermediation*, 21(2), 243-267.

[5] Adams, R. B., & Mehran, H. (2012). Bank board structure and performance: Evidence for large bank holding companies. *Journal of Financial Intermediation*, 21(2), 243-267.

[6] Adams, R. B., Hermalin, B. E., & Weisbach, M. S. (2010). The role of boards of directors in corporate governance: A conceptual framework and survey. *Journal of economic literature*, 48(1), 58-107.

[7] Adams, R. B., Hermalin, B. E., & Weisbach, M. S. (2010). The role of boards of directors in corporate governance: A conceptual framework and survey. *Journal of economic literature*, 48(1), 58-107.

[8] Adams, R., & Ferreira, D. (2009). Women in the boardroom and their impact on governance and performance. *Journal of Financial Economics*, 94, 291–309.

[9] Adeusi, S. O., Akeke, N. I., Adebisi, O. S., & Oladunjoye, O. (2014). Risk management and financial performance of banks in Nigeria. *Risk Management*, 6(31), 123-129.

[10] Adger, W. N., Arnell, N. W., & Tompkins, E. L. (2005). Successful adaptation to climate change across scales. *Global Environmental Change*, 15(2), 77-86.

[11] Adrian, T. (2018). Risk management and regulation. International Monetary Fund.

[12] Aebi, V., Sabato, G. & Schmid, M. (2012). Risk management, corporate governance, and bank performance in the financial crisis. *Journal of Banking & Finance*, 36(12), 3213-3226.

[13] Aebi, V., Sabato, G. & Schmid, M. (2012). Risk management, corporate governance, and bank performance in the financial crisis. *Journal of Banking & Finance*, 36(12), 3213-3226.

[14] Agarwal, V., & Taffler, R. J. (2008). Comparing the performance of market-based and accounting-based bankruptcy prediction models. *Journal of Banking & Finance*, 32(8), 1541-1551.

[15] Aguilera, R. V., Desender, K. A., Bednar, M. K., & Lee, J.-H. (2015). Connecting the Dots: Bringing External Corporate Governance into the Corporate Governance Puzzle. *Academy of Management Annals*, 9(1), 483-573.

[16] Alam, N. (2014). Regulations and bank risk taking in dual banking countries. *Journal of Banking Regulation*, 15(2), 105–116. https://doi.org/10.1057/jbr.2012.15

[17] Almashhadani, M., & Almashhadani, H. A. (2022). Corporate Governance as an Internal Control Mechanism and its Impact on Corporate Performance. *International Journal of Business and Management Invention*, *11*(8), 53-59.

[18] Altunbas, Y., Manganelli, S., & Marques-Ibanez, D. (2011). Bank risk during the financial crisis: do business models matter? ECB Working Paper No. 1394.

[19] André, P., Filip, A., & Marmousez, S. (2014). The impact of IFRS on the relationship between conservatism and investment efficiency. *Accounting Auditing Control*, 20(3), 101-124.
[20] Arnone, M., & Gambini, A. (2007). Architecture of supervisory authorities and banking supervision. Designing Financial Supervision Institutions: Independence, Accountability and Governance, Edward Elgar, Cheltenham, 262-308.
[21] Authority, A. P. R. (2015). Prudential Standard CPS 220. Risk Management. Available at https://www.apra.gov.au/sites/default/files/Prudential-Standard-CPS-220-Risk-Management-January-2015_0.pdf
[22] Authority, F. C. (2019). The senior managers and certification regime: guide for FCA solo-regulated firms. SM&CR'), July.
[23] Authority, F. C., Britain, G., & Bank of England. Prudential Regulation Authority. (2013). Prudential Sourcebook for Banks, Building Societies and Investment Firms. Financial Conduct Authority.
[24] Aven, T. (2012). The risk concept—Historical and recent development trends. *Reliability Engineering & System Safety*, 99, 33-44.
[25] Aven, T., & Renn, O. (2010). Risk management and governance: Concepts, guidelines and applications (Vol. 16). Springer Science & Business Media.
[26] Bace, E. (2016). Bank profitability: Liquidity, capital, and asset quality. *Journal of Risk Management in Financial Institutions*, 9(4), 327-331.
[27] Baele, L., Farooq, M., & Ongena, S. (2014). Of Religion and Redemption: Evidence from Default on Islamic Loans. *Journal of Banking & Finance*, 44, 141-159.
[28] Banco de España. (2017). Financial Stability. Retrieved from https://www.bde.es/f/webbde/Secciones/Publicaciones/InformesBoletinesRevistas/InformesEstabilidadFinancera/17/IEF_Noviembre2017Ing.pdf
[29] Bank for International Settlements. (2011). Basel III: A global regulatory framework for more resilient banks and banking systems. Retrieved from https://www.bis.org/publ/bcbs189.htm
[30] Bank of England. (2020). Prudential Regulation. Retrieved from https://www.bankofengland.co.uk/prudential-regulation
[31] Bargeron, L. L., Lehn, K. M., & Zutter, C. J. (2010). Sarbanes-Oxley and corporate risk-taking. *Journal of Accounting and Economics*, 49(1-2), 34-52.
[32] Barnett, T., & King, R. (2008). Good fences make good neighbors: A longitudinal analysis of an industry self-regulatory institution. *Academy of Management Journal*, 51(6), 1150-1170.
[33] Barth, J. R., Caprio Jr, G., & Levine, R. (2013). Bank regulation and supervision in 180 countries from 1999 to 2011. *Journal of Financial Economic Policy*, 5(2), 111-219.
[34] Barth, J. R., Caprio, G., & Levine, R. (2004). Bank regulation and supervision: what works best? *Journal of Financial intermediation*, 13(2), 205-248.
[35] Basel Committee on Banking Supervision (BCBS). (2011). Basel III: A global regulatory framework for more resilient banks and banking systems. Bank for International Settlements.
[36] Basel Committee on Banking Supervision [BCBS]. (2000). Principles for the Management of Credit Risk.
[37] Basel Committee on Banking Supervision [BCBS]. (2005). Compliance and the compliance function in banks. Bank for International Settlements.
[38] Basel Committee on Banking Supervision [BCBS]. (2006). International convergence of capital measurement and capital standards: A revised framework (Basel II). Retrieved from https://www.bis.org/publ/bcbs128.htm

[39] Basel Committee on Banking Supervision [BCBS]. (2010). Basel III: A global regulatory framework for more resilient banks and banking systems. Bank for International Settlements.
[40] Basel Committee on Banking Supervision [BCBS]. (2010). Principles for Sound Risk Management and Supervision.
[41] Basel Committee on Banking Supervision [BCBS]. (2010). Principles for Enhancing Corporate Governance. Bank for International Settlements.
[42] Basel Committee on Banking Supervision [BCBS]. (2011). Basel III: A global regulatory framework for more resilient banks and banking systems. Bank for International Settlements.
[43] Basel Committee on Banking Supervision [BCBS]. (2011). Principles for the Sound Management of Operational Risk. Bank for International Settlements.
[44] Basel Committee on Banking Supervision [BCBS]. (2011). Principles for the Sound Management of Operational Risk. Bank for International Settlements.
[45] Basel Committee on Banking Supervision [BCBS]. (2011). Principles for the Sound Management of Operational Risk.
[46] Basel Committee on Banking Supervision [BCBS]. (2012). Core Principles for Effective Banking Supervision. Bank for International Settlements.
[47] Basel Committee on Banking Supervision [BCBS]. (2013). Principles for effective risk data aggregation and risk reporting. Bank for International Settlements.
[48] Basel Committee on Banking Supervision [BCBS]. (2013). Principles for an Effective Risk Appetite Framework.
[49] Basel Committee on Banking Supervision [BCBS]. (2015). Corporate Governance Principles for Banks. Basel, Switzerland: Bank for International Settlements.
[50] Basel Committee on Banking Supervision [BCBS]. (2015). Guidelines: Corporate governance principles for banks. Basel Committee on Banking Supervision, Bank for International Settlements.
[51] Basel Committee on Banking Supervision [BCBS]. (2017). Basel III: Finalising post-crisis reforms. Bank for International Settlements.
[52] Battaglia, F., & Gallo, A. (2015). Risk governance and Asian bank performance: An empirical investigation over the financial crisis. *Emerging Markets Review*, 25, 53-68.
[53] Batten, S., Sowerbutts, R., & Tanaka, M. (2016). Let's talk about the weather: the impact of climate change on central banks. Bank of England Staff Working Paper No. 603.
[54] Battiston, S., Dafermos, Y., & Monasterolo, I. (2021). Climate risks and financial stability. *Journal of Financial Stability*, 54, 100867.
[55] Beasley, M. S., Branson, B. C., & Hancock, B. V. (2008). Rising expectations. *Journal of Accountancy,* 205(4), 44.
[56] Beasley, M. S., Clune, R., & Hermanson, D. R. (2005). Enterprise risk management: An empirical analysis of factors associated with the extent of implementation. *Journal of Accounting and Public Policy*, 24(6), 521–531.
[57] Beck, T., De Jonghe, O., & Mulier, K. (2022). Bank sectoral concentration and (systemic) risk: Evidence from a worldwide sample of banks. *Journal of Money, Credit and Banking*, 54(6), 1705-1739.
[58] Beck, T., De Jonghe, O., & Schepens, G. (2013). Bank competition and stability: Cross-country heterogeneity. *Journal of financial Intermediation*, 22(2), 218-244.
[59] Behr, P., Schmidt, R. H., & Xie, R. (2010). Market Structure, Capital Regulation and Bank Risk Taking. *Journal of Financial Services Research*, 37(2-3), 131–158.
[60] Beltratti, A., & Stulz, R. M. (2012). The credit crisis around the globe: Why did some banks perform better? *Journal of Financial Economics*, 105(1), 1-17.

[61] Berger, A. N. (1995). The relationship between capital and earnings in banking. *Journal of Money, Credit and Banking*, 27(2), 432-456.
[62] Berger, A. N., & Bouwman, C. H. (2017). Bank liquidity creation, monetary policy, and financial crises. *Journal of Financial Stability*, 30, 139-155.
[63] Berger, A. N., Kick, T., & Schaeck, K. (2014). Executive board composition and bank risk taking. *Journal of Corporate Finance*, 28, 48-65.
[64] Berkhout, F. (2012). Adaptation to climate change by organizations. Wiley Interdisciplinary Reviews: *Climate Change*, 3(1), 91-106.
[65] Bessis, J. (2011). Risk management in banking. John Wiley & Sons.
[66] Bhagat, S., & Bolton, B. (2008). Corporate governance and firm performance. *Journal of Corporate Finance*, 14(3), 257-273.
[67] Biermann, F., Pattberg, P., van Asselt, H., & Zelli, F. (2009). The fragmentation of global governance architectures: A framework for analysis. *Global Environmental Politics*, 9(4), 14-40.
[68] Bikker, J. A., & Vervliet, T. M. (2018). Bank profitability and risk-taking under low interest rates. *International Journal of Finance & Economics*, 23(1), 3-18.
[69] BIS (2011). Principles for the Sound Management of Operational Risk. Basel Committee on Banking Supervision.
[70] BIS. (2011). Basel III: A global regulatory framework for more resilient banks and banking systems. Bank for International Settlements.
[71] Bitar, M., Pukthuanthong, K., & Walker, T. (2018). The effect of capital ratios on the risk, efficiency and profitability of banks: Evidence from OECD countries. *Journal of international financial Markets, Institutions and Money*, 53, 227-262.
[72] Blommestein, H. J. (2009). The financial crisis as a symbol of the failure of academic finance? (A methodological digression). A Methodological Digression
[73] Bloom, R. (2013). Global financial crisis in retrospect. *The CPA Journal*, 83(3), 6.
[74] Bluhm, C., Overbeck, L., & Wagner, C. (2016). Introduction to credit risk modeling. Crc Press.
[75] Blundell-Wignall, A., & Atkinson, P. (2010). Thinking beyond Basel III: Necessary solutions for capital and liquidity. *OECD Journal: Financial Market Trends*, 2010(1), 9-33.
[76] Board of Governors of the Federal Reserve System [BGFRS]. (2019). Supervision and Regulation. Retrieved from https://www.federalreserve.gov/publications/2019-may-supervision-and-regulation-report.htm
[77] Board, F. S. (2014). Key attributes of effective resolution regimes for financial institutions. Financial Stability Board.
[78] Board, F. S. (2020). Global monitoring report on non-bank financial intermediation. Financial Stability Board Report, December, 16.
[79] Boin, A., Hart, P. T., Stern, E., & Sundelius, B. (2016). The politics of crisis management: Public leadership under pressure. Cambridge University Press.
[80] Bonaimé, A. A., Hankins, K. W., & Harford, J. (2014). Financial flexibility, risk management, and payout choice. *The Review of Financial Studies*, 27(4), 1074-1101.
[81] Bonfim, D., & Kim, M. (2012). Liquidity risk in banking: is there herding. *European Banking Center Discussion Paper,* 24, 1-31.
[82] Bordeleau, É., & Graham, C. (2010). The impact of liquidity on bank profitability (No. 2010-38). Bank of Canada.
[83] Borio, C. (2003). Towards a macroprudential framework for financial supervision and regulation?. CESifo *Economic Studies*, 49(2), 181-215.

[84] Borio, C. (2011). Rediscovering the Macroeconomic Roots of Financial Stability Policy: Journey, Challenges, and a Way Forward. *Annu. Rev. Financ. Econ*., 3(1), 87-117.
[85] Borio, C., Furfine, C., & Lowe, P. (2001). Procyclicality of the financial system and financial stability: issues and policy options. BIS papers, 1(3), 1-57.
[86] Boudriga, A., Taktak, N. B., & Jellouli, S. (2010). Bank specific, business and institutional environment determinants of banks nonperforming loans: evidence from mena countries. In Economic research forum, working paper, 547, 1-28.
[87] Brickley, J. A., & Zimmerman, J. L. (2010). Corporate governance myths: Comments on Armstrong, Guay, and Weber. *Journal of Accounting and Economics*, 50(2-3), 235-245.
[88] Bromiley, P., McShane, M., Nair, A., & Rustambekov, E. (2015). Enterprise risk management: Review, critique, and research directions. Long range planning, 48(4), 265-276.
[89] Brunnermeier, M. K. (2009). Deciphering the Liquidity and Credit Crunch 2007-2008. *Journal of Economic Perspectives*, 23(1), 77-100.
[90] Buchak, G., Matvos, G., Piskorski, T., & Seru, A. (2018). Fintech, regulatory arbitrage, and the rise of shadow banks. *Journal of Financial Economics*, 130(3), 453-483.
[91] Buehler, K. S., Freeman, A. W., & Hulme, R. J. (2008). Owning the right risks. *Harvard Business Review*, 86(9), 102-110.
[92] Bushman, R., & Smith, A. (2001). Financial accounting information and corporate governance. *Journal of Accounting and Economics*, 32(1-3), 237-333.
[93] Caglio, A., Dossi, A., & Van der Stede, W. A. (2018). CFO role and CFO compensation: An empirical analysis of their implications. *Journal of Accounting and Public Policy*, 37(4), 265–281.
[94] Calem, P. S., & Rob, R. (1999). The impact of capital-based regulation on bank risk-taking. *Journal of Financial Intermediation*, 8(4), 317-352.
[95] Calomiris, C. W., & Mason, J. R. (2003). Consequences of Bank Distress During the Great Depression. *American Economic Review*, 93(3), 937-947.
[96] Carpenter, M. A., Geletkanycz, M. A., & Sanders, W. G. (2004). Upper echelons research revisited: Antecedents, elements, and consequences of top management team composition. *Journal of Management*, 30(6), 749-778.
[97] Casta, J. F., Lejard, C., & Paget-Blanc, E. (2019, August). The implementation of the IFRS 9 in banking industry. In EUFIN 2019: The 15th Workshop on European Financial Reporting.
[98] Cavico, F. J., & Mujtaba, B. G. (2017). Wells Fargo's fake accounts scandal and its legal and ethical implications for management. *SAM Advanced Management Journal*, 82(2), 4.
[99] Chalermchatvichien, P., Jumreornvong, S., & Jiraporn, P. (2014). Basel III, capital stability, risk-taking, ownership: Evidence from Asia. *Journal of Multinational Financial Management,* 28, 28–46.
[100] Chapelle, A. (2019). Operational risk management: Best practices in the financial services industry. John Wiley & Sons.
[101] Chernobai, A. S., Rachev, S. T., & Fabozzi, F. J. (2008). Operational risk: a guide to Basel II capital requirements, models, and analysis (Vol. 180). John Wiley & Sons.
[102] Choi, J. J., Park, S. W., & Yoo, S. S. (2007). The Value of Outside Directors: Evidence from Corporate Governance Reform in Korea. *Journal of Financial and Quantitative Analysis*, 42(4), 941–962.

[103] Cizel, J., Frost, J., Houben, A., & Wierts, P. (2019). Effective Macroprudential Policy: Cross-Sector Substitution from Price and Quantity Measures. *Journal of Money, Credit and Banking*, 51(5), 1209-1235.
[104] Claessens, S., & Yurtoglu, B. B. (2013). Corporate Governance in Emerging Markets: A Survey. *Emerging Markets Review*, 15, 1-33.
[105] Claessens, S., Djankov, S., Fan, J. P., & Lang, L. H. (2002). Disentangling the incentive and entrenchment effects of large shareholdings. *The Journal of Finance*, 57(6), 2741-2771.
[106] Coccorese, P., & Pellecchia, A. (2009). Multimarket contact and profitability in banking: evidence from Italy. *Journal of Financial Services Research*, 35, 245-271.
[107] Cohen, J. R., Krishnamoorthy, G., & Wright, A. (2004). The corporate governance mosaic and financial reporting quality. *Journal of accounting literature*, 87-152.
[108] Committee of Sponsoring Organizations of the Treadway Commission [COSO] (2017). Enterprise Risk Management – Integrating with Strategy and Performance. Retrieved from https://www.coso.org/Shared%20Documents/2017-COSO-ERM-Integrating-with-Strategy-and-Performance-Executive-Summary.pdf
[109] Committee of Sponsoring Organizations of the Treadway Commission. (2017). Enterprise Risk Management: Integrating with Strategy and Performance - Executive Summary. https://www.coso.org/Shared%20Documents/2017-COSO-ERM-Integrating-with-Strategy-and-Performance-Executive-Summary.pdf
[110] Correia, S. (2014). REGHDFE: Stata module to perform linear or instrumental-variable regression absorbing any number of high-dimensional fixed effects. *Statistical Software Components*, S457874, Boston College Department of Economics, revised 18 Nov 2019.
[111] Crouhy, M., Galai, D., & Mark, R. (2006). The essentials of risk management (Vol. 1). New York: McGraw-Hill.
[112] Cunningham, L. A. (2006). Too Big to Fail: Moral Hazard in Auditing and the Need to Restructure the Industry before It Unravels. Columbia Law Review, 106(7), 1698–1748.
[113] Daud, W. N. W. D., Yazid, A. S., & Hussin, H. M. R. (2010). The Effect Of Chief Risk Officer (CRO) On Enterprise Risk Management (ERM) Practices: Evidence From Malaysia. The International Business & Economics Research Journal, 9(11), 55–64.
[114] De Andres, P., Azofra, S. V., & Lopez, F. J. (2005). Corporate boards in OECD countries: size, composition, functioning and effectiveness. *Corporate Governance: An International Review*, 13(2), 197-210.
[115] Demirgüç-Kunt, A., & Huizinga, H. (2001). Financial structure and bank profitability. Financial structure and economic growth: A cross-country comparison of banks, markets, and development, 243-261.
[116] Demirgüç-Kunt, A., & Huizinga, H. (2010). Bank activity and funding strategies: The impact on risk and returns. *Journal of Financial economics*, 98(3), 626-650.
[117] Demsetz, R. S., & Strahan, P. E. (1997). Diversification, Size, and Risk at Bank Holding Companies. *Journal of Money, Credit and Banking*, 29(3), 300-313.
[118] Dey, P. K. (2002). Project risk management: a combined analytic hierarchy process and decision tree approach. *Cost Engineering*, 44(3), 13-27.
[119] Diamond, D. W., & Dybvig, P. H. (1983). Bank runs, deposit insurance, and liquidity. *Journal of Political Economy*, 91(3), 401-419.
[120] Dietz, S., Bowen, A., Dixon, C., & Gradwell, P. (2016). 'Climate value at risk' of global financial assets. *Nature Climate Change*, 6(7), 676–679.
[121] Dionne, G. (2013). Risk Management: History, Definition and Critique. *Risk Management and Insurance Review*, 16(2), 147-166.

[122] Dionne, G., Chun, O. M., & Triki, T. (2019). The governance of risk management: The importance of directors' independence and financial knowledge. *Risk Management and Insurance Review,* 22(3), 247-277.
[123] Dodd-Frank Wall Street Reform and Consumer Protection Act [DFA], Pub. L. No. 111-203, 124 Stat. 1376 (2010).
[124] Dornbusch, R. (2001). Malaysia: Was it different?. Working Paper 8325. Available at https://www.nber.org/papers/w8325
[125] Draper, N. R., & Smith, H. (1998). *Applied regression analysis* (Vol. 326). John Wiley & Sons.
[126] Drehmann, M., & Tsatsaronis, K. (2014). The credit-to-GDP gap and countercyclical capital buffers: Questions and answers. BIS Quarterly Review, March.
[127] Dupire, M., & Slagmulder, R. (2019). Risk governance of financial institutions: The effect of ownership structure and board independence. Finance Research Letters, 28, 227–237.
[128] Efron, B., & Tibshirani, R. J. (1994). *An introduction to the bootstrap*. CRC press.
[129] Ehiedu, V. C. (2014). The impact of liquidity on profitability of some selected companies: The financial statement analysis (FSA) approach. *Research Journal of Finance and Accounting*, 5(5), 81-90.
[130] Eisenhardt, K. M. (1989). Agency theory: An assessment and review. *Academy of Management Review*, 14(1), 57-74.
[131] Ellis, L., Haldane, A., & Moshirian, F. (2014). Systemic risk, governance, and global financial stability. *Journal of Banking & Finance*, 45, 175-181.
[132] Ellul, A., & Yerramilli, V. (2013). Stronger risk controls, lower risk: Evidence from U.S. bank holding companies. *The Journal of Finance*, 68(5), 1757-1803.
[133] Ellul, A., & Yerramilli, V. (2013). Stronger risk controls, lower risk: Evidence from U.S. bank holding companies. *The Journal of Finance*, 68(5), 1757-1803.
[134] Engle, R. F., & Granger, C. W. (1987). Co-integration and error correction: representation, estimation, and testing. *Econometrica: Journal of the Econometric Society*, 251-276.
[135] Erin, O. & Aribaba, F. (2021). Risk governance and firm value: exploring the hierarchical regression method. *Afro-Asian Journal of Finance and Accounting*, 11(1), 104-130.
[136] Erin, O., Asiriuwa, O., Olojede, P., Ajetunmobi, O. and Usman, T. (2018). Does risk governance impact bank performance? Evidence from the Nigerian banking sector, *Academy of Accounting and Financial Studies Journal*, 22 (4), 1-14.
[137] Erin, O., Asiriuwa, O., Olojede, P., Ajetunmobi, O., & Usman, T. (2018). Does risk governance impact bank performance? Evidence from the Nigerian banking sector. *Academy of Accounting and Financial Studies Journal*, 22(4), 1-14.
[138] Erkens, D. H., Hung, M., & Matos, P. (2012). Corporate governance in the 2007–2008 financial crisis: Evidence from financial institutions worldwide. *Journal of Corporate Finance*, 18(2), 389-411.
[139] Erkens, D. H., Hung, M., & Matos, P. (2012). Corporate governance in the 2007–2008 financial crisis: Evidence from financial institutions worldwide. *Journal of Corporate Finance*, 18(2), 389-411.
[140] European Central Bank - Banking Supervision (2021). Supervisory priorities for 2022-2024. Retrieved July 25, 2023, from https://www.bankingsupervision.europa.eu/banking/priorities/html/ssm.supervisory_priorities2022~0f890c6b70.en.html
[141] European Central Bank [ECB] (2019). Banking supervision. Retrieved from

[142] European Central Bank [ECB] (2020). Guide on Climate-related and Environmental Risks. Retrieved from https://www.bankingsupervision.europa.eu/ecb/pub/pdf/ssm.202011finalguideonclimate-relatedandenvironmentalrisks~58213f6564.en.pdf
[143] European Union [EU] (2013). Directive 2013/36/EU of the European Parliament and of the Council of 26 June 2013 on access to the activity of credit institutions and the prudential supervision of credit institutions and investment firms. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32013L0036&from=EN
[144] Fahlenbrach, R., Prilmeier, R., & Stulz, R. (2012). This time is the same: Using bank performance in 1998 to explain bank performance during the recent financial crisis. *Journal of Finance*, 67(6), 2139-2185.
[145] Fama, E. F., & Jensen, M. C. (1983). Separation of ownership and control. *Journal of law and economics,* 26(2), 301-325.
[146] Fanta, A. B., Kemal, K. S., & Waka, Y. K. (2013). Corporate governance and impact on bank performance. *Journal of Finance and Accounting*, 1(1), 19-26.
[147] Ferrero-Ferrero, I., Fernández-Izquierdo, M. Á., & Muñoz-Torres, M. J. (2012). The impact of the board of directors characteristics on corporate performance and risk-taking before and during the global financial crisis. *Review of Managerial Science*, 6, 207-226.
[148] Financial Stability Board. (2013, November 18). Principles for an Effective Risk Appetite Framework. Retrieved July 25, 2023, from https://www.fsb.org/2013/11/r_131118/
[149] Finkelstein, S., & Hambrick, D. C. (1996). Strategic leadership: Top executives and their effects on organizations. West Publishing Company.
[150] Francis, B. B., and Osborne, M. (2012). Capital requirements and bank behavior in the UK: Are there lessons for international capital standards?, *Journal of Banking and Finance*, 36(3), 803-816.
[151] Fraser, J. R., Quail, R., & Simkins, B. (Eds.). (2021). Enterprise risk management: Today's leading research and best practices for tomorrow's executives. John Wiley & Sons.
[152] Frigo, M. L., & Anderson, R. J. (2009). A strategic framework for governance, risk, and compliance. Strategic Finance, 90(8), 20.
[153] Fungáčová, Z., & Solanko, L. (2009). Risk-taking by Russian banks: Do location, ownership and size matter?. Экономический журнал Высшей школы экономики, 13(1), 101-129.
[154] Gericke, R. C., Gericke, & Torregrosa. (2018). Corporate governance and risk management in financial institutions. Springer International Publishing AG, part of Springer Nature.
[155] Gigerenzer, G., & Gaissmaier, W. (2011). Heuristic Decision Making. *Annual Review of Psychology,* 62, 451-482.
[156] Gontarek, W. (2016). Risk governance of financial institutions: The growing importance of risk appetite and culture. *Journal of Risk Management in Financial Institutions*, 9(2), 120–129.
[157] Gontarek, W., & Belghitar, Y. (2018). Risk governance: Examining its impact upon bank performance and risk-taking. *Financial Markets, Institutions & Instruments*, 27(5), 187–224. https://doi.org/10.1111/fmii.12103.
[158] Gordon, L. A., Loeb, M. P., & Tseng, C. Y. (2009). Enterprise risk management and firm performance: A contingency perspective. *Journal of Accounting and Public Policy*, 28(4), 301-327.

[159] Gormley, T. A., & Matsa, D. A. (2014). Common errors: How to (and not to) control for unobserved heterogeneity. *The Review of Financial Studies*, 27(2), 617-661.
[160] Granger, C. W. (1969). Investigating causal relations by econometric models and cross-spectral methods. Econometrica: *Journal of the Econometric Society*, 424-438.
[161] Greene, W. H. (2003). *Econometric Analysis*. Pearson Education India.
[162] Gropp, R., Mosk, T., Ongena, S., & Wix, C. (2019). Banks response to higher capital requirements: Evidence from a quasi-natural experiment. *The Review of Financial Studies*, 32(1), 266-299.
[163] Grote, G. (2007). Understanding and assessing safety culture through the lens of organizational management of uncertainty. Safety science, 45(6), 637-652.
[164] Hair, J. F., Black, W. C., & Babin, B. J. (2010). Multivariate Data Analysis (7th ed.). Upper Saddle River, NJ: Pearson Prentice Hall.
[165] Haldane, A. G. (2009). Rethinking the financial network. Speech at the Financial Student Association, Amsterdam.
[166] Hambrick, D. C., & Mason, P. A. (1984). Upper echelons: The organization as a reflection of its top managers. *Academy of Management Review*, 9(2), 193-206.
[167] Hermalin, B. E., & Weisbach, M. S. (2003). Boards of directors as an endogenously determined institution: A survey of the economic literature. *Economic Policy Review*, 9(1), 7-26.
[168] Hermalin, B. E., & Weisbach, M. S. (2012). Information disclosure and corporate governance. *The Journal of Finance*, 67(1), 195-234.
[169] Hermalin, B. E., & Weisbach, M. S. (2012). Information Disclosure and Corporate Governance. *The Journal of Finance*, 67(1), 195-233.
[170] Herring, R. J., & Carmassi, J. (2012). The corporate structure of international financial conglomerates: Complexity and its implications for safety and soundness. In A. N. Berger, P. Molyneux, & J. O. S. Wilson (Eds.), The Oxford Handbook of Banking. Oxford Academic. https://doi.org/10.1093/oxfordhb/9780199640935.013.0008
[171] Hillson, D. (2003). Using a risk breakdown structure in project management. *Journal of Facilities Management*, 2(1), 85-97.
[172] Hirtle, B., & Lehnert, A. (2015). Supervisory stress tests. *Annual Review of Financial Economics*, 7, 339-355.
[173] Hsieh, Y. H., & Chen, H. M. (2011). Strategic fit among Business Competitive Strategy, Human Resource Strategy, and Reward System. *Academy of Strategic Management Journal,* 10(2).
[174] https://www.bankingsupervision.europa.eu/home/html/index.en.html
[175] Huizinga, H., Bertay, A. C., & Demirgüç-Kunt, A. (2011). Is the Financial Safety Net a Barrier to Cross-Border Banking?. European Banking Center Discussion Paper, (2011-037).
[176] Hull, J. (2012). Risk management and financial institutions,+ Web Site (Vol. 733). John Wiley & Sons.
[177] International Association of Insurance Supervisors. (2011). ICP 16: Enterprise Risk Management for Solvency Purposes. Retrieved July 25, 2023, from https://www.iaisweb.org/icp-online-tool/13527-icp-16-enterprise-risk-management-for-solvency-purposes/
[178] International Monetary Fund. (2018, September 25). A Decade after the Global Financial Crisis: Are We Safer? Global Financial Stability Report, October 2018. Retrieved July 25, 2023, from https://www.imf.org/en/Publications/GFSR/Issues/2018/09/25/Global-Financial-Stability-Report-October-2018

[179] International Monetary Fund. (2020, April 14). Global Financial Stability Report: Markets in the Time of COVID-19. Retrieved July 25, 2023, from https://www.imf.org/en/Publications/GFSR/Issues/2020/04/14/global-financial-stability-report-april-2020
[180] International Organization of Securities Commissions [IOSCO] (2017). IOSCO Objectives and Principles of Securities Regulation. Available at https://www.iosco.org/library/pubdocs/pdf/IOSCOPD561.pdf
[181] International Risk Governance Center. (2020). Involving Stakeholders in the Risk Governance Process. Retrieved July 25, 2023, from https://irgc.org/wp-content/uploads/2020/10/IRGC-Stakeholder-Engagement-Resource-Guide_Version2_2020-3.pdf
[182] Iqbal, J., Strobl, S., & Vähämaa, S. (2015). Corporate governance and the systemic risk of financial institutions. *Journal of Economics and Business*, 82, 42–61.
[183] Jallali, S., & Zoghlami, F. (2022). Does risk governance mediate the impact of governance and risk management on banks' performance? Evidence from a selected sample of Islamic banks. *Journal of Financial Regulation and Compliance*, 30(4), 439–464.
[184] James, B. J., & Joseph, C. (2015). Corporate governance mechanisms and bank performance: Resource-based view. *Procedia Economics and Finance*, 31, 117-123.
[185] Jensen, M. C., & Meckling, W. H. (2019). Theory of the firm: Managerial behavior, agency costs and ownership structure. *In Corporate governance* (pp. 77-132). Gower.
[186] Jolliffe, I. T. (2002). Principal component analysis. *In International Encyclopedia of Statistical Science* (pp. 1094-1096). Springer.
[187] Jolliffe, I. T., & Cadima, J. (2016). Principal component analysis: a review and recent developments. *Philosophical transactions of the royal society A: Mathematical, Physical and Engineering Sciences*, *374*(2065).
[188] Jones, D. S. (2020). 1MDB corruption scandal in Malaysia: a study of failings in control and accountability. *Public Administration and Policy*, 23(1), 59–72.
[189] Jorion, P. (2000). Risk Management Lessons from Long-Term Capital Management. *European Financial Management*, 6(3), 277-300.
[190] Jorion, P. (2007). Value at Risk: The New Benchmark for Managing Financial Risk. McGraw-Hill.
[191] Kahneman, D., Slovic, P., & Tversky, A. (Eds.). (1982). Judgment under uncertainty: Heuristics and biases. Cambridge university press.
[192] Kaiser-Meyer-Olkin value (KMO value). (2007). In Dictionary of Psychological Testing, Assessment and Treatment.
[193] Kapinos, P. S., Martin, C., & Mitnik, O. A. (2018). Stress testing banks: whence and whither?. *Journal of Financial Perspectives*, 5(1).
[194] Kaplan, R. S., & Mikes, A. (2012). Managing risks: A new framework. *Harvard Business Review,* 90(6), 48-60.
[195] Karanja, E., & Rosso, M. A. (2017). The Chief Risk Officer: a study of roles and responsibilities. *Risk Management*, 19, 103-130.
[196] Karyani, E., Dewo, S. A., Santoso, W., & Frensidy, B. (2020). Risk governance and bank profitability in ASEAN-5: a comparative and empirical study. International *Journal of Emerging Markets*, 15(5), 949-969.
[197] Karyani, E., Kolade, O. & Dewo, S.A. (2020*).* Risk governance, market competition and operational risk disclosure quality: a study of the ASEAN-5 banking sector, *Journal of Operational Risk*, 16(2).

[198] Kaufman, G. G., & Scott, K. E. (2003). What Is Systemic Risk, and Do Bank Regulators Retard or Contribute to It? Independent Review, 7(3), 371-391.
[199] Kim, J. B., Li, Y., & Zhang, L. (2011). CFOs versus CEOs: Equity incentives and crashes. *Journal of financial economics*, 101 (3), 713-730.
[200] Kirkpatrick, G. (2009). The corporate governance lessons from the financial crisis. *OECD Journal: Financial market trends,* 2009(1), 61-87.
[201] Knight, F. H. (1921). Risk, uncertainty, and profit. 31, Houghton Mifflin.
[202] Konchar, S. (2014). The 2012 LIBOR scandal: an analysis of the lack of institutional oversight and incentives to deter manipulation of the world's most "important number." *Transnational Law & Contemporary Problems*, 23(1), 173.
[203] Kose, M. A., Prasad, E. S., & Terrones, M. E. (2006). How do trade and financial integration affect the relationship between growth and volatility? *Journal of International Economics*. 69(1), 176-202.
[204] Kossovsky, N., Greenberg, M., & Brandegee, R. (2012). Reputation, stock price, and you: Why the market rewards some companies and punishes others. Apress.
[205] Kress, J. C. (2018). Board to death: How busy directors could cause the next financial crisis. *BCL Rev*., 59, 877.
[206] Kroszner, R., & Rajan, R. (1994). Is the Glass-Steagall Act Justified? A Study of the U.S. Experience with Universal Banking Before 1933. *The American Economic Review*, 84(4), 810-832.
[207] Krüger, S., Rösch, D., & Scheule, H. (2018). The impact of loan loss provisioning on bank capital requirements. *Journal of Financial Stability*, 36, 114-129.
[208] Laeven, L., & Levine, R. (2009). Bank governance, regulation and risk taking. *Journal of Financial Economics*, 93(2), 259-275.
[209] Laeven, L., Ratnovski, L., & Tong, H. (2014). Bank size and systemic risk. IMF Staff Discussion Note, SDN/14/04.
[210] Lam, J. (2014). Enterprise Risk Management: From Incentives to Controls. John Wiley & Sons.
[211] Li, H., Lam, H. K., Ho, W., & Yeung, A. C. (2022). The impact of chief risk officer appointments on firm risk and operational efficiency. *Journal of Operations Management,* 68(3), 241-269.
[212] Liebenberg, A. P., & Hoyt, R. E. (2003). The determinants of enterprise risk management: Evidence from the appointment of chief risk officers. *Risk management and insurance review*, 6(1), 37-52.
[213] Llewellyn, D. T. (1999). The economic rationale for financial regulation. In: Goodhart, C., & Schoenmaker, D. (Eds.), Financial Regulation: Why, How, and Where Now? (pp. 1-33). Routledge.
[214] Luu, H. N., & Vo, X. V. (2021). The Impact of Supervisory Stress Tests on Bank Ex-Ante Risk-Taking Behaviour: Empirical Evidence from a Quasi-Natural Experiment. *International Review of Financial Analysis*, 75, 101586.
[215] Macey, J. R. (2008). Corporate Governance: Promises Kept, Promises Broken. Princeton, NJ: Princeton University Press.
[216] Magnan, M., & Markarian, G. (2011). Accounting, governance and the crisis: is risk the missing link?. *European Accounting Review*, 20(2), 215-231.
[217] Mallin, C. A. (2016). Corporate Governance. Oxford, UK: Oxford University Press.
[218] Markowitz, H. (1952). Portfolio Selection. *The Journal of Finance*, 7(1), 77-91.
[219] Mayer-Schönberger, V., & Ramge, T. (2018). Reinventing capitalism in the age of big data. Hachette UK.
[220] Merna, T., & Al-Thani, F. F. (2008). Corporate risk management. John Wiley & Sons.

[221] Merrouche, O., & Nier, E. W. (2017). Monetary policy and bank risk-taking: Evidence from the corporate loan market. *Journal of Financial Intermediation*, 30, 35-49.
[222] Merton, R. C. (1973). Theory of Rational Option Pricing. *The Bell Journal of Economics and Management Science*, 4(1), 141-183.
[223] Mikes, A. (2011). From Counting Risk to Making Risk Count: Boundary-Work in Risk Management. *Accounting, Organizations and Society*, 36(4-5), 226-245.
[224] Mikes, A., & Kaplan, R. (2013). Towards a Contingency Theory of Enterprise Risk Management. AAA 2014 Management Accounting Section (MAS) Meeting Paper
[225] Minton, B. A., Taillard, J. P., & Williamson, R. (2014). Do Independence and Financial Expertise of the Board Matter for Risk Taking and Performance? *Journal of Financial and Quantitative Analysis*, 49(2), 351-380.
[226] Mongiardino, A., & Plath, C. (2010). Risk governance at large banks: have any lessons been learned?. *Journal of Risk Management in Financial Institutions*, 3(2), 116-123.
[227] Naceur, S. B., Marton, K., & Roulet, C. (2018). Basel III and bank-lending: Evidence from the United States and Europe. *Journal of Financial Stability*, 39, 1-27.
[228] Nahar, S., Jubb, C., & Azim, M. I. (2016). Risk governance and performance: a developing country perspective. *Managerial Auditing Journal*, 31(3), 250-268.
[229] Nguyen, B. D., & Nielsen, K. M. (2010). The value of independent directors: Evidence from sudden deaths. *Journal of Financial Economics*, 98(3), 550-567.
[230] Nguyen, Q. K. (2022). The impact of risk governance structure on bank risk management effectiveness: evidence from ASEAN countries. Heliyon, 8(10), e11192.
[231] OECD. (2010). *OECD Banking Statistics: Methodological Country Notes 2010*. Retrieved from https://www.oecd.org/
[232] OECD. (2019). OECD Corporate Governance Factbook 2019. Retrieved July 25, 2023, from https://www.oecd.org/daf/ca/OECD-Corporate-Governance-Factbook-2019.pdf
[233] Ojeka, S. A., Adegboye, A., Adegboye, K., Alabi, O., Afolabi, M., & Iyoha, F. (2019). Chief financial officer roles and enterprise risk management: An empirical based study. *Heliyon,* 5(6), e01934.
[234] Onyiriuba, L. (2016). Bank risk management in developing economies: Addressing the unique challenges of domestic banks. Academic Press.
[235] Organisation for Economic Co-operation and Development [OECD] (2015). G20/OECD Principles of Corporate Governance. Retrieved from https://www.oecd.org/corporate/principles-corporate-governance.htm
[236] Pathan, S. (2009). Strong boards, CEO power and bank risk-taking. *Journal of Banking & Finance,* 33(7), 1340-1350.
[237] Pathan, S. (2009). Strong boards, CEO power and bank risk-taking. *Journal of Banking & Finance,* 33(7), 1340-1350.
[238] Pathan, S., & Faff, R. (2013). Does Board Structure in Banks Really Affect Their Performance? *Journal of Banking & Finance*, 37(5), 1573-1589.
[239] Pathan, S., & Faff, R. (2013). Does board structure in banks really affect their performance? *Journal of Banking & Finance*, 37(5), 1573-1589.
[240] Petersen, M. A., & Rajan, R. G. (1994). The benefits of lending relationships: Evidence from small business data. *Journal of Finance*, 49(1), 3-37.
[241] Petersen, Mitchell A. 2008. "Estimating standard errors in finance panel data sets: Comparing approaches." *Review of Financial Studies* 22 (1): 435–80. https://doi.org/10.1093/rfs/hhn053.
[242] Pfleeger, S. L., & Caputo, D. D. (2012). Leveraging behavioral science to mitigate cybersecurity risk. *Computers & Security*, 31(4), 597-611.

[243] Pidgeon, N. (1997). The Limits to Safety? Culture, Politics, Learning, and Man-Made Disasters. *Journal of Contingencies and Crisis Management*, 5(1), 1-14.
[244] Pirson, M., & Turnbull, S. (2011). Corporate governance, risk management, and the financial crisis: An information processing view. *Corporate Governance: An International Review,* 19(5), 459-470.
[245] Pittman, J. A., & Fortin, S. (2004). Auditor choice and the cost of debt capital for newly public firms. *Journal of accounting and economics*, 37(1), 113-136.
[246] Platt, R. H. (2012). Disasters and democracy: The politics of extreme natural events. Island Press.
[247] Power, M. (2007). Organized uncertainty designing a world of risk management. Oxford; Oxford University Press.
[248] Power, M. (2009). The risk management of nothing. *Accounting, Organizations and Society*, 34(6-7), 849-855.
[249] PwC. (2016). Global Economic Crime Survey 2016. Retrieved July 25, 2023, from https://www.pwc.com/gx/en/economic-crime-survey/pdf/GlobalEconomicCrimeSurvey2016.pdf
[250] Renn, O. (2017). Risk governance: coping with uncertainty in a complex world. Routledge.
[251] Renn, O. (2020). Risk governance: From knowledge to regulatory action. Knowledge for governance, 93-111.
[252] Rittenberg, L., Martens, F., & Committee of Sponsoring Organizations of the Treadway Commission. (2012). Enterprise risk management: understanding and communicating risk appetite.
[253] Roberts, M. R., & Whited, T. M. (2013). Endogeneity in empirical corporate finance. *In Handbook of the Economics of Finance*, 2, 493-572.
[254] Rochet, J. C. (2009). Why Are There So Many Banking Crises?: The Politics and Policy of Bank Regulation. Princeton University Press.
[255] Rosen, R. J. (2003). Is three a crowd? Competition among regulators in banking. *Journal of Money, Credit and Banking*, 35(6), 967-998.
[256] Saltelli, A., Ratto, M., Andres, T., Campolongo, F., Cariboni, J., Saisana, D. M., & Tarantola, S. (2008). *Global sensitivity analysis: the primer*. John Wiley & Sons.
[257] Saunders, A., & Cornett, M. M. (2008). Financial Institutions Management: A Risk Management Approach. McGraw-Hill Irwin.
[258] Scheuch, C., Voigt, S., & Weiss, P. (2022). Tidy Finance with R. Available at https://tidy-finance.org/fixed-effects-and-clustered-standard-errors.html
[259] Schoenmaker, D., & Schramade, W. (2019). Investing for Long-Term Value Creation. *Journal of Sustainable Finance & Investment*, 9(4), 356-377.
[260] Schrand, C. M., & Zechman, S. L. (2012). Executive Overconfidence and the Slippery Slope to Financial Misreporting. *Journal of Accounting and Economics*, 53(1-2), 311-329.
[261] Shamsuddin, A., & Xiang, D. (2012). Does bank efficiency matter? Market value relevance of bank efficiency in Australia. *Applied Economics*, 44(27), 3563-3572.
[262] Sheedy, E., & Griffin, B. (2018). Risk governance, structures, culture, and behavior: A view from the inside. *Corporate Governance: An International Review*, 26(1), 4-22.
[263] Shleifer, A., & Vishny, R. W. (1997). A survey of corporate governance. *The Journal of Finance*, 52(2), 737-783.
[264] Sijtsma, K. (2009). On the use, the misuse, and the very limited usefulness of Cronbach's alpha. *Psychometrika*, 74, 107-120.
[265] Simkins, B. (2008). Enterprise risk management: Current initiatives and issues journal of applied finance roundtable. *Journal of Applied Finance*, 18(1), 115.

[266] Sironi, A. (2003). Testing for market discipline in the European banking industry: evidence from subordinated debt issues. *Journal of Money, Credit and Banking*, 443-472.
[267] Srivastav, A. and Hagendorff, J. (2016), *"Corporate governance and bank risk-taking",* Corporate Governance: An International Review, Vol. 24 No. 3, pp.334-345.
[268] Srivastav, A., & Hagendorff, J. (2016). Corporate governance and bank risk-taking. *Corporate Governance: An International Review*, 24(3), 334-345.
[269] Stein, V., Wiedemann, A., & Bouten, C. (2019). Framing risk governance. *Management Research Review*, 42(11), 1224-1242.
[270] Strange, R., Filatotchev, I., Buck, T., & Wright, M. (2009). Corporate governance and international business. *Management International Review*, 49, 395-407.
[271] Stulz, R. M. (2016). Risk management, governance, culture, and risk taking in banks. *Economic Policy Review*, Issue Aug, 43-60.
[272] Šútorová, B., & Teplý, P. (2013). The Impact of Basel III on Lending Rates of EU Banks. Finance a Uver: *Czech Journal of Economics & Finance*, 63(3).
[273] Switzer, L. N., & Wang, J. (2013). Default Risk Estimation, Bank Credit Risk, and Corporate Governance: Default Risk Estimation. *Financial Markets, Institutions & Instruments*, 22(2), 91–112. https://doi.org/10.1111/fmii.12005
[274] Takats, E. (2011). A Theory of "Crying Wolf": The Economics of Money Laundering Enforcement. *Journal of Law, Economics, and Organization*, 27(1), 32-78.
[275] Tarullo, D. K. (2008). Banking on Basel: The future of international financial regulation. Peterson Institute.
[276] Terraza, V. (2015). The effect of bank size on risk ratios: Implications of banks' performance. *Procedia Economics and Finance*, 30, 903-909.
[277] Tricker, B., & Tricker, R. I. (2015). Corporate governance: Principles, policies, and practices. Oxford University Press, USA.
[278] U.S. Congress. (2010). Dodd-Frank Wall Street Reform and Consumer Protection Act, H.R. 4173, 111th Cong. Retrieved July 25, 2023, from https://www.congress.gov/bill/111th-congress/house-bill/4173
[279] U.S. Government Accountability Office. (2013). GAO-14-67, DODD-Frank Regulations: Agencies Conducted Regulatory Analyses and Coordinated but Could Benefit from Additional Guidance on Major Rules. https://www.gao.gov/assets/gao-14-67.pdf
[280] United Nations International Strategy for Disaster Reduction. (2005). Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters. World Conference on Disaster Reduction. Retrieved July 25, 2023, from https://www.unisdr.org/2005/wcdr/intergover/official-doc/L-docs/Hyogo-framework-for-action-english.pdf
[281] Urquhart, A., & Zhang, H. (2022). PhD CEOs and firm performance. *European financial management,* 28(2), 433-481.
[282] Veeramoothoo, S., & Hammoudeh, S. (2022). Impact of Basel III liquidity regulations on US Bank performance in different conditional profitability spectrums. *The North American Journal of Economics and Finance*, 63.
[283] Velez, S., Neubert, M., & Halkias, D. (2020). Banking finance experts consensus on compliance in US bank holding companies: An e-Delphi study. *Journal of Risk and Financial Management*, 13(2), 28.
[284] Walker, D. (2009). A review of corporate governance in UK banks and other financial industry entities. HM Treasury.

[285] Wang, Y. J. (2002). Liquidity management, operating performance, and corporate value: evidence from Japan and Taiwan. *Journal of multinational financial management,* 12(2), 159-169.
[286] Wiley, J., Kenett, R. S., & Raanan, Y. (2010). Operational Risk Management: a practical approach to intelligent data analysis. *Reliability: Theory & Applications*, 5(4 (19)), 57-60.
[287] Woods, M. (2009). A contingency theory perspective on the risk management control system within Birmingham City Council. *Management Accounting Research*, 20(1), 69-81.
[288] Wooldridge, J. M. (2010). *Econometric analysis of cross section and panel data*. MIT Press.
[289] Wooldridge, J. M. (2015). Introductory econometrics: A modern approach. Nelson Education.
[290] World Economic Forum, W. (2019). The global risks report. Geneva, Switzerland: World Economic Forum.
[291] Wright, S., Sheedy, E., & Magee, S. (2018). International compliance with new Basel Accord principles for risk governance. *Accounting & Finance*, 58(1), 279-311.
[292] Yusuf, I., Ahmed Aliyu, I., & Al-Faryan, M. A. S. (2023). Board risk committee composition and risk-taking of deposit money banks in Nigeria. *Cogent Business & Management*, 10(1).
[293] Zagorchev, A., & Gao, L. (2015). Corporate governance and performance of financial institutions. *Journal of Economics and Business*, 82, 17-41.