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Essays on Environmental Responsibility of Financial Intermediaries

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Declaration

I confirm that this thesis is my own work and it is the result of my own achievements unless the contents referenced in the text. I am aware of the University's Guidance on the Use of Unfair Means (www.sheffield.ac.uk/ssid/unfair-means). The material contained in the thesis has not been submitted elsewhere for any other degree or qualification in this or any other institution. However, parts of the thesis have been submitted in various workshops and conferences.

Rasim Simsek
Dec 2022

Abstract

In this thesis, I explore the role of financial intermediaries in climate and environmental issues. The thesis focuses on the climate and environmental responsibilities of financial institutions in three standalone chapters.

Paper 1 compares Islamic Banks (IBs) and Conventional Banks (CBs) based on their corporate governance structures and measures the effects of different corporate governance structures on the extent of Climate-Related Disclosure (CRD). Using a sample of 591 banks (169 IBs and 422 CBs) from 24 countries for the period between 2016 and 2019, I find that the different corporate governance structures in IBs and CBs impact CRD at different levels. The findings suggest that the complex and multi-level corporate governance structure of IBs is associated with a lower level of CRD, while the relatively straightforward corporate governance structure prompts CBs to disclose more information regarding climate and the environment. Further analysis confirms that the board of directors in financial intermediaries resort to increasing the extent of disclosure when the companies experience high levels of information asymmetry.

Paper 2 also compares IBs and CBs regarding the effects of CRD on their financial performance. Using the same sample as Paper 1 for the same period, the findings imply that CRD is associated with financial performance differently in IBs and CBs. Higher CRD improves the financial performance of CBs, as proxied by ROA and ROE, while CRD has a negative relationship with the financial performance of IBs. This negative relationship mainly occurs because engaging in more environmental and climate-related actions, and thus increasing CRD, significantly increases the costs for IBs. Furthermore, the channel analysis suggests that a positive association between CRD and financial performance occurs when information asymmetry is relatively higher in CBs. On the other hand, additional disclosure on the environment and climate plays a negative role in the performance of CBs when transparency has already been achieved.

Paper 3 focuses on the relationship between environmental investments of banks and their risk-taking behaviors. Employing a sample of 6,800 observations of 619 banks from 52 countries for the period between 2010 and 2020, the findings demonstrate that higher levels of environmental investments disrupt the stability of banks by increasing their risk-taking tendencies. However, further analysis shows that a heterogeneously composed board of directors, taking board age, gender, board tenure, and financial expertise into account, reverses this negative relationship between environmental investment and bank risk-taking. I find that a heterogeneously constructed board of directors continues to decrease the riskiness of banks even in the presence of high levels of environmental investments.

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Acronyms

AGW Anthropogenic Global Warming

CB Conventional Bank

CDP Carbon Disclosure Project

CEO Chief Executive Officer

CGI Corporate Governance Index

CRD Climate-Related Disclosure

CSR Corporate Social Responsibility

ESG Environmental, Social, and Governance

FSB Financial Stability Board

GDPPC Gross Domestic Product per Capita

GHG Greenhouse Gas

GMM Generalized Method of Moments

$GtCO_2e$ Gigatonnes of CO_2 Equivalent

IAH Investment Account Holder

IB Islamic Bank

IFSB Islamic Financial Services Board

IIFS Islamic Financial Services

IRR Investment Risk Reserves

IV Instrumental Variable

OLS Ordinary least squares

PER Profit Equalization Reserves

PLS Profit and Loss Sharing

RAN Rainforest Action Network

ROA Return on Assets

ROE Return on Equity

SSB Sharia Supervisory Board

TCFD Task Force on Climate-Related Financial Disclosure

UNFCCC United Nations Framework Convention on Climate Change

Introduction

1 Background

The Earth, which is the only known planet that humankind can live on, has already taken a considerable way to lose its peacefulness. Global warming has started to show its effect more seriously, and climate-related disasters have got worse year by year. Apart from the most important effects of these disasters threatening human lives, they have the power of destroying the regular life of local residents and causing huge amounts of expenses for governments, financial institutions, businesses, and individuals.

The need to do something about climate change has reached a situation that must not be ignored any more if climate change is wanted to overcome[1]. The most important step taken with Paris Agreement which was negotiated by 196 parties on 12 December 2015 and entered into force on 4 November 2016. Paris Agreement has been adopted by 194 members of the United Nations Framework Convention on Climate Change (UNFCCC) as of October 2022. The long-term target of the Paris Agreement is to keep global temperature increase under 2 °C or preferably limit the increase to 1.5 °C by 2100. One of the most important stepstone achieving these goals is to cut global emissions at significant levels which have not succeeded as of today. Although a reduction in emissions by 45% by 2030 and the net zero carbon emissions target by 2050 is still possible (Deutch, 2020), the current ambitions and determinations of both governments and private sectors for these targets seem insufficient and poor.

Achieving the targets of the Paris Agreements cannot be successful without the contributions of financial institutions. Financial institutions are the crucial component in fulfilling the proposed and accepted targets besides governments and the sectors specifically relates to climate-related issues such as gas and oil or agriculture sectors[2]. The fight against climate change would be more effective in case of the banks set strongly motivated policies and formulate their business and economic plans accordingly. However, the reports published by environmental non-profit organizations (e.g., Banking on Climate Chaos 2021 by Rainforest

[1]There is a debate on global warming in the literature. While one group suggest the global temperature is changing as a natural process, the another group argue that temperature increase occurs unnaturally and mainly because of the human actions. The Anthropogenic Global Warming (AGW) is discussed in the General Appendices A.

[2]The role of the financial intermediaries on AGW is discussed in General Appendices B.

Action Network (RAN), The Time to Green Finance 2020 by Carbon Disclosure Project (CDP)) demonstrate that banks have not been putting promising efforts nor setting realistic targets in line with the aims of the Paris Agreement. The majority of the biggest financial institutions do not have a current convincing oil and gas, and coal policy, and they have been continuing to pour more and more funds every year into companies with the worst fossil fuel expansion plans from the oil and gas, and coal sectors.

This thesis aims to investigate the causes and consequences of the environmental-climate responsibility of the banks. Throughout the thesis, I search for answers to different topics and questions; the corporate governance structure that leads banks to disclose more information about their perspective regarding the climate and environment, the effects of engaging the climate and environmental responsibility and providing this information through their annual reports on the accounting financial profitability, and finally the effect of environmental investments on their risk-taking behaviours and the moderating effect of the heterogeneity of the board of directors in this relationship.

2 Research Questions

This thesis aims to explore the environmental responsibility engagement, as indicated by disclosure and performance scores, in financial institutions. This section provides insights for each paper included in this thesis. Table 1 summarizes these three standalone research.

i. Paper 1

Paper 1 addresses the topic of climate-related disclosures (CRD) in Islamic Bank (IB)s and Conventional Bank (CB)s. Throughout Paper 1, the aim is to find answers to the questions of "*Are IBs and CBs aware of climate-related issues and do they mention these issues in their reports?*" and "*Do corporate governance structures of IBs and CBs play a role in CRD of these banks?*" The second question is particularly important, given that IBs adopt a different corporate governance structure compared to CBs due to the need to address different types of agency problems and legitimacy concerns[3]. Besides the board of directors, IBs establish another level of authority called the Sharia Supervisory Board (SSB). The main objective of

[3]The agency problems in CBs and IBs are discussed in General Appendices C.

Table 1: Summary of Paper 1, Paper 2, and Paper 3

	Research Questions	Key Hypotheses	Sample	Dependent Variables	Explanatory Variables	Methodology	Main Findings
Paper 1	Do corporate governance structures of IBs and CB play a role in CRD of these banks?	**H**: The corporate governance structures of CBs and IBs affect the level of CRDs differently.	591 Banks 169 IBs 422 CBs 24 Countries 2016-2019	CRD	CGI, CB·CGI	Panel Regression, OLS Estimator	CGI improves the CRD in CBs while IBs with complex corporate governance structure is associated with low-level CRD.
Paper 2	What is the effect of CRD on the financial performance of the IBs and CBs?	$\mathbf{H_1}$: CRD positively affects the performance of CB. $\mathbf{H_2}$: CRD negatively affects the performance of IBs	591 Banks, 169 IBs 422 CBs, 24 Countries, 2016-2019	ROA, ROE	CRD	Panel Regression, Random Effect, GLS Technique	CRD improves the performance in CBs while it deteriorates the financial performance in IBs by making them more expensive.
Paper 3	What is the moderating role of BoardHet on the relationship between EnvIns and risk-taking?	**H**: BoardHet moderates the relationship between EnvIns and risk-taking positively.	619 Banks, 52 Countries, 2010-2020	Z-Score	EnvIns, BoardHet, EnvIns·BoardHet	Panel Regression, OLS Estimator	EnvIns exacerbates bank risk-taking. Heterogeneous board moderates this negative relation by improving EnvIns and alleviating risk-taking.

IBs: Islamic Banks; CBs: Conventional Banks; CRD: Climate-Related Disclosure; CGI: Corporate Governance Index; OLS: Ordinary Least Squares; ROA: Return on Assets; ROE: Return on Equity; GLS: Generalized Least Squares; BoardHet: Board Heterogeneity; EnvIns: Environmental Investment.

SSB is to monitor and control the compatibility of the actions and decisions taken at the directors' or executives' level according to Sharia rules and principles. In this regard, SSBs constrain, endorse, or disapprove these actions and decisions to ensure Sharia compliance of the IBs. Therefore, SSBs in IBs play a critical role in ensuring the legitimacy of the IBs in the eyes of stakeholders and mitigating agency problems. IBs could face serious problems, such as losing all credibility, if they fail to maintain high levels of legitimacy and experience high levels of agency problems.

The main objective of Paper 1 is to provide insight into how the corporate governance of IBs and CBs responds to the current climate and environmental crises, and the level of disclosure they provide regarding these issues in their annual reports. A large number of studies (such as Beekes and Brown 2006; Botosan et al. 2004; Chan et al. 2014; de Villiers et al. 2011; Giannarakis et al. 2020; Haniffa and Cooke 2005; Liao et al. 2015) investigate the effect of corporate governance on the disclosure practices and policies of firms, with the majority of researchers finding a positive association between effective and better corporate governance and the level and extent of disclosure. I hypothesize that CBs with plain and less complex corporate governance structures have a higher level of disclosure, while IBs require more time for decision-making and action-taking compared to CBs due to their complicated and rigid corporate governance structure. In this section, I construct and create my own index to measure corporate governance efficiency and CRD in IBs and CBs.

ii. Paper 2

Paper 2 deals with the question "*What is the effect of CRD on the financial performance of IBs and CBs?*" A considerable amount of literature has been published on environmental disclosure and financial performance[4]. However, a consensus regarding the effect of environmental disclosure on the financial performance of a firm has not yet been reached, as the results of studies have suggested contradictory findings.

[4]See Al-Tuwaijri et al. 2004; Ambec and Lanoie 2008; Barnett and Salomon 2006; Bernardi and Stark 2018; Clarkson et al. 2008; Delmas et al. 2015; Friedman 1970; Griffin et al. 2017; Hillman and Keim 2001; Hull and Rothenberg 2008; Jacobs et al. 2010; Jensen 2002; Kang et al. 2016; Lorraine et al. 2004; Lu and Abeysekera 2014; Margolis and Walsh 2003; Matsumura et al. 2014; Mcguire et al. 1988; McWilliams and Siegel 1997; Orlitzky et al. 2003; Patten 2002; Qi et al. 2014; Qiu et al. 2016; Russo and Fouts 1997; Saeidi et al. 2015; Surroca and Tribó 2008; Tang et al. 2012; Vishwanathan et al. 2020; Waddock and Graves 1997; Xie et al. 2017, 2019 for recent studies in the literature.

Different theories have been widely cited in the literature to explain the positive and negative effects of environmental disclosure and performance on the profitability of firms. On one hand, firms could improve their image and reputation by using environmental disclosures as a means of demonstrating the alignment between the society's interests and the company (Brown and Deegan, 1998; Dowling and Pfeffer, 1975; Guidry and Patten, 2012; Hooghiemstra, 2000; O'Donovan, 2002; Patten, 1991, 2002). Furthermore, disclosing non-voluntary information to maximize stakeholder benefits and respond to the concerns of environment-sensitive stakeholders is an important responsibility of managers in the company (Brammer and Pavelin, 2006; Chen and Roberts, 2010; Cormier et al., 2004; Gray et al., 1995; Huang and Kung, 2010; Roberts, 1992; Ullmann, 1985).

On the other hand, this relationship could be established differently in IBs. Some researchers suggest that environmental activities and the performance of the company could lower the financial performance of the company (Barnett and Salomon, 2006; Cai et al., 2016; Chiaramonte et al., 2022; Friedman, 1970; Jensen, 2002; McWilliams and Siegel, 1997). According to the over-investment theory, the environmental performance of the company increases the costs of the company, which reduces its competitive ability and advantages in the market. IBs do not possess the same competitive power as CBs; they are less stable, less cost-effective, less diversified, less hedged, less competitive, operate with higher costs, have less market power, and have a less effective business model compared to CBs (Ariss, 2010; Beck et al., 2013; Čihák and Hesse, 2010; Johnes et al., 2014; Meslier et al., 2017). Environmental disclosure linked to environmental performance could increase costs in IBs relatively more than the financial benefits of environmental disclosure. Therefore, environmental disclosure could have a negative impact on the financial performance of IBs compared to CBs.

iii. Paper 3

Finally, Paper 3 explores the relationship between environmental investment and bank risk-taking behaviours. Although the existing literature provides evidence of a positive relationship between the Environmental, Social, and Governance (ESG) performance of banks and their risk-taking behaviours (Chiaramonte et al., 2022; Di Tommaso and Thornton, 2020; Gangi et al., 2019), the relationship between environmental performance and risk-taking ex-

hibits differences in these studies. Considering the fact that green investments have not yet provided sufficient returns in many sectors except for the utility sector (Kruse et al., 2020), the green market is still considered ineffective in capturing new investors' attention. Furthermore, Davis-Peccoud et al. (2016) shows that the success rate of sustainability programs and initiatives is very poor, with around 98% of these programs and initiatives failing to meet expectations. Therefore, a higher amount of environmental investment by banks could increase their level of riskiness. In this paper, I assess the effect of the level of environmental investment on the risk-taking behaviours of banks.

The board of directors plays a crucial role in managing the risk-taking behavior of the bank (Jensen, 1993; Bhagat and Bolton, 2008), while the composition of the board of directors is an important factor in determining the quality of this internal control mechanism for risk-taking (Fama, 1980; Fama and Jensen, 1983). Following Webber and Donahue (2001), Harjoto et al. (2015), and Harjoto et al. (2018), I construct a board heterogeneity index to assess the composition of the board of directors using both relation-oriented attributes (age and gender) and task-oriented attributes (board tenure and financial expertise).

After exploring the relationship between environmental investment and bank risk-taking, I measure the moderating effect of the board of directors' heterogeneity, proxied by board age, gender, tenure, and financial expertise, on this relationship. I hypothesize that having a heterogeneous board of directors with dynamic, open-minded, diversified, and stakeholder-friendly members would create the necessary link, relatedness, recognition, and empathy to understand the needs of stakeholders. This would make it easier to align the company's and its stakeholders' interests, leading firms to increase their environmental investments. On the other hand, this board of directors could mitigate the risk exposure that arises from a high level of environmental engagement by conducting strict and effective monitoring and control activities.

3 Contribution to the Literature

This thesis makes several contributions to the literature on climate-related disclosures from both the perspectives of IBs and CBs, along with the relationship between corporate governance and financial performance. It also delves into the impact of environmental per-

formance, proxied by environmental investment, on financial performance and risk-taking behaviours of banks.

Paper 1 contributes to the ongoing debate on the corporate governance of IBs and CBs. While there are numerous theoretical and normative studies that compare the corporate governance structures of IBs and CBs, empirical evidence on this topic is relatively scarce. Paper 1 utilizes unique data on corporate governance and climate-related disclosures, collected manually from the banks' annual reports. Additionally, this study employs a distinct measure to assess the climate sensitivity of both IBs and CBs, differing from existing literature.

Paper 2 contributes to the literature on environmental responsibility and financial performance of CBs and IBs. Most studies focus on broader concepts like corporate social responsibility (CSR) or environmental, social, and governance (ESG) factors (e.g., Aribi and Gao 2010; Platonova et al. 2018), whereas Paper 2 specifically investigates the climate-related performance of banks and its impact on their financial performance. Hence, this study provides more explicit evidence regarding the relationship between climate-related disclosures and financial performance. Similarly to Paper 1, unique hand-collected data on climate-related disclosures are utilized.

Paper 3 contributes to the literature on environmental investment, proxied by environmental performance, and risk-taking behaviors of banks. To the best of my knowledge, only three studies exist on the relationship between environmental performance and bank risk-taking. While Chiaramonte et al. (2022) and Di Tommaso and Thornton (2020) explore this relationship in European banks, Gangi et al. (2019) employs an international sample. However, the sample size in Gangi et al. (2019) includes fewer banks from fewer countries, and they cover a narrower period compared to this study. Additionally, Paper 3 assesses the moderating effect of board of directors' heterogeneity, which is a novel contribution. It is the first study to explore the impact of a heterogeneous board on the relationship between bank risk-taking and environmental investment.

The environmental responsibility and engagement of financial institutions are crucial in addressing current climate-related issues. Achieving the net-zero emission target by 2050 is nearly impossible without financial institutions committing to reducing their financed emissions and taking necessary steps to mitigate greenhouse gas emissions. Overall, this thesis

makes important contributions to the environmental responsibility of financial institutions. Throughout the thesis, the causes and effects of environmental responsibility and engagement by financial institutions are explored in-depth.

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Paper 1

Corporate Governance Structure and Climate-Related Disclosure: Conventional Banks vs. Islamic Banks

Abstract

This paper focuses on examining the impact of different corporate governance structures in Conventional Banks (CBs) and Islamic Banks (IBs) on Climate-Related Disclosure (CRD). Using a unique dataset encompassing CRD and corporate governance structures of CBs and IBs from 2016 to 2019, the study finds that corporate governance structures affect CRD differently in these two types of banks. The findings indicate that the relatively less complex corporate governance structure of CBs facilitates greater disclosure of climate-related information compared to IBs. This study is the first to investigate the influence of different governance systems between CBs and IBs on CRD, highlighting the complexity of the governance system in IBs due to their adherence to Sharia compliance. This complexity acts as a barrier to achieving a higher level of CRD in IBs. The study contributes to the literature on stakeholders and legitimacy theories and holds important implications for climate change, particularly in relation to the Paris Accord and COP26. It sheds light on the policy implications of sustainable financial markets and the role of the financial services sector. By revealing the sensitivity of corporate governance systems in CRD for CBs and IBs, the study challenges the legitimacy of the Islamic banking system concerning climate change. Additionally, it provides valuable insights for policymakers and practitioners.

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1 Introduction

Climate change, as one of the major challenges of the twenty-first century, has enjoyed significant attention from researchers and practitioners alike. The Kyoto Protocol (1997) and the Paris Agreement (2015) are amongst notable attempts to combat climate change. More recently (in 2017), the Financial Stability Board (FSB) launched the Task Force on Climate-Related Financial Disclosure (TCFD) for corporate climate-related risk reporting. An extant body of literature suggests that stakeholder groups put firms under enormous pressure to be more active in mitigating climate change (Bui and de Villiers, 2017; Bui et al., 2020). In this context, environmental responsibility actions and Climate-Related Disclosure (CRD) have become important elements for institutional and individual investors (Bui and de Villiers, 2017; de Villiers and van Staden, 2010). In the same vein, the existing studies suggest that stakeholders are the most important driving force in CRD of the firms (Caby et al., 2020). Thus, regulators are increasingly requiring firms to disclose their impact on the environment, as well as their actions to tackle the negative impact of climate change.

Banks play a key role in the transformation of economies to low carbon or net-zero emissions through sustainable finance and green banking. How do banks do this difficult job? Extant research on corporate governance suggests that the board of directors plays an important role in serving not only the shareholders (Beasley, 1996) but also the stakeholders through monitoring and controlling management actions and decisions (Anderson et al., 2004). In the wake of climate change, the role of bank boards is more important than ever before. Disclosure of climate-related information has come to the spotlight due to the pressure from stakeholders after the TCFD was launched in 2017. Likewise, bank boards of directors are under serious pressure by the stakeholders for the transformation towards more sustainable practices that contribute towards climate change mitigation and adaptation. This study aims to investigate the effects of various corporate governance structures of the different bank types on CRD.

A strand of corporate governance literature suggests that an effective board of directors is likely to increase the quality of financial disclosure (Chau and Gray, 2010; Eng and Mak, 2003; Gul and Leung, 2004; Haniffa and Cooke, 2002; Laksmana, 2008; Mallin and Ow-Yong, 2012). Likewise, another strand of literature stresses that better corporate governance affects

environmental disclosure positively. For example, Ben-Amar and McIlkenny (2015) show that board effectiveness increases the firm's carbon disclosure quality among Canadian firms. Meanwhile, by investigating the associations between climate change disclosure and corporate governance, Reid and Toffel (2009) show that the board of directors is one vital organ that secures the flow of useful and necessary information to the stakeholders. Yet, to the best of my knowledge, there has been no attempt made to explore whether board governance helps to improve CRD. This study is different from previous studies as mentioned before because it is the first study to investigate the effect of different corporate governance structures between CBs and IBs on CRD. The uniqueness of the paper is the comparison of the governance structure of the IBs and CBs and the examination of the effect of governance structures of these banks on CRD.

IBs and CBs are significantly different in their business models as they operate under different corporate governance systems. Abedifar et al. (2013) argue that even traditional finance methods of IBs, which are non-Profit and Loss Sharing (PLS) contracts peculiar to IBs, are complicated and not as straightforward as CBs contracts. For example, instead of issuing a loan directly to the customers, which is the regular procedure in CBs, IBs sell a particular good (e.g., diamond) to the customer who requests a loan on a deferred payment basis. Then, IBs buy the good on a cash basis at a lower price than the selling price. Therefore, while the customer obtains the cash, the customer is in debt and needs to pay it in installments for a decided period. In many cases, IBs appoint the customer as their agent to purchase that good or project in the name of the bank. This difference in the contracts of these two types of banks arises from the requirement of Sharia Law. However, strict compliance with Sharia principles not only makes IBs' products and contracts complicated but also transforms the governance system of IBs into a more complex structure compared to CBs. Mollah and Zaman (2015) suggest that an additional disparate monitoring routine exists in IBs to control whether Sharia compliance is achieved by Sharia Supervisory Board (SSB), which could perform either a supervisory or advisory role. Every action and contract of the IBs must be in compliance with Sharia rules and principles, or else the legitimacy of the IBs is questioned by the customers of IBs (Ullah et al., 2018). Therefore, SSBs carry a great burden of responsibility to ensure that IBs are operated in line with Sharia law; SSBs

investigate the operations and contracts of the IBs in detail. Compared to this multilevel and intertwined corporate governance structure in IBs, CBs are expected to be more open in adopting new processes since their corporate governance structure appears to be more straightforward, while the multidimensional concept of the corporate governance structure of IBs turns itself into a more complex system. Thus, one would argue that CBs would be more flexible in adopting CRD compared to IBs, and hence, a positive impact of the corporate governance system in CBs is expected on the CRD.

This study aims to examine the effect of different corporate governance systems between conventional and Islamic systems on CRDs. To achieve this objective, I use hand-collected data for a sample of 591 banks (169 IBs, 422 CBs) from 24 countries for the period 2016-2019. I construct a Corporate Governance Index (CGI) using six different board of directors' characteristics (board size, board independence, board meeting, meeting attendance rate, board committees, and woman directors) to capture the corporate governance structure, as well as a CRD index that contains 29 different items under five categories. The data collection process for these two indices is based on hand collection since the databases provide insufficient data, especially board of directors' information for the IBs; I have searched every single annual report published by IBs and CBs to collect board of directors' information. I find that higher corporate governance scores are associated with higher CRD in CBs compared to IBs, which supports my hypothesis that the complexity of the corporate governance affects the environmental performance and thus CRD. One possible explanation for this result is that the legitimacy concerns of the IBs prevent them from acting fast without considering Sharia principles and obtaining approval from SSBs. Furthermore, the endorsement of CRD by the board of directors in CBs decreases the level of information asymmetry in CBs more than in IBs, as it increases transparency by revealing useful and adequate climate-related information. Consequently, the agency costs for CBs are mitigated relative to IBs (Healy and Palepu, 2001; Huang and Zhang, 2012). Accordingly, I reveal that a higher level of CRD channels through information asymmetry.

This study is the first to examine the effects of corporate governance structures on CRD in CBs and IBs. While the theoretical comparisons of corporate governance structures between CBs and IBs (e.g., Abu-Tapanjeh 2009; Choudhury and Hoque 2006; Grais and Pellegrini

2006b,a; Hassan 2011; Lewis 2005; Safieddine 2009; Shibani and De Fuentes 2017) outnumber practical comparisons (Aslam et al., 2021; Mollah and Zaman, 2015; Safiullah and Shamsuddin, 2019), the literature relatively lacks empirical evidence on the effects of these differences. Therefore, this study fills a significant research gap in the literature. Shedding light on these areas would provide a clear understanding of the effects of the composition of the board of directors in different corporate governance structure environments.

There is an extant body of literature that investigates the effect of different governance systems between CBs and IBs on risk-taking and performance (Farag et al., 2018; Mollah and Zaman, 2015; Mollah et al., 2017, 2021a). However, this study implements a similar empirical setting in investigating the effect of different corporate governance systems between CBs and IBs on corporate CRD. Thus, this study attempts to move the conversation on the comparative governance between CBs and IBs a step ahead by spotlighting the CRD issue.

This study, further, employs a key theoretical framework which is legitimacy theory as a guide to discover the relationship between corporate governance structure and CRD in CBs and IBs. Understanding how CBs and IBs address societal concerns and expectations by disclosing climate-related information would uncover the role of corporate governance in enhancing legitimacy. By analyzing the effectiveness of governance mechanisms such as board size, independence, composition, or practices, I can gain insights into how these structures align management's incentives with shareholder interests, fostering transparency in CRD. Integrating this theoretical framework into the analyses of this study would provide a comprehensive understanding of the relationship between corporate governance structures and CRD in CBs and IBs, contributing to the broader literature on corporate governance, sustainability, and the role of banks in addressing climate change.

The empirical findings of this study provide valuable insights into the relationship between corporate governance structures and CRD in CBs and IBs, grounded in the framework of legitimacy theory. My analysis reveals that the corporate governance index, composed of various mechanisms such as board size, independence, board meeting attendance, board committees, and the presence of women directors, significantly influences the level of CRD in CBs. However, in the case of IBs, this index does not exert the same influence due to a distinctive legitimacy concern: Sharia compliance. Sustaining the legitimacy of Shariah is of

utmost importance for IBs, which leads them to construct corporate governance frameworks with stringent monitoring of compliance. Nevertheless, this unique corporate governance structure in IBs adds complexity and diminishes the effectiveness of the board of directors. These findings underscore the relevance of legitimacy theory in explaining how corporate governance structures shape disclosure behaviors, enabling CBs and IBs to address societal concerns and maintain their legitimacy. By consistently integrating the theoretical discussions of legitimacy theory throughout my thesis, I strengthen the theoretical underpinnings of my study and contribute to the existing knowledge on the role of corporate governance in CRD practices.

Furthermore, unlike the existing studies, this study addresses endogeneity more rigorously by employing the Instrumental Variable (IV) method, propensity score matching (PSM), among others. The study also tackles the issues surrounding omitted variables and sample selection bias, and reverse causality carefully. The study also establishes that the causality channels through information asymmetry. After all robustness checks and endogeneity tests, the study shows that the causality stems from different governance systems between CBs and IBs. Finally, the study makes important contributions by presenting a unique dataset. In particular, NVivo is used as a machine learning technique to generate climate-related data from annual reports. Apart from the climate-related data, the data gather corporate governance data (board and Chief Executive Officer (CEO)-related items) through hand-collected items.

The remainder of the paper is structured as follows. Section 2 provides the theoretical framework and hypothesis while Section 3 specifies the sample, data, and the model applied in this study. Section 4 includes the empirical result, and finally, Section 5 presents the conclusion.

2 Theoretical Framework and Hypothesis Development

2.1 Role of the Banks on the Climate Problem

There are ongoing debates and discussions on climate change. Cook et al. (2016) argue that human-caused recent global warming is largely shared by various researchers and experts;

between 90% and 100% of the climate scientists accept that humans' actions are the main cause of the recent global warming. Beyond that, Cook et al. (2016) advocate that "it doesn't matter if the consensus number is 90% or 100%. The level of scientific agreement on AGW is overwhelmingly high because the supporting evidence is overwhelmingly strong." (pg. 6)

Climate change has been threatening all forms of life around the globe (Allen et al., 2009; Lash and Wellington, 2007). The global campaigns (such as 'New Plastic Economy' by Ellen MacArthur Foundation) that aim to raise awareness against climate change and environmental degradation have become more popular than ever, and more and more people have been understanding the importance of showing a reaction against these issues (Ballew et al., 2019). This realization of the people also leads them to put pressure on corporations and organizations to act more actively about adapting and mitigating climate change because it is obvious that the main source of climate change and environmental degradation is the corporations.

From the financial perspective, the Banking on Climate Chaos (2021) report published in March 2021 by BankTrack shows that the 60 largest private sector banks from the globe invested around US$3.8 trillion into fossil fuel projects in a 4-year period from 2016 to 2020. Furthermore, only 100 companies that are leading fossil fuel consumption and greenhouse gas emissions have utilized almost 40% of the total investment amount. In the same report, banks' policies on finance emission are also investigated, and the result does not seem optimistic; the majority of the banks have weak policies in subjects such as 'commitment to zero out financed emission', 'intermediate commitment to cut financed emission', or 'financed emission measurement and disclosure'.

Corporations have a critical role in the existence of climate-related issues and environmental degradation. The banking sector is a vital agency in this scene since banks are one of the biggest financial supporters and the major capital and funds providers for some sectors, industries, and corporations contributing to anthropogenic climate change as the Banking on Climate Chaos (2021) report exemplifies. Therefore, banks' positions on climate change carry the weight for other companies from various sectors as well since they decide which operations and what activities to finance (Caby et al., 2020). During the 2008 global crisis, the importance of the banking and financial sectors for other sectors and the whole econ-

omy was experienced. Banks' tendency on climate-related issues undertakes an important role in fighting these issues. The realization of the existence and consequences of AGW and the need to act immediately against it have made customers, investors, suppliers, and other stakeholders start to have a non-negotiable attitude regarding acting against climate change (Bui and de Villiers, 2017; Bui et al., 2020).

Besides the institutional and governmental pressure (Kyoto Protocol, Paris Agreement, TCFD), there is an increasing demand from communities as well. Hence, environmental responsibility actions and disclosures of the companies have become essential actions to meet the demand of institutional and individual investors (Bui and de Villiers, 2017; de Villiers and van Staden, 2010). To satisfy the demand of society on climate-related issues is also important to sustain legitimacy in stakeholders' eyes (Dowling and Pfeffer, 1975). Consequently, apart from the profound risks of exposing climate-related issues, banks need to take actions to de-escalate the momentum of climate change, environmental deterioration, and pollution. Similarly, they are expected to provide useful, relevant, and adequate information about the actions, plans, policies, and principles against climate-related information. This is not only a requirement of international and national regulations and legislation but also to satisfy stakeholders' apprehensions and concerns.

2.2 Theoretical Framework

Legitimacy theory has been widely used in the literature to explain the disclosure attitudes for social responsibility and environmental subjects (Archel et al., 2011; Deegan et al., 2002; Haniffa and Cooke, 2005; Chan et al., 2014). Legitimacy theory is defined as the alignment of an organization's actions and operations with the bonds, norms, values, beliefs, definitions, and moral and ethical codes of society (Suchman, 1995). Deegan (2002) state that the foundation of legitimacy theory rests on a 'social contract' existing between corporations and the society in which they conduct their businesses. This social contract is as important as legislation and regulations, as laws set out the explicit terms for corporations, while societal demands construct the implicit terms of corporations (Deegan, 2002). Therefore, the inevitable end for organizations ignoring societal beliefs, values, and norms is to cease to exist; it is impossible to maintain existence without ensuring society's approval (Maignan

and Ralston, 2002). Consequently, the management of organizations aims to achieve harmony between the aims and actions of the organizations and those of society (Dowling and Pfeffer, 1975) or its stakeholders (Haniffa and Cooke, 2002). Sethi (1979) coins the term 'legitimacy gap', which occurs when corporations cannot meet some of society's values. This might happen because of differences between the values of the organization and society, or because organizations cannot keep up with some values and expectations that can change constantly and quickly.

Legitimacy theory is the basis of analysis in this study because organizations resort to disclosing social information not only for economic favor, but also to ensure their legitimacy in society by showing that they operate in alignment with society's desires (Deegan et al., 2002). Bridges (2004) argues that having a legitimacy gap poses a dire threat to corporations, while ensuring legitimacy among society establishes an enviable image, trust, and reputation, leading to positive outcomes in profitability, share prices, and firm value.

This expectation holds true for CBs; however, IBs have a different scenario due to the distinct expectations society has for these two types of banks. This difference, like others, arises from Sharia, which prohibits IBs from violating Shariah under any circumstances. Unlike CBs, the corporate governance structure of IBs requires construction that considers the importance of obeying Sharia law without any exceptions. This is crucial because compliance with Sharia principles plays a vital role in the preference of most investors and depositors for IBs over CBs. Obeying Sharia is more important to these customers than the rate of return provided by banks (Dusuki and Abdullah, 2007; Rehman and Masood, 2012). Therefore, one of the primary concerns of depositors, investors, and borrowers of IBs is whether all operations, business activities, and transactions of IBs are 100% Sharia-compliant (Khan et al., 2007), which can be accomplished by avoiding transactions involving riba, gharar, maysir, or any other haram, and committing to obligated transactions and activities such as Zakat. Grais and Pellegrini (2006b) argue that contravening Sharia principles would significantly damage the image and reputation of IBs among Sharia-sensitive customers. In fact, maintaining moral and religious legitimacy, which is a primary concern for many customers and other stakeholders, is impossible without implementing an effective and efficient Sharia governance structure (Ullah et al., 2018). These characteristics of IBs are also the reasons

for having an extra corporate governance layer in these banks, known as Sharia supervisory boards (SSB), to ensure Sharia compliance for the banks' stakeholders (Grais and Pellegrini, 2006b).

This multi-layered, rigid, and dense corporate governance structure of the IBs might enhance the level of information disclosed by the IBs and support the legitimacy theory better in IBs. However, the problem is that this compact corporate governance structure of IBs might also make these banks relatively unwieldy. While CBs might commit an act quickly whenever the legitimacy gap is not the case and the positive outcome is apparent, IBs consult SSBs first and obtain a 'fatwa' that legitimises the actions and operations in the eyes of the community. Therefore, I expect less information to be disclosed by IBs compared to CBs because of the Sharia orientation of IBs, which creates extra goals, values, and beliefs for these banks.

2.3 Literature Review and Hypothesis Development

Fama and Jensen (1983) suggest that well-established corporate governance benefits shareholders since they mitigate the agency costs for the firm using monitoring and controlling mechanisms on the decision makers' actions. Apart from duties such as hiring, firing, compensating the executives, the board of directors elected by shareholders is the centre of the internal control mechanism to monitor and supervise managerial actions and decisions (Fama, 1980). The other means that corporate governance might employ to increase firm efficiency are to motivate executives with incentive compensation that aligns their interests with shareholders' (Haugen and Senbet, 1981; Eisenhardt, 1989) and to set an efficient monitor channel for creditors (Jensen, 1986; Li and Wang, 2016). On the other hand, Healy and Palepu (2001) propose that disclosing relevant and useful information is one way to reduce inefficiency. Accordingly, disclosure enables investors to monitor and control firms' operations strictly and evaluate whether their resources and funds are managed in their best interest. Similarly, Huang and Zhang (2012) suggest that the monitoring and controlling ability of shareholders becomes more limited in opaque firms.

The board of directors performs an important role in the whole process of delivering useful, relevant, and adequate information to stakeholders because of their responsibilities in

the preparation of financial and non-financial information disclosure (Anderson et al., 2004). Therefore, a well-structured corporate governance system boosts the disclosure policies and practices that lead to quality information disclosures, which serve to benefit shareholders as well as stakeholders. In this sense, Roychowdhury (2010) claims that corporate governance characteristics, such as board independence, maintain better information disclosure practices and policies that result in more efficient investments.

de Villiers et al. (2011) suggest that environmental practices are critical for companies considering the benefits of environmental performance for shareholders' wealth and other non-financial advantages. It is vital that the board of directors gives enough importance to those practices and makes them one of the primary objectives. Chan et al. (2014) anticipate that good corporate governance is supposed to present better socially and environmentally responsible behaviors compared to poor corporate governance, considering the positive outcomes regarding finances and prestige. Consequently, since a higher level of disclosure is an indication of socially responsible behavior (Gelb and Strawser, 2001; Lone et al., 2016), a strong positive association exists between good corporate governance and the level of social and environmental disclosure. Extensive literature demonstrates the effects of corporate governance structures on the social disclosure policies of firms. Haniffa and Cooke (2005) support the idea that better corporate governance positively affects social responsibility disclosure. Similarly, Liao et al. (2015) conclude that an effective board of directors increases ecological transparency of companies, consistent with stakeholder theory. Giannarakis et al. (2020) find that improved corporate governance increases sustainable transparency while reducing agency costs. These studies confirm the idea that an effective corporate governance structure improves the quality of information disclosure argued by various researchers (Beekes and Brown, 2006; Botosan et al., 2004).

The unique characteristic of IBs leads them to have a more complex corporate governance structure compared to CBs. This dense structure is not unreasonable because only one violating action of Sharia principles in IBs damages the validity of the banks in the eyes of most stakeholders who care about the Sharia-compliance level of the banks (Echchabi and Olaniyi, 2012). Therefore, every policy, transaction, contract, and product needs to be evaluated under Sharia law by managers and directors. Furthermore, these practices

are monitored by SSB that publishes a Sharia Supervisory Report every year, providing information about Sharia-compliant banks. Therefore, the risk of violating Sharia Law makes IBs have a more rigid corporate governance structure; managers and directors need to consider Sharia Law while designing a new product, setting up a new contract, or implementing a new principle, even before considering the advantages and gains of these actions. On the other hand, these processes go through a more relaxed and easy environment in CBs compared to their Islamic counterparts. Consequently, CBs' adaptationto new strategies, policies, and principles is more straightforward, while IBs need to undergo a scrutinizing process. Accordingly, my conjecture follows that CRD should be different in CBs and IB as a result of the relationship between the corporate governance structure, which is different in CBs and IBs, and CRD;

Hypothesis H_1: The corporate governance structures of CBs and IBs do not differently affect the level of corporate CRDs of these banks.

A rejection of Hypothesis H_1 implies that boards of directors in CBs and IBs exert different pressure on CRD, indicating distinct differences in the boards of directors of these banks affecting their CRD differently.

Furthermore, the Shariah-compliant nature of IBs makes their production processes and corporate governance structures more complex compared to CBs. IBs have developed unique products to comply with Shariah rules and include an additional layer, SSB, in their corporate governance structure primarily to ensure legitimacy in the eyes of their customers. The SSB in IBs serves as a monitoring, controlling, and constraining authority for Sharia compliance and is considered the 'Supra Authority' (Choudhury and Hoque, 2006). This unique 'multi-layer' governance and other Sharia responsibilities contribute to the more complex governance structure of IBs, while CBs have relatively simpler corporate governance structures, which may have a positive impact on CRD. Therefore, I argue that the board of directors in CBs promotes CRD positively in these banks since the level of complexity of the corporate governance structure in CBs is relatively lower compared to the level of complexity of the corporate governance structure in IBs. Based on this argument, I propose my second hypothesis as follows;

Hypothesis H_2: The less complex corporate governance structure of CBs increases the level

of corporate CRDs of these banks.

A rejection of Hypothesis H_2 implies that the differences between corporate governance structures in CBs and IBs distinguish the CRDs in these banks, and less complex corporate governance structure in CBs induces a higher level of CRD.

3 Data and Method

3.1 Sample

I form my primary sample based on the Bankfocus database. Following the extant literature, I employ the following sample selection criteria: (i) countries that have both CBs and IBs, which allows for a comparative analysis between the two banking systems; (ii) countries that have at least four banks, ensuring an adequate sample size for meaningful analysis, as well as indicating a relatively strong banking system with competition; and (iii) banks with at least three years of data, which minimizes missing data and ensures a sufficient time series for analysis over a reasonable period as well as the inclusion of lag variables in subsequent stages of the analysis necessitates a larger amount of available data (Beck et al., 2013; Mollah and Zaman, 2015; Mollah et al., 2017, 2021a). Among these settings, the 'countries with at least four banks' criterion is especially important because I aim to capture a broader range of banking institutions and reduce the likelihood of a monopolistic banking structure. Including multiple banks in the sample increases the potential for competition and can provide a more representative picture of the banking sector in terms of market dynamics, pricing, innovation, and overall performance.

These sampling criteria help us identify a total of 591 banks, including 169 IBs and 422 CBs from 24 countries for the period from 2016 to 2019. The sample selection process is summarized in Appendix Table A. I begin with 2016 because I want to assess the effect of the TCFD framework on corporates, which was published in 2017, and end with 2019 because it is the current date when the data was collected. The sample consists of approximately 29% IBs and 71% CBs. The distribution of CBs and IBs is similar to other studies in the extant literature (e.g., Abdelsalam et al., 2016; Abedifar et al., 2013; Mollah et al., 2017, 2021b). Table 2 presents the sample distribution across the countries.

Table 2: Sample distribution

Country	CBs	%	IBs	%	Total	%
Algeria	14	3.32%	2	1.18%	16	2.71%
Bahrain	13	3.08%	20	11.83%	33	5.58%
Bangladesh	40	9.48%	9	5.33%	49	8.29%
Egypt	19	4.50%	3	1.78%	22	3.72%
Indonesia	55	13.03%	13	7.69%	68	11.51%
Iraq	11	2.61%	18	10.65	29	4.91%
Jordan	14	3.32%	5	2.96%	19	3.21%
Kenya	18	4.27%	3	1.78%	21	3.55%
Kuwait	6	1.42%	11	6.51%	17	2.88%
Lebanon	14	3.32%	2	1.18%	16	2.71%
Libya	10	2.37%	1	0.59%	11	1.86%
Malaysia	38	9.00%	19	11.24%	57	9.64%
Mauritania	7	1.66%	5	2.96%	12	2.03%
Oman	6	1.42%	3	1.78%	9	1.52%
Pakistan	26	6.16%	9	5.33%	35	5.92%
Qatar	8	1.90%	6	3.55%	14	2.37%
Saudi Arabia	10	2.37%	5	2.96%	15	2.54%
Sri Lanka	14	2.32%	2	1.18%	16	2.71%
Syrian Arab Republic	10	2.37%	3	1.78%	13	2.20%
Tunisia	12	2.84%	2	1.18%	14	2.37%
Turkey	23	5.45%	7	4.14%	30	5.08%
United Arab Emirates	23	5.45%	10	5.92%	33	5.58%
United Kingdom	27	6.40%	8	4.73%	35	5.92%
Yemen	4	0.95%	3	1.78%	7	1.18%
Total	**422**	**100%**	**169**	**100%**	**591**	**100%**

Notes: This table presents the sample distribution for CBs, IBs and whole sample for given countries over a period of 2016-2019.

3.2 Definitions and Measures of the Variables

3.2.1 Dependent Variable

I start by constructing my CRD index to measure the level of CRD across the different banks in my sample. I hand-collect financial statement data for all firms in my sample for the period from 2016 to 2019. I use hand-collection as several of the banks in my sample are unlisted. To quantify the level of disclosure across firms, I deploy a content analysis approach by conducting text mining using NVivo qualitative and quantitative content analysis and statistical software. The keywords I use are based on TCFD Final Report (2017) and TCFD Status Report (2019), as well as literature that investigates CRD (Caliskan and Esen, 2021;

de Aguiar and Bebbington, 2014). Based on these sources, I identify twenty-nine keywords under five specific sections: Carbon, Climate, Emission, Environment, and Agreements. I present these keywords in Appendix Table B. To capture all the related words, I also consider the verb, adjective, and noun forms of those keywords, as well as their synonyms, by stemming them and applying special characters such as dash (-), slash (/), space ( ), or concatenate (). I use NVivo to examine the frequency of occurrence of the keywords within each report. One problem I encounter in this process is the use of synonyms in annual reports. For example, the word "environment" in NVivo gives results of different contexts such as "the natural world", "the setting or condition in which a particular activity carried on", or "the overall structure within which a user, computer, or programme operates", including "financial environment", "business environment", or "development environment". Therefore, the whole process has been carried out carefully by manually checking every word in context.

3.2.1.1 Reliability of the CRD

To evaluate the reliability of the constructed index, various measures and techniques recommended in the literature have been followed in this section. The development of the index categories and items involved gathering information from diverse and multiple sources, including TFCD and various literature sources mentioned in 3.2.1. Dependent Variable section (Grassa et al., 2021). Additionally, since the index scores were derived by counting the appearance of words in the annual reports using NVivo, the index is reproducible (Beattie et al., 2004).

Furthermore, Cronbach's alpha is employed to assess the reliability of the CRD index (Xiao and Dew, 2011). The full CRD index demonstrates a Cronbach's alpha value of 0.86, indicating good internal consistency. Moreover, Cronbach's alpha scores are calculated for all subcategories of CRD. The subscales for Carbon, Climate, Emission, Environment, and Agreements exhibit satisfactory Cronbach's alpha scores of 0.87, 0.85, 0.85, 0.74, and 0.85, respectively.

3.2.1.2 Validity of the CRD

To assess the validity of the CRD index created by this study, I conduct a construct-related validity test (Butler et al., 2012; Schwab, 2005; Tahri et al., 2023). Firstly, I examined the correlation between the level of CRD and the various categories of CRD (Botosan, 1997). The results, presented in Table 3, reveal positive and significant correlations between all categories of the CRD and the overall level of CRD. These findings indicate that the disclosure index of CRD demonstrates validity and can be considered reliable in measuring the level of disclosure and transparency in this context.

Table 3: The correlation between CRD and the components of CRD index

	CRD	Carbon	Climate	Emission	Environment	Aggrement
CRD	1.000					
Carbon	0.714***	1.000				
Climate	0.791***	0.619***	1.000			
Emission	0.767***	0.657***	0.556***	1.000		
Environment	0.907***	0.431***	0.512***	0.474***	1.000	
Agreements	0.572***	0.560***	0.734***	0.366***	0.193	1.000

Notes: This table provides correlation coefficients used to determine the validity of the CRD index.

3.2.2 Independent Variable

My main explanatory variable is corporate governance quality. To capture the key variable of interest, the corporate governance structure, I follow Mollah et al. (2017) and construct a CGI based on six different characteristics of the board of directors: board size, board independence, board meetings, board attendance, board committees, and women directors. I create dummy variables for each characteristic using the medians of my sample. If a bank's number of board members is lower than the sample medians, and the number of independent directors, board meetings, and board committees is higher than the sample medians of these variables, then it is coded as 1. Similarly, if the attendance rate is larger than 75% (Mollah et al., 2017), and if there is any woman on the board of directors (the median of women directors in the sample is 0.5), then it is coded as 1. A bank that has larger figures than the medians of these variables in the sample is scored as 6 (1 for each variable), and thus 100%. If a bank has larger figures in 3 variables than the medians of these variables in the sample, then this bank gets a score of 3 out of 6, and thus its governance rating is 50%. The

governance index ranges from 0 to 1.

The number of directors on the board has been used as a metric for corporate governance structure in the literature (Pathan, 2009), as the size of the board shapes the extent of monitoring and controlling activities, as well as the decision-making process in a firm (Haniffa and Hudaib, 2006; Jensen, 1993; Yermack, 1996). High-frequency board meetings intensify the effectiveness of the monitoring and controlling activities of the board, and members of the board have more time together as a group, which increases the connection between the board members (Brick and Chidambaran, 2010; Laksmana, 2008; Vafeas, 1999). However, a higher number of board meetings is not significant unless the board meeting attendance rate is higher. Consistent with board meetings, a lower rate of board attendance records leads to a higher possibility of financial misreporting and decreases the efficiency of the boards (Cai et al., 2009; Masulis et al., 2012). Board committees under the board of directors enable specialization in specific areas, knowledge, task-division efficiency, and accountability (Anderson et al., 2004; Beasley, 1996; Reeb and Upadhyay, 2010). Adams and Ferreira (2009) find that women directors show more commitment to attend meetings compared to male directors, and the presence of women on the boards boosts men's meeting attendance records. Furthermore, members of heterogeneous groups would have a different aura than a homogeneous board of directors, and women directors could bring a fresh perspective to the table (Campbell and Minguez-Vera, 2008).

3.2.3 Control Variables

Again, I follow the extant literature to capture CEO Power as a control variable. For example, CEO and Chairperson duality are widely used as a proxy for CEO Power (Korkeamäki et al., 2017; Onali et al., 2016). Internally recruited CEOs are also considered as a CEO Power proxy (Adams et al., 2005; Pathan, 2009). The tenure of the CEO, with more tenure than the median CEO tenure in the sample, is also used as a CEO Power proxy in several studies (Chikh and Filbien, 2011; Schmid et al., 2018). By considering these three proxies, I construct a CEO Power Index.

Firm control variables include company size measured by the logarithm of total assets, profitability proxied by the return on assets, leverage proxied by the ratio of customers' term

deposits to total equity, loans assessed by the ratio of loans to total assets, financial slack calculated by cash and cash equivalents divided by total assets, and firm age, which is the natural logarithm of the bank's age. Finally, a dummy variable for CBs is employed, where 1 indicates a CB and 0 indicates an IB. When coding bank types, I consider 100% Sharia-compliant banks as IBs. Some CBs offer Islamic products to their customers, and these banks are coded as IBs in BankFocus. I conduct a strict elimination process for Islamic Window banks and keep only pure IBs. I created a dummy variable (i.e. ListedBanks = 1; otherwise, 0). Based on the statistics of ListedBanks, I found that out of the total Conventional Banks, 212 are listed while the remaining 210 are unlisted. Similarly, among the Islamic Banks, 75 are listed and 94 are unlisted. Furthermore, I add some country controls to the model, including the natural logarithm of GDP per capita, inflation proxied by yearly changes in the customer price index. Finally, I include the country-level Islamicity Index to capture religiosity in the model (Rehman and Askari, 2010).

3.3 Empirical Model

First, I create the following model to test the effect of corporate governance on CRD for CBs, IBs and for all the sample.

$$CRD_{b,c,t} = \alpha_0 + \beta_1 CGI_{b,c,t} + \gamma X_{b,c,t} + \vartheta Y_{c,t} + \epsilon_{b,c,t} \tag{1}$$

Secondly, to test the effect of different corporate governance systems between CBs and IBs on different levels of the CRD of two types of banks, I use the following model:

$$CRD_{b,c,t} = \alpha_0 + \alpha_1 CBs + \beta_1 CGI_{b,c,t} + \beta_2 CBs \cdot CGI_{b,c,t} + \gamma X_{b,c,t} + \vartheta Y_{c,t} + \epsilon_{b,c,t} \tag{2}$$

The bank-level control variables are total assets, ROA, leverage, loans, financial slacks, and firm age. The country-level control variables are Islamicity, Gross Domestic Product per Capita (GDPPC), and inflation rate. The descriptions of the variables are provided in Appendix Table C.

The variables used in the models are as following;

$CRD_{b,c,t}$	is the CRD of bank b in country c at time t.
CBs	is the CB dummy.
$CGI_{b,c,t}$	is a matrix CGI of bank b in country c at time t.
$CBs \cdot CGI_{b,c,t}$	is the interaction between CB dummy and CGI.
$X_{b,c,t}$	is a matrix of CEO Power and firm-level control variables of bank b in country c at time t.
$Y_{c,t}$	is a matrix of country-level control variables of country c at time t.
$\epsilon_{b,c,t}$	is the error term; α_0 is the constant; and α, β, γ, and ϑ are the vectors of coefficient estimates.

3.4 Descriptive Statistics

Table 4 presents the descriptive statistics of the variables. To identify and address outliers, which could be due to extreme situations or data coding errors, quantile-based methods are applied. Specifically, the 99$^{\text{th}}$ and 1$^{\text{st}}$ percentiles are considered in this analysis. Data points that fall above the 99$^{\text{th}}$ percentile or below the 1$^{\text{st}}$ percentile are identified as potential outliers and these values that deviate significantly from the majority of the data are identified and winsorized. The table presents the number of observations, mean, standard deviation, median, 5$^{\text{th}}$ and 95$^{\text{th}}$ percentiles for CBs, IBs, and the full sample, as well as a two-sample t-test to compare the means of CBs and IBs.

The mean value of the CRD for the sample is 2.81 with a standard deviation of 1.60, while for CBs it is 3.12 with a standard deviation of 1.56, and for IBs it is 1.88 with a standard deviation of 1.34. Furthermore, the mean value of the CGI is 2.78 with a standard deviation of 1.26, while for CBs it is 2.84 with a standard deviation of 1.29, and for IBs it is 2.62 with a standard deviation of 1.15. After comparing these two banks using a t-test, CBs are found to disclose a significantly higher level of climate-related information. Additionally, the comparison of the CGI of these two banks shows that CBs structure their corporate governance significantly better than their Islamic counterparts. The descriptive statistics for CEO power indicate that CEOs in CBs are significantly more powerful compared to CEOs in IBs. The mean value of the CEO Power index in CBs is 1.05 with a standard deviation of 0.77, and in IBs it is 0.90 with a standard deviation of 0.71. Furthermore, CBs have significantly higher total assets (CBs: 15.87, IBs: 14.68) and return on assets (CBs: 1.25, IBs: -0.15). Finally, descriptive statistics show that CBs have a significantly longer history compared to IBs, with a mean value of 48 years and 24 years, respectively. On the other

Table 4: Descriptive statistics

	Panel A: CBs						**Panel B:** IBs						**Panel C:**
	Obs.	Mean	S.D.	50%	5%	95%	Obs.	Mean	S.D.	50%	5%	95%	t-test
CRD	934	3.12	1.56	3.38	0	5.33	307	1.88	1.34	1.79	0	4.3	12.48***
CGI	891	2.84	1.29	3	1	5	298	2.62	1.15	3	1	5	2.64***
CEO Power	879	1.05	0.77	1	0	2	294	0.90	0.71	1	0	2	2.97***
Total Assets	903	15.87	1.71	15.68	13.42	18.57	299	14.68	1.98	14.93	11.13	17.3	10.02***
ROA	895	1.25	1.51	1.15	-0.21	3.15	295	-0.15	5.13	0.85	-8.88	3.0	7.27***
Leverage	911	6.92	8.97	5.87	1.51	13.62	274	6.56	4.52	5.76	0.04	15.0	0.65
Loans	924	0.58	0.17	0.63	0.24	0.77	302	0.59	0.22	0.64	0.02	0.8	-0.62
Financial Slacks	901	0.10	0.07	0.08	0.02	0.25	292	0.09	0.09	0.07	0.00	0.3	1.78*
Firm Age	840	47.75	37.43	41	11.50	99	252	23.95	13.72	20.50	5	47	9.89***
Listed Banks	934	0.66	0.47	1	0	1	307	0.55	0.49	1	0	1	
Islamicity	934	1.50	0.32	1.55	0.96	2.12	307	1.57	0.29	1.59	0.96	2.1	
GDPPC	934	8.76	1.15	8.33	7.25	10.67	307	9.31	1.14	9.34	7.29	11.0	
Inflation	910	4.38	4.06	3.53	0.13	14.40	290	3.26	3.46	2.62	-0.78	11.1	

Panel D: Full Sample

	Obs.	Mean	S.D.	50%	5%	95%
CRD	1241	2.81	1.60	2.89	0	5.24
CGI	1189	2.78	1.26	3	1	5
CEO Power	1173	1.01	0.76	1	0	2
Total Assets	1202	15.57	1.86	15.52	12.65	18.37
ROA	1190	0.90	2.93	1.09	-1.48	3.11
Leverage	1185	6.83	8.16	5.84	0.58	13.79
Loans	1226	0.58	0.18	0.63	0.20	0.78
Financial Slacks	1193	0.10	0.08	0.08	0.01	0.25
Firm Age	1092	42.26	34.95	35.50	10	91
Listed Banks	1241	0.63	0.48	1	0	1
Islamicity	1241	1.52	0.31	1.55	0.96	2.12
GDPPC	1241	8.89	1.17	8.39	7.25	10.67
Inflation	1200	4.11	3.95	3.20	-0.67	13.81

Table 5: Correlation matrix

	CRD	CB	CGI	CP	TA	ROA	LV	LO	FS	FA	LB	OIS	GDPPC	INF
CRD	1.00													
CB	0.33***	1.00												
CGI	040***	0.09***	1.00											
CEO Power	0.03	0.09***	-0.02	1.00										
Total Assets	0.25***	0.26***	0.17***	0.13***	1.00									
ROA	0.11***	0.08***	0.01	0.09***	0.06***	1.00								
Leverage	0.08***	0.30	0.01	-0.02	0.04	-0.07***	1.00							
Loans	0.21***	-0.01	0.17***	-0.09***	0.20***	0.04*	0.04**	1.00						
Financial Slacks	-0.11***	0.01	-0.11***	0.19**	-0.17***	0.07***	-0.02	-0.46***	1.00					
Firm Age	0.20***	0.32***	0.16***	0.12***	0.42***	0.03	-0.01	0.01	0.01	1.00				
Listed Banks	0.15***	0.05*	0.07**	0.06**	0.19***	0.02	-0.01	0.09***	-0.11***	0.05**	1.00			
Islamicity	-0.04	-0.19	0.16***	-0.04	0.38***	0.03	-0.05	0.29***	-0.28***	0.14***	-0.08***	1.00		
GDPPC	-0.31***	-0.14***	-0.11***	0.03	0.32***	0.01	-0.09***	-0.02	-0.04*	0.02	-0.02	0.73***	1.00	
Inflation	0.16***	0.13***	-0.05*	0.01	0.02	0.03	0.05**	-0.02	-0.02	0.11***	-0.02	-0.36***	-0.38***	1.00

CRD: Climate-Related Disclosure; CB: Conventional Bank Dummy; CGI: Corporate Governance Index; CP: CEO Power Index; TA: Total Assets, log of total assets; ROA: Return on Assets; LV: Leverage, the ratio of customers' term deposits to total equity; LO: Loans, the ratio of loans to total assets which shows the liquidity ratio; FS: Financial Slacks, cash and cash equivalents divided by total assets; FA: Firm Age, the natural logarithm of the age of the firm; LB: Listed Banks, dummy variables for listing status of the banks; OIS: Islamicity Index; GDPPC: GDP per capita, the natural logarithm of the GDP per capita; INF: Inflation, change in the inflation rate. ***, **, and * represent significance level of 0.01, 0.05, and 0.1, respectively.

hand, there are no significant differences in the other bank-level control variables: leverage and loans between CBs and IBs.

A Pearson's pairwise correlation analysis is performed for the full sample, as shown in Table 5. The signs of the variables between the dependent and independent variables yield no surprises. The correlation analysis reveals that there are no highly correlated coefficients among the regressors, except for a strong relationship between gross domestic products per capita (GDPPC) and the Islamicity Index (OIS), with a correlation coefficient exceeding 0.5, as indicated by Cohen (1988). Consequently, a variance inflation factor analysis is conducted to further investigate this relationship. The results, presented in Appendix Table D, indicate that the variables remain within a safe threshold and do not exceed 10 (James et al., 2013; Kennedy, 1998; Marquardt, 1970; Vittinghoff et al., 2005), suggesting that a problematic amount of collinearity is not a concern in this study.

4 Empirical Results

4.1 The Effect of Corporate Governance on Climate-Related Disclosure

By following Mollah and Zaman (2015), I employ Eq. (1) separately on each bank type. The results are reported in Table 6. My primary results suggest that the CGI positively affects CRD for CBs and the whole sample, while the effect is negative (insignificant) for IBs. These results clearly distinguish CBs from IBs. The results support my first hypothesis that corporate governance of CBs is a driving factor, while this is not the case for IBs. One plausible explanation for the result is the difference in complexity and simplicity of the governance systems between the two banking systems. The corporate governance structure in CBs could decide to perform based on the values, beliefs, and concerns of their stakeholders and improve CRD. On the other hand, the main reason for the existence of IBs, which is Sharia compliance, leads IBs to structure a more complex corporate governance system. Additionally, the priorities, aims, and objectives of the governance level of IBs could be different from those of CBs. The priority for IBs is not to violate Sharia rules and principles, which is the main concern regarding legitimacy. Having an extra layer in the corporate governance structure that protects and sustains legitimacy makes IBs more complex and

slower in decision-making and action-taking compared to CBs. Although the rigid corporate structure of IBs might deliver more useful and relevant information to stakeholders, this structure might decelerate and slow down decision-making. Thus, the level of information provided by IBs decreases. Consistently, these results suggest that the corporate governance systems between CBs and IBs affect CRD differently. Thus, H_1 is accepted.

After the difference between the two banking systems is visible, I employ Eq. (2), using the CBs dummy. The results are reported in Panel A, Table 7. The main variable of interest in the model is the interaction term of the CBs dummy and the CGI (CB·CGI). The results of the Ordinary least squares (OLS) estimates are presented in Table 7. While the CBs dummy and the CGI have a negative effect individually on CRD, the interaction term of the CBs dummy and the CGI turns out to be positive and highly significant at the 1% level.

The results presented in Table 6 suggest that CBs have the potential to enhance their CRD by establishing a stronger corporate governance structure and implementing effective governance practices. The positive coefficient of the interaction term (CB·CGI) signifies that the presence of a better corporate governance structure of CBs leads them to disclose more climate-related information. In other words, when operating under a less complex banking system, CBs and their corporate governance demonstrate a greater responsiveness to stakeholder demands, resulting in higher levels of information disclosure compared to the Islamic banking system. However, the findings reveal a contrasting pattern for IBs. Despite IBs potentially having a better board of directors and implementing improved governance practices, their complex corporate governance structure, characterized by multiple tiers, does not lead to an improvement in CRD. This suggests that the relationship between corporate governance and CRD differs between CBs and IBs. In summary, the results indicate that CBs could improve their CRD by constructing a better corporate governance structure and implementing effective governance practices. On the other hand, for IBs, a complex corporate governance structure with multiple tiers, even if accompanied by a superior board of directors and better practices, does not lead to an improvement in CRD. These findings highlight the importance of considering the specific characteristics and dynamics of different banking systems when examining the relationship between corporate governance and disclosure practices in the context of climate-related information.

These results indicate that the corporate governance system of CBs encourages high CRD. Overall, my results accept H_2 that a less complex corporate governance structure of CBs (with a higher CGI) increases CRD. My results are in line with the existing literature on disclosure, which suggests that effective boards of directors increase the level of information provided to stakeholders (Anderson et al., 2004; Chau and Gray, 2010; Haniffa and Cooke, 2002; Laksmana, 2008; Mallin and Ow-Yong, 2012).

Furthermore, similarly to previous studies (Hui and Matsunaga, 2015; Li et al., 2018; Ruigrok et al., 2006), the result of the OLS estimate demonstrates that powerful CEOs of the banks have an important positive effect on the CRD (significant). Among the bank-level control variables, I find that total assets and the level of leverage of the banks have a positive relationship with the level of CRD, indicating that larger banks disclose more climate-related information, consistent with other studies (e.g. Clarkson et al., 2008; Cooke, 1989, 1992; Deumes and Knechel, 2008; Eng and Mak, 2003; Haniffa and Cooke, 2002; Inchausti, 1997; Khanna et al., 2004; Linsley and Shrives, 2005; Meek et al., 1995; Meng et al., 2013; Watson et al., 2002). However, I find that the financial slack affects CRD negatively, indicating that the greater financial slack, the lower the CRD, which is opposite to a small number of previous studies (e.g. Kim et al., 2019; de Villiers et al., 2011). Finally, the regression results do not show any significant relation between CRD and the level of ROA and loans of the banks, as well as banks' age.

For the country-level variables, I find that the Islamicity score positively affects CRD, which is not surprising when considering the content of the Islamicity index. However, GDPPC appears to have a negative effect on CRD, which is consistent with the findings of Jahn and Brühl (2019) and Kothari et al. (2009). The inflation rate of the country encourages companies to disclose more information, as corporate entities strive to maintain reliability and enable informed decision-making by investors (Meek and Saudagaran, 1990; Archambault and Archambault, 2003).

Finally, I include the country-year interaction ($Country \cdot Year$) variable to capture the effects of unobservable country-level factors that occur within a specific year and country. This approach has been employed by several studies, such as Beck et al. (2013) and Uddin et al. (2020). After controlling for country-year fixed effects, my results remain consistent.

Table 6: CRD and corporate governance in CBs and IBs

	Panel A	**Panel B**	**Panel C**
	CBs	IBs	Full Sample
	(1)	(2)	(3)
Variables	CRD	CRD	CRD
CGI	0.266***	-0.046	0.197***
	(0.041)	(0.079)	(0.035)
CEO Power	0.162***	0.051	0.152***
	(0.061)	(0.098)	(0.052)
Total Assets	0.266***	0.263***	0.291***
	(0.035)	(0.099)	(0.033)
ROA	0.031	-0.046	0.001
	(0.048)	(0.038)	(0.032)
Leverage	0.066***	0.023	0.044***
	(0.016)	(0.029)	(0.012)
Loans	0.117	0.343	0.226
	(0.362)	(0.471)	(0.289)
Financial Slacks	-2.174***	-2.804**	-2.046***
	(0.801)	(1.093)	(0.605)
Firm Age	0.001	0.013***	0.001
	(0.001)	(0.004)	(0.001)
Listed Banks	0.355***	0.355*	0.439***
	(0.114)	(0.196)	(0.097)
Islamicity	2.603***	2.123***	2.625***
	(0.321)	(0.666)	(0.271)
GDPPC	-0.829***	-1.124***	-0.998***
	(0.086)	(0.197)	(0.071)
Inflation	0.057***	0.032	0.055***
	(0.015)	(0.031)	(0.014)
Constant	0.677	4.336***	1.709***
	(0.728)	(1.152)	(0.594)
Observation	743	207	950
R-Squared	0.464	0.429	0.429
Year FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Chi^2		15.29***	
$Prob>Chi^2$		0.000	

Notes: This table presents the results of Equation (1) and shows the analysis of association between corporate governance structure in CBs, IBs, and overall sample and climate-related financial disclosure. The dependent variable is *CRD* which is the index to measure climate-related financial disclosure. The main independent variable is *CGI* which is the index for board of directors consisting of 6 different characteristics of the board of directors. *CEO Power* is the index that measures CEO power in the banks consisting of 3 different characteristics of a CEO. *Total Assets* is the natural logarithm of total assets of the banks. *ROA* is the return on average assets. *Leverage* is the ratio of customers' term deposits to total equity. *Loans* is the ratio of loans to total assets. *Financial Slacks* is the cash and cash equivalents divided by total assets. *Firm Age* is the natural logarithm of the age of the firms. *Islamicity* is the Islamicity index constructed by Rehman and Askari (2010). *GDPPC* is the natural logarithm of the GDP per capita. *Inflation* is the year-on-year change of consumer price index. ***, **, and * represent significance level of 0.01, 0.05, and 0.1, respectively. Robust standard errors are presented in parentheses.

Table 7: Baseline estimation and robustness tests

	Baseline Estimation		**Robustness check**
	Panel A	**Panel B**	**Panel C**
	OLS	Fixed Effect	GMM Model
	(1)	(2)	(3)
Variables	CRD	CRD	CRD
CBs*CGI	0.255***	0.251***	1.695*
	(0.068)	(0.074)	(0.974)
CBs	-0.316*	-0.311**	-2.856
	(0.214)	(0.225)	(4.133)
CGI	0.005	-0.004	-1.078
	(0.061)	(0.068)	(0.782)
CEO Power	0.140**	0.119**	1.934***
	(0.052)	(0.052)	(0.626)
Total Assets	0.262***	0.265***	0.058
	(0.034)	(0.034)	(0.286)
ROA	-0.006	0.000	-0.029
	(0.033)	(0.026)	(0.131)
Leverage	0.048***	0.045***	0.101
	(0.013)	(0.012)	(0.077)
Loans	0.317	0.284	1.731**
	(0.285)	(0.232)	(1.009)
Financial Slacks	-1.931***	-1.586**	-4.564
	(0.614)	(0.575)	(2.780)
Firm Age	0.001	0.001	-0.002
	(0.001)	(0.001)	(0.007)
ListedBanks	0.381	0.369	0.045
	(0.096)	(0.092)	(0.514)
Islamicity	2.465***	2.512**	1.491
	(0.270)	(0.256)	(1.944)
GDPPC	-0.910***	-0.960***	-0.501
	(0.073)	(0.073)	(0.768)
Inflation	0.053***	0.047**	-0.001
	(0.014)	(0.011)	(0.043)
Constant	1.871***	2.212***	2.252
	(0.628)	(0.491)	(4.348)
Observations	950	950	946
R-squared	0.435		
Year & Country FE	Yes	No	Yes
F-Statistics			32.330***
AR(1) p-value			0.025
AR(2) p-value			0.189
Hansen J-Statistics p-value			0.807

Notes: This table illustrates the results of Equation (2) based on the analysis of the effect of the board of directors in CBs on CRD using different methods. Specifically, Panel A presents the OLS analysis, while Panel B provides the result for the same model under fixed effect analysis. Finally, Panel C demonstrates the result for the same model using GMM. All regressions control for year and country fixed effects, whose coefficients are supressed. ***, **, and * represent significance level of 0.01, 0.05, and 0.1, respectively. Robust standard errors are presented in parentheses

I test the same model using fixed-effect panel regressions. Panel B in Table 7 presents the results that confirm once again the positive association between less complex and higher scored corporate governance structure of CBs and CRD. The two-step system Generalized Method of Moments (GMM) regression results in Panel C, Table 7, suggest that the model is not biased, as the residuals in the first difference show serial correlation (as indicated by a statistically significant AR(1)), while the residuals in the second difference do not exhibit serial correlation (as indicated by a statistically insignificant AR(2)). The model includes valid instruments, as the Hansen J-statistics of over-identifying restrictions are statistically insignificant, indicating instrument validity. Overall, the analysis demonstrates that the results are consistent with those of the baseline regression: strong corporate governance continues to promote CRD in CBs, even after controlling for unobserved heterogeneity, simultaneity, and dynamic endogeneity. However, there is a decrease in the significance level of the interaction term in the model. While the significance level is 1% in the baseline model, it is 10% in the two-step system GMM analysis. Consequently, the findings from the OLS, fixed-effect panel, and two-step system GMM regressions presented in Table 7, under Panel A, Panel B, and Panel C, respectively, demonstrate consistency and provide clear evidence supporting my hypothesis. Therefore, the empirical tests establish that the complexity of corporate governance is a determinant of CRD, and the less complex corporate governance structure of CBs increases the level of corporate CRD in these banks.

4.2 Endogeneity Tests

After finding that the extent of climate financial disclosure significantly differs between CBs and IBs, I understand that the corporate governance structures of IBs and CBs are factors causing this difference. They enhance the CRD in CBs, while an adverse effect is observed in the case of IBs. In this section, I examine the potential endogeneity concerns that may affect my findings regarding the effects of corporate governance on CRD in CBs and IBs. Specifically, I address the possible endogeneity issues that might influence my main regression and utilize IV analysis and propensity score matching techniques.

4.2.1 Instrumental Variables Analysis

Although the board of directors plays a key role in determining the content of disclosures, there may be external factors that influence the disclosure policy. For instance, public pressure can be a significant driving factor for companies to disclose more information. Therefore, banks may disclose CRD in response to such pressure rather than solely due to the influence of the board of directors (Dyck and Zingales, 2002). To address endogeneity concerns, I employ a two-stage least square IV approach.

In this study, I use the number of newspapers circulated in the bank's headquartered country as the instrumental variable. Dyck and Zingales (2004) define "extra-legal institutions" associated with the legal protection of investors (La Porta et al., 1998, 2006). According to Dyck (2000), these "extra-legal" institutions can affect corporate governance decisions. Chen et al. (2009) use the number of newspaper circulation as a proxy for measuring "extra-legal institutions" since countries with relatively higher newspaper circulation tend to have greater public opinion pressure. Higher newspaper circulation may indicate a more active and informed public, which could lead to increased scrutiny and monitoring of companies, thereby influencing their governance practices as well as the characteristics and composition of their boards of directors.

Higher newspaper circulation implies a larger audience for news and information, which can raise public awareness and scrutiny of corporate activities, including board of directors' composition. When newspapers have a wide readership, they serve as an important channel for disseminating information about companies and their governance practices to a broader audience, including shareholders, stakeholders, and the general public. Increased media attention, driven by higher newspaper circulation, can shed light on board composition and draw attention to issues related to diversity, independence, expertise, and potential conflicts of interest. Media outlets may conduct investigations, publish reports, or provide commentary that highlights companies with board compositions perceived as inadequate or lacking key aspects. Therefore, it is expected that a higher level of CGI and consequently a higher level of CRD can be seen in countries with higher newspaper circulation, as a way to manage public opinion and media pressure.

Cragg-Donald Wald F-statistics and Kleibergen-Paap Wald rk F-statistics are higher than

Table 8: Instrumental variable analysis

	Panel A	**Panel B**
	First Stage	Second Stage
	(1)	(2)
Variables	CGI	CRD
Daily Newspaper	0.023***	
	(0.002)	
CBs*CGI		2.959***
		(0.947)
CBs	-0.114	-7.827***
	(0.090)	(2.594)
CGI		-2.871***
		(1.005)
CEO Power	0.012	0.135
	(0.053)	(0.086)
Total Assets	0.06***	0.429***
	(0.015)	(0.070)
ROA	-0.013*	-0.031
	(0.015)	(0.055)
Leverage	-0.028*	0.026
	(0.016)	(0.021)
Loans	0.714**	0.739
	(0.336)	(0.469)
Financial Slacks	-0.071***	-2.371*
	(0.336)	(1.271)
Firm Age	0.092	0.002
	(0.030)	(0.001)
ListedBanks	-0.057	0.308*
	(0.053)	(0.175)
Islamicity	0.746***	4.176***
	(0.201)	(0.748)
GDPPC	-0.319***	-1.594***
	(0.096)	(0.260)
Inflation	-0.013	0.018
	(0.018)	(0.021)
Constant	3.445***	10.784***
	(0.241)	(3.240)
Observations	950	950
R-squared		0.557
Year & Country FE	Yes	Yes
Weak Identification Test		
Kleibergen-Paap rk LM statistic	10.50***	
Cragg-Donald Wald F statistic	25.635	
Weak Identification Test		
Kleibergen-Paap Wald rk F statistics	19.780	

Notes: This table presents estimation results for the instrumental variable approach based on Equation (2). The dependent variable is CRFD which is the climate-related financial disclosure. *Daily Newspapers* refers to the circulation of daily newspaper in the country. 1st column presents first stage results for CGI The second stage of the estimation is presented in the 2nd column. The models are estimated using two-stage-least-squares (2sls) instrumental variables (IV) approach. ***, **, and * represent significance level of 0.01, 0.05, and 0.1, respectively. Robust standard errors are presented in parentheses

the 10% critical value (16.38), suggesting that I reject the hypothesis of weak instruments. Additionally, the statistically significant Kleibergen-Paap rk LM test indicates that the model is not under-identified.

In Panel A of Table 8, I report the first-stage regression estimates using newspaper circulation as instruments for CGI. Consistent with my expectations, the instrument has a positive and significant impact on CGI. The second-stage models are presented in Panel B. The results show that the interaction terms of the CBs dummy and CGI are positive and significant at the 1% level. Overall, the IV results support the baseline regression estimates, indicating that better corporate governance promotes a higher level of CRD in CBs compared to IBs. Therefore, the IV analysis confirms the findings of the baseline regression after addressing the endogeneity concerns.

4.2.2 Propensity Score Matching

The descriptive statistics of the sample presented in Table 4 indicate that there are differences between CBs and IBs from various perspectives. The mean comparisons for IBs and CBs suggest that CBs disclose more climate-related information, have a higher CGI, more powerful CEOs, higher total assets and return on assets, hold more cash, and are older and more experienced compared to IBs. This study argues that the differences in the CRD of the banks are due to their different corporate governance structures, which also have varying effects on CRD. However, existing literature suggests that firm characteristics may also influence the level of disclosure. CEOs, for example, have an impact on the level and quality of disclosure (Botosan, 1997; Bushman and Smith, 2001; Francis et al., 2008; Hui and Matsunaga, 2015), and Li et al. (2018) find that more powerful CEOs enhance ESG disclosure. Similarly, firm size (Eng and Mak, 2003; Haniffa and Cooke, 2002; Linsley and Shrives, 2005), firm performance (Khanna et al., 2004; Adams and Hardwick, 1998; Ben-Amar and McIlkenny, 2015), and cash holdings (Kim et al., 2019; de Villiers et al., 2011) are factors that may affect disclosure. Therefore, the differences in the level of CRD between banks may be attributed to firm characteristics rather than the corporate governance structures of CBs and IBs. Additionally, the number of observations for CBs is approximately three times higher than that for IBs in all variables.

To address this potential sample selection bias, a propensity score matching technique is employed. This technique allows us to examine whether the differences in CRD between CBs and IBs are not due to the corporate governance structure of the banks but rather to differences in sample size or other factors. Following Rosenbaum and Rubin (1983), the propensity score matching technique creates a similar and balanced sample by matching CBs (treatment group) with IBs (control group) based on observed covariates. The matching is done on a one-to-one basis without replacement, using variables such as CGI, CEO power, total assets, return on assets, leverage, financial slack, firm age, year, and country. Panel A of Table 9 presents the descriptive statistics of the matched sample. After propensity score matching, the sample consists of 219 matched pairs (438 total observations). The results show that the matching procedure successfully eliminates most of the differences between the treatment and control groups.

Panel B of Table 9 demonstrates that after running the same regression model using the propensity score-matched sample, the regression results for the interaction term of CBs and strong corporate governance remain positive and significant at the 1% level. However, the CBs dummy variable has a negative and highly significant relationship, while strong corporate governance has an insignificant negative relationship. Therefore, the regression estimates using the propensity score-matched sample confirm that the baseline regression results are not biased due to sample selection.

4.3 Robustness Tests

This section provides robustness tests on the main findings indicating that less complex corporate governance structures of CBs promote higher level of CRD in the banks.

4.3.1 Channel Analysis

In this study, the aim is to examine the relationship between corporate governance, information asymmetry, and climate disclosure. Previous research emphasizes that robust governance practices can effectively mitigate firm-level information asymmetry (Healy and Palepu, 2001; Kanodia and Lee, 1998; Huang and Zhang, 2012). Consequently, such practices may enhance the disclosure of information and promote information transparency (Healy and

Table 9: Propensity score matching

Panel A: Balancing table for propensity score matching						
	Treatment Group		Control Group			t-test
Variables	N	Mean	N	Mean	%Bias	Treat.-Cont.
CGI	219	2.639	219	2.653	-1.1	-0.12
CEO Power	219	0.858	219	0.899	-5.5	-0.60
Total Assets	219	15.169	219	15.193	-1.2	-0.17
ROA	219	0.758	219	0.467	5.6	1.82*
Leverage	219	6.961	219	6.606	2.6	0.83
Loans	219	0.611	219	0.588	9.4	1.23
Financial Slacks	219	0.089	219	0.091	-1.6	-0.33
Firm Age	219	21.027	219	24.425	-12.5	-3.12***

Panel B: Baseline regression using propensity score matched sample			
	(1)	(2)	(3)
Variables	CRD	CRD	CRD
CBs*CGI	6.899***	6.352***	6.825***
	(3.299)	(3.313)	(3.381)
CBs	-6.979	-3.896	-3.959
	(9.351)	(9.390)	(9.571)
CGI	-1.641	-1.462	-1.011
	(1.754)	(1.649)	(1.727)
CEO Power	2.751	1.720	2.026
	(2.605)	(2.654)	(2.656)
Total Assets	6.804***	6.042***	5.651***
	(1.696)	(1.659)	(1.622)
ROA	1.048	1.027	1.185**
	(0.867)	(0.906)	(0.905)
Leverage	0.504	0.729	0.968*
	(0.579)	(0.572)	(0.554)
Loans	0.982	2.383	0.548
	(9.722)	(9.582)	(9.469)
Financial Slacks	-98.683***	-85.606***	-94.011**
	(27.001)	(26.913)	(27.416)
Firm Age	-0.369**	-0.388***	-0.372***
	(0.115)	(0.117)	(0.118)
Listed Banks	17.596**	18.678***	19.564***
	(3.824)	(3.723)	(3.803)
Islamicity	30.820***	30.675***	34.016***
	(11.813)	(11.418)	(11.339)
GDPPC	-26.953***	-25.488***	-21.203***
	(3.561)	(3.383)	(3.395)
Inflation	-0.464	0.470	1.406**
	(0.516)	(0.512)	(0.582)
Constant	122.678***	110.438***	83.620***
	(21.162)	(20.733)	(23.723)
Observations	425	425	425
R-squared	0.385	0.393	0.388
Year / Country FE	No / No	Yes / No	Yes / Yes

Notes: This table presents estimation results for propensity score matching method where CBs are denoted as treatment groups while IBs are denoted as control groups. Panel A illustrates the descriptive statistics of the matched sample. Panel B presents estimation done using matched sample. ***, **, and * represent significance level of 0.01, 0.05, and 0.1, respectively. Robust standard errors are presented in parentheses.

Palepu, 2001). Building upon these findings, it is argued that superior governance practices in commercial banks (CBs) compared to investment banks (IBs) can mitigate information asymmetry, thereby resulting in a higher level of climate disclosure. The central objective is to test whether the causality between governance and climate disclosure operates through the channel of information asymmetry.

Table 10: Channel analysis

Panel A: CBs and the corporate governance index and spread, illiquidity		
Variables	Spread	Illiquidity
CBs*CGI	-2.917**	-1.098***
	(1.135)	(0.501)
CBs	7.022*	5.537***
	(3.763)	(1.878)
CGI	1.168	0.465
	(0.911)	(0.376)
Control Variables	Yes	Yes
Observations	518	718
R-squared	0.151	0.128
Year FE	Yes	Yes
Country FE	Yes	Yes

Panel B: CBs and the corporate governance index via level of spread, illiquidity

Variables	CRD High Spread	CRD Low Spread	CRD High Illiquidity	CRD Low Illiquidity
CBs*CGI	0.433***	-0.147*	0.342***	0.032
	(0.157)	(0.147)	(0.117)	(0.111)
CBs	-1.159***	0.460	-0.827**	0.081
	(0.401)	(0.429)	(0.385)	(0.297)
CGI	-0.243	0.227*	-0.117	0.093
	(0.147)	(0.133)	(0.117)	(0.103)
Controls Variables	Yes	Yes	Yes	Yes
Observations	248	223	270	385
R-squared	0.762	0.746	0.712	0.715
Year FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Chi^2	9.28***		4.11**	
$Prob>Chi^2$	0.002		0.043	

Notes: This table illustrates results of estimation of the channel analysis method. Panel A presents how corporate governance affect the information asymmetry. ***, **, and * represent significance level of 0.01, 0.05, and 0.1, respectively. Robust standard errors are presented in parentheses.

Transparency plays a pivotal role in mitigating information asymmetry for organizations

(Healy and Palepu, 2001; Huang and Zhang, 2012). By enhancing the quality of disclosure and increasing the amount of relevant and useful information revealed, companies can establish better communication channels with shareholders. This enables shareholders to monitor companies' operations and practices more effectively, thereby evaluating whether the companies are acting in the best interest of their owners (Healy and Palepu, 2001). Moreover, Kanodia and Lee (1998) suggest that companies can discipline management by implementing stricter disclosure policies, leading to the disclosure of relevant and useful information. This prevents managers from exploiting shareholders' wealth for personal gain, rather than maximizing shareholders' benefits. One plausible motivation for banks to disclose more information could be to reduce the negative effects of information asymmetry. Thus, recognizing the pivotal role of an effective disclosure policy in addressing information asymmetry, the focus lies on facilitating transparency, accountability, and the timely dissemination of information. By providing accurate, reliable, and pertinent information to shareholders and stakeholders, firms can effectively reduce the informational disparities between managerial agents and investors. Consequently, it is expected that the board of directors would promote a higher level of disclosure in banks characterized by high information asymmetry. In this section, the levels of CRD in companies with high and low levels of information asymmetry are investigated.

To assess information asymmetry among investors, two proxies are employed: spread and illiquidity. Following the approach of previous studies (Cheng et al., 2011; Corwin and Schultz, 2012), daily bid-ask spreads to the closing prices are collected from DataStream, and the annual average ratios of these spreads are calculated. A wider spread suggests a larger gap between buyers and sellers, indicating higher transaction costs and potential information asymmetry. When information is asymmetric, buyers and sellers may have differing opinions on the value of a security, leading to wider spreads. Smaller spreads, on the other hand, indicate a more efficient market with better information dissemination and reduced information asymmetry. Additionally, illiquidity is utilized as another proxy for information asymmetry. Price impact, as suggested by Amihud (2002), is a popular measure of illiquidity in the literature (Amiram et al., 2016; Fu et al., 2012; Guay et al., 2016; Lang and Maffett, 2011; Nagar et al., 2019; Schoenfeld, 2017). To calculate annualized Amihud illiquidity, measuring

the daily price sensitivity to one dollar trading volume, the daily ratios of absolute return to dollar trade volume are calculated using DataStream and averaged annually. Illiquidity refers to the difficulty of buying or selling a security without causing significant price impact. In an illiquid market, small trades can have a substantial effect on the security's price, indicating the presence of information asymmetry. High illiquidity suggests that information about a security is not widely known or easily accessible, leading to greater uncertainty and potential information asymmetry. Conversely, high market liquidity indicates a more efficient market with greater information dissemination, reducing the potential for information asymmetry.

Panel A of Table 10 presents the impact of corporate governance on information asymmetry. As expected, strong corporate governance in CBs decreases the level of information asymmetry at a 1% significance level. Furthermore, the banks are divided into two categories by the median of the sample, representing high and low information asymmetry. Panel B shows the effect of the board of directors in CBs on CRD in the high and low spread and illiquidity environment. Accordingly, the board of directors promotes CRD significantly when spread and illiquidity levels are high in CBs, while in banks where low information asymmetry exists, the boards do not seem to resort to increasing the level of disclosure. Therefore, the regression results are consistent with the literature, indicating that the causality stems from a difference in governance structure between CBs and IBs and operates through mitigating information asymmetry.

4.3.2 Reverse Causality and Omitted Variables Analyses

To address reverse causality, this study incorporates 1-year and 2-year lagged values of the explanatory and interaction variables into the model (Larcker et al., 2013). In this regard, the 1-year and 2-year lag values of the CGI are calculated, and the interaction term is formed using a 1-year and 2-year lagged CGI and CBs dummy. Models 2 and 3 in Table 11 include 1-year and 2-year lagged values of the board structure and interaction term, respectively. The results show no significant differences; the coefficients of the 1-year and 2-year lagged interaction terms maintain their positive and highly significant signs, remaining very close to the estimated coefficient in the baseline regression model. Thus, the results suggest that endogeneity problems, such as reverse causality, do not drive the findings of this study.

Einhorn and Ziv (2008) argue that disclosures tend to persist across periods, implying that information disclosure by companies in previous periods is indicative of a similar level of disclosure in the future. To address this issue, this study follows the approach of Amin et al. (2020); Cheng (2008); Faleye (2007) by incorporating lagged values of the dependent and independent variables as additional controls in the model. This method helps mitigate both unobserved heterogeneity and reverse causality problems (Amin et al., 2020; Faleye et al., 2014). In Table 11, columns 4 and 5 present the models including 1-year and 2-year lagged variables of the dependent variable as an independent variable in the model. The results remain consistent; the positive and significant relationship between the interaction terms and CRD indicates that the findings are not affected by reverse causality and unobserved heterogeneity.

5 Conclusion

The purpose of this study is to explore whether the difference in corporate governance structures between CBs and IBs affects CRD differently. Using a sample of a total of 591 banks (169 IBs and 422 CBs) from 24 countries for the period of 2016 to 2019, the findings suggest that the board of directors in CBs contributes to a higher level of CRD, which is significantly different from their Islamic counterparts. The results indicate that a more flexible corporate governance structure in CBs enables them to easily adopt new policies and implement new practices compared to IBs. Furthermore, the study confirms that CRD in CBs helps mitigate information asymmetry for these banks.

The findings of this research provide good examples for IBs to follow in terms of climate-related actions and the corporate governance system. As discussed earlier, the complex structure of corporate governance in IBs presents certain disadvantages, especially in terms of CRD, despite ensuring legitimacy to their customers. The findings of the study suggest that IBs may need to restructure their corporate governance system to mitigate complexity and enhance climate disclosure within the boundaries of Sharia compliance.

This study acknowledges limitations regarding the inclusion of other important governance mechanisms, such as audit committee characteristics, the quality of external auditing, ownership structure, and more, in addition to the six corporate governance mechanisms al-

Table 11: Reverse causality analysis and omitted variables

Variables	(1) CRD	(2) CRD	(3) CRD	(4) CRD	(5) CRD
CBs*CGI	0.255***				
	(0.068)				
CBs*CGI_{t-1}		0.259***	0.049**		
		(0.078)	(0.052)		
CBs*CGI_{t-2}				0.189**	0.045*
				(0.103)	(0.077)
CBs	-0.316*	-0.351	-0.028	-0.174	-0.005
	(0.214)	(0.249)	(0.165)	(0.320)	(0.240)
CGI	0.005				
	(0.061)				
CGI_{t-1}		-0.039	-0.034*		
		(0.071)	(0.046)		
CGI_{t-2}				0.048	-0.015
				(0.094)	(0.068)
CRD_{t-1}			0.783***		
			(0.025)		
CRD_{t-2}					0.663***
					(0.039)
CEO Power	0.140***	0.150***	0.031	0.171**	0.073
	(0.052)	(0.059)	(0.042)	(0.078)	(0.059)
Total Asset	0.262***	0.282***	0.101***	0.293***	0.137***
	(0.034)	(0.038)	(0.027)	(0.047)	(0.038)
ROA	-0.006	-0.024	-0.013	-0.038	-0.022
	(0.033)	(0.043)	(0.018)	(0.054)	(0.026)
Leverage	0.048***	0.046***	0.008*	0.055***	0.027**
	(0.013)	(0.015)	(0.008)	(0.019)	(0.013)
Loans	0.317	0.171	0.148	-0.284	-0.545*
	(0.285)	(0.321)	(0.187)	(0.401)	(0.286)
Financial Slacks	-1.931***	-2.142***	-1.045***	-2.777***	-2.276***
	(0.614)	(0.692)	(0.472)	(0.947)	(0.814)
Firm Age	0.001	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Listed Banks	0.381***	0.451***	0.020	0.527***	0.026
	(0.096)	(0.112)	(0.072)	(0.143)	(0.108)
Islamicity	2.465***	2.786***	0.919***	3.201***	1.414***
	(0.270)	(0.302)	(0.219)	(0.383)	(0.286)
GDPPC	-0.910***	-1.019***	-0.347***	-1.030***	-0.477***
	(0.073)	(0.082)	(0.063)	(0.104)	(0.086)
Inflation	0.053***	0.041***	0.004	0.060***	0.010
	(0.014)	(0.014)	(0.011)	(0.019)	(0.014)
Constant	1.871***	2.360***	0.959	1.752**	1.412**
	(0.628)	(0.722)	(0.439)	(0.921)	(0.638)
Observations	950	692	650	437	403
R-squared	0.435	0.433	0.802	0.485	0.731
Year/Country YE	Yes	Yes	Yes	Yes	Yes

Notes: This table presents results of the estimations of the Equation (2) using lagged variables of the main interest variables. 1st model includes regression results of the base model. 2nd model presents the model that includes 1 year lagged CBs*CGI, CGI while 3rd model adds 1 year lagged of CRFD to 2nd model. In 4th and 5th models, I used 2 year lagged variables instead of 1 year. ***, **, and * represent significance level of 0.01, 0.05, and 0.1, respectively. Robust standard errors are presented in parentheses.

ready considered (board size, board independence, board meetings, board attendance, board committees, and women directors). These limitations primarily arise from data constraints, particularly concerning IBs. Considering these additional factors could provide further insights into the topic and enhance understanding of the relationship between governance and climate disclosure. Moreover, the analysis in this study does not incorporate the specific roles and responsibilities of SSBs in IBs. This omission is due to limited information available in annual reports or the unavailability of such data in databases. Future research could consider incorporating SSBs and their impact on CRD. Furthermore, the study focuses on a four-year time period from 2016 to 2019 to assess the effect of the TCFD Recommendations, which were first published in 2017. Conducting the analysis over an extended period with a larger dataset could provide a more comprehensive understanding of the long-term effects of climate-related governance practices. Lastly, this study specifically measures the impact of board of directors' composition and characteristics on climate disclosure. Future studies could expand their analysis to assess the influence of the board of directors on climate performance in both IBs and CBs, thus providing a broader perspective on the relationship between board governance and climate-related outcomes.

Appendices

Table A: Sample selection process

	Initial Sample			3-Year Data Applies			Final Sample		
Country	**CBs**	**IBs**	**Total**	**CBs**	**IBs**	**Total**	**CBs**	**IBs**	**Total**
Albania	11	1	12	10	0	10		Dropped	
Algeria	15	2	17	14	2	16	14	2	16
Bahrain	13	20	33	13	20	33	13	20	33
Bangladesh	46	9	55	40	9	49	40	9	49
Bosnia & Herzegovina	22	1	23	20	0	20		Dropped	
Cyprus	31	1	32	10	0	10		Dropped	
Egypt	30	3	33	19	3	22	19	3	22
Germany	93	1	94	72	0	72		Dropped	
Guinea	8	1	9	5	0	5		Dropped	
Indonesia	104	13	117	55	13	68	55	13	68
Iraq	16	18	34	11	18	29	11	18	29
Jordan	14	5	19	14	5	19	14	5	19
Kazakhstan	37	1	38	30	0	30		Dropped	
Kenya	36	3	39	18	3	21	18	3	21
Kuwait	6	11	17	6	11	17	6	11	17
Lebanon	35	2	37	14	2	16	14	2	16
Libya	10	1	11	10	1	11	10	1	11
Malaysia	38	19	57	38	19	57	38	19	57
Maldives	3	1	4	1	0	1		Dropped	
Mauritania	7	5	12	7	5	12	7	5	12
Nigeria	24	1	25	22	0	22		Dropped	
Oman	7	3	10	6	3	9	6	3	9
Pakistan	27	9	36	26	9	35	26	9	35
Philippines	61	1	62	54	0	54		Dropped	
Qatar	8	6	14	8	6	14	8	6	14
Saudi Arabia	10	5	15	10	5	15	10	5	15
Senegal	20	1	21	16	0	16		Dropped	
Seychelles	3	1	4	1	0	1		Dropped	
Singapore	14	1	15	12	0	12		Dropped	
South Africa	36	1	37	31	0	31		Dropped	
Sri Lanka	27	2	29	14	2	16	14	2	16
Syrian Arab Republic	12	3	15	10	3	13	10	3	13
Tajikistan	9	1	10	5	0	5		Dropped	
Thailand	28	1	29	25	0	25		Dropped	
Tunisia	16	2	18	12	2	14	12	2	14
Turkey	59	7	66	23	7	30	23	7	30
United Arab Emirates	23	10	33	23	10	33	23	10	33
United Kingdom	168	8	176	27	8	35	27	8	35
Tanzania	32	1	33	26	0	26		Dropped	
Yemen	4	3	7	4	3	7	4	3	7
TOTAL	1163	185	1348	762	169	931	422	169	591

Notes: This table presents the sample selection process. Panel A shows the total number of banks from countries where both Conventional and Islamic banks operate, with a minimum of four banks. At the end of this stage, there are 1163 Conventional Banks and 185 Islamic Banks. Panel B summarizes the second stage of the process in which banks with less than three years of total assets data are excluded. At the end of this stage, 401 Conventional Banks and 16 Islamic Banks are dropped. In the final stage, I remove countries where only one type of bank remains and does not meet the minimum four banks criteria. Consequently, the sample consists of a total of 591 banks, with 422 of them being Conventional and 169 of them being Islamic Banks.

Table B: CRD keyword list

A. Carbon
1. Carbon
2. Carbon footprint
3. Carbon pricing/trading
4. Carbon related assets
5. Carbon disclosure project
6. Carbon emission
B. Climate
7. Climate
8. Climate change
9. Climate risk/opportunity
C. Emission
10. Emission
11. Greenhouse gases
12. Greenhouse gases emission
13. Scope 1
14. Scope 2
15. Scope 3
16. Greenhouse gases protocol
17. Reducing greenhouse gases
18. Harmful gases
D. Environment
19. Environment
20. Pollution
21. Global warming
22. Natural disasters
23. Energy consumption
24. Water consumption
25. Green finance
E. Agreements
26. Kyoto
27. Paris agreement
28. TCFD

Table C: Descriptions of variables

Name	Exp. Sign	Definition
		Dependent Variable
Climate-Related Disclosure (CRD)		Content analysis is undertaken. First, I determine a checklist that contains keywords for the climate-related disclosure that are presented in Appendix Table A. Then, I analyse the number of words that appear in the annual reports of the banks.
		Corporate Governance
Corporate Governance Index (CGI)	+	The corporate governance index consists of 6 different characteristics of the board of directors; (1) *Board Size:* If the board size of this bank is smaller than the median board size of the sample, then one, otherwise zero. (2) *Board Independence:* If the value of the board's independence is larger than the median of the sample, then one, otherwise zero. (3) *Board Meeting:* If the number of board meetings is larger than the median board meetings of the sample, then one, otherwise zero. (4) *Board Attendance:* If the percent of board attendance is larger than 75 %, then one, otherwise zero. (5) *Board Committees:* If the number of board committees is larger than the median board committees of the sample, then one, otherwise zero. (6) *Woman Directors:* If there any woman director on the board then one, otherwise zero.
		CEO Power Index
CEO Power Index (CEO Power)	+	CEO power index consists of 3 different characteristics of the CEO; (1) *CEO Duality:* If the roles of CEO and Chairperson are not separated, then one, otherwise zero. (2) *Internal CEO:* If the CEO is internally recruited, then one, otherwise zero. (3) *CEO Tenure:* If the CEO has more than the median tenure in the sample then one, otherwise zero.
		Bank-Specific Variables
Total Assets	+	Log of total assets.
ROA	+	Return on average assets.
Leverage	+	The ratio of customers' term deposits to total equity.
Loans	+	The ratio of loans to total assets.
Financial Slacks	-	Cash and cash equivalents divided by total assets.
Firm Age	+	The natural logarithm of the age of the firm.
Listed Banks	+	Listed Banks is dummy for listed banks. If the bank is a listed bank then one, otherwise zero.
Conventional Banks	+	Conventional Banks is dummy for conventional banks. If the bank is a conventional bank then one, otherwise zero.
		Country-Specific Variables
Islamicity	-	I use the Islamicity index by Rehman and Askari (2010).
GDPPC	-	The natural logarithm of the GDP per capita.
Inflation	+	Year-on-year change of Consumer Price Index (CPI).

Table D: Variance Inflation Factor (VIF) analysis

Variable	VIF	1/VIF
CBs	1.28	0.782
CGI	1.37	0.728
CEO Power	1.13	0.883
Total Assets	2.33	0.429
ROA	1.18	0.847
Leverage	1.53	0.654
Loans	1.16	0.863
Financial Slacks	1.20	0.835
Firm Age	1.44	0.692
Listed Banks	1.28	0.782
OIS	4.74	0.215
GDPPC	5.24	0.191
Inflation	1.34	0.748
Mean VIF	1.95	

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Paper 2

The Effect of Climate-Related Disclosure on Corporate Financial Performance: A comparison of Conventional and Islamic Bank

Abstract

This paper examines how CRD affects the financial performance of CBs and IBs. By employing a unique dataset of CRD for CBs and IBs over the periods of 2016-2019, I find that CRD of these two types of banks affects their financial performance significantly differently. My findings suggest that while CBs experience a significant increase in their financial performance as they disclose more information regarding the environment and climate in the reports, the relationship turns out to be significantly negative in the case of IBs. The study makes important contributions to the literature on stakeholders and voluntary disclosure theories. The findings of the study have important implications for climate change, especially for the Paris Accord and COP26. In particular, the study indicates the policy implications of sustainable financial markets and the role of the financial services sector. This study reveals the sensitivity of financial performance to CRD for CBs and IBs.

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1 Introduction

Important decisions to adapt and mitigate climate change have been taken by governments at the country level. The most notable of these attempts were The Kyoto Protocol (1997) and the Paris Agreement (2015). On the other hand, at the company level, the Financial Stability Board (FSB) launched the Task Force on Climate-Related Financial Disclosure (TCFD) for corporate climate-related risk reporting in 2017, which provides sets of recommendations for companies to report their response to the risks and opportunities arising from global warming and climate change.

The association between financial and social performance has been a fruitful topic for more than half a decade. However, a consensus on the relationship between economic and social performance has not yet been achieved by the studies. Existing studies provide theoretical and empirical evidence on both positive (Al-Tuwaijri et al., 2004; Griffin et al., 2017; Hull and Rothenberg, 2008; Jacobs et al., 2010; Kang et al., 2016; Matsumura et al., 2014; Russo and Fouts, 1997; Tang et al., 2012; Vishwanathan et al., 2020; Waddock and Graves, 1997) and negative (Barnett and Salomon, 2006; Friedman, 1970; Hillman and Keim, 2001; Jensen, 2002; McWilliams and Siegel, 1997; Surroca and Tribó, 2008) effects of socially responsible actions of the companies on financial performance. In this study, I explore the effect of climate-related disclosure (hereafter CRD) on profitability in the banking sector and compare CBs and IBs.

Multiple theories have been suggested to explain the positive link between social and financial performance. Stakeholder theory suggests that companies with a social and environmental performance/disclosure containing positive and progressive information can attract several types of stakeholders and strengthen the engagement and commitment of those groups to the companies (Freeman, 1984; Friedman, 1970). Legitimacy theory mainly focuses on the interaction between the company and society (Deegan, 2002); companies may deliver disclosures to their stakeholders, providing information about the companies' actions, beliefs, definitions, visions, and values to build their image and reputation. As a result, this reflects a positive trend in the financial performance of the companies (Al-Tuwaijri et al., 2004; Galbreath, 2013; Barnett, 2007; Clarkson et al., 2008, 2011; Leonidou et al., 2013; Jacobs et al., 2010; Patten, 2002). Furthermore, the information voluntarily provided by the company to

stakeholders decreases the opacity and cost of capital (Dhaliwal et al., 2011; Kim et al., 2012; Ng and Rezaee, 2015) and improves the financial performance and the firm value (Buchanan et al., 2018; Harjoto and Jo, 2015; Hillman and Keim, 2001). However, these mechanisms do not always hold true for some companies. Some researchers propose that the social performance of the companies diminishes the firm value (Friedman, 1970; Hong and Kacperczyk, 2009; Jensen, 2002; Mackey et al., 2007; McWilliams and Siegel, 1997). Barnett and Salomon (2006) argue that any voluntary spending on social welfare unnecessarily increases the firms' expenditures and causes an economic disadvantage in the competitive market. Consequently, the management of the companies could improve their reputation in the competitive market, attract more stakeholders' attention, especially to climate-related issues, decrease the cost of capital, and financially benefit from improving the firm value and economic performance. However, this instrument does not work for less efficient companies due to an increase in expenses resulting from social responsibility engagements.

On the other hand, using resources for social actions is not always an instrument that firms can utilize to improve their financial performance. According to one group of scholars (Barnett and Salomon, 2006; Friedman, 1970; Hillman and Keim, 2001; Jensen, 2002; McWilliams and Siegel, 1997; Surroca and Tribó, 2008), actively participating in social welfare actions, engaging in charity projects, minimizing environmental damage, and allocating limited financial and intellectual resources to social responsibilities could detract from a firm's financial performance. For some companies that do not have a competitive power in the market with limited financial and intellectual resources, social welfare expenses unnecessarily increase the firm's expenditures, surpassing the positive financial outcome of being socially active. Therefore, any voluntary spending on social welfare creates financial burdens for these companies and negatively affects their financial performance.

Banks play a key role in the transformation of economies to low carbon or net-zero emissions through sustainable finance and green banking (Reghezza et al., 2022). In practice, the direct effect of banks on climate change is just a drop in the ocean when compared to other manufacturing and production industries. For example, 100 companies are responsible for 71% of global emissions (CDP Carbon Majors Report, 2017); 20 polymer producers account for an estimated 55% of plastic waste and pollution globally, while the top 100

account for 90% of the whole figure (The Plastic Waste Makers Index, 2021); 55% of the 100 most significant tropical timber and pulp companies do not publicly commit to protecting biodiversity, and only 44% have yet to publicly commit to zero deforestation (ZLS, 2020[1]). The banking sector supports these and other sectors by providing financial sources. Recently, according to The Time to Green Finance (2020), a first-of-its-kind report by the non-profit CDP, "Portfolio emissions of global financial institutions on average over 700 times larger than direct emissions, per organization reporting financed emissions".

As a major provider of credit and the main source of funding, banks are the primary financial supporters of companies and sectors damaging fauna, flora, and fungi, contributing to and aggravating global warming, and causing more frequent, severe, and intense droughts, storms, floods, heatwaves, and wildfires, rising sea levels, melting glaciers, and other climate-related issues and disasters worldwide. To illustrate this argument, the 60 largest commercial and investment banks poured a total of $3.8 trillion into fossil fuels from 2016 to 2020, with 39% of total financing allocated to just 100 key companies with the worst fossil fuel expansion plans (Banking on Climate Chaos, 2021). Therefore, there is an indisputable need for banks to ensure resource and finance flows align with the objectives of sustaining "low greenhouse gas emission and climate-resilient development" as recognized by the Paris Agreement (2015).

This is not only important because banks can satisfy their stakeholders, but also because banks themselves are not immune to climate change. 70% of banks in the UK view climate change as a threat to the financial system, but only 10% are building a strategy on climate-related financial risk management (Bank of England, 2018). Severe climate-related issues affect banks as these catastrophes can harm the tangible assets of banks, decrease the profitability of banks' debtors, result in non-performing loans, and negatively impact the human and intellectual resources of the banks (Deryugina and Hsiang, 2014; Nordhaus, 2019; O'Neill et al., 2017; Reghezza et al., 2022; Stern, 2008). Nevertheless, banks are hesitant to increase their investments, instruments, and products in the green sector at present. However, there is an increasing trend regarding banks' investments and instruments in the green sector. Out of 101 banks, 51% currently do not yet offer dedicated climate products, but 88% are interested

[1]Companies failing to protect millions of hectares of tropical forest, Publication, July 17, 2020, available at https://www.zsl.org/conservation/news/companies-failing-to-protect-millions-of-hectares-of-tropical-forest (accessed: 25 Nov 2021).

in providing those kinds of products and services in the future (Stein et al., 2018). One reason for banks sitting on the fence about green investment could be that banks still consider the market to have insufficient incentives, such as green revenues and profitability (Kruse et al., 2020).

IBs and CBs are different from each other in various aspects, such as their financial structure, the products they offer to their customers, the business models they structure, or the corporate governance system they have established. However, it is not clear to determine theoretically whether IBs are more cost-effective or more stable than their conventional counterparts (Beck et al., 2013). The empirical studies show that the IBs are less stable (Čihák and Hesse, 2010), less cost-effective, diversified, and hedged as well as IBs have higher intermediation costs (Beck et al., 2013). Ariss (2010) find that IBs' competitive ability is less compared to CBs. Meslier et al. (2017) suggest that CBs which have higher market power compared to IBs could set lower deposit rates allowing CBs to operate more cost-efficiently. Johnes et al. (2014) argue that the business model structured and adopted by IBs put these banks at a disadvantage by causing them to be less efficient.

This study deals with the question of whether the relationship between financial performance and climate disclosure differentiate in IBs and CBs originating from the different nature of these banks. I propose that with different levels of cost-efficiency and the banks' positions in the competitive market, the CRD could affect the banks' financial performance differently in the case of CBs and IBs. To assess this proposition, I use hand-collected data for a sample of 591 banks (169 IBs, 422 CBs) from 24 countries for the period 2016-2019. I construct a CRD index to capture firm level CRD extent that contains 29 different items under 5 categories. Using these items, I conduct a content analysis using NVivo and annual reports published by banks. The findings of the study suggest that while CRD has a positive association with profitability in CBs, the opposite relation is observed in IBs. This result might be explained by using stakeholder and legitimacy theories for CBs, which imply that CBs attract better resources (Waddock and Graves, 1997) and more climate-sensitive investors, higher-calibre human capital (Greening and Turban, 2000), better marketing products and services (Fombrun, 1996), grants and subventions (Davis et al., 2016), additional unforeseen opportunities (Fombrun et al., 2000) and thereby CRD could create a competitive advantage

for CBs. On the other hand, comparing IBs with CBs, IBs have a relatively smaller market share (IBs' global market share accounts for approximately 6%), attract fewer customers and investors, have limited options for human resources, and operate with fewer branches in specific countries. Additionally, I find that the higher CRD increases the costs of IBs which are already more expensive compared to CBs. Therefore, allocating resources for climate favour actions, or investing in unprofitable climate-friendly investments could aggravate the competitive conditions for IBs. This results in a decrease in the profitability of these banks.

This study aims to make a significant theoretical contribution by examining the relationship between CRD and financial performance in CBs and IBs. The existing literature lacks comprehensive research on how different governance structures and stakeholder orientations influence the outcomes of CRD in these two types of banks, presenting a notable theoretical gap that this study aims to fill. This study contributes to the existing literature by providing a comprehensive understanding of the role of governance structures and stakeholder orientations in shaping CRD practices and their impact on financial performance in CBs and IBs. By drawing on stakeholder theory, voluntary disclosure theory, and shareholder wealth maximization theory, and considering the latest scholarship, this study fills the theoretical gap and addresses the need for comparative research in the context of CRD and financial performance in the banking sector.

To address this gap, this study draws on stakeholder theory and voluntary disclosure theory to explain the positive association between CRD and financial performance in CBs. Stakeholder theory emphasizes the importance of meeting the needs and expectations of various stakeholders, enabling CBs to enhance their legitimacy by addressing societal concerns through CRD (Donaldson and Preston, 1995; Freeman, 1984). Voluntary disclosure theory provides insights into how CBs strategically disclose climate-related information to build trust and attract socially responsible investors (Dye, 1985; Lang and Lundholm, 1993; Verrecchia, 1983). In contrast, this study incorporates shareholder wealth maximization theory to understand the potential negative association between CRD and financial performance in IBs. The theory suggests that excessive disclosure requirements may divert resources from value-maximizing activities, ultimately impacting the financial performance of IBs (Friedman, 1970; Jensen, 2002; McWilliams and Siegel, 1997). By integrating these theoretical

frameworks and considering the latest scholarship (e.g., Antoniuk 2023; Liesen et al. 2017; Maji and Kalita 2022; Velte et al. 2020), this study aims to provide a comprehensive understanding of the role of governance structures and stakeholder orientations in shaping CRD practices and their impact on financial performance in CBs and IBs.

Additionally, this study contributes to the field by investigating the effect of CRD on financial performance in a comparative view of CBs and IBs. While there have been a limited number of studies that have explored the CSR, sustainability, and environmental aspects of IBs (Aribi and Arun, 2015; Belal et al., 2015; Haniffa and Hudaib, 2007; Kamla and Rammal, 2013; Maali et al., 2006; Mallin et al., 2014; Williams and Zinkin, 2010), there is a lack of research specifically examining the climate-related perspective. This study fills this gap by investigating the effects of CRD on the financial performance of IBs from a climate perspective.

Finally, this study employs a unique dataset for the analyses. Corporate governance-related data, including board size, CEO duality, internal CEO, and CEO tenure, have been collected manually from various sources such as annual reports, corporate governance reports, banks' websites, and databases. The use of NVivo software has facilitated the extraction of climate-related data from annual reports, ensuring a comprehensive assessment of CRD.

The remainder of the paper is structured as follows. Section 2 provides the theoretical framework and hypothesis while Section 3 specifies the sample, data, and the model applied in this study. Section 4 includes the empirical result, and finally, Section 5 presents the conclusion.

2 Theoretical Framework and Hypothesis Development

Extensive prior literature on financial performance and environmental performance and disclosure has proposed various approaches and theories. The research advocates a positive relationship and has formed various approaches and theories to explain the concept of being green and its effects on profitability. Some of the most cited theories on this topic are stakeholder theory, legitimacy theory, and voluntary disclosure theory.

A stakeholder is defined as "any group or individual who can affect or is affected by the achievement of the firm's objectives" by Freeman (1984). According to the basic stakeholder

concept, one of the important factors leading companies' success is companies' ability to best match their business strategies, model, and decision with stakeholder groups which can be classified as shareholders, investors, creditors, customers, suppliers, employees, government, media, local communities, and societies (Deegan and Unerman, 2006). The stakeholder theory is widely used to reason CSR, environmental, sustainability, and CRD (Berrone and Gomez-Mejia, 2009; Buysse and Verbeke, 2003; de Villiers et al., 2011; Delmas and Toffel, 2008; Kassinis and Vafeas, 2006; Roberts, 1992; Schnackenberg and Tomlinson, 2016). A company with social and environmental disclosure containing positive and progressive information could attract several types of stakeholders and strengthen the engagement and commitment of those groups to the company. Huang and Zhang (2012) demonstrate that stakeholder groups have an important power to influence the quantity and extent of information of the environmental disclosure. While stakeholders push the companies to be more active in social welfare actions and to disclose more information about these actions, investors who advocate social welfare investments are willing to give up higher returns, expose lower reward-to-risk ratios, and pay higher fees (Riedl and Smeets, 2017).

Companies that recognize the stakeholders' demands, needs, and concerns and inform those stakeholders regarding environmentally favorable actions are rewarded positively in financial means. Al-Tuwaijri et al. (2004) show a positive relationship between economic and environmental performance, which is a win-win scenario. Accordingly, good environmental performance is recognized as an intangible asset of the company for investors, and thereby, better environmental performance is rewarded by the market. Matsumura et al. (2014) compare companies disclosing and non-disclosing carbon emission information. The findings suggest that every additional ton of carbon emission diminishes the firm value by around $212, while the market value of the companies disclosing the information is about $2.3 billion higher than the compared companies. This implies that whereas there is a cost of emitting carbon into the atmosphere, this cost becomes bigger when a company does not reveal the carbon emission information to the markets. Although Griffin et al. (2017) do not find any significant difference between disclosing and non-disclosing companies, their findings show that greenhouse gas emissions negatively affect the equity values and there is a decrease of $79 per ton of greenhouse gas emission.

In a similar vein, another popular theory applied by researchers to explain non-financial voluntary disclosure of the companies is the voluntary disclosure theory (Clarkson et al., 2008; Dye, 1985; Lang and Lundholm, 1993; Verrecchia, 1983). Voluntary disclosure means that companies freely prefer to deliver important information to the stakeholders without a mandate regarding delivering that information by regulations or legislation (Meek et al., 1995). Providing nonmandatory information is good for strengthening the legitimacy of the company among stakeholders by influencing the stakeholders' perception of the company's image and reputation (Guidry and Patten, 2012; Hooghiemstra, 2000) and reducing social and political pressure (Patten, 1991; Warren and Schwartz, 1997). Plumlee et al. (2015) document that discretionary environmental disclosure quality is positively associated with the firm value, which is proxied by expected future cash flows and the cost of equity. Martin and Moser (2016) suggest that the management of the companies is encouraged to make and disclose green investments because they capture investors' reactions and attention to green investment, even though green investments do not contribute to future cash flows. Green investments do not bring financial benefits since the investment costs are always higher than the benefits. Managers and shareholders, however, are in favour of green investments because the gain of attracting new investors through making and disclosing these investments exceeds the costs of green investments.

Using stakeholder and voluntary disclosure theories, I hypothesize that providing an extent of information that reflects the actions the banks take in climate-related issues captures the stakeholders' interest and causes a positive return for the bank. Therefore, I set the first hypothesis as follows.

Hypothesis H_1: The extent of the CRD positively affects the corporate financial performance in CBs.

On the other hand, Friedman (1970) criticizes corporate social responsibility actions. According to the writer, the management of the firms that engage in social responsibility "spend someone else's money for a general social interest". If social responsibility actions reduce the shareholder wealth, then the executive spends shareholders' money; if those actions create extra costs for customers, then the executive spends customers' money; and if those actions reduce some employees' earnings, then it means that executives spend employees'

money. The executives could spend someone else's money on a "social responsibility action" that is not very necessary to be addressed or that is addressed more than the required amount. Therefore, if executives of the companies engage in social responsibility actions in a way different from those that shareholders, customers, or employees would engage in, then executives do not act as an agent of these groups. What Friedman (1970) advocates is that the executives should stay as an agent of those groups, and leave the decision to them to involve any social responsibility actions with their own money rather than spending their money in a way which they would not wish. If executives exploit the shareholders', customers', employees' or someone else's money to invest in particular social responsibility actions, this behaviour is a redistribution of those groups' wealth to other stakeholders rather than creating an extra value for the company which has a negative effect on financial performance for the company (McWilliams and Siegel, 1997). In this regard, (Jensen, 2002) suggests that firms must focus more on maximising total firm value than on maximising social welfare. This is not because social welfare maximation is not important or social problems do not exist but because social welfare is closely linked to wealth creation. As long as the shareholder value is maximised, the social welfare maximation is also succeeded; focusing on only social welfare maximation decreases the firm value.

Some researchers argue that environmental performance worsens the firms' financial performance (Barnett and Salomon, 2006; Friedman, 1970; Hillman and Keim, 2001; Jensen, 2002; McWilliams and Siegel, 1997; Surroca and Tribó, 2008) and the negative association between environmental performance/disclosure has been documented by a number of studies. Bolton and Kacperczyk (2021) investigate the relationship between carbon emission data and US stock returns. They find that as the CO_2 emission proxied by Scope 1, Scope 2, and Scope 3 increases, the companies achieve higher returns. In et al. (2019) demonstrate that carbon-efficient firms outperform carbon-inefficient firms. However, the researchers cannot find this result for small firms sample. Lyon et al. (2013) find that the companies from low-pollution industries that have been awarded by Green Company Awards in China experience negative significant returns and small companies with the same award negative insignificant returns.

Barnett and Salomon (2006) argue that any voluntarily spending for social welfare increases the firms' expenditures and causes an economic disadvantage in the competitive

market. Comparing CBs and IBs regarding the competition, IBs are definitely in a less advantageous position even in the Muslim-majority countries. IBs are less stable, less cost-effective, less diversified, less hedged, less competitive, operate with higher costs, have less market power, and less effective business model (Ariss, 2010; Beck et al., 2013; Čihák and Hesse, 2010; Johnes et al., 2014; Meslier et al., 2017). Furthermore, CBs have better and bigger sources even in Muslim majority countries. According to Ernst & Young (2016), IBs assets share constitutes 34% in GCC , 13% in ASEAN (Malaysia, Indonesia), 12% in South Asia (Pakistan, Bangladesh), and 6% in the rest of the world (Egypt, Jordan, Turkey, South Africa, Sudan, etc.) . Globally, 93% of IBs assets are based in only 9 countries (33% in Saudi Arabia, 15.5% in Malaysia, 15.4 % in UAE, 10.1% in Kuwait, 8.1% in Qatar, 5.1% in Turkey, 2.5% in Indonesia, 1.6% in Bahrain, and 1.4% in Pakistan) around the world. Therefore, I argue that IBs have distinct disadvantages in the competitive market compared to CBs. Nationwide, only in Saudi Arabia, the majority of the banking assets belong to IB with a minor difference, 51.2%, while in Kuwait, IBs' assets comprise 45% of the whole banking assets (The IBs assets share in other countries are as follows; 29.3% in Bahrain, 25.8% in Qatar, 21.6% in UAE, 21.3% in Malaysia, 10.4% in Pakistan, 5.5% in Turkey, and 3.7% in Indonesia).

Hypothesis H_2: The extent of the CRD negatively affects the corporate financial performance in IBs.

3 Data and Method

3.1 Sample

I form my primary sample based on the BankFocus database. By following the extant literature, I set a series of sample selection criteria: (i) countries that have both CBs and IBs, which allows for a comparative analysis between the two banking systems, (ii) countries that have at least four banks, ensuring an adequate sample size for meaningful analysis by countries. Having at least four banks in a country also signals a relatively strong banking system with competition, and (iii) banks with at least three years of data, minimising missing data and ensuring a sufficient time series for analysis over a reasonable period (Beck et al.,

2013; Mollah and Zaman, 2015; Mollah et al., 2017, 2021a). Among these settings, "countries with at least four banks" criterion is especially important because it aims to capture a broader range of banking institutions and reduce the likelihood of a monopolistic banking structure. Including multiple banks in the sample increases the potential for competition and provides a more representative picture of the banking sector in terms of market dynamics, pricing, innovation, and overall performance. After applying these sampling criteria and eliminating the banks that do not meet them, I construct a sample of 591 banks, including 169 IBs and 422 CBs from 24 countries, covering the period from 2016 to 2019. The sample selection process is summarised in Appendix Table E. The starting year of 2016 is chosen to assess the effect of the TCFD framework on corporations, as it was published in 2017. Then end year is set as 2019, which was the current date when the data was collected. The sample consists of approximately 29% of IBs and 71% of CBs. The distribution of CBs and IBs in the sample aligns with other studies in the extant literature (e.g., Abdelsalam et al., 2016; Abedifar et al., 2013; Mollah et al., 2017, 2021b. Table 12 presents the distribution of the sample across countries.

3.2 Definitions and Measures of the Variables

3.2.1 Dependent Variable

I investigate the link between the CRD and bank financial performance measured by two different accounting-based measures to represent financial performance, Return on Assets (ROA) and Return on Equity (ROE). These two variables are widely used in the prior environmental performance/disclosure and performance studies (Aguilera-Caracuel and Ortiz-de Mandojana, 2013; Chien and Peng, 2012; Leonidou et al., 2013; Waddock and Graves, 1997; Wang and Bansal, 2012; Wiengarten et al., 2017). Al-Tuwaijri et al. (2004) point out the limitations of using firms' economic performance mentioning that "using various economic performance metrics is that they tend to focus narrowly on one aspect of a firms' economic performance." (p. 456). For example, net income is used to measure firm profitability without taking firm size into consideration. To overcome this limitation, Al-Tuwaijri et al. (2004) suggest scaling the profitability of the firm's investment in their asset base unless the sample of a study includes firms from different industries with different industry-driven levels of fixed

Table 12: Sample distribution

Country	CBs	%	IBs	%	Total	%
Algeria	14	3.32%	2	1.18%	16	2.71%
Bahrain	13	3.08%	20	11.83%	33	5.58%
Bangladesh	40	9.48%	9	5.33%	49	8.29%
Egypt	19	4.50%	3	1.78%	22	3.72%
Indonesia	55	13.03%	13	7.69%	68	11.51%
Iraq	11	2.61%	18	10.65	29	4.91%
Jordan	14	3.32%	5	2.96%	19	3.21%
Kenya	18	4.27%	3	1.78%	21	3.55%
Kuwait	6	1.42%	11	6.51%	17	2.88%
Lebanon	14	3.32%	2	1.18%	16	2.71%
Libya	10	2.37%	1	0.59%	11	1.86%
Malaysia	38	9.00%	19	11.24%	57	9.64%
Mauritania	7	1.66%	5	2.96%	12	2.03%
Oman	6	1.42%	3	1.78%	9	1.52%
Pakistan	26	6.16%	9	5.33%	35	5.92%
Qatar	8	1.90%	6	3.55%	14	2.37%
Saudi Arabia	10	2.37%	5	2.96%	15	2.54%
Sri Lanka	14	2.32%	2	1.18%	16	2.71%
Syrian Arab Republic	10	2.37%	3	1.78%	13	2.20%
Tunisia	12	2.84%	2	1.18%	14	2.37%
Turkey	23	5.45%	7	4.14%	30	5.08%
United Arab Emirates	23	5.45%	10	5.92%	33	5.58%
United Kingdom	27	6.40%	8	4.73%	35	5.92%
Yemen	4	0.95%	3	1.78%	7	1.18%
Total	**422**	**100%**	**169**	**100%**	**591**	**100%**

Notes: This table presents the sample distribution for CBs, IBs and whole sample for given countries over a period of 2016-2019.

assets. Since this study deals with only one sector, which is the banking industry, this study would not fall into this mentioned bias, thus, I elect to use the accounting-based metrics to represent economic performance.

3.2.2 Independent Variable

My main explanatory variable is the CRD. I start by constructing a CRD index to measure the level of the CRD across the different banks in my sample. Financial statement data for all firms in my sample for the period from 2016 to 2019 are hand-collected, as several of the banks in my sample are unlisted. To quantify the level of disclosure among firms, I employ a content analysis approach by conducting text mining using NVivo qualitative statistical

software. The keywords used are based on TCFD Reports (2017 and 2019) and literature investigating the CRD (Caliskan and Esen, 2021; de Aguiar and Bebbington, 2014). From these sources, I identify twenty-nine keywords under five specific sections: Carbon, Climate, Emission, Environment, and Agreements. These keywords are presented in Appendix Table F. To capture all the related words, I consider the verb, adjective, and noun forms of the keywords, as well as their synonyms, by stemming them and applying special characters such as dash (-), slash (/), space ( ), or concatenate (). NVivo is used to examine the frequency of occurrence of the keywords within each report. One challenge encountered in this process is the use of synonyms in annual reports. For example, the word "environment" in NVivo gives results in different contexts such as "the natural world", "the setting or condition in which a particular activity is carried on" or "the overall structure within which a user, computer, or programme operates", including "financial environment", "business environment", or "development environment". Therefore, the entire process is carried out carefully, with observation and manual verification of every word in the context.

3.2.2.1 Reliability of the CRD

To evaluate the reliability of the constructed index, various measures and techniques recommended in the literature have been followed in this section. The development of the index categories and items involved gathering information from diverse and multiple sources, including TFCD and various literature sources mentioned in 3.2.2. Independent Variable section (Grassa et al., 2021). Additionally, since the index scores were derived by counting the appearance of words in the annual reports using NVivo, the index is reproducible (Beattie et al., 2004).

Furthermore, Cronbach's alpha is employed to assess the reliability of the CRD index (Xiao and Dew, 2011). The full CRD index demonstrates a Cronbach's alpha value of 0.86, indicating good internal consistency. Moreover, Cronbach's alpha scores are calculated for all subcategories of CRD. The subscales for Carbon, Climate, Emission, Environment, and Agreements exhibit satisfactory Cronbach's alpha scores of 0.87, 0.85, 0.85, 0.74, and 0.85, respectively.

3.2.2.2 Validity of the CRD

To assess the validity of the CRD index created by this study, I conduct a construct-related validity test (Butler et al., 2012; Schwab, 2005; Tahri et al., 2023). Firstly, I examined the correlation between the level of CRD and the various categories of CRD (Botosan, 1997). The results, presented in Table 13, reveal positive and significant correlations between all categories of the CRD and the overall level of CRD. These findings indicate that the disclosure index of CRD demonstrates validity and can be considered reliable in measuring the level of disclosure and transparency in this context.

Table 13: The correlation between CRD and the components of CRD index

	CRD	Carbon	Climate	Emission	Environment	Aggrement
CRD	1.000					
Carbon	0.714***	1.000				
Climate	0.791***	0.619***	1.000			
Emission	0.767***	0.657***	0.556***	1.000		
Environment	0.907***	0.431***	0.512***	0.474***	1.000	
Agreements	0.572***	0.560***	0.734***	0.366***	0.193	1.000

Notes: This table provides correlation coefficients used to determine the validity of the CRD index.

3.2.3 Control Variables

Firm control variables include company size measured by the logarithm of total assets, non-performing loans to total assets, debt-to-equity ratio measured by dividing long-term debts by equity, firm age which is the natural logarithm of the age of the bank, and the number of branches of the banks. The number of directors on the board has been used as a metric of corporate governance structure in the literature (Pathan, 2009) since the size of the board shapes the extent of the monitoring and controlling activities, as well as the decision-making process in a firm (Jensen, 1993; Yermack, 1996). I follow the extant literature to capture CEO Power as a control variable. For example, CEO and Chairperson duality are widely used as a proxy for CEO Power (Korkeamäki et al., 2017; Onali et al., 2016). An internally recruited CEO is also considered a CEO Power proxy (Adams et al., 2005; Pathan, 2009). The tenure of the CEO, with more tenure than the median CEO tenure of the sample, is also used as a CEO Power proxy in several studies (Chikh and Filbien, 2011; Schmid et al., 2018). By considering these three proxies, I construct a CEO Power Index.

I created a dummy variable (i.e. ListedBanks = 1; otherwise, 0). Based on the statistics of ListedBanks, I found that out of the total Conventional Banks, 212 are listed while the remaining 210 are unlisted. Similarly, among the Islamic Banks, 75 are listed and 94 are unlisted. Furthermore, some country controls are added to the model: the natural logarithm of GDP per capita (GDPPC), and inflation proxied by yearly changes in the customer price index. I include the global Gallup survey research conducted in 2009 for 114 countries to capture religiosity in the model (Abdelsalam et al., 2021). The survey includes one main question for adults, which is "*Is religion an important part of your daily life?*". Finally, a dummy variable for CBs employed where 1 if the bank is a CB and 0 if the bank is IB. While coding bank types, I consider 100% Sharia compliance banks as IBs. Some of the CBs offer some Islamic products to their customers, and these banks are coded as IBs in BankFocus. I conduct a strict elimination process for Islamic Window banks and keep only pure IBs.

3.3 Economic Model

I create the following model to test the effect of the CRD on the corporate financial performance of the whole sample, only CBs and only IBs.

$$CFP_{b,c,t} = \alpha_0 + \beta_1 CRD_{b,c,t} + \gamma X_{b,c,t} + \vartheta Y_{c,t} + \epsilon_{b,c,t} \tag{3}$$

The variables used in the model are as following.

$CFP_{b,c,t}$	is the corporate financial performance of bank b in country c at time t.
$CRD_{b,c,t}$	is the CRD of bank b in country c at time t.
$X_{b,c,t}$	is a matrix of firm-level control variables of bank b in country c at time t.
$Y_{c,t}$	is a matrix of country-level control variables of country c at time t.
$\epsilon_{b,c,t}$	is the error term; α_0 is the constant; and α, β, γ, and ϑ are the vectors of coefficient estimates.

The bank-level control variables are total assets, non-performing loans to total assets, debt-to-equity ratio, firm age, number of branches, the board size, and CEO Power. The country-level control variables are GDP per capita, religiosity, and inflation rate. The descriptions of the variables are provided in Appendix Table G.

In this study, I employ the random-effect GLS technique with robust standard errors for my estimations. The random-effect method has widely been used in the literature (Abedifar

et al., 2013; Izzeldin et al., 2021; Johnes et al., 2014; Mollah and Zaman, 2015; Mollah et al., 2017; Pathan, 2009). Following these researches, I select random effect because of several reasons; (1) an OLS ignores the panel data structure (Gambin, 2004); (2) fixed-effect fails to be efficient at estimating time-invariant variables such as religiosity (Abedifar et al., 2013; Mollah and Zaman, 2015; Mollah et al., 2017); (3) fixed-effect estimation is inefficient to estimate limited-variance variables such as Board Size and CEO Power since these variables remain similar over time and thus employing fixed-effect technique would cause a loss of degrees of freedom (Baltagi, 2008; Wooldridge, 2002).

3.4 Descriptive Statistics

Table 14 presents the descriptive statistics of the variables. To identify and address outliers, which could be due to extreme situations or data coding errors, quantile-based methods were applied. Specifically, the 99^{th} and 1^{st} percentiles are considered as outliers in this analysis. Data points that fall above the 99^{th} percentile or below the 1^{st} percentile are identified as potential outliers and these values that deviate significantly from the majority of the data are identified and winsorized. The table presents the number of observations, mean, standard deviation, median, minimum and maximum values for the full sample, CBs, and IBs. A two-sample t-test to compare the means of CBs and IBs is also displayed in Table 14. For the full sample, the mean value of ROA is 0.94, with a standard deviation of 2.44. The mean value of ROA is 1.21 for CBs and 0.13 for IBs, with standard deviations of 1.39 and 4.14, respectively. The difference is in ROA between these two types of banks is statistically significant. The other accounting-based performance measures show a similar pattern. The mean value of the ROE for the full sample is 8.45, with a standard deviation of 12.85. For CBs, the mean ROE is 9.52 (σ=10.52), and for IBs, it is 5.21 (σ=17.82). Furthermore, the mean value of the CRD, my main explanatory variable, is 2.90 (σ=1.58) for the entire sample. For CBs, the mean CRD is 3.22 (σ=1.52), and for IBs, it is 1.96 (σ=1.39). The t-test reveals a highly significant difference between the mean CRD of these two types of banks.

The means for the bank-specific variables for the full sample (CBs sample; IBs sample) are as follows; the logarithm of total assets (TA) is 15.61 (15.91; 14.72), the ratio of non-performing loans to total assets (NPL/TA) is 6.86 (5.81; 10.08), the ratio of debt to equity

Table 14: Descriptive statistics

	Panel A: CBs						**Panel B:** IBs						**Panel C:**
	Obs.	Mean	S.D.	50%	Min	Max	Obs.	Mean	S.D.	50%	Min	Max	t-test
ROA	668	1.21	1.39	1.11	-6.16	16.68	224	0.13	4.14	0.92	-32.00	10.21	3.74***
ROE	667	9.52	10.52	10.05	-135.40	34.77	220	5.21	17.82	7.97	-137.19	34.84	2.36**
CRD	697	3.22	1.52	3.53	0	6.84	235	1.96	1.39	1.95	0	5.46	11.31***
TA	674	15.91	1.69	15.69	10.52	21.72	227	14.72	1.98	15.02	7.32	18.44	12.39***
NPL/TA	614	5.81	8.70	3.94	0	100	199	10.08	20.84	2.57	0.00	100	-2.32**
Debt/Equity	674	8.89	4.95	7.93	-27.13	41.11	227	7.89	5.98	7.26	-11.14	42.72	1.84*
Firm Age	629	3.68	0.64	3.74	1.39	5.80	193	3.01	0.66	3.04	0.69	4.19	18.81***
No. Branch	585	2.14	1.44	2.08	0	7.85	188	1.89	1.07	1.95	0	4.60	3.14***
Board Size	668	2.14	0.41	2.20	0.69	3.00	229	2.04	0.42	2.08	0	3.00	3.88***
CEO Power	662	1.11	0.77	1	0	3	227	0.94	0.69	1	0	3	3.57***
Listed Banks	697	0.66	0.47	1	0	1	235	0.56	0.49	1	0	1	
GDPPC	697	8.76	1.13	8.33	7.16	11.10	235	9.33	1.15	9.34	7.16	11.10	
Religiosity	697	0.90	0.19	0.96	0.27	1	235	0.90	0.17	0.94	0.27	1	
Inflation	697	4.70	4.41	3.53	-2.09	29.51	235	3.36	3.85	2.17	-2.09	16.33	

	Panel D: Full Sample					
	Obs.	Mean	S.D.	50%	Min	Max
ROA	892	0.94	2.44	1.07	-32.00	16.68
ROE	887	8.45	12.85	9.61	-137.19	34.84
CRD	932	2.90	1.58	3.00	0	6.84
TA	901	15.61	1.84	15.54	7.32	21.72
NPL/TA	813	6.86	12.90	3.78	0	100
Debt/Equity	901	8.64	5.24	7.79	-27.13	42.72
Firm Age	822	3.53	0.70	3.58	0.69	5.80
No. Branch	773	2.08	1.36	2.08	0	7.85
Board Size	897	2.11	0.42	2.20	0	3.00
CEO Power	889	1.07	0.76	1	0	3
Listed Banks	932	0.64	0.47	1	0	1
GDPPC	932	8.90	1.16	8.39	7.16	11.10
Religiosity	932	0.90	0.18	0.96	0.27	1
Inflation	932	4.36	4.31	3.20	-2.09	29.51

Table 15: Correlation matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1) ROA	1.00													
(2) ROE	0.21***	1.00												
(3) CRD	0.11***	0.15***	1.00											
(4) TA	0.06***	0.08***	0.26***	1.00										
(5) NPL/TA	-0.23***	-0.12***	-0.19***	-0.40***	1.00									
(6) Debt/Equity	-0.03	-0.33***	0.20***	0.05**	-0.01	1.00								
(7) Firm Age	0.07***	0.16***	0.22***	0.42***	-0.16***	0.04*	1.00							
(8) No. Branch	0.01	0.04	0.22***	0.52***	-0.12***	0.05*	0.25***	1.00						
(9) Board Size	-0.01	0.07**	0.05	0.25***	-0.04	0.08***	-0.02	0.23***	1.00					
(10) CEO Power	0.10***	0.14***	0.02	0.12***	-0.05*	-0.03	0.20***	0.10***	0.05*	1.00				
(11)Listed Banks	0.02	-0.01	0.15***	0.19***	-0.05**	-0.02	0.16**	0.26***	0.26***	0.04	1.00			
(12) GDPPC	0.01	-0.03*	-0.32***	0.32***	-0.09***	-0.05**	-0.04	0.23***	0.03	0.01	-0.02	1.00		
(13) Religiosity	-0.02	0.04*	-0.06*	-0.23***	0.05*	-0.01	0.06**	-0.26***	-0.18***	0.02	0.11***	-0.47***	1.00	
(14) Inflation	0.03	0.07***	0.14***	0.06***	-0.06**	0.03	0.18***	-0.02	0.09***	0.07**	-0.08***	-0.41***	0.11***	1.00

ROA: Return of Assets; ROE: Return on Equity; CRD: Climate-Related Disclosure; TA: Total Assets, log of total assets; NPL/TA: The ratio of Non-Performing Loans to total assets; Debt/Equity: The ratio of total debt to total equity; Firm Age: The natural logarithm of the age of the firm; No. Branch: Number of banks branches; Board Size The natural logarithm of number of members on the booard of directors; CEO Power: CEO Power Index; Listed Banks: Listing dummy that shows the listing status of banks; GDPPC: GDP per capita, the natural logarithm of the GDP per capita; Religiosity: Gallup Survey on the religiosity by countries; INF: Inflation, change in the inflation rate. ***, **, and * represent significance level of 0.01, 0.05, and 0.1, respectively.

(Debt/Equity) is 8.64 (8.89; 7.89), the logarithm of firm age (Firm Age) is 3.53 (3.68; 3.01), the logarithm of the number of branches (No. Branches) is 2.08 (2.14; 1.89), the logarithm of board size (Board Size) is 2.11 (2.14; 2.04), and the CEO Power index score is 1.07 (1.11; 0.94). Significant differences can be observed in all the bank-specific variables. Moving on to the country-specific variables, the means are as follows: the logarithm of the GDP per capita (GDPPC) is 8.90, religiosity is 0.90, and inflation is 4.36.

A Pearson's pairwise correlation analysis for the full sample is presented in Table 15. The signs of the variables between dependent variables and independent variables show no surprises. The correlation analysis results indicate that there are no highly correlated coefficients between the regressors. The only strong correlation appears between total assets (TA) and the number of branches (No. Branch), exceeding 0.5 (Cohen, 1988). Therefore, a variance inflation factor test is conducted for further investigation. Appendix Table H demonstrates that all of the variables meet the rule of thumb, which is lower than 10 (James et al., 2013; Kennedy, 1998; Marquardt, 1970; Vittinghoff et al., 2005). Consequently, the collinearity problem is not a concern in this study.

4 Empirical Results

4.1 The Link Between the CRD and Corporate Financial Performance

I employ my model for the full sample and separately for each bank types. I document the regression results for the baseline specification in Table 16, including the full sample, only CBs, and only IBs, using the dependent variables of ROA and ROE. Panel A of Table 16 reports the results for the effects of CRD on ROA. I find a positive association between ROA and firms' disclosure level for the full sample. When examining the bank types separately, I observe a positive association between CRD and performance for CBs, supporting my H_1. However, this relationship becomes negative for IBs, supporting my H_2. In Panel B of Table 16, I examine the relationship between disclosure and my other financial performance variable, ROE. Consistent with previous findings, I find a positive association between disclosure and performance for the CBs sample, and a negative association between these for the IBs sample, supporting my first and second hypotheses. Although the direction of the

relationship remains the same for both ROA and ROE, there is a difference in significance levels. The impact of CRD on ROA is significant at the 1% level, while it occurs at the 5% level for ROE in CBs.

On the other hand, I find an opposite relationship between the CRD and the financial performance of the IBs. The disclosure of more information negatively affects the profitability of the IBs at the 1% level in both ROA and ROE. Therefore, the results show consistency for both ROA and ROE. I also conduct a coefficient comparison between CBs and IBs in ROA and ROE. I find that the coefficient of CRD for CBs and IBs are significantly different in both ROA and ROE. Furthermore, I perform Hausman tests to determine whether a random-effects regression model is suitable for testing the panel data. If the result of the Hausman test is insignificant, it suggests that the random-effects technique is preferred due to higher efficiency (Hausman, 1978). In all of the baseline models, I fail to reject the null hypotheses, indicating that the random-effects technique is more consistent with my data and models.

These results clearly differentiate CBs from IBs in terms of the relationship between climate disclosure/performance and financial performance. I argue that CBs can enhance their firm value and improve their financial performance by disclosing extensive voluntary climate-related information, aligning with stakeholder, legitimacy, and voluntary disclosure theories. This finding is consistent with existing literature (Aguilera-Caracuel and Ortiz-de Mandojana, 2013; Al-Tuwaijri et al., 2004; Griffin et al., 2017; Hull and Rothenberg, 2008; Jacobs et al., 2010; Kang et al., 2016; Leonidou et al., 2013; Matsumura et al., 2014; Russo and Fouts, 1997; Tang et al., 2012; Vishwanathan et al., 2020; Waddock and Graves, 1997).

On the other hand, IBs lack the adaptive competitive financial and non-financial capabilities to prioritise climate-related issues. Given these limitations, when IBs allocate their financial and non-financial resources to climate-related issues, these discretionary expenditures increase their expenses and costs, negatively impacting their competitive position in the market and financial performance.

I propose that the climate disclosure/performance makes IBs more costly, considering that they are already more expensive compared to CBs.

Thus, I argue that the more extensive disclosure significantly raises the costs of IBs significantly compared to CBs. To evaluate this argument, I examine the effect of disclosure

Table 16: Accounting performance and CRD in CBs and IBs

	Random Effect					
	Panel A: ROA			**Panel B:** ROE		
	Full Sample	CBs	IBs	Full Sample	CBs	IBs
Variables	(1)	(2)	(3)	(4)	(5)	(6)
CRD	0.014***	0.039***	-0.385***	0.305**	0.548**	-1.182***
	(0.002)	(0.006)	(0.055)	(0.308)	(0.311)	(0.442)
TA	0.112*	-0.038	0.703***	1.631***	1.052***	3.825***
	(0.066)	(0.037)	(0.157)	(0.319)	(0.345)	(1.133)
NPL/TA	-0.049***	0.015	-0.071**	-0.250***	-0.274	-0.143*
	(0.009)	(0.018)	(0.036)	(0.019)	(0.200)	(0.086)
Debt/Equity	-0.091***	-0.144***	-0.107*	-0.557	-0.757*	-0.041
	(0.011)	(0.009)	(0.064)	(0.380)	(0.463)	(0.236)
Firm Age	0.090	-0.131***	0.269	-0.629*	-0.692	1.568***
	(0.083)	(0.047)	(0.169)	(0.383)	(0.493)	(0.400)
No. Branch	-0.037	0.113***	-0.032	-0.246	-0.054	0.667*
	(0.056)	(0.040)	(0.133)	(0.446)	(0.521)	(0.396)
Board Size	-0.397**	-0.186	-1.713***	1.903	3.346	-4.248***
	(0.182)	(0.177)	(0.559)	(1.581)	(2.320)	(0.305)
CEO Power	0.241***	0.171***	0.290***	1.060***	1.053***	1.190***
	(0.009)	(0.009)	(0.084)	(0.330)	(0.383)	(0.181)
Listed Banks	0.669***	0.191***	1.482***	1.265	-0.142	3.677***
	(0.211)	(0.021)	(0.445)	(0.953)	(1.267)	(0.701)
GDPPC	-0.196***	-0.021	-0.794***	-1.311***	-1.343	-3.462**
	(0.056)	(0.030)	(0.298)	(0.330)	(0.998)	(1.748)
Religiosity	0.180	-0.343	-3.640***	11.347***	10.281**	-8.740*
	(0.247)	(0.229)	(1.101)	(3.224)	(4.415)	(4.669)
Inflation	0.019***	0.031***	0.033***	0.389***	0.368***	0.325***
	(0.003)	(0.001)	(0.000)	(0.008)	(0.046)	(0.037)
Constant	1.765	3.718	4.680	-15.879**	-6.892	-8.423
	(1.273)	(0.857)	(2.430)	(4.525)	(10.208)	(6.711)
Observations	604	463	141	602	463	139
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
chi^2 (1)		9.86***			4.12**	
Prob >chi^2		0.001			0.043	
Hausman chi^2	1.36	0.63	2.60	0.41	0.40	2.65
Prob>chi^2	0.506	0.729	0.272	0.815	0.820	0.265

Notes: This table presents the results of Equation (3) and shows the analysis of association between climate-related disclosure and corporate financial performance of CBs, IBs, and overall sample. The dependent variable is *ROA* and *ROE* which are the measures of accounting performance of the banks. The main independent variable is *CRD* which the index to measure climate-related disclosure. *TA* is the natural logarithm of total assets of the banks. *NPL/TA* is the ratio of non-performing loans to total assets, *Debt/Equity* is the ratio of total debt to total equity, *Firm Age* is the natural logarithm of the age of the firm, *No. Branch* is the number of banks branches, *Board Size* is the natural logarithm of number of members on the booard of directors, *CEO Power* is the index that measures CEO power in the banks consisting of 3 different characteristics of a CEO, *GDPPC* is the natural logarithm of the GDP per capita, *Religiosity* is the Gallup Survey on the religiosity by countries and *INF* is the year-on-year change of consumer price index. ***, **, and * represent significance level of 0.01, 0.05, and 0.1, respectively. Robust standard errors are presented in parentheses.

Table 17: Costliness of the banks and CRD in CBs and IBs

	Full Sample	CBs	IBs
Variables	(1)	(2)	(3)
CRD	0.559	-0.226	6.399***
	(0.389)	(0.394)	(1.422)
TA	-6.344***	-5.328***	-12.710*
	(1.525)	(1.044)	(7.390)
NPL/TA	0.667*	0.415***	0.594
	(0.401)	(0.070)	(0.693)
Debt/Equity	0.816**	0.981***	0.881
	(0.414)	(0.250)	(1.408)
Firm Age	-0.433	2.964***	-6.522*
	(1.358)	(0.565)	(3.814)
No. Branch	2.024	0.938	-0.340
	(2.240)	(1.122)	(6.386)
Board Size	-7.715***	-6.352***	-6.161
	(1.452)	(1.792)	(6.531)
CEO Power	-0.851***	-0.403***	-0.936
	(0.080)	(0.134)	(1.824)
Listed Banks	-5.584	2.182**	-16.938
	(3.639)	(1.128)	(11.406)
GDPPC	-0.859	-2.490***	5.650
	(1.610)	(0.705)	(9.931)
Religiosity	-62.998***	-74.468***	17.634
	(12.853)	(3.507)	(56.364)
Inflation	-0.994***	-0.781***	-1.865***
	(0.075)	(0.039)	(0.057)
Constant	233.956***	221.717***	218.381***
	(23.131)	(13.191)	(56.506)
Observations	610	468	142
Country FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
chi2 (1)		9.74***	
Prob >chi2		0.001	

Notes: This table presents the effect of climate related disclosure on the costliness of the CBs, IBs, and the overall sample. The dependent variable is the cost to income ratio which measures the expensiveness of the banks. The main independent variable is *CRD* which the index to measure climate-related disclosure. *TA* is the natural logarithm of total assets of the banks. *NPL/TA* is the ratio of non-performing loans to total assets, *Debt/Equity* is the ratio of total debt to total equity, *Firm Age* is the natural logarithm of the age of the firm, *No. Branch* is the number of banks branches, *Board Size* is the natural logarithm of number of members on the booard of directors, *CEO Power* is the index that measures CEO power in the banks consisting of 3 different characteristics of a CEO, *GDPPC* is the natural logarithm of the GDP per capita, *Religiosity* is the Gallup Survey on the religiosity by countries and *INF* is the year-on-year change of consumer price index. ***, **, and * represent significance level of 0.01, 0.05, and 0.1, respectively. Robust standard errors are presented in parentheses.

on the cost-to-income ratio for the full sample, CBs, and IBs. Table 17 presents the association between disclosure and cost-to-income ratio for these three sample groups. The results show that while disclosure does not significantly affect the cost of CBs, it has a positive and significant effect on the cost-to-income ratio in IBs. This suggests that IBs lack the necessary resources and competitive power to effectively address climate-related issues, and when they do, it leads to increased costs and reduced profitability compared to CBs.

4.2 Endogeneity Concerns

4.2.1 Instrumental Variables Analysis

In the baseline models of this study, I examine the impact of the CRD of banks on their financial performance. Building upon prior literature (Botosan, 1997; Lang and Lundholm, 1993), I make the assumption that the quantity of disclosure is positively associated with the quality of disclosure, and that the CRD serves as a proxy for the performance of climate-related operations, actions, and transactions of banks. However, these assumptions give rise to the issue of endogeneity, where the CRD may be determined by the banks' climate-related activities but can also be influenced by other factors. To address this concern, I employ a two-stage least squares instrumental variable (IV) approach.

I use two different instruments to tackle this problem. First instrument of the analysis is motivated by the observation that companies are more likely to disclose additional information in countries with stronger investor protection. Shareholder protection regulations aim to ensure that shareholders receive adequate information to make well-informed investment decisions. Robust shareholder protection regulations are associated with a greater emphasis on disclosure practices, including CRD. For example, de Villiers and Marques (2016) find that regulations protecting minority shareholders in countries ensure that shareholders receive sufficient, reliable, and useful information for their investment decisions. Moreover, common-law countries, which have stronger protection for minority shareholders and a greater focus on promoting shareholder values compared to civil law countries (Ball et al., 2000; La Porta et al., 1998, 2000), tend to exhibit higher levels of disclosure, including CRD, compared to companies in civil law countries (Beekes et al., 2016; Bushman et al., 2004; DeFond et al., 2007; Jaggi and Low, 2000). Shareholder protection regulations primarily concentrate on

governance mechanisms and information transparency, indirectly influencing firms' financial performance. As shareholder protection regulations do not directly impact profitability, the instrument satisfies the exclusion assumption of instrumental variables.

My second instrument is the climate risk index, which ranks countries based on their exposure to extreme weather events and associated losses. In countries that frequently experience climate-related events and suffer significant human and economic losses, corporations are more likely to disclose information about these events. This is driven by the need to address stakeholder concerns, manage risks, and demonstrate preparedness. Particularly in these countries, banks may prioritize disclosing climate-related information due to the high demand for such information from stakeholders. Therefore, it can be argued that the primary motivation for CRD is not solely the companies' climate-related operations, actions, decisions, or transactions, but rather the current climate situation of the country itself. To address this endogeneity concern, I include the climate risk index as the second instrument in my model.

One can argue that the extreme weather events causing significant human and economic losses could also have a detrimental impact on the profitability of banks. However, research by Caby et al. (2022) suggests that the exposure of banks to weather-related loss events does not affect their profitability. This finding is consistent with the views expressed by Professor John Cochrane in the "**21st Century Economy: Protecting the Financial System from Risks Associated with Climate Change**" event organised by **Financial Stability Climate Committee**. According to Prof. Cochrane "*Climate change is an important challenge. But climate change poses no measurable risk to the financial system. This emperor has no clothes. ... Moreover, the financial system is only at risk when banks as a whole lose so much, and so suddenly, that they blow through their loss reserves and capital, leading to a run on their short-term debt. That a "climate crisis" could cause a sudden, unexpected, and enormous economic effect endangering the financial system in the next decade is a fantasy unsupported by scientific evidence*[2]."

To obtain data on minority shareholder protection, I used the "Protection of Minority

[2]The hearing is available at https://www.banking.senate.gov/hearings/21st-century-economy-protecting-the-financial-system-from-risks-associated-with-climate-change (accessed: 11 June 2023).

Table 18: Instrumental variable analysis

Panel A: ROA						
	First Stage: CRD			**Second Stage:** ROA		
	(1)	(2)	(3)	(4)	(5)	(6)
Variables	F. Sample	CBs	IBs	F. Sample	CBs	IBs
Climate Risk	-0.825***	-0.929***	-0.772***			
	(0.116)	(0.130)	(0.260)			
Sharehol. Gov.	1.628***	1.077***	2.488**			
	(0.455)	(0.483)	(0.963)			
CRD				0.148*	0.147**	-0.102*
				(0.150)	(0.058)	(0.564)
TA	0.262***	0.251***	-0.072	0.084**	-0.137***	0.731*
	(0.066)	(0.094)	(0.132)	(0.111)	(0.044)	(0.354)
NPL/TA	-0.008	-0.011	-0.005	-0.023	0.049	-0.057***
	(0.006)	(0.013)	(0.007)	(0.049)	(0.049)	(0.007)
Debt/Equity	0.008	0.021	0.061*	-0.088***	-0.159***	-0.129
	(0.015)	(0.020)	(0.036)	(0.018)	(0.019)	(0.061)
Firm Age	0.190	-0.033	0.831***	0.145**	-0.187***	0.370
	(0.099)	(0.118)	(0.181)	(0.083)	(0.036)	(0.694)
No. Branch	0.140**	0.216***	0.207	-0.081*	0.095***	0.047
	(0.056)	(0.080)	(0.144)	(0.082)	(0.025)	(0.346)
Board Size	0.151	0.523***	0.082	-0.772	-0.811**	-1.752**
	(0.333)	(0.407)	(0.545)	(0.484)	(0.306)	(1.017)
CEO Power	-0.066	-0.080	-0.161	0.202***	0.119***	-0.034
	(0.082)	(0.092)	(0.178)	(0.010)	(0.042)	(0.168)
Listed Banks	0.569***	0.367*	0.550**	0.606**	0.238***	1.165*
	(0.178)	(0.245)	(0.240)	(0.300)	(0.009)	(0.681)
GDPPC	-0.343***	-0.096	-0.407***	-0.062	0.103	-0.655
	(0.096)	(0.113)	(0.166)	(0.195)	(0.082)	(0.628)
Religiosity	-2.198***	-1.451***	-2.151**	0.240	-0.931***	-3.255
	(0.452)	(0.581)	(0.686)	(0.726)	(0.071)	(3.313)
Inflation	-0.036	-0.015	-0.122	0.024	0.041***	0.059**
	(0.026)	(0.028)	(0.076)	(0.015)	(0.006)	(0.036)
Constant	5.258***	3.509	7.379	1.242	6.049***	2.452
	(1.481)	(79941.78)	(149810)	(1.407)	(1.052)	(4.799)
Observations	388	305	83	388	305	83
R-squared				0.145	0.505	0.304
Country & Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Weak Identification Test:						
Cragg-Donald Wald	8.759	10.846	3.408			
Underidentification Test:						
K.-Paap Wald rk	14.675***	11.048***	4.704***			
Overidentification Test:						
Sargan-Hansen	0.224	0.293	1.123			

Table 18: Continued - Instrumental variable analysis

	Panel B: ROE					
	First Stage: CRD			**Second Stage:** ROE		
	(1)	(2)	(3)	(4)	(5)	(6)
Variables	F. Sample	CBs	IBs	F. Sample	CBs	IBs
Climate Risk	-0.829***	-0.929***	-0.790***			
	(0.117)	(0.130)	(0.268)			
Sharehol. Gov.	1.633***	1.077***	2.516***			
	(0.456)	(0.483)	(0.971)			
CRD				0.831***	0.994***	-0.235*
				(0.469)	(0.127)	(0.932)
TA	0.246***	0.251***	-0.146	0.946***	0.591***	2.622**
	(0.067)	(0.094)	(0.140)	(0.201)	(0.167)	(0.198)
NPL/TA	-0.012	-0.011	-0.015	-0.064	-0.055	-0.010*
	(0.008)	(0.013)	(0.010)	(0.065)	(0.104)	(0.013)
Debt/Equity	0.011	0.021	0.072**	-0.097***	-0.208**	-0.075
	(0.015)	(0.020)	(0.038)	(0.050)	(0.070)	(0.040)
Firm Age	0.190	-0.033	0.804***	-0.337	-0.837**	2.179***
	(0.099)	(0.118)	(0.181)	(0.443)	(0.388)	(0.801)
No. Branch	0.157**	0.216***	0.274*	-0.266	-0.201	1.283**
	(0.058)	(0.080)	(0.150)	(0.093)	(0.061)	(0.567)
Board Size	0.188	0.523**	0.170	-1.841	-2.793**	-3.103
	(0.337)	(0.407)	(0.568)	(1.097)	(1.298)	(0.639)
CEO Power	-0.066	-0.080	-0.217	0.881***	1.104***	0.047
	(0.082)	(0.092)	(0.185)	(0.158)	(0.269)	(0.673)
Listed Banks	0.544***	0.367*	0.497**	1.385**	0.827**	2.675**
	(0.182)	(0.245)	(0.245)	(0.625)	(0.963)	(1.158)
GDPPC	-0.327***	-0.096	-0.319*	-0.386	-0.611**	-1.672
	(0.097)	(0.113)	(0.170)	(0.463)	(0.197)	(0.761)
Religiosity	-2.090***	-1.451**	-1.649*	11.893***	9.834***	0.199**
	(0.464)	(0.581)	(0.730)	(2.632)	(1.953)	(2.158)
Inflation	-0.036	-0.015	-0.121	0.251***	0.243***	0.208
	(0.026)	(0.028)	(0.078)	(0.045)	(0.047)	(0.067)
Constant	5.172***	3.509	7.120***	-11.715***	1.943	-21.399***
	(1.483)	(79941)	(2.406)	(4.929)	(2.752)	(4.940)
Observations	386	305	81	386	305	81
R-squared				0.331	0.311	0.658
Country & Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Weak Identification Test:						
Cragg-Donald Wald	8.356	10.518	4.084			
Underidentification Test:						
K.-Paap Wald rk	14.696***	11.046***	4.750***			
Overidentification Test:						
Sargan-Hansen	0.907	1.243	3.274			

Notes: This table presents estimation results for the instrumental variable approach using two-stage-least-squares (2sls) based on Equation (3). The dependent variables *ROA* and *ROE* which are the measures of accounting performance of the banks. *Climate Risk* is the measure for the weather-related loss events cause human life and financial loses by countries. *Sharehol. Gov.* measures the minority shareholder protection regulations by the countries that provide shareholders with sufficient, reliable, and useful information to make informed investment decisions.1st column presents first stage results for CGI The second stage of the estimation is presented in the 2nd column. ***, **, and * represent significance level of 0.01, 0.05, and 0.1, respectively. Robust standard errors are presented in parentheses.

Shareholders Interest" indicator from TCdata360, The World Bank database. This indicator provides information on the level of protection offered to minority shareholders in various countries. For climate risk data, I relied on the yearly "Global Climate Risk Index" reports published by Germanwatch. These reports include four components: annual average fatalities, annual average fatalities per 100,000 inhabitants, annual average losses in US$ million, and annual average losses per unit GDP. A lower climate risk index score indicates a higher climate risk faced by a country in these four components, while a higher climate risk index score suggests lower losses in terms of human lives and economic impact.

The results of the instrumental variable (IV) analysis are presented in Table 18. The IV test was conducted for both financial performance measures: ROA and ROE. Panel A of the table reports the first-stage regression estimates using the global climate risk index and shareholder protection as instruments for the CRD. These estimates are provided for the full sample, CBs, and IBs in columns 1, 2, and 3 of Panel A (ROA) and Panel B (ROE).

The findings indicate that the global climate risk index has a statistically significant negative impact on the CRD of banks. This aligns with my expectations, as I argue that companies in countries with higher exposure to severe weather-related events tend to increase their CRD. These results hold consistently across all three sample groups. Additionally, the presence of stronger shareholder protection regulations in a country appears to have a significant positive effect on the CRD of banks.

To assess the validity of the instruments, I examine the Cragg-Donald Wald F-statistics in the first-stage regression models. The F-statistics exceed the 10% critical value, indicating that both instruments are not weak for the full sample and CBs. Moreover, the statistically significant Kleibergen-Paap rk LM statistic indicates that the model is not under-identified. Overall, these instrument validity and endogeneity test results support the reliability of the instruments used in the IV models.

I find that the CRD still affects the financial performance of the CBs after being instrumented with shareholder protection and climate risk by the countries. Although the direction of the relationship between the CRD and IBs' financial performance remains the same, the significance level drops to 10%. Therefore, the results of the IV analysis support my baseline regression findings after addressing the endogeneity concerns, indicating that the relation-

ships between the CRD and the financial performance of the CBs and IBs are unlikely to be influenced by unmeasured factors.

4.2.2 Propensity Score Matching

The t-test reported in Table 14 indicates significant differences between CBs and IBs in various contexts. The mean comparison analysis reveals that CBs outperform IBs in terms of ROA and ROE, disclose more information (CRD), have larger total assets (TA), are older in terms of firm age, exhibit a lower non-performing loans to total assets ratio (NPL/TA), have a higher debt-to-equity ratio (Debt/Equity), operate more branches (No. of Branch), have a larger board of directors (Board Size), and possess more powerful CEOs (CEO Power) compared to IBs. These differences suggest a potential selection bias in my model, as the disparities between CBs and IBs could be driven by factors other than their climate-related orientation, actions, operations, or transactions. To address this issue, I employ a propensity score matching technique to control for observable differences between CBs and IBs.

Following the approach outlined by Rosenbaum and Rubin (1983), the propensity score matching technique involves creating a balanced and comparable sample by matching CBs as the treatment group with IBs as the control group. The matching is conducted on a one-to-one basis without replacement, considering the CRD, total assets, non-performing loans to total assets ratio, debt-to-equity ratio, age, number of branches, board size, CEO power, year, and country as the observed covariates.

Panel A and Panel C of Table 19 present the descriptive statistics of the matched sample. After applying propensity score matching, the sample consists of 141 matched pairs (282 total observations) for the outcome variable ROA, and 139 matched pairs (278 total observations) for the outcome variable ROE. The results demonstrate that the matching procedure has largely minimised the differences between the treatment and control groups.

Panel B and Panel D of Table 19 point out that after running the same baseline regression model using a propensity score-matched sample, the relationship between the CRD and financial performance remains positive and significant for CBs, and negative and significant for IBs. Therefore, the result of regression using the propensity score-matched sample verifies that the baseline regression results are not biased because of the sample selection.

Table 19: Propensity score matching

Panel A: Balancing table for propensity score matching

	Treatment Group		Control Group			t-test
Variables	N	Mean	N	Mean	%Bias	Treatment - Control
CRD	141	2.297	141	1.958	24.1	0.044
TA	141	15.684	141	15.439	16.4	0.169
NPL/TA	141	6.378	141	9.435	-19.2	0.108
Debt/Equity	141	8.675	141	8.141	10.6	0.375
Firm Age	141	3.302	141	3.088	36.4	0.002
No. Branch	141	1.774	141	1.961	-16.3	0.171
Board Size	141	2.135	141	2.138	-0.9	0.937
CEO Power	141	0.893	141	0.950	-8.4	0.482
Listed Banks	141	0.780	141	0.659	27.0	0.024

Panel B: Baseline regression using propensity score matched sample - ROA

	(1)	(2)	(3)
Variables	Full Sample	CBs	IBs
CRD	0.028***	0.390***	-0.241*
	(0.060)	(0.130)	(0.066)
TA	0.315	-0.193	0.807***
	(0.176)	(0.215)	(0.273)
NPL/TA	-0.046***	0.026	-0.070
	(0.008)	(0.017)	(0.045)
Debt/Equity	-0.119***	-0.220***	-0.113
	(0.006)	(0.039)	(0.067)
Firm Age	0.145	-0.319	-0.003
	(0.193)	(0.339)	(0.239)
No. Branch	-0.089	0.023	-0.136
	(0.075)	(0.179)	(0.220)
Board Size	-0.834***	-0.426	-2.162*
	(0.351)	(0.840)	(1.326)
CEO Power	0.416***	0.160	0.501***
	(0.086)	(0.191)	(0.179)
CEO Power	1.546	0.327	1.362***
	(0.771)	(0.400)	(0.432)
GDPPC	-0.281	0.610	-3.426*
	(3.184)	(3.488)	(3.399)
Religiosity	-1.750	-0.500	-5.178
	(1.521)	(3.405)	(3.594)
Inflation	-0.007	0.053	-0.085
	(0.067)	(0.088)	(0.085)
Constant	1.408	1.685	32.634
	(32.491)	(38.013)	(36.278)
Observations	282	141	141
R-squared	0.198	0.527	0.432
Country & Year FE	Yes	Yes	Yes
chi^2 (1) (Prob >chi^2)		5.31** (0.021)	

Table 19: Continued - Propensity score matching

Panel C: Balancing table for propensity score matching

	Treatment Group		Control Group			t-test
Variables	N	Mean	N	Mean	%Bias	Treatment - Control
CRD	139	2.314	139	1.948	26.0	0.031
TA	139	15.68	139	15.497	12.7	0.292
NPL/TA	139	6.471	139	8.405	-13.1	0.277
Debt/Equity	139	8.664	139	8.283	7.6	0.527
Firm Age	139	3.291	139	3.082	35.4	0.003
No. Branch	139	1.799	139	1.990	-16.8	0.163
Board Size	139	2.143	139	2.141	0.6	0.958
CEO Power	139	0.906	139	0.949	-6.4	0.595
Listed Banks	139	0.776	139	0.654	27.3	0.024

Panel D: Baseline regression using propensity score matched sample - ROE

	(1)	(2)	(3)
Variables	Full Sample	CBs	IBs
CRD	0.342***	0.675**	-1.182**
	(0.114)	(0.447)	(0.442)
TA	3.677***	2.820***	3.825***
	(0.745)	(0.429)	(1.133)
NPL/TA	-0.173***	-0.153	-0.143
	(0.054)	(0.308)	(0.086)
Debt/Equity	-1.120	-1.919**	-0.041
	(0.661)	(0.854)	(0.236)
Firm Age	0.425	2.150	1.568***
	(1.011)	(2.034)	(0.400)
No. Branch	-0.559	-0.786	0.667*
	(0.381)	(0.364)	(0.396)
Board Size	3.205***	7.623***	-4.248***
	(2.316)	(1.924)	(0.305)
CEO Power	0.677	-0.526	1.190***
	(0.774)	(1.700)	(0.181)
Listed Banks	3.617	4.356	3.677
	(1.122)	(1.112)	(0.701)
GDPPC	-2.574***	-3.654***	-3.462*
	(0.803)	(1.249)	(1.748)
Religiosity	-2.557	-20.633	-8.740
	(3.430)	(13.056)	(4.669)
Inflation	0.655***	0.580***	0.325***
	(0.098)	(0.087)	(0.037)
Constant	-26.293***	1.375	-8.423
	(5.727)	(31.285)	(6.711)
Observations	278	139	139
R-squared	0.332	0.451	0.491
Country & Year FE	Yes	Yes	Yes
chi^2 (1) (Prob >chi^2)		6.77*** (0.0093)	

Notes: This table presents estimation results for propensity score matching method where CBs are denoted as treatment groups while IBs are denoted as control groups. Panel A and Panel C illustrate the descriptive statistics of the matched sample for ROA and ROE, respectively. Panel B and Panel D present estimation done using matched sample for ROA and ROE, respectively. ***, **, and * represent significance level of 0.01, 0.05, and 0.1, respectively. Robust standard errors are presented in parentheses.

4.3 Robustness Tests

4.3.1 Channel Analysis

The existing body of literature highlights the importance of firms' disclosure policies and the provision of useful and reliable information to shareholders in reducing information asymmetry(Cheng et al., 2011; Dhaliwal et al., 2011; Diamond, 1985; Diamond and Verrecchia, 1991; Healy and Palepu, 2001; Healy et al., 1999; Hope and Thomas, 2008; Lambert et al., 2007; Lang and Lundholm, 1996; Leuz and Verrecchia, 2000; Verrecchia, 2001; Welker, 1995). Building on these findings, I argue that CRD practices can effectively mitigate information asymmetry between different parties involved, namely managers as agents and shareholders and stakeholders as principals. As a result, it is posited that CRD can enhance a company's value and financial performance.

The objective of this section is to examine the impact of CRD, specifically its relationship with information asymmetry, on companies' financial performance. By engaging in CRD practices that are channeled through addressing information asymmetry, firms can improve their financial outcomes. The underlying premise is that by adopting robust disclosure policies and facilitating the flow of relevant information to shareholders, firms can reduce information asymmetry. This reduction in information asymmetry, in turn, leads to improved decision-making processes by shareholders and stakeholders, positively influencing the company's overall value and financial performance.

By conducting a comprehensive analysis in this section, I aim to shed light on the relationship between CRD, information asymmetry, and financial performance. This examination will contribute to my understanding of how CRD practices, through their impact on information asymmetry, can affect the financial outcomes of companies. Through a coherent discussion, I will explore the mechanisms and pathways by which CRD can enhance financial performance by mitigating information asymmetry and promoting a transparent and reliable flow of information to relevant stakeholders.

Table 20: Channel analysis

Panel A: CRD and spread

	Spread		
	(1)	(2)	(3)
	Full Sample	CBs	IBs
CRD	-0.311***	-0.237**	-0.672*
	(0.104)	(0.111)	(0.362)
Firm Controls	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes
Observation	350	285	65
R-Squared	0.382	0.426	0.615
Country & Year FE	Yes	Yes	Yes

Panel B: CRD and ROA by spread

	ROA					
	Full Sample		CBs		IBs	
	H. Spread	L. Spread	H. Spread	L. Spread	H. Spread	L. Spread
CRD	0.0999	-0.133**	0.108**	-0.069**	-0.162	-0.205
	(0.061)	(0.052)	(0.052)	(0.034)	(0.195)	(0.201)
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observation	165	181	135	147	30	34
R-Squared	0.581	0.599	0.795	0.767	0.696	0.902
Country & Year FE	Yes	Yes	Yes	Yes	Yes	Yes
chi2 (1)	9.20***		8.90***		0.38	
Prob >chi2	0.002		0.003		0.535	

Panel C: CRD and ROE by spread

	ROE					
	Full Sample		CBs		IBs	
	H. Spread	L. Spread	H. Spread	L. Spread	H. Spread	L. Spread
CRD	0.364	-0.698**	0.677**	-0.592*	0.686	-2.272
	(0.292)	(0.333)	(0.285)	(0.347)	(1.438)	(1.605)
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observation	165	181	135	147	30	34
R-Squared	0.388	0.406	0.401	0.437	0.734	0.844
Country & Year FE	Yes	Yes	Yes	Yes	Yes	Yes
chi2 (1)	5.65**		7.39***		3.12*	
Prob >chi2	0.017		0.006		0.077	

Table 20: Continued - Channel analysis

Panel D: CRD and illiquidity

	Illiquidity		
	(1)	(2)	(3)
	Full Sample	CBs	IBs
CRD	-0.257***	-0.241***	-0.823***
	(0.058)	(0.063)	(0.264)
Firm Controls	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes
Observation	462	367	95
R-Squared	0.210	0.257	0.343
Country & Year FE	Yes	Yes	Yes

Panel E: CRD and ROA by illiquidity

	ROA					
	Full Sample		CBs		IBs	
	H. Spread	L. Spread	H. Spread	L. Spread	H. Spread	L. Spread
CRD	0.164**	-0.153***	0.223***	-0.121***	-0.129	-0.471**
	(0.082)	(0.043)	(0.061)	(0.035)	(0.332)	(0.209)
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observation	180	277	141	223	39	54
R-Squared	0.355	0.473	0.725	0.583	0.616	0.672
Country & Year FE	Yes	Yes	Yes	Yes	Yes	Yes
chi2 (1)	10.12***		20.59***		0.65	
Prob >chi2	0.002		0.000		0.421	

Panel F: CRD and ROE by illiquidity

	ROE					
	Full Sample		CBs		IBs	
	H. Spread	L. Spread	H. Spread	L. Spread	H. Spread	L. Spread
CRD	0.774***	-0.467**	0.924***	-0.464*	1.211	-1.359**
	(0.244)	(0.236)	(0.274)	(0.270)	(1.071)	(0.587)
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observation	179	276	141	223	38	53
R-Squared	0.416	0.347	0.402	0.371	0.707	0.733
Country & Year FE	Yes	Yes	Yes	Yes	Yes	Yes
chi2 (1)	12.78***		13.25***		5.88**	
Prob >chi2	0.001		0.001		0.015	

Notes: This table illustrates results of estimation of the channel analysis method. Panel A and Panel D present how climate related disclosure affects the information asymmetry proxied by spread and illiquidity, respectively. Panel B and Panel E demonstrate the relationship between CRD and ROA in different information asymmetry levels in banks while Panel C and Panel E show the same analyses for CRD and ROE. ***, **, and * represent significance level of 0.01, 0.05, and 0.1, respectively. Robust standard errors are presented in parentheses.

To accomplish this purpose, I follow a two-step procedure, first, I investigate the direct association between the CRD and information asymmetry that I measure using spread and

illiquidity which are commonly used by the literature to assess information asymmetry (Amihud, 2002; Daske et al., 2008; Fu et al., 2012; Goyenko et al., 2009; Mohd, 2005; Silber, 2005). Following the prior literature, I calculate spread as *(Ask–Bid)/((Ask+Bid)/2)*, and I calculate illiquidity as the absolute return divided by the one dollar of the trading volume.

Panel A and Panel D of Table 20 present the results for information asymmetry and the CRD. As expected, higher CRD significantly mitigate the information asymmetry in all my sample groups (Full sample, CBs, and IBs). In the second stage, I divide my sample groups into high and low information asymmetry environments. I find that the CRD are likely to significantly increase the financial performance of the banks in the companies where a higher degree of information asymmetry exists. On the other hand, when companies increase their CRD while the information asymmetry is low, the financial performance of the banks worsens. One possible explanation of these findings is that when companies with higher information asymmetry increase their disclosures, this negatively affects the information asymmetry between the company and the market, and the market reacts positively. Conversely, if a bank with lower information asymmetry discloses more information, extensive disclosure could increase the expenses and costs of the company, and thus negatively affects the financial performance of the banks. I also find a significant difference between high and low asymmetric environments in almost all my models. Overall, the results suggest that the risk mitigation characteristic of CRD is channelled through the mitigation of information asymmetry.

4.3.2 Reverse Causality and Omitted Variables Analyses

In this section, possible reverse causality and omitted variables problems are explored. My baseline results suggest that disclosing more information increases the banks' financial performance. However, this result could occur not because of the climate disclosure/performance but rather because companies performing well in one period continue their positive performance in the following period or vice versa. Jegadeesh and Titman (1993) reveal evidence of this momentum effect in stock returns, the strategy of buying well-performing stocks and selling poor performing stocks earn an average monthly return of %1. The momentum effect is also observed by other studies (Griffin et al., 2003; Rouwenhorst, 1998, 1999). Therefore, I run my baseline regression model by adding the 1-year lag value of the ROA and ROE in

Table 21: Reverse causality analysis and omitted variables

	Panel A: ROA			**Panel B:** ROE		
	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Full Sample	CBs	IBs	Full Sample	CBs	IBs
CRD	0.153	0.128**	-0.068***	1.032	0.545*	-0.093***
	(0.063)	(0.132)	(0.042)	(0.492)	(0.480)	(0.505)
TA	0.065	-0.730***	0.637***	2.467***	-1.620***	3.507***
	(0.063)	(0.584)	(0.055)	(0.702)	(0.735)	(0.684)
NPL/TA	-0.047	-0.016	-0.026***	-0.056***	0.034**	-0.019**
	(0.005)	(0.060)	(0.002)	(0.049)	(0.358)	(0.014)
Debt/Equity	-0.235***	-0.249***	-0.111	-0.017	0.804	0.002
	(0.049)	(0.168)	(0.014)	(0.408)	(0.371)	(0.384)
Firm Age	0.185	0.005***	0.006***	2.418*	0.449**	2.999***
	(0.043)	(0.286)	(0.237)	(0.775)	(1.867)	(1.710)
No. Branch	0.263	-0.116***	0.090	0.732	-1.887	0.984**
	(0.034)	(0.450)	(0.037)	(0.261)	(1.280)	(0.260)
Board Size	-0.324*	0.684	-0.278**	-3.779	3.979	-6.784***
	(0.434)	(1.283)	(0.384)	(2.713)	(4.416)	(4.528)
CEO Power	0.606***	0.095***	0.251**	2.774***	1.429***	1.450***
	(0.121)	(0.163)	(0.014)	(0.437)	(0.710)	(1.103)
Listed Banks	0.375***	27.957***	-0.007**	1.714***	25.282***	0.144***
	(0.068)	(18.905)	(0.064)	(0.965)	(20.562)	(0.998)
GDPPC	0.123***	0.271***	-0.309	-0.165***	-0.023***	-1.777**
	(0.180)	(0.700)	(0.027)	(1.099)	(4.728)	(0.578)
Religiosity	1.189***	-17.030	-1.483	-0.675***	-104.146***	-4.206***
	(0.655)	(15.592)	(0.496)	(3.453)	(58.855)	(4.912)
Inflation	0.188***	-0.010***	0.099***	1.306***	-0.356***	1.129**
	(0.026)	(0.098)	(0.005)	(0.121)	(0.686)	(0.145)
ROA_{t-1}	0.065	0.146**	-0.006			
	(0.022)	(0.411)	(0.059)			
ROE_{t-1}				0.065***	0.020**	0.152*
				(0.009)	(0.062)	(0.073)
Constant	-1.725	2.531***	-3.218	-36.891***	-4.267	-27.365***
	(1.815)	(0.594)	(1.449)	(13.241)	(9.421)	(16.676)
Observations	549	419	130	546	418	128
R-squared	0.178	0.348	0.376	0.334	0.344	0.487
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
chi2 (1)		5.96**			9.94**	
Prob >chi2		0.035			0.012	

Notes: This table presents results of the estimations of the Equation (3) using lagged variables of the main interest variables. 1st, 2nd, and 3rd models present regression results include 1 year lagged ROA (ROA_{t-1}), while 4th, 5th, and 6th models present regression results include 1 year lagged ROE (ROE_{t-1}). ***, **, and * represent significance level of 0.01, 0.05, and 0.1, respectively. Robust standard errors are presented in parentheses.

which the results are presented in Panel A and Panel B in Table 21, respectively. The results are in line with my baseline regression findings for the CBs sample and full sample, although the significance of the relationship between CRD and financial performance does not remain

the same as it does in my baseline model for IBs.

5 Conclusion

The relationship between firm environmental welfare performance/disclosure and financial performance has been still a debated topic for the researchers. Most extant studies have suggested that environmental disclosures providing required information and satisfying climate sensitive stakeholders would benefit to financial performance of the companies. On the other hand, one group of scholars argue that focussing on social welfare actions unnecessarily increase the expenditures of the companies and thus decreases firms' profitability and value especially for firms having low competitive power.

Although the indirect effects of banks on climate based issues are substantially important, the banking sector has been ignored by many environmental studies. Although banks themselves make a limited direct contributions to climate related problems, the banks have been continuing to pour trillion-dollar funds to low environmental-friendly sectors and companies (Fossil Fuel Finance Report 2022, Banking on Climate Chaos). Given the argument of climate related disclosure affects the profitability of the banks according to their competitive power, I select CBs and IBs as a sample of this study. Considering the previous studies' findings of that IBs are less-stable, less cost-effective, less competitive, and more expensive, I argue that CRD could affect the profitability of the CBs and IBs differently. The purpose of this study is to observe the effect of CRD on the accounting performance of the CBs and IBs.

With an examination of a sample of a total of 591 banks (169 IBs and 422 CBs) from 24 countries for the period of 2016 to 2019, the findings of this study suggest that climate related information given in the annual reports affects the profitability of CBs and IBs differently; while CBs experience a significant increase in their ROA and ROE as they mention more about climate in the reports, the relationship turns out be significantly negative in case of IBs. The one of the factors resulting in this difference between CBs and IBs could be that climate related disclosure/performance creates an extra financial burden for IBs exacerbating the expensiveness and alleviating the profitability of these banks. Consistently with this argument, I find that CRD increases the costs of IBs significantly. On the other hand, the

finding shows a negative but insignificant association between costs and climate disclosure in case of CBs.

This study acknowledges several limitations in its methodology and scope. Firstly, the chosen time period of four years (2016-2019) focuses on assessing the impact of the Task Force on Climate-related Financial Disclosures (TCFD) Recommendations, which were first published in 2017. Future studies could consider conducting analyses over a longer time span with an extended dataset to capture any potential long-term effects of these recommendations. Additionally, although a *Listed Bank* dummy variable has been included in the model, limiting the analysis to listed banks only may provide a more comprehensive understanding of the topic. Including market performance measures such as share price, buy-and-hold return, and earnings per share alongside the accounting performance metrics (ROA and ROE) used in this study could provide a broader perspective on the relationship between governance, climate disclosure, and financial performance. Furthermore, due to data limitations, this study solely focuses on the relationship between climate disclosure and accounting performance. However, it is worth noting that the relationship between environmental performance and financial performance is equally important. Future research could explore the association between environmental performance indicators and financial performance measures to gain a more comprehensive understanding of the interplay between environmental disclosure, environmental performance, and financial outcomes. Lastly, this study does not consider the role of SSB in IBs and their impact on climate disclosure and financial performance. However, it is widely recognized that SSB practices can significantly influence disclosure practices and performance outcomes in the context of sustainable banking. Future studies could incorporate SSB measures into their models to further explore the relationship between SSB, climate-related actions, and disclosure practices in IBs. This would provide valuable insights into the specific role of SSB in shaping the sustainability strategies and performance of IBs in relation to climate change.

Appendices

Table E: Sample selection process

	Initial Sample			3-Year Data Applies			Final Sample		
Country	**CBs**	**IBs**	**Total**	**CBs**	**IBs**	**Total**	**CBs**	**IBs**	**Total**
Albania	11	1	12	10	0	10		Dropped	
Algeria	15	2	17	14	2	16	14	2	16
Bahrain	13	20	33	13	20	33	13	20	33
Bangladesh	46	9	55	40	9	49	40	9	49
Bosnia & Herzegovina	22	1	23	20	0	20		Dropped	
Cyprus	31	1	32	10	0	10		Dropped	
Egypt	30	3	33	19	3	22	19	3	22
Germany	93	1	94	72	0	72		Dropped	
Guinea	8	1	9	5	0	5		Dropped	
Indonesia	104	13	117	55	13	68	55	13	68
Iraq	16	18	34	11	18	29	11	18	29
Jordan	14	5	19	14	5	19	14	5	19
Kazakhstan	37	1	38	30	0	30		Dropped	
Kenya	36	3	39	18	3	21	18	3	21
Kuwait	6	11	17	6	11	17	6	11	17
Lebanon	35	2	37	14	2	16	14	2	16
Libya	10	1	11	10	1	11	10	1	11
Malaysia	38	19	57	38	19	57	38	19	57
Maldives	3	1	4	1	0	1		Dropped	
Mauritania	7	5	12	7	5	12	7	5	12
Nigeria	24	1	25	22	0	22		Dropped	
Oman	7	3	10	6	3	9	6	3	9
Pakistan	27	9	36	26	9	35	26	9	35
Philippines	61	1	62	54	0	54		Dropped	
Qatar	8	6	14	8	6	14	8	6	14
Saudi Arabia	10	5	15	10	5	15	10	5	15
Senegal	20	1	21	16	0	16		Dropped	
Seychelles	3	1	4	1	0	1		Dropped	
Singapore	14	1	15	12	0	12		Dropped	
South Africa	36	1	37	31	0	31		Dropped	
Sri Lanka	27	2	29	14	2	16	14	2	16
Syrian Arab Republic	12	3	15	10	3	13	10	3	13
Tajikistan	9	1	10	5	0	5		Dropped	
Thailand	28	1	29	25	0	25		Dropped	
Tunisia	16	2	18	12	2	14	12	2	14
Turkey	59	7	66	23	7	30	23	7	30
United Arab Emirates	23	10	33	23	10	33	23	10	33
United Kingdom	168	8	176	27	8	35	27	8	35
Tanzania	32	1	33	26	0	26		Dropped	
Yemen	4	3	7	4	3	7	4	3	7
TOTAL	1163	185	1348	762	169	931	422	169	591

Notes: This table presents the sample selection process. Panel A shows the total number of banks from countries where both Conventional and Islamic banks operate, with a minimum of four banks. At the end of this stage, there are 1163 Conventional Banks and 185 Islamic Banks. Panel B summarizes the second stage of the process in which banks with less than three years of total assets data are excluded. At the end of this stage, 401 Conventional Banks and 16 Islamic Banks are dropped. In the final stage, I remove countries where only one type of bank remains and does not meet the minimum four banks criteria. Consequently, the sample consists of a total of 591 banks, with 422 of them being Conventional and 169 of them being Islamic Banks.

Table F: CRD keyword list

A. Carbon
1. Carbon
2. Carbon footprint
3. Carbon pricing/trading
4. Carbon related assets
5. Carbon disclosure project
6. Carbon emission
B. Climate
7. Climate
8. Climate change
9. Climate risk/opportunity
C. Emission
10. Emission
11. Greenhouse gases
12. Greenhouse gases emission
13. Scope 1
14. Scope 2
15. Scope 3
16. Greenhouse gases protocol
17. Reducing greenhouse gases
18. Harmful gases
D. Environment
19. Environment
20. Pollution
21. Global warming
22. Natural disasters
23. Energy consumption
24. Water consumption
25. Green finance
E. Agreements
26. Kyoto
27. Paris agreement
28. TCFD

Table G: Descriptions of variables

Name	Expected Sign	Definition
		Dependent Variable
Corporate Financial Performance (CFP)		Proxied by two accounting-based economic performance variables; return on assets (ROA) and return on equity (ROE)
		Main Explanatory Variable
Climate-Related Disclosure (CRD)	+	Content analysis is undertaken. First, I determine a checklist that contains keywords for the climate-related disclosure that are presented in Appendix Table C. Then, I analyse the number of words that appear in the annual reports of the banks.
		Bank-Specific Variables
Total Assets	+	Log of total assets.
NPL/TA	-	The ratio of non-performing loans to total assets.
Debt/Equity	-	The ratio of long-term debts to equity.
Firm Age	+	The natural logarithm of the age of the firm.
No. Branch	+	The natural logarithm of the number of the banks' branches.
Board Size	-	The number of the directors on the board of the banks.
CEO Power	+	CEO power index consists of 3 different characteristics of the CEO; (1) *CEO Duality:* If the roles of CEO and Chairperson are not separated, then one, otherwise zero. (2) *Internal CEO:* If the CEO is internally recruited, then one, otherwise zero.(3) *CEO Tenure:* If the CEO has more than the median tenure in the sample then one, otherwise zero.
Listed Banks	+	Listed Banks is dummy for listed banks. If the bank is a listed bank then one, otherwise zero.
Conventional Banks	+	Conventional Banks is dummy for conventional banks. If the bank is a conventional bank then one, otherwise zero.
		Country-Specific Variables
GDPPC	+	The natural logarithm of the GDP per capita.
Religiosity	-	The Gallup Survey research conducted in 2009.
Inflation	+	Year-on-year change of Consumer Price Index (CPI).

Table H: Variance Inflation Factor (VIF) analysis

	ROA		ROE	
Variable	VIF	1/VIF	VIF	1/VIF
CRD	1.55	0.647	1.55	0.646
TA	3.45	0.289	3.39	0.295
NPL/TA	1.41	0.711	1.40	0.716
Debt/Equity	1.62	0.618	1.62	0.617
Firm Age	1.45	0.691	1.45	0.690
Number of Branch	1.94	0.515	1.96	0.509
Board Size	1.17	0.856	1.17	0.858
CEO Power	1.10	0.906	1.10	0.906
ListedBanks	1.30	0.767	1.31	0.764
GDPPC	3.22	0.311	3.23	0.309
Religiosity	1.89	0.528	1.92	0.522
Inflation	1.38	0.723	1.38	0.723
Mean VIF	1.82		1.82	

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Paper 3

Environmental Investment and Bank Risk-Taking: International Evidence

Abstract

This paper examines the relationship between environmental investments of banks and their risk-taking behaviors, and how the heterogeneity of the board of directors, measured by both relation-oriented characteristics (gender and age) and task-oriented characteristics (board tenure and expertise), moderates this relationship. Using a sample of 6800 observations from 619 banks in 52 countries over the period 2010-2020, the findings suggest that environmental investments in banks increase the banks' risk-taking tendencies, thereby threatening their stability. However, the study also finds that board heterogeneity plays a stabilizing role in this relationship. While boards with higher diversity encourage companies to engage in more environmental actions, they also mitigate the risk-taking attributes of banks, even with increased environmental investments. These results support the argument that a more diverse board of directors aligns the interests of stakeholders and the company, enhancing firms' motivation to meet a broader range of stakeholder needs. Furthermore, the findings indicate that this moderating effect of board heterogeneity is particularly evident in larger firms with higher environmental investments. Additionally, the study investigates this effect in countries based on the number of people affected by environmental-related natural disasters. Interestingly, it reveals that in countries with a low total number of affected people, a heterogeneous board of directors fails to stabilize banks with higher environmental investments.

1 Introduction

The effects of environmental performance on the financial stability of financial institutions have rarely been explored by researchers. The focus has primarily been on the link between financial performance and overall Corporate Social Responsibility (CSR) and Environmental, Social, and Governance (ESG) performance. These studies have presented two opposing theories: one argues for a positive relationship between environmental performance and financial performance, while the other suggests a negative relationship. Drawing upon stakeholder theory, it is proposed that engaging in environmental actions can yield positive financial returns for companies. This is achieved by enhancing the company's image and reputation among stakeholders, thereby attracting shareholders who are willing to invest in environmentally responsible companies (Donaldson and Preston, 1995; Freeman, 1984; Harrison and Wicks, 2013; Kassinis and Vafeas, 2006; Parmar et al., 2010). However, the overinvestment theory posits that environmental performance may increase companies' expenditures while generating lower returns (Barnea and Rubin, 2010; Barnett and Salomon, 2006; Surroca and Tribó, 2008). Consequently, the resources allocated to environmental initiatives may be considered wasteful, diminishing the overall value of the company (Friedman, 1970; Jensen, 2002).

In this study, the relationship between the level of environmental engagement, bank performance, and banks' risk-taking behaviour is explored. Heavy investment in environmental projects may pose risks to banks. The literature has questioned the link between environmental performance and corporate financial performance, yielding inconclusive results over the past four decades. Some studies have demonstrated positive relationships (Al-Tuwaijri et al., 2004; Clarkson et al., 2008; Patten, 2002; Xie et al., 2019), while others have found negative relationships (Brammer and Millington, 2008; Busch et al., 2022; Clarkson et al., 2013; Fujii et al., 2013; Wang et al., 2014). More recently, Barnett and Salomon (2012) discovered a non-linear relationship, suggesting a U-shaped curve. According to their hypothesis, low social responsibility is associated with high financial performance compared to moderate social responsibility, but firms with high social responsibility exhibit the highest financial performance. However, Pekovic et al. (2018) examined the curve in greater detail and found that only a limited amount of green investments remain profitable at higher levels of investment. They concluded that a win-win scenario exists but only for a limited time

and a limited number of firms in the market. Furthermore, Horváthová (2010) conducted a meta-analysis on the relationship between environmental performance and firms' financial performance, highlighting a negative link in the case of portfolio studies.

While considerable attention has been given to the relationship between financial performance and environmental sustainability, there has been limited exploration of the link between financial stability and environmental performance. Only a few studies (e.g., Chiaramonte et al., 2022; Di Tommaso and Thornton, 2020; Gangi et al., 2019) have analysed the relationship between environmental performance and the financial stability of financial institutions. These studies have yielded inconsistent findings, with the primary focus being on the relationship between the bank's environmental, social, and governance performance and financial stability. Consequently, these studies provide a narrow perspective on the effects of environmental performance on financial stability, failing to paint a clear picture of how environmental investment affects the financial stability of banks.

One potential explanation for the link between environmental investment and bank stability is that the profit margin from green activities is currently insufficient in many sectors, except for utility sectors such as green electricity or water, which remain profitable (Kruse et al., 2020). While early investors or adopters of green investment, products, and services have enjoyed significant benefits, allocating more resources and intensifying investments into green projects, products, or activities has not provided an adequate rate of return, primarily due to higher capital costs. The market currently lacks effective financial incentives to attract new investors or persuade existing investors to increase their market share (Kruse et al., 2020; Pekovic et al., 2018). Consequently, companies may engage in green activities and strive for higher levels of environmental performance to serve stakeholders' interests, attract environmentally sensitive investors, enhance company image and reputation, or avoid negative reactions, rather than solely aiming for a higher accounting rate of return on green and environmental investment.

Furthermore, while green investment has been gaining popularity, green technology and environmentally friendly initiatives still carry higher risks compared to conventional establishments. According to a 2016 survey conducted by *Bain & Company*, around 98% of sustainability programs and initiatives fail to achieve or exceed expectations (Davis-Peccoud

et al., 2016). Consequently, engaging in higher levels of environmental activities, increasing the amount and share of investments in green fields, and transitioning to sustainability initiatives and programs at the expense of established conventional non-green counterparts could increase the instability of financial institutions.

This study explores the effect of environmental investment on the financial stability of firms in the banking sector. Increasing investments in environmental issues could potentially decrease the stability of banks since the financial returns from green investments may not match those of conventional investments and could increase the level of risk for banks.

In this study, I further explore the moderating role of a stakeholder-friendly board of directors' composition on the nexus between environmental performance and banks' stability. Financial institutions face a unique risk-shifting problem due to deposit insurance and government bail-out guarantees, which incentivizes shareholders to exert pressure for taking excessive risks that may impact the wealth of creditors, insurers, the government, taxpayers, and other stakeholders (Jensen and Meckling, 1976; Macey and O'Hara, 2003). One solution to mitigate the excessive risk-taking pressure from shareholders is to establish a stakeholder-friendly and effective corporate governance structure that can provide strict monitoring and wise guidance (Anderson et al., 2011; Berger et al., 2014; Forbes and Milliken, 1999; Laeven and Levine, 2009).

On one hand, a stakeholder-friendly board of directors is expected to mitigate excessive risk-taking behaviours and minimize risk-shifting problems. On the other hand, this board of directors can enhance environmental performance to meet stakeholders' needs, demands, and concerns. However, intensifying environmental responsibilities could also pose a threat to the company's stability. This study investigates this multi-connected relationship by examining how banks' stability is affected by environmental performance and how the composition of the board of directors moderates banks' risk-taking behaviour.

Following the approach ofHarjoto et al. (2015) and Harjoto et al. (2018b), I measure the stakeholder-friendly board of directors by considering the relation-oriented attributes (age and gender) and task-oriented attributes (board tenure and financial expertise) of the directors. The composition of the board of directors, based on these characteristics, brings unique knowledge, information, experience, perspectives, and cultures originating from their

respective groups, communities, backgrounds, or social statuses. Companies can promote or restrict the presence of directors with specific attributes to achieve harmony on the board. This allows firms to establish an effective dynamic, diversity, and heterogeneity on the board, enabling them to recognize and understand the needs, demands, interests, and concerns of different stakeholder groups (Harjoto et al., 2018a).

Using a sample of 6,809 observations across 619 banks from 52 countries during the period from 2010 to 2020, the findings suggest that environmental investment, as measured by environmental performance, negatively influences banks' stability by increasing risk-taking behaviour. Additionally, the study finds that age and financial expertise heterogeneities on the board tend to increase risk in banks, while gender and board tenure diversities on the banks' board mitigate default risk. Overall, the results of my analyses demonstrate that boards with lower age and financial expertise diversity and higher gender and board tenure diversity enhance environmental performance and reduce the riskiness of banks. This board heterogeneity also serves as a negative moderator between environmental performance and firm risk-taking behaviour. In other words, when this board heterogeneity is present, increasing environmental performance no longer poses a risk. Instead, the board of directors improves stability even as banks increase their environmental performance. Therefore, a stakeholder-friendly board of directors can utilize its power to serve stakeholders and address their needs, demands, concerns, and interests regarding environmental issues. Furthermore, such a board can effectively mitigate the risk exposure arising from risk-shifting problems in banks. This allows banks to benefit from being environmentally friendly corporations and differentiate themselves from their competitors (Freeman, 1984).

This study makes a significant theoretical contribution by examining the moderating role of board heterogeneity in the relationship between environmental performance and bank risk-taking behaviour. While existing literature has primarily focused on the link between environmental performance and financial performance, limited attention has been given to the relationship between environmental performance and bank risk-taking behaviour, with only three identified studies in this domain (Chiaramonte et al., 2022; Di Tommaso and Thornton, 2020; Gangi et al., 2019). Building upon these studies, this research uniquely incorporates board heterogeneity as a critical determinant, recognizing the pivotal role played

by the board of directors in shaping risk-taking strategies. Thus, my primary contribution lies in elucidating how a heterogeneous board of directors influences the relationship between environmental engagement and the risk-taking attributes of banks. Additionally, my study surpasses previous research in terms of a larger sample size, including more banks, and covering a longer time period, enhancing the robustness and generalizability of my findings.

Furthermore, while the relationship between corporate governance and bank risk-taking has been explored through measures such as board size, board independence, and ownership structure (Adams and Funk, 2012; Erkens et al., 2012; Fracassi and Tate, 2012; Fracassi, 2017; Laeven and Levine, 2009; Minton et al., 2014; Pathan, 2009; Vallascas et al., 2017), studies focusing on the characteristics of individual directors on the board have predominantly considered a single aspect, such as gender, race, or expertise, as a diversification measure (Harjoto et al., 2015). In contrast, only a limited number of studies have thoroughly examined board heterogeneity, considering both relation-oriented dimensions (e.g., gender, age, race) and task-oriented dimensions (e.g., tenure, expertise) to explore the relationship between board heterogeneity and corporate risk-taking (Berger et al., 2014; Harjoto et al., 2015, 2018b,a). Therefore, my study provides a fresh perspective by comprehensively investigating the relationship between board composition and bank risk-taking, questioning the impact and significance of various board characteristics and composition on bank financial stability.

The remainder of the paper is structured as follows: Section 2 provides the theoretical framework and hypotheses, while Section 3 specifies the sample, data, and the model applied in this study. Section 4 includes the baseline results, endogeneity test, and robustness tests. Finally, Section 5 concludes the study.

2 Theory and Literature Review

2.1 The Shareholder-Stakeholder Issues in Banking

The risk preferences of bank shareholders and bank creditors often conflict with each other. Banks benefit from explicit deposit insurance and liquidity assistance guarantees provided by governments, especially during times of financial distress. These privileges can incentivize banks to take on more risk, considering their highly leveraged financial structure. Excessive

risk-taking poses a higher possibility of losses for bank creditors and other stakeholders, while bank shareholders can benefit from such risk-taking without being fully exposed to its negative consequences. As a result of moral hazard problems, limited liability, and the convex risk preferences of shareholders (Galai and Masulis, 1976; Jensen and Meckling, 1976; Mollah et al., 2017), bank shareholders may push banks to take on more risk at the expense of creditors and taxpayers, who typically have concave risk preferences (Bhattacharya and Thakor, 1993; John et al., 1991; Mollah et al., 2021). Studies have shown that banks are more likely to take on risk when agency problems between shareholders and managers are alleviated John et al. (1991). Additionally, shareholder-friendly corporate governance has been found to increase risk, as measured by stand-alone and systemic risks, especially in larger banks Anginer et al. (2018). The alignment of interests between managers and shareholders can lead to increased potential gains for shareholders, but it also increases the potential losses for stakeholders. Consequently, bank shareholders may establish inappropriate incentive schemes for bank executives, encouraging excessive risk-taking (Bolton et al., 2015; Guo et al., 2015).

Other empirical studies have also justified that a shareholder-friendly board of directors increases the level of risk in banks (Beltratti and Stulz, 2012). Similarly, smaller and less restrictive boards tend to favor shareholders and have a positive impact on bank risk-taking (Pathan, 2009). Laeven and Levine (2009) find that banks with powerful and large shareholders are more likely to engage in greater risks to serve the interests of shareholders at the expense of stakeholders' wealth. Saunders et al. (1990) investigate bank risk-taking behaviours between 1979 and 1982 in the US, which was considered a relatively deregulated period. The findings suggest that risk-taking behaviours were more common in banks controlled by shareholders compared to those controlled by managers during this period. Other studies also yield consistent results in the US across different timelines. Gorton and Rosen (1995)) suggest that as directors and managers hold more shares of the bank, the risk-taking behaviours of the banks intensify from 1979 through 1982. Anderson and Fraser (2000) show that in the absence of a strong regulator, managerial shareholdings are one of the important factors that exacerbate the risk-taking behaviours of banks between 1987 and 1989.

On the other hand, the risk-shifting problem in banking has received significant recognition in the banking literature, emphasizing the importance of aligning the interests of share-

holders with those of creditors, taxpayers, and other stakeholders (Adams and Mehran, 2003; Berger et al., 2014; Bolton et al., 2015; Macey and O'Hara, 2003). Scholars have proposed various approaches to achieve this alignment, such as imposing higher costs in the interbank borrowing market for risky banks (Furfine, 2001; King, 2008) and the debt market (Flannery and Sorescu, 1996), or demanding higher saving rates from risk-taking banks by depositors (Berger et al., 2014; Peria and Schmukler, 2001). Additionally, numerous studies highlight the benefits of corporate governance mechanisms in balancing the interests of shareholders and stakeholders (Pathan, 2009).

The Basel Committee emphasizes the significance of effective corporate governance in the banking industry in the first paragraph of their corporate governance principles for banks. Indeed, an effective corporate governance structure can be a valuable tool for addressing excessive risk-taking behaviours in banks. Harjoto et al. (2018b) argue that the composition of the board of directors is one of the most important and often overlooked factors that influence the board's ability to fulfil its control and advisory roles within a firm. They suggest that board composition can significantly enhance the monitoring and advisory functions of the board of directors.

In line with this argument, many countries have redesigned their legislation and regulations to promote board diversity. For instance, in Norway, a law passed in 2003 and implemented in 2009 mandates listed firms to have at least 40% representation of minority genders on their boards, with noncompliance leading to delisting and liquidation. Other countries, such as Belgium, France, Iceland, India, Italy, Malaysia, the Netherlands, Slovenia, South Africa, Spain, Switzerland, and the United Arab Emirates, have either required or suggested gender quotas, primarily under codes following the "comply or explain" principle, for increasing minority gender representation on boards of public or state-owned companies. In the United States, the Securities and Exchange Commission approved a set of rules in December 2009 that require companies to disclose whether and how board nomination committees consider diversity when evaluating and identifying director candidates, which was implemented in February 2010 (Ahern and Dittmar, 2012; Bøhren and Staubo, 2014; Gopalan and Watson, 2015; Harjoto et al., 2018a).

These legislations aimed at increasing the level of board heterogeneity can bring benefits

to companies and societies from various perspectives. Firstly, from a social perspective, achieving board heterogeneity contributes to promoting social equality in societies (Gopalan and Watson, 2015; Sarhan et al., 2019; Terjesen et al., 2015). By providing equal opportunities for different marginalized groups in society, companies can tap into a larger talent pool and foster legitimacy among these underrepresented and diverse groups while upholding social equality.

From a financial and corporate governance standpoint, board heterogeneity is associated with improved board advising and monitoring capabilities (Adams and Ferreira, 2009; Dobbin and Jung, 2010; Farrell and Hersch, 2005; Sarhan et al., 2019). Encouraging diversity on the board can enhance companies' innovation, creativity, and productivity by leveraging different perspectives, unique knowledge, skills, and experiences. A diverse directorial team is better equipped to identify effective solutions to problems and make companies more inclusive, fair, and capable of understanding customers from diverse social groups and other stakeholders. Additionally, a diverse board can have a broader information network, as directors from diverse backgrounds often have access to specific information that may be difficult to obtain for those outside these diverse groups.

2.2 Hypothesis Development

While there is significant interest in CSR, ESG, and environmental performance in the finance field among researchers, practitioners, and regulators, the banking sector has often been neglected, with many studies focusing on environmental performance and sustainable practices in non-financial companies (Chiaramonte et al., 2022; Godfrey et al., 2020; Santis et al., 2016). Much of the existing research has primarily examined the relationship between environmental performance and banks' financial performance (Cornett et al., 2016; Forgione et al., 2020; Hasan et al., 2022; Simpson and Kohers, 2002; Weber, 2012; Wu and Shen, 2013).

There are two contrasting perspectives on the financial effects of environmental performance on corporations. One viewpoint argues that greater involvement in environmental activities and better environmental performance are positively associated with improved financial outcomes. Satisfactory environmental performance can enhance a company's legitimacy among stakeholders by influencing their perception of the company's image and reputation

(Guidry and Patten, 2012; Hooghiemstra, 2000), reducing social and political pressures (Patten, 1991; Warren and Schwartz, 1997), and attracting environmentally conscious investors who are willing to pay a premium for environmentally favorable actions (Riedl and Smeets, 2017).

On the other hand, some researchers argue that engaging in environmental actions can have negative financial implications for firms (Barnett and Salomon, 2006; Friedman, 1970; Hillman and Keim, 2001; Jensen, 2002; McWilliams and Siegel, 1997; Surroca and Tribó, 2008). The main argument put forth to explain this negative relationship is that voluntary spending on social welfare increases a firm's expenditures and creates an economic disadvantage in the competitive market (Barnett and Salomon, 2006). Furthermore, managers and executives who seek to enhance their reputations, derive personal benefits, or exploit socially conscious investors may over-invest in environmental initiatives without fully considering the potential negative financial consequences of such investments.

While companies in the utility sector are more likely to experience positive financial effects from environmental and green initiatives, the same cannot be said for companies in other sectors such as finance and banking (Kruse et al., 2020). The conventional view regarding the financial returns of environmental performance suggests that being environmentally friendly comes with a cost. Consequently, companies would strategically pursue profitable green investments and opportunities. However, any further attempts to achieve social benefits by increasing environmental actions and performance would come at a higher cost that outweighs the financial returns. This creates a trade-off for companies between environmental performance and financial performance (Palmer et al., 1995). Moreover, executives of companies may invest in environmental projects and initiatives primarily to serve and promote their own self-interest, rather than aiming for a win-win scenario for both shareholders and stakeholders (Friedman, 1970; Jensen, 2002). In such cases, management may unnecessarily deplete shareholders' wealth, increase the company's costs, and destabilize its financial situation, leading to economic disadvantages that worsen competition (Barnett and Salomon, 2006).

Several studies suggest a negative relationship between corporate social performance and corporate financial performance. Brammer et al. (2006) found that corporate social per-

formance, particularly when companies engage in environmental and community-oriented initiatives, has a negative impact on the returns of listed companies. Bouslah et al. (2013) provide insights into the relationship between firm risk measures and specific dimensions of social performance. They found that environmental strengths of companies have a negative impact on total risk but a positive impact on idiosyncratic risk, although these results were statistically insignificant. Interestingly, when differentiating the sample between listed and non-listed firms, the environmental strengths were found to have a statistically significant positive impact on risks for listed firms. Similar distinctions between sectors may also exist. Cai et al. (2016) examine the effects of corporate environmental performance on firm risk, measured by market risk, and find an inverse relationship between corporate environmental performance and firm risk. However, significant differences emerge when separating the sample into categories, as environmental indicators may vary across sectors due to their differing environmental sensitivities. The results suggest that firm risk is negatively influenced in environmentally controversial sectors such as manufacturing, while the relationship becomes positive in non-controversial sectors such as services.

In the context of banking and environmental performance, I have come across three studies in the literature. Gangi et al. (2019) investigated the effects of environmental performance on banks' distance to default using a sample of 142 banks from 35 countries between 2011 and 2015. The findings suggest that effective corporate governance has a positive impact on environmental performance, while increased engagement in environmental activities reduces risk. Chiaramonte et al. (2022) examined the effects of banks' ESG performance on their stability, using a sample of 439 European banks from 21 countries during the period of 2005 to 2017. The study found an inverse association between the total ESG score and bank fragility, as measured by distance to default, during financial distress periods, as well as for each component of ESG: environmental, social, and governance scores. However, outside of crisis periods, the total ESG score and its components had positive but insignificant effects on distance to default. Lastly, Di Tommaso and Thornton (2020)) found that environmental performance has a deterrent effect on banks' risk-taking behaviour. However, it also reduces the value of banks, as measured by Tobin's Q, Book Value of Capital, and Equity Price.

Based on the empirical evidence and theoretical views regarding the relationship between

environmental investment and bank stability, I set my first hypothesis as the following:

Hypothesis H_1: Environmental engagement increases the banks' risk-taking.

The component of the board of directors plays an important role in the firm's reaction to the risky actions. Anginer et al. (2018) find that shareholder-friendly corporate governance mechanisms pose a higher risk for larger banks and banks from countries where strong financial protection against financial distress exists for financial institutions, meaning risk shifting through stakeholders from shareholders. In non-financial firms, one of the most important roles of the board of directors is to resolve the conflicts between shareholders and managers. However, because of the risk-shifting issues peculiar to financial institutions, an effective board of directors should also serve in the interest of the stakeholders of the financial institutions, such as depositors, creditors, and taxpayers. I argue that a diverse board of directors, who perform better advising and monitoring abilities, might achieve this effect and act in the line with the shareholders' interest as well as oversee the best benefits of the stakeholders in the financial institutions.

In the diversity literature, the majority of the studies have examined only one aspect of the heterogeneity attributes, mainly gender diversity while ignoring other characteristics of heterogeneity. Following prior studies such as Webber and Donahue (2001), Harjoto et al. (2015), and Harjoto et al. (2018b), I consider both relation-oriented and task-oriented aspects of heterogeneity. In this regard, I measure the board heterogeneity of the board of directors using attributes age and gender (relation-oriented attributes), and board tenure and financial expertise (task-oriented attributes).

Age diversity on the board could have both negative and positive effects on the effectiveness of the board of directors. Combining older and younger directors on the board could improve the monitoring and advising abilities since board age diversity could sever connectedness and social cohesion on the board while bringing a wider knowledge exclusive to the age of the directors (e.g., younger directors are more likely to catch up with the latest technological developments) and, thus, improving the quality of the discussions (Berger et al., 2014; Chatman and Flynn, 2001; Jahani et al., 2022). On the other hand, the negative consequences of age diversity on the board might outweigh the benefits of it. People can perform, trust, or cooperate with other people better in an environment with people from

similar groups compared to people from outside groups (Brewer and Brown, 1998; Tajfel and Turner, 2004; van Knippenberg and van Ginkel, 2010). Age diversity on the board could pose serious problems by resulting in communication inefficiencies and building barriers to the effective decision-making process. Therefore, a decay in the good harmony of the board and a decrease in the effectiveness and performance becomes inevitable in the board. The studies on age diversity and the risk-taking tendency of the boards provide mixed arguments. Li et al. (2017) argue that younger managers might avoid excessive risk-taking decisions mainly because of the possibilities of the negative consequences of the risky decisions for their future careers while younger CEOs are more likely to be bold enough to take riskier decisions to prove themselves. However, from the managerial perspective, empirical studies suggest that younger managers are more likely to show risk-taking attributes (Berger et al., 2014; Cheng et al., 2010), and the risk tolerance of the people decomposes as they get older, they become more risk-averse and conservative (Bertrand and Schoar, 2003; Bucciol and Miniaci, 2011; Grable et al., 2009). The risk-taking tendency of the younger directors could create a conflict with the risk-averse characteristics of the older directors and decrease the board's efficiency. Further, younger directors might push companies to increase risk appetite of companies.

The literature on gender diversity and risk-taking provides an extensive theoretical framework and empirical findings. Female directors are less likely to act with overconfidence, which makes female directors take decisions without overestimating the investment decisions compared with their male associates (Levi et al., 2014). Huang and Kisgen (2013) support this argument by showing that female directors have a more profound thought process, they are more cautious, and deeply commit themselves to the process of making important decisions. Female directors conduct more strict and proper monitoring actions as well as they are more eager to take part in the monitoring process and committees, and female directors insist on a higher level of auditing performance (Adams and Ferreira, 2009; Gul et al., 2011). Yang et al. (2019) demonstrate that female directors' presence on the board, especially after the gender quota law in Norway which require gender diversity, adversely affects the firm's risk-taking behaviour. This result is consistent with Faccio et al. (2016) suggesting female CEOs are negatively associated with leverage and volatile earnings and Bernile et al. (2018) finding greater board gender diversity comes with lower volatility and better financial performance.

Recently, Mollah et al. (2021) find that gender diversity influences the risk-taking behaviour in large banks negatively. However, Adams and Funk (2012) argue that having female directors on the board does not necessarily associate with a lower level of risk. Risk aversion of the female directors could happen to be not because the natures of female and male genders are different, but because the characteristics such as age, tenure, or other of the female and male directors on the board are different.

Many studies investigate the relationship between board tenure and the risk-taking attributes of corporations. One of the important factors that increase firm risk-taking is CEO power; powerful CEOs are positively related to higher stock-return volatility (Adams et al., 2005). Having a diverse board of directors with different tenures in sense of tenure could be a remedy for such situations. Long-tenured directors tend to lose their effective monitoring ability as a result of the possibility of deeper friendship cultivation between these long-tenured directors and CEOs (Ji et al., 2021). The friendship between long-tenured directors and CEOs might be exploited to gain benefits from both directors and CEOs. For example, CEOs might increase their re-election possibility with long-tenured directors on the board and CEOs, in exchange, could provide some perks, business deals, extra compensation or contribution directly or indirectly for the long-tenured directors (Bebchuk and Fried, 2006). Having a mixed board of directors in case of tenure might prevent these mutual misuses by powerful CEOs and long-tenured directors. Indeed, a tenure-heterogeneous board of directors could demolish compliance and utilitarian expectations by increasing the quality of the monitoring and controlling (Anderson et al., 2004; Li and Wahid, 2018; O'Reilly III et al., 1989).

The discussion on the role of financial expertise in corporate governance started to take place during the financial crisis, although the number of studies is still sparse. Aebi et al. (2012) find directors with financial expertise affect bank performance negatively during the crisis in the U.S. banks. However, Hau and Thum (2009) suggest the inconsistent findings which are less financially experienced board members fuel the higher losses in German banks during the financial crisis. Similarly, Minton et al. (2014) explore the financial effects of financial expertise directors on the board of U.S. banks during the financial crisis period. Accordingly, the result suggests that financial expert independent directors pave the way

to higher risk-taking behaviour in banks during the early period of the financial crisis. In addition, financial expertise is weakly associated with better performance before the crisis, but the association turns out to be strongly negative when the crisis hits. Consistently, Mollah et al. (2021) also find that higher heterogeneity in financial expertise independent directors disciplines the risk-taking behaviour in large banks.

In light of this empirical evidence, I argue that the board of directors maintaining the heterogeneity in sense of board age, board tenure, gender, and expertise would improve the stability of the banks by minimizing the risk-taking behaviours, and I set my second hypothesis as follows:

Hypothesis H_2: Heterogeneous board of directors decreases the banks' risk-taking.

Harjoto et al. (2015) propose that CSR performance reflects the potential of a company to fulfil the interests of its stakeholders. Having a diverse board of directors could help companies in this regard since diversity on the board could help to establish the necessary link, relatedness, recognition, and empathy, which makes the board able to acknowledge the needs and interests of different groups among stakeholders. Board diversity could result in a better sense of making decisions and taking action regarding the benefits of these stakeholders, which suggests an association between board heterogeneity and social responsibility performance. Therefore, the board of directors consisted heterogeneous members could create a win-win scenario thanks to their abilities and attributes derived from their relation-oriented (age and gender) and task-oriented (board tenure and expertise) by evading risk-shifting problems between shareholders and stakeholders in financial institutions. In the same vein, this dynamic, open-minded, diversified, and stakeholder-friendly board of directors is also expected to focus on delivering efficient solutions for social issues and perform better in the sense of environmental actions and investments.

A board of directors with heterogeneous characteristics in sense of age, tenure, gender, and expertise is more likely to be inversely associated with the risk-taking behaviour of the banks as this specific composition is capable of conducting effective monitoring and advising roles while this board of directors is expected to do more to achieve social responsibility and contribute to environmental improvements. I hypothesise that board of directors' heterogeneity is positively associated with better environmental performance, while it could be

an effective remedy for risk-shifting problems in financial institutions by regulating excessive risk-taking.

Hypothesis H_3: Heterogeneous board of directors decreases the banks' risk-taking.

3 Data and Method

3.1 Data

This study employs a sample of large listed and delisted 619 banks with 6,809 observations from 52 countries. I form my primary sample based on the Eikon Datastream database. In the process of data collection, I initially first specify 5002 listed and delisted banks from 2010 to 2020, with 55022 observations from 127 countries. By following the extant literature (Beltratti and Stulz, 2012; Mollah et al., 2021), I set a series of sample selection criteria on this group of banks to decide my final sample: (i) the banks whose at least 9-year total assets data is available, (ii) the banks from countries where at least 3 banks operate, (iii) the banks whose at least 2-year ESG data is available. Appendix Table I summarises the sample selection process.

Applying these screening processes gives us a sample of 619 banks, including approximately 6800 bank-year observations for a period of 2010-2020 from 52 countries. Country-wise distribution of the sample is presented in Table 22. The sample summary demonstrates that almost the half banks of the sample are from the United States with 47.7%. Apart from the United States, the highest proportions of the banks from my sample belong to Japan and China, with 4.04% and 3.40% respectively.

3.2 Definitions and Measures of the Variables

3.2.1 Dependent Variable – *ZScore* as a Risk Measure

I investigate the moderating effect of the board of directors' composition on the relationship between bank risk-taking behaviour and environmental performance. Following the literature on bank risk-taking, I construct *ZScore* as a dependent variable of the study (Bertay et al., 2013; Hakenes et al., 2015; Laeven and Levine, 2009; Schaeck et al., 2012; Vallascas et al., 2017). The *ZScore* measures the bank's distance to capital exhaustion or distance to

Table 22: Sample distribution

Country	Banks	Obs.	%	Country	Banks	Obs.	%
Argentina	6	66	0.97%	Mexico	6	66	0.97%
Australia	7	77	1.13%	Netherlands	2	22	0.32%
Austria	3	33	0.48%	Norway	6	66	0.97%
Belgium	2	22	0.32%	Oman	6	66	0.97%
Brazil	7	77	1.13%	Pakistan	3	33	0.48%
Canada	8	88	1.29%	Peru	4	44	0.65%
Chile	6	66	0.97%	Philippines	4	44	0.65%
China	21	231	3.39%	Poland	10	110	1.62%
Colombia	5	55	0.81%	Portugal	3	33	0.48%
Cyprus	2	22	0.32%	Puerto Rico	3	33	0.48%
Denmark	5	55	0.81%	Qatar	6	66	0.97%
Egypt	2	22	0.32%	Romania	2	22	0.32%
Finland	3	33	0.48%	Russia	4	44	0.65%
France	3	33	0.48%	Saudi Arabia	10	110	1.62%
Germany	5	55	0.81%	Singapore	3	33	0.48%
Greece	5	55	0.81%	South Africa	2	22	0.32%
Hong Kong	5	55	0.81%	South Korea	7	77	1.13%
India	13	143	2.10%	Spain	7	77	1.13%
Indonesia	6	66	0.97%	Sweden	4	44	0.65%
Ireland	3	33	0.48%	Switzerland	10	110	1.61%
Israel	4	44	0.65%	Taiwan	12	132	1.94%
Italy	15	165	2.42%	Thailand	8	88	1.29%
Japan	25	275	4.04%	Turkey	7	77	1.13%
Jordan	2	22	0.32%	United Arab Emirates	8	88	1.29%
Kuwait	6	66	0.97%	United Kingdom	10	110	1.62%
Malaysia	8	88	1.29%	United States	295	3245	47.66%
Total	**619**	**6809**	**100%**				

Notes: This table presents the sample distribution throughout countries over a period of 2010-2020.

default to estimate the probability of insolvency, the point at which the bank's equity is no longer sufficient to cover the bank's losses. In the literature, there are various formulas to calculate *ZScore*, and in this study, I employ the formula generated by Roy (1952) which is a log of the sum of the bank's return on assets and the ratio of the equity to asset divided by the standard deviation of return on assets with 1-year rolling period:

$$ZScore = ln\left(\frac{ROA + \frac{E}{A}}{\sigma(ROA)} + 1\right) \tag{4}$$

where ROA is the return on assets, E is equity, A is assets and, hence, E/A denotes the

equity to assets ratio while the dominator stands for the standard deviation of return on assets. Following the literature, I also use the natural logarithm of the *ZScore* to deal with the high skewness of the data. Higher *ZScore* represents lower risk exposure. When *ZScore* is closer to zero, it means the bank has closer to being insolvent and has higher risk exposure.

3.2.2 Independent Variables – Environmental Investment and Board Heterogeneity

I use data from Eikon Datastream to measure the level of environmental investment and spending (*EnvIns*) of the banks, which has been widely employed in the literature (Kölbel et al., 2017; Liang and Renneboog, 2017). According to the definition in Thomson Reuter's Eikon database, "the environmental pillar measures a company's impact on living and non-living natural systems, including the air, land and water, as well as complete ecosystems. It reflects how well a company uses best management practices to avoid environmental risks and capitalise on environmental opportunities to generate long-term shareholder value." The environmental score under ESG in Eikon synthesises over 70 data points under 3 main environmental-related categories: Resource use, Emission and Waste Reduction, and Environmental (Product) Innovation. The environmental score of Eikon ESG provides a wide spectrum of environmental policies and strategies of the companies (Gangi et al., 2019).

I construct a Board Heterogeneity Index (*BoardHet*) using 4 different board of directors' characteristics: directors' age, board tenure, gender, and financial expertise. Following the literature, I calculate the Blau Index for "board of directors' gender" (*BlauGender*) and "board of directors' financial expertise" (*BlauFinExpert*) (Blau, 1977; Fang et al., 2018; Harrison and Klein, 2007; Miller and Triana, 2009) and standard deviation for "board of directors' age" (*SDAge*) and "board of directors' board tenure" (*SDBoardTenure*) (Bernile et al., 2018; Mollah et al., 2021; Schopohl et al., 2021). After calculating Blau Indices and standard deviations to measure the composition of the board of directors, following Bernile et al. (2018) and Mollah et al. (2021), I standardise all the board of directors' characteristics; age, board tenure, gender, and financial expertise by using their means and standard deviations, as presented in the following formula:

$$Z = \left(\frac{x - \mu}{\sigma} \right) \tag{5}$$

After standardization of the board of directors' age, board tenure, gender, and financial expertise diversity, I created a board of directors' composition index by employing these four attributes consistent with their expected effects on risk-taking:

$$\begin{aligned} \textit{Board Heterogeneity Index} = &- \textit{Z(SDAge)} + \textit{Z(SDBoardTenure)} \\ &+ \textit{Z(BlauGender)} - \textit{Z(BlauFinExpert)} \end{aligned} \tag{6}$$

3.2.3 Control Variables

I employ various firm corporate governance, firm financial, and country-specific variables in my models. Firm corporate governance control variables include *BoardSize*, *BoardInd*, and *CEODuality*. *BoardSize* is measured by the natural logarithm of the number of directors on the bank's board (Pathan, 2009). The extant literature shows that board size is positively associated with the risk-taking behaviour of the firms since smaller boards perform better monitoring performance compared to larger boards (Jensen, 1993; Lipton and Lorsch, 1992; Yermack, 1996). *BoardInd* is the ratio of independent directors to the number of directors on the board (Vallascas et al., 2017). The proportion of independent directors is found to negatively affect risk-taking in firms in many studies (Akhigbe and Martin, 2006; Altunbaş et al., 2020). *CEODuality* is calculated to measure CEO power in the banks which is widely adopted by other researchers (Adams et al., 2005; Altunbaş et al., 2020). CEO duality is the dummy variable that takes 1 when the CEO is the chairperson of the board of directors. Daily and Dalton (1994) show that companies in which the CEO hold also chair of the board of directors are more likely to go bankrupt.

I add total assets *(TotalAssets*), equity to assets ratio (*EquityRatio*), return on equity (*ROE*), deposits to assets ratio (*Deposits*), loans to assets ratio (*Loans*), and cost to income ratio (*FinEfficiency*) as firm financial controls variables. I proxy firm size by the natural logarithm of the total assets (*TotalAssets*). *ROE* is included to measure the profitability of the banks since the profitability of the firms is found to be negatively associated with the risk-taking attributes of the banks (Mollah et al., 2021). I also measure the book value of the banks' equity divided by the total assets (*EquityRatio*), the banks' funding choices by the ratio of the customer deposit to the total asset (*Deposits*), and asset composition by the ratio of loans to the total assets (*Loans*). Finally, I measure the financial efficiency by adding cost to income ratio of the banks in my models (*FinEfficiency*). Since my sample consists

of a cross-country sample, I include countries' GDP (*GDP*) and inflation (*Inflation*) data as country control variables.

3.3 Model Specification

To test the relation between bank risk-taking attributes and the environmental performance of the firms, I use panel data OLS regression analysis. The baseline model I employ to test my first hypothesis is as follows:

$$\begin{aligned} ZScore_{it} =& \alpha_0 + \beta_1 \cdot EnvIns_{it} + \sum \beta_k \cdot GC_{it} + \sum \beta_l \cdot FC_{it} \\ &+ \sum \beta_m \cdot CC_{it} + \sum \beta_n \cdot FE_{it} + \varepsilon_{it} \end{aligned} \tag{7}$$

where i denotes the bank and t denotes the year. *ZScore* is measured by the distance to default, default risk. EnvIns measures the environmental performance of the banks while *GC*, *FC*, and *CC* are governance-level, financial-level, and country-level control variables, respectively. To control governance level characteristics, I include the number of directors on the board (*BoardSize*), board independence ratio (*BoardInd*), and CEO Duality (*CEODuality*), I control firm financial level characteristics with total assets (*TotalAssets*), equity to assets ratio (*EquityRatio*), return on equity (*ROE*), deposits to assets ratio (*Deposits*), loans to assets ratio (*Loans*), and cost to income ratio (*FinEfficiency*), and finally, I employ GDP (*GDP*) and inflation (*Inflation*) to control county-level factors. All regressions include year and country-fixed effects with robust standard errors. The direction and significance level of the coefficient of *EnvIns* (β_1) determines the acceptance of H_1.

Further, I employ my BoardHet variables constructed scaling and equally weighting all these boards of directors' characteristics to test H_2.

$$\begin{aligned} ZScore_{it} =& \alpha_0 + \beta_1 \cdot EnvIns_{it} + \beta_2 \cdot BoardHet_{it} + \sum \beta_k \cdot GC_{it} \\ &+ \sum \beta_l \cdot FC_{it} + \sum \beta_m \cdot CC_{it} + \sum \beta_n \cdot FE_{it} + \varepsilon_{it} \end{aligned} \tag{8}$$

Finally, I expand my regression model to test the effect of my board heterogeneity index on the relationship between banks' risk-taking and environmental performance. The acceptance of H_3 depends on the coefficient of the *EnvIns·BoardHet* (β_3) to be positive.

$$\begin{aligned} ZScore_{it} =& \alpha_0 + \beta_1 \cdot EnvIns_{it} + \beta_2 \cdot BoardHet_{it} + \beta_3 \cdot EnvIns_{it} \cdot BoardHet_{it} \\ &+ \sum \beta_k \cdot GC_{it} + \sum \beta_l \cdot FC_{it} + \sum \beta_m \cdot CC_{it} + \sum \beta_n \cdot FE_{it} + \varepsilon_{it} \end{aligned} \tag{9}$$

The interaction term, *EnvIns·BoardHet*, provides insights into how my board heterogeneity index moderates the effect of the environmental performance of the banks on their risk-taking behaviour. The interpretation of the interaction term is largely linked to the results of H_1 and H_2.

3.4 Descriptive Statistics

Table 23 presents the definitions of the variables and summary statistics. All financial variables are winsorised at the 1st and 99th percentile to deal with extreme outliers, or any data coding errors. Table 23 includes the number of observations, mean, standard deviation, minimum, maximum, 1st quarter, median, and 3rd quarter. The mean and median values of my dependent variable, *ZScore* is 4.22 and 4.33, respectively, which is consistent with Anginer et al. (2018) and Vallascas et al. (2017). The mean and median values for *EnvIns* are 3.46 and 3.74, respectively. The *EnvIns* stats are in line with Brogi and Lagasio (2019), Chaudhry et al. (2021), and Hauptmann (2018). The mean (median) values for *SDAge*, *SDBoardTenure*, *BlauGender*, and *BlauFinExpert* are 7.85 (7.66), 5.18 (4.92), 0.23 (0.23), and 0.15 (0.14) respectively, while my mean and median values for *BoardHet* occur as 0.11 and 0.24. My age diversity (*SDAge*) measure statistics match up with Talavera et al. (2018), Bernile et al. (2018), and Schopohl et al. (2021); board tenure diversity (*SDBoardTenure*) are consistent with Ji et al. (2021), and Li and Wahid (2018); gender diversity (*BlauGender*) are in line with Owen and Temesvary (2018) and Ben-Amar et al. (2017), and financial expertise diversity (*BlauFinExpert*) are similar with Mollah et al. (2021) and Minton et al. (2014). Finally, my board heterogeneity index (*BoardHet*) has a mean value of 0.10 and a median value of 0.24 which is consistent with Mollah et al. (2021).

Table 24 demonstrates the Pearson's pairwise correlation analysis. The correlation between *ZScore* and *EnvIns* is negative, while *ZScore* and *BoardHet* exhibit a positive correlation at the 1% significance level for both variables. Additionally, the coefficients between *ZScore* and *SDBoardTenure*, *BlauGender*, and *BlauFinExpert* align with the expected results. However, the correlation between *SDAge* and the risk-taking proxy is positive but insignificant. Furthermore, Table 24 indicates that some coefficients suggest strong correlations exceeding 0.5 (Cohen, 1988). Consequently, a variance inflation factor (VIF) analysis

Table 23: Definitions of variables and summary statistics

Sign	Variables	Definition of Variables	Obs.	Mean	S.D.	50%	Min	Max
	ZScore	ZScore is the distance to default calculated by the return on assets added to equity to asset ratio divided by the standard deviation of return on assets. I use the natural logarithm of the ZScore. Source: Author's calculation based on data from the BankFocus database.	2827	4.236	0.901	4.329	1.513	6.115
-	EnvIns	I employ Eikon's ESG database to collect the Environmental Investment of the banks. I use the natural logarithm of the Environmental Score to assess the environmental performance of the banks. Source: Thomson Reuters' Eikon, ESG.	2834	3.482	1.038	3.846	0.113	4.551
-	SDAge	I calculate the standard deviation of the age of the board member as the age diversity of the board of directors. Source: Author's calculations based on data from the BoardEx database.	2819	7.659	2.384	7.440	0.000	23.452
+	SDBoardTenure	I calculate the standard deviation of the board tenure of the board member as tenure diversity of the board of directors. Source: Author's calculations based on data from the BoardEx database.	2834	5.027	2.904	4.601	0.370	11.112
+	BlauGender	I calculate the Blau index for gender diversity on the board of directors. Source: Author's calculations based on data from the BoardEx database.	2834	0.256	0.153	0.278	0.000	0.500
-	BlauFinExpert	I calculate the Blau index for financial expertise diversity on the board of directors. Source: Author's calculations based on data from the BoardEx database.	2766	0.101	0.153	0.000	0.000	0.500

Table 23: **Continued** - Definitions of Variables and Summary Statistics

Sign	Variables	Definition of Variables	Obs.	Mean	S.D.	50%	Min	Max
+	BoardHet	By following Bernile et al. (2018) and Mollah et al. (2021), I standardize the board of directors SDAge, SDBoardTenure, BlauGender, and BlauFinExpert by using their averages and standard deviations. Then I scale these characteristics according to their expected impact on risk-taking and equally weigh each of the four characteristics to construct BoardHet. Source: Author's calculations based on data from the BoardEx database.	2751	0.544	1.476	0.726	-2.620	2.458
-	BoardSize	The natural logarithm of the number of directors on the board. Source: Author's calculations based on data from the BoardEx database.	2834	2.483	0.312	2.485	1.609	3.178
+	BoardInd	The ratio of the independent directors to the total number of directors on the board. Source: Author's calculations based on data from the BoardEx database.	2834	0.561	0.256	0.600	0.000	1.000
-	CEODuality	If CEO-Chair role duality exists, then 1, otherwise 0. Source: Author's calculations based on data from the BoardEx database.	2834	0.278	0.448	0.000	0.000	1.000
+	TotalAssets	The natural logarithm of total assets. Source: Author's calculation based on data from the BankFocus database.	2834	18.153	1.747	18.073	13.627	21.604
-	EquityRatio	The ratio of the book value of banks' equity to total assets. Source: Author's calculation based on data from the BankFocus database.	2834	0.095	0.053	0.090	-0.022	0.847
+	ROE	Net income divided by average total equity.	2834	10.139	4.692	9.965	2.990	17.780

Table 23: **Continued** - Definitions of Variables and Summary Statistics

Sign	Variables	Definition of Variables	Obs.	Mean	S.D.	50%	Min	Max
		Source:Author's calculation based on data from the BankFocus database.						
+	Deposits	The ratio of the total customer deposits to total assets. Source: Author's calculation based on data from the BankFocus database.	2834	0.651	0.166	0.686	0.000	0.912
-	Loans	The ratio of the total loans to total assets. Source: Author's calculation based on data from the BankFocus database.	2834	0.641	0.130	0.660	0.351	0.847
-	FinEfficiency	The ratio of the operating costs to the operating income. Source:Author's calculation based on data from the BankFocus database.	2834	3.506	2.062	2.873	0.889	7.557
+	GDP	The natural log of gross domestic products of the countries. Source: Author's calculation based on data from the WorldBank database.	2834	28.466	1.569	28.244	26.405	30.657
+	Inflation	The inflation rate of the countries. Source: WorldBank.	2834	2.063	1.619	1.617	0.335	5.443

Table 24: Correlation matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) ZScore	1.000								
(2) EnvIns	-0.081***	1.000							
(3) BoardHet	0.073***	0.160***	1.000						
(4) SDAge	0.018	-0.084***	-0.490***	1.000					
(5) SDBoardTenure	0.049***	-0.148***	0.473***	0.119***	1.000				
(6) BlauGender	0.072***	0.154***	0.554***	-0.132***	0.009	1.000			
(7) BlauFinExpert	-0.030**	-0.225***	-0.396***	-0.025*	0.124***	0.040***	1.000		
(8) BoardSize	-0.035**	0.151***	0.089***	0.027*	0.014	0.108***	-0.066***	1.000	
(9) BoardInd	-0.028**	-0.123***	-0.047***	-0.084***	0.098***	0.221***	0.511***	-0.072***	1.000
(10) CEODuality	0.042***	-0.135***	-0.081***	0.053***	0.221***	-0.034**	0.320***	0.029**	0.153***
(11) TotalAssets	0.067***	0.585***	0.286***	-0.144***	-0.130***	0.198***	-0.375***	0.331***	-0.435***
(12) EquityRatio	0.002	-0.049***	-0.134***	0.166***	0.156***	-0.136***	0.139***	-0.004	0.077***
(13) ROE	0.131***	0.048***	0.072***	0.006	0.060***	-0.035***	-0.119***	-0.073***	-0.162***
(14) Deposits	-0.011	-0.318***	-0.101***	-0.086***	0.096***	-0.085***	0.328***	-0.109***	0.285***
(15) Loans	0.062***	-0.156***	-0.013	-0.013	0.006	-0.001	0.043***	-0.149***	0.097***
(16) FinEfficiency	-0.126***	0.214***	0.001	0.004	-0.115***	-0.016	-0.158***	0.087***	-0.138***
(17) GDP	0.019	-0.310***	-0.242***	-0.036***	0.081***	-0.013	0.606***	0.080***	0.556***
(18) Inflation	0.001	0.050***	-0.021	-0.008	-0.056***	-0.149***	-0.166***	-0.092***	-0.267***

	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
(10) CEODuality	1.000								
(11) TotalAssets	-0.156***	1.000							
(12) EquityRatio	0.047***	0.033***	1.000						
(13) ROE	-0.006	0.108***	0.017	1.000					
(14) Deposits	0.124***	-0.443***	-0.041***	-0.065***	1.000				
(15) Loans	0.012	-0.241***	-0.041***	-0.094***	0.270***	1.000			
(16) FinEfficiency	-0.091***	0.120***	0.028**	-0.276***	-0.183***	-0.031**	1.000		
(17) GDP	0.328***	-0.448***	0.051***	-0.221***	0.430***	-0.014	-0.143***	1.000	
(18) Inflation	-0.001	0.105***	0.011	0.331***	-0.134***	-0.031**	0.070***	-0.282***	1.000

Notes: ZScore: Distance to the default; EnvIns: Environmental investment; BoardHet: Board heterogeneity; SDAge: Standard deviation of the age of the board members; SDBoardTenure: Standard deviation of the board tenure of the board members; BlauGender: Blau index of gender on the board; BlauFinExpert: Blau index of financial expertise of the board members; BoardSize: Log of numbers of board members; BoardInd: The ratio of independent directors to board members; CEODuality: CEO-Chair role duality; TotalAssets: Total Assets, log of total assets; EquityRatio: The ratio of the book value of banks equity to total assets; ROE: Return on Equity; Deposits: The ratio of the total customer deposits to total assets; Loans: The ratio of the total loans to total assets; FinEfficiency: The ratio of the operating costs to the operating income; GDP: The natural log of gross domestic products of the countries; Inflation: The inflation rate of the countries. ***, **, and * represent significance level of 0.01, 0.05, and 0.1, respectively.

is employed for further investigation. The VIF values of the control variables, as reported in Appendix Table J, do not indicate significant collinearity issues; all variables remain well below the rule-of-thumb VIF value of 10 (James et al., 2013; Kennedy, 1998; Marquardt, 1970; Vittinghoff et al., 2005).

4 Empirical Results

4.1 The Relation of Board Heterogeneity, and Environmental Investment with Bank Risk-Taking

Initially, I examined how environmental performance influences the risk-taking behaviors of banks using Eq. 7 to test H_1.. The results, presented in Table 25, Model (1), suggest a positive association between higher environmental performance and greater risk-taking behaviours in banks. This finding is consistent with previous studies that have shown a negative relationship between overall ESG or environmental performance and financial performance (Brammer et al., 2006; Branco and Rodrigues, 2008; Duque-Grisales and Aguilera-Caracuel, 2021; Horváthová, 2010). It supports the 'overinvestment view' and 'resource-constraint hypothesis', which explain how corporate environmental responsibility may increase firm risk by potentially being perceived as a waste of resources (Cai et al., 2016; Chiaramonte et al., 2022). Corporate philanthropic actions could also weaken financial strength and increase risk exposure compared to environmentally irresponsive peers (Aupperle et al., 1985; Brammer and Millington, 2008).

Next, I investigated the board heterogeneity index, which combines age, financial expertise, gender, and board tenure, to examine its impact on risk-taking. The results indicate that a board with less age and financial expert diversity, and more gender and board tenure diversity, mitigates risk-taking behaviours in banks. These findings align with the view that an effective board of directors can minimize the exploitation of stakeholders' wealth for the benefit of shareholders, thereby reducing risk-shifting disputes (Talavera et al., 2018; Wang and Hsu, 2013). Additionally, Model (4) of Table 25 shows that a board with these characteristics significantly increases environmental involvement, confirming the findings of Harjoto et al. (2015) and Katmon et al. (2019). A well-diversified board is more likely to address

Table 25: Bank risk-taking and environmental investment and board heterogeneity

	(1)	(2)	(3)	(4)
Variables	ZScore	ZScore	ZScore	EnvIns
EnvIns	-0.053**	-0.075***	-0.079***	
	(0.021)	(0.021)	(0.021)	
BoardHet		0.103***	0.056**	0.036***
		(0.012)	(0.025)	(0.011)
EnvIns*BoardHet			0.012**	
			(0.005)	
BoardSize	-0.245***	-0.225***	-0.224***	0.056
	(0.075)	(0.077)	(0.077)	(0.0497
BoardInd	0.123	0.199***	0.189**	0.233***
	(0.077)	(0.076)	(0.076)	(0.063)
CEODuality	-0.276***	-0.252***	-0.249***	0.015
	(0.032)	(0.039)	(0.039)	(0.036)
TotalAssets	0.190***	0.193***	0.193***	0.339***
	(0.016)	(0.015)	(0.015)	(0.011)
EquityRatio	-2.744***	-2.631***	-2.631***	0.074
	(0.426)	(0.373)	(0.374)	(0.277)
ROE	0.013***	0.023***	0.022***	0.020***
	(0.005)	(0.005)	(0.005)	(0.004)
Deposits	1.331***	1.019***	1.021***	-0.558***
	(0.160)	(0.146)	(0.146)	(0.103)
Loans	-0.724***	-0.535***	-0.556***	0.430***
	(0.150)	(0.139)	(0.140)	(0.130)
FinEfficiency	-0.015	-0.007	-0.007	0.035***
	(0.012)	(0.011)	(0.011)	(0.007)
GDP	0.109***	0.119***	0.121***	-0.144***
	(0.014)	(0.015)	(0.015)	(0.012)
Inflation	-0.059***	-0.047***	-0.047***	-0.036***
	(0.011)	(0.011)	(0.011)	(0.009)
Constant	-1.721***	-2.308***	-2.333***	0.988**
	(0.549)	(0.540)	(0.541)	(0.410)
Observations	2,834	2,751	2,751	2,795
R-squared	0.218	0.236	0.236	0.480
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Notes: This table presents the results of Equation (7), Equation (8), Equation (9) in model (1), (2), and (3) respectively. It suggests that *EnvIns* boosts the instability in banks (model 1) while *BoardHet* improves the stability of the banks (model 2). Model (3) shows that a heterogenous board of directors eliminates the risk exposures of environmental investments, and decreases the instability of the banks. Finally, model (4) demonstrates the relationship between a heterogenous board of directors and the level of environmental investments. The dependent variable is *ZScore* which is proxy for stability of the banks measured the distance of the banks to default. The main independent variable is *EnvIns*BoardHet* which is the interaction term of EnvIns and BoardHet variables. *EnvIns* denotes for the level of environmental investment engaged by banks and *BoardHet* is the index for the heterogeneity level of the board of directors in the banks. ***, **, and * represent significance level of 0.01, 0.05, and 0.1, respectively. Robust standard errors are presented in parentheses.

contemporary social issues, such as environmental and climatic problems, and take proactive measures to mitigate them.

I also analysed the effects of individual board heterogeneity characteristics on risk-taking behaviours, as presented in Appendix Table K. Consistent with expectations, the results suggest that a higher standard deviation of age in the board poses a threat to bank stability. Conversely, gender, board tenure, and expertise diversities tend to increase the distance to default in banks. These findings support the research of Talavera et al. (2018) and Wang and Hsu (2013) regarding the negative effect of age diversity, as well as the findings of Croson and Gneezy (2009), Hau and Thum (2009), Kang et al. (2022), Minton et al. (2014), Mollah et al. (2021), and Phuong et al. (2022) regarding the positive effects of gender, board tenure, and expertise diversities on bank risk-taking.

4.2 The Moderating Effect of Board Heterogeneity on the Relation of Environmental Investment and Bank Risk-Taking

Model (3) in Table 25 reports OLS regression results for environmental score, board heterogeneity index, and interaction term of environmental investment and board heterogeneity index with risk-taking attributes of the banks measured by their *ZScore*. Similar to previous models, *EnvIns* and *BoardHet* have negative and positive effects on the risk-taking behaviours of the banks. A potential explanation of these influences is environmental activities could burden extra costs for banks or that investing in green projects might not provide a higher return than investments in conventional non-green or green-neutral industries and projects. Therefore, some investors might not value the environmental responsibility actions as something necessary but as a waste of resources for the banks. On the other hand, an effective board of directors that could perform productive and better monitoring and advising abilities could a remedy for excessive risk-taking behaviours of banks which occurs as a result of risk-shifting issue between shareholders and stakeholders that is unique to financial institutions.

This study aims to shed light on the role of the board of directors concerning environmental performance and risk-taking behaviours of banks. In line with this purpose, I have created an interaction term for environmental performance and board heterogeneity index

Table 26: Further tests on risk-taking and environmental investment and board heterogeneity

	Panel A: EnvIns		**Panel B:** BankSize		**Panel C:** TotAffected	
	High	Low	Big	Small	High	Low
	(1)	(2)	(3)	(4)	(5)	(6)
Variables	ZScore	ZScore	ZScore	ZScore	ZScore	ZScore
EnvIns	-0.222***	0.007	-0.073***	-0.106	-0.101**	-0.095**
	(0.051)	(0.024)	(0.027)	(0.069)	(0.041)	(0.047)
BoardHet	0.058*	0.072**	0.062**	0.035	0.061*	0.227***
	(0.031)	(0.034)	(0.027)	(0.041)	(0.035)	(0.058)
EnvIns*BoardHet	0.011*	0.001	0.011**	-0.001	0.011**	-0.021*
	(0.005)	(0.011)	(0.005)	(0.012)	(0.005)	(0.012)
BoardSize	-0.231***	0.051	-0.172***	0.133	-0.014**	-0.027**
	(0.054)	(0.091)	(0.049)	(0.123)	(0.006)	(0.011)
BoardInd	0.095	0.086	0.032	0.714***	0.053	0.324***
	(0.063)	(0.131)	(0.058)	(0.201)	(0.103)	(0.120)
CEODuality	-0.175***	-0.125***	-0.157***	-0.135*	-0.262***	-0.198**
	(0.037)	(0.047)	(0.033)	(0.069)	(0.045)	(0.086)
TotalAssets	0.192***	0.058**	0.187***	0.076	0.158***	0.271***
	(0.015)	(0.022)	(0.014)	(0.056)	(0.019)	(0.041)
EquityRatio	-2.364***	-1.091***	-1.827***	-0.558	-2.735***	-4.106**
	(0.515)	(0.347)	(0.311)	(0.676)	(0.327)	(1.720)
ROE	0.021***	0.009	0.021***	-0.021**	0.014**	0.047***
	(0.004)	(0.006)	(0.003)	(0.011)	(0.006)	(0.009)
Deposits	0.723***	0.535***	0.761***	0.016	1.341***	0.956***
	(0.115)	(0.194)	(0.102)	(0.274)	(0.249)	(0.244)
Loans	-0.744***	-0.179	-0.555***	-0.415	-0.497***	-0.367
	(0.137)	(0.187)	(0.124)	(0.259)	(0.173)	(0.279)
FinEfficiency	-0.003	-0.063***	-0.006	-0.101***	-0.011	0.006
	(0.009)	(0.015)	(0.008)	(0.023)	(0.015)	(0.019)
GDP	0.019	0.121***	0.048***	0.051	0.168***	0.113*
	(0.013)	(0.021)	(0.011)	(0.045)	(0.021)	(0.061)
Inflation	-0.054***	-0.052***	-0.055***	-0.065**	-0.038***	-0.017
	(0.009)	(0.020)	(0.009)	(0.032)	(0.006)	(0.029)
Constant	1.488***	-0.293	-0.105	2.049	-3.311***	-3.951**
	(0.473)	(0.725)	(0.385)	(1.605)	(0.728)	(1.971)
Observations	1,813	938	2,243	508	1,957	783
R-squared	0.305	0.183	0.283	0.232	0.255	0.272
Country & Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table assesses the bank risk-taking on the nexus of environmental investment and board heterogeneity in different sample settings. Model (1) and model (2) show the relationship in banks that making high and low environmental investment determined by the sample median of environmental investment. Accordingly, if a banks environmental investment is lower than the median value of the sample, it is coded as 0 and 1 otherwise. Model (3) and model (4) redo the baseline model for big and small banks. If a banks total assets is higher than the median value of the sample, then it is coded as 1 and 0 otherwise. Finally, model (5) and model (6) reanalyse the relationship in countries separated according to their human life and financial loss as a result of extreme climate base events. The countries are divided into two categories using median value of the total loss of the full sample. The dependent variable is *ZScore* which is proxy for stability of the banks measured the distance of the banks to default. ***, **, and * represent significance level of 0.01, 0.05, and 0.1, respectively. Robust standard errors are presented in parentheses.

EnvIns·BoardHet and the coefficient of this term is significantly positive. This result implies that a board of directors performing efficient monitoring and advising roles could play the role of attenuating the risk originating from the environment-related actions and policies in the banks. A board with less age and financial expertise diversity and more gender and board tenure diversity might be inclined to be more stakeholders friendly and to provide benefits to the stakeholders with better environmental performance and lower risk-taking preferences.

I, further, conduct analyses to examine the effects of environmental investment and spending, and board heterogeneity index on the bank risk-taking behaviours categorizing banks according to their environmental performance in Table 26. In models (1) and (2), I report the differences between companies having high and low environmental performance scores. I separate the companies into two categories: high (*HighEnvIns*) and low (*LowEnvIns*) environmental scores using the median of the environmental performance score of the sample. The board heterogeneity index maintains its negative and significant association with risk-taking in banks with *HighEnvIns* and *LowEnvIns*. However, the *EnvIns* variable shows a substantial difference between these two categories of banks. It is negative and significantly associates with stability in *HighEnvIns* as it is in my baseline result, while it turns out to be positive and insignificant in banks with *LowEnvIns*. This is consistent with my expectations since I argue that an increase in environmental investment and spending leads companies to invest in unprofitable and risky projects among the banks that have already heavily invested in environmental projects. On the other hand, banks do not expose this risk in low levels of environmental engagements, thus environmental performance does not appear a threatening factor for the stability of the banks. The interaction term *EnvIns·BoardHet* remains positive and significant in banks with *HighEnvIns* which means the heterogeneous board absorbs the negative effect of the environmental engagement to the riskiness of the banks. The results presented in models (1) and (2), in Table 26 are consistent with the conventional view on the financial return of environmental performance (Palmer et al., 1995).

The social pressure on companies to engage in environmental activities is higher for larger companies compared to smaller companies (Al-Tuwaijri et al., 2004; Thornton et al., 2009). Further, big companies could identify and manage whole environmental related issues more effectively with their more extensive human and financial sources (Al-Tuwaijri et al., 2004;

Clarkson et al., 2008; de Villiers et al., 2011). Therefore, the smaller and larger banks could have a different approach to overcome environmental issues. Specifically, larger banks have more power to engage in environmental investment compared to smaller banks. I compare the environmental performance and board heterogeneity index nexus for large and small banks in models (2) and (3) in Table 26. The large banks coded if the total assets of the bank is bigger than the median total assets of the sample show no difference with my baseline result. Environmental engagement still affects risk-taking positively while board heterogeneity takes on a disciplinary role and reduces the risk-taking behaviours of the banks in large banks. However, the situation does not hold for small banks in which the total assets of the bank is smaller than the median of the sample. Even though the coefficients of the interest variables (*EnvIns*, *BoardHet*, *EnvIns·BoardHet*) are not statistically significant, the interaction term (*EnvIns·BoardHet*) turns out to be negative which suggest a positive relationship between the interaction term and risk-taking in small banks. The positive interaction term in large banks implies that large banks could have the power and tools which the board of directors requires to control risk-taking attributes of banks while small banks could lack resources putting them in a disadvantageous position to deal with the risk.

Finally, if a country experiences a higher amount and severe environmental disasters that impact a large proportion of the population in the country, then the people are more likely to be sensitive and to pay more attention to these issues. Consistent with this expectation, the board of directors of the banks from these countries is expected to have a higher awareness of the importance of environmental investment and to pay more attention to environmental performance. In this regard, models (5) and (6) in Table 26 report my baseline model in countries according to the number of people affected by environmental disasters that I download the data using the Emergency Events Database (EM-DAT). The data present 1959 unique environmental disasters such as floods, droughts, wildfires, extreme temperatures, or thunderstorms for 52 countries between 2010 and 2020. During this period, approximately 1.5 billion people were recorded as being affected by these disasters in these countries. Cyprus and Finland do not experience any environmental disasters while Denmark, Kuwait, Netherlands, and Sweden have reported no affected besides these two countries. China, the USA, India and the Philippines are the countries with the highest number of environmental disasters in

10 years, with 255, 251, 166, and 156 total environmental disasters, respectively. These four countries hold also leading positions in the number of disaster victims, although the order is different; around 550 million people have been affected by environmental disasters during this period in China, this number has occurred around 500 million people in India, 100 million people in the Philippines and 88 million people have been affected from the natural disasters in the USA.

I divide countries into two categories according to the total number of affected people each year. Accordingly, the countries are coded as high total affected countries if the number of people affected is bigger than the median of the sample in the given year. Model (5) from Table 26 presents the regression results for the relationship between environmental investment, board heterogeneity, and risk-taking behaviors in countries with a high number of people affected by environmental catastrophes. The findings confirm my baseline results with a statistically significant negative coefficient of *EnvIns* and positive coefficients of *BoardHet* and *EnvIns·BoardHet*. On the other hand, the countries that have lower amount people affected by environmental catastrophes do show the opposite result for the relation between the interaction term (*EnvIns·BoardHet*). This suggests that the board of directors in banks from these countries may focus on improving their images and reputations through increased environmental performance, rather than prioritizing benefits to the public or seeking a positive return on environmental investments and spending.

4.3 Endogeneity Issue: Difference-in-Difference Method

I employ a natural experiment to deal with endogeneity issues by adding the death of the directors on the board. I argue that the death of any directors on the board causes an exogenous shock to the composition and efficiency of the board of directors. The sudden and unexpected death of a director has been found to have a significant association with the firm's financial performance at that moment. (Fang et al., 2018). However, the death of a director has wide-ranging effects on the firm's financial performance, efficiency of the board of directors, and market reactions. Fracassi (2017) suggests that in addition to the loss of knowledge, experience, skills, know-how, and competencies, the social connections and networks brought by the director are also lost upon their death. Therefore, deceased

Table 27: Propensity score matching

Panel A: Balancing Table for Propensity Score Matching

	Treatment Group		Control Group			t-test
Variables	N	Mean	N	Mean	%bias	Treatment - Control
EnvIns	122	3.514	122	3.551	-3.5	-0.26
BoardHet	122	0.427	122	0.607	-9.4	-0.72
BoardSize	122	2.545	122	2.526	6.0	0.46
BoardInd	122	0.616	122	0.578	15.3	1.14
CEODuality	122	0.311	122	0.245	14.1	1.14
TotalAssets	122	17.289	122	17.474	-9.1	-0.75
EquityRatio	122	0.101	122	0.093	15.1	1.46
ROE	122	8.878	122	9.183	-1.4	-0.39
Deposits	122	0.671	122	0.693	-14.2	-1.17
Loans	122	0.681	122	0.692	-8.5	-0.72
FinEfficiency	122	5.866	122	4.234	1.6	0.56
GDP	122	28.852	122	28.710	8.2	0.64
Inflation	122	1.549	122	2.386	-19.7	-2.08**

directors could be a great shock for other directors and other colleagues of the directors, and even cause post-traumatic syndromes for acquaintances of the deceased directors. The whole corporate could be devastatingly influenced by the loss of a director, it could lead to huge changes in corporate policies and strategies. Moreover, even if the position of the deceased director is filled, the market may still react negatively due to the costs associated with searching for and nominating a new director. Additionally, the new director may need to undergo a steep learning curve to match the efficiency of the deceased director (Nguyen and Nielsen, 2010). The effects of the sudden death of the directors have been employed commonly as an exogenous shock by the extant literature. Intintoli et al. (2021) find that the death of the directors causes an increase in loan spreads whereas Nguyen and Nielsen (2010) find a decrease in stock prices following the director's death.

Following the literature (Intintoli et al., 2021; Nguyen and Nielsen, 2010), I collect data on directors' deaths using the BoardEx database to examine their effects on various variables. I create a dummy variable that defines the death of a director for a company that takes 1 if there is a loss on the board for a given year and 0 otherwise. Next, I divide my sample into treatment and control groups based on the presence of deceased directors. Banks with deceased directors in any year are categorized as the treatment group, while the remaining

banks are coded as the control group. In total, out of 5502 firm-year observations, I have only 197 firm-year observations in the treatment group. To address the imbalance in sample sizes between the control and treatment groups, I utilize propensity score matching to balance the two groups and ensure comparability for the analysis. My company matching criteria, including total assets (*TotalAssets*), deposit to total assets ratio (*Deposits*, loans to total assets ratio (*Loans*), and the number of directors on the board (*BoardSize*), are used to match companies in the treatment and control groups based on their similar characteristics. I match the treatment and control group using these variables measured the previous year to the director's death to eliminate endogenous selection bias, following Shi et al. (2017). I also set the nearest neighbour one-to-one matching without replacement technique in my model.

Panel A of Table 27 presents the summary statistics of the matched sample. I have found 244 banks in total, 122 banks from the treatment and 122 banks from the control group, that show similar financial and governance structures prior to the death of the directors. My balancing table shows that the financial and governance characteristics of the treatment and control groups do not exhibit statistically significant differences, indicating that the propensity score matching technique has successfully created a balanced and comparable sample. Therefore, using this sample, if I observe any changes in the risk-taking behaviors of the banks between the period prior to and following the death of the director, it is highly likely that the death of the director is the cause for such changes.

Panel B of Table 27 indicates OLS regression results with a difference-in-differences (DID) design based on the sample acquired by propensity score matching. Model (1) presents the difference in risk-taking attributes of the banks for a period of one year prior to and subsequent years to the death of directors for both control and treatment groups. As I expected, the coefficient of death of the director is significantly negative at the 1% level which suggests the death of the director shortens banks' distance to default and elevates the riskiness of the banks. However, the coefficient of my board heterogeneity (*BoardHet*) remains positive and significant which means even in the case of this traumatic event, the board of directors do not lose their risk awareness. Further, my main interest variable, the interaction term of board heterogeneity and environmental performance (*EnvIns·BoardHet*) also does not show differences to baseline results which implies that even after the death of the director, my board

Table 25: Continued - Propensity score matching

Variables	Treatment – Control Post – Pre ZScore	Treatment – Control All Post – All Pre ZScore
DeathDummy	-0.015***	-0.033***
	(0.002)	(0.002)
EnvIns	-0.025***	-0.055***
	(0.002)	(0.003)
BoardHet	0.019***	0.007***
	(0.003)	(0.002)
EnvIns*BoardHet	0.001**	0.003***
	(0.001)	(0.001)
BoardSize	-0.007	-0.073***
	(0.009)	(0.009)
BoardInd	0.023***	0.213***
	(0.007)	(0.013)
CEODuality	-0.066***	-0.141***
	(0.003)	(0.006)
TotalAssets	0.016***	0.123***
	(0.002)	(0.004)
EquityRatio	0.623***	-1.434***
	(0.126)	(0.068)
ROE	0.001***	0.009***
	(0.001)	(0.001)
Deposits	0.009	0.555***
	(0.014)	(0.021)
Loans	0.019	-0.391***
	(0.015)	(0.028)
FinEfficiency	0.001	-0.014***
	(0.001)	(0.001)
GDP	0.031***	0.059***
	(0.001)	(0.004)
Inflation	-0.008***	-0.031***
	(0.001)	(0.001)
Constant	-0.567***	0.126***
	(0.052)	(0.131)
Observation	160	2590
Country FE	Yes	Yes
Year FE	Yes	Yes
AR(1)-p-value	-1.82**	-4.72***
AR(2)-p-value	-0.85	-0.91
Hansen J p-value	0.958	0.176

Notes: This table reports change in *ZScore* following the death of director as a quasi-natural experiment. Panel A shows the balancing properties of 122 treatment firms that experience death of director(s) as an exogenous shock. For matching purposes, the control group consists of firms with no shock but that have similar characteristics to the treatment firm a year before the treatment firms shock. The propensity score matching (PSM) method matches the treatment and control groups. Panel B shows the regression results for a propensity-matched sample where the main dependent variable is *ZScore*. The main variable of interest is *DeathDummy* which equals 1 if a director dies in any firm-year and0 otherwise. **, and * represent significance level of 0.01, 0.05, and 0.1, respectively. Robust standard errors are presented in parentheses.

heterogeneity eliminates the risks brought by environmental actions of the banks which is consistent with baseline results. Similarly, when I extend the timeline and include all pre- and post-death periods instead of taking only one prior and following years for the treatment and control groups of banks in Model (2), the findings remain the same. While the death of the director increases the riskiness of the banks, board heterogeneity mitigates the intensity of the risk and negatively moderates the relationship between environmental performance and risk. Therefore, the results suggest no difference in the directions or significance of the variables after the death of directors in the short and long run. My baseline results are confirmed by a quasi-natural experiment in which I test the effect of an exogenous shock. Overall, this analysis would be useful to allay some of the endogeneity concerns.

4.4 Robustness Tests

4.4.1 Sample Selection Bias

Another issue that needs to be addressed is sample selection bias which could occur by the criteria I set while constructing my sample. The banks in my sample may show significant differences regarding environmental performance or heterogeneity level compared to the banks excluded by this study. Following the literature, to address the potential bias arising from sample selection, I employ a two-stage Heckman selection model. (Chiaramonte et al., 2022; McGuinness et al., 2017; Mollah et al., 2021; Wu and Shen, 2013). I employ a probit model to estimate the probability of an heterogeneus board of directors using my board heterogeneity. I use the natural logarithm of the population of the city in which the banks have established their headquarters as the exogenous variable and the dummy variable I create for my board heterogeneity index. Accordingly, I categorize banks as 1 if their board heterogeneity index score is higher than the sample median value, and as 0 otherwise, to indicate the presence or absence of board heterogeneity. I choose the bank to headquarters city's population as an exogenous variable since the larger cities could constitute a better source and supply of director candidates from various minority and diverse groups to the organizations that allow them to construct more efficient a board of director that is hard to accomplish in smaller and monotonous cities. In the first stage in Table 26, In the first stage in Table 26, I find a significantly positive relationship between the population of the headquarters city and the

board heterogeneity index dummy which suggests that
a higher population enable companies to form a more efficient board of directors. Furthermore, I estimate the inverse Mills ratio (IMR) in the first-stage model, which is then included in the second-stage model to account for potential sample selection bias. The second stage in Table 26 presents the second stage that I control for self-selection bias through the IMR and the findings are consistent with my baseline results. Therefore, I conclude that my results from Heckman's two-stage method could possibly alleviate the sample selection concerns.

4.4.2 Omitted Variables and Reverse Causality

My next approach investigates concerns related to omitted variables and reverse causality problems. Following Hausman and Taylor (1981) who suggest that the fixed effects model is a common method for unobservable induvial characteristics, I use firm fixed effects to mitigate unobservable time-invariant firm characteristics which have an impact on my dependent and independent variables, bank risk-taking and board heterogeneity. Vallascas et al. (2017) argue that the fixed effect model is also an effective tool to deal with cross-sectional variation across banks. Furthermore, Mollah et al. (2021) imply that the endogeneity of several control variables creates important concerns. Applying a two-step GMM model could address endogeneity concerns by treating all bank-level variables as endogenous covariates and country-level variables as exogenous (Mollah et al., 2017; Wintoki et al., 2012). The (1) Models of Table 26 demonstrates results from fixed effects and two-step GMM models in Panel B, and Panel C while applying these methods in my Eq. 9 The direction and level of significance of my interest variables, *EnvIns*, *BoardHet*, and *EnvIns·BoardHet* remain consistent with my baseline estimations in Model 3, Table 25.

Next, I include the lagged values of my explanatory variables (1-year and 2-year) to address potential reverse causality issues, where the dependent variable could influence the independent variables. The literature (Boone et al., 2007; Faleye et al., 2014; Faleye, 2015; Vallascas et al., 2017; Wintoki et al., 2012) suggest that historical trends of explanatory variables are largely predetermined, and Mollah et al. (2021) argue that regressing my bank risk-taking measure with these potential explanatory variables could be a remedy for the reverse causality problems. The (2) and (3) models in Table 26 present the results of OLS,

Table 26: Heckman two-stage model for sample selection bias

	First Stage: Probit	**Second Stage:** OLS
Variables	BoardHet Dummy	ZScore
HQ City Population	0.103***	
	(0.014)	
EnvIns		-0.042**
		(0.017)
BoardHet		0.052**
		(0.021)
EnvIns*BoardHet		0.009**
		(0.004)
BoardSize	-0.328***	-0.163***
	(0.081)	(0.049)
BoardInd	-0.606***	0.115*
	(0.111)	(0.061)
CEODuality	-0.047	-0.159***
	(0.051)	(0.031)
TotalAssets	-0.141***	0.119***
	(0.018)	(0.012)
EquityRatio	-1.055**	-2.116***
	(0.493)	(0.286)
ROE	-0.004	0.011***
	(0.005)	(0.003)
Deposits	-0.883***	0.398***
	(0.176)	(0.117)
Loans	0.141	-0.649***
	(0.195)	(0.115)
FinEfficiency	0.001	-0.028***
	(0.012)	(0.009)
GDP	0.211***	0.077***
	(0.019)	(0.011)
Inflation	0.021	-0.049***
	(0.016)	(0.008)
IMR		-0.638**
		(0.301)
Constant	-3.511***	0.732***
	(0.673)	(0.458)
Observation	3,519	2,682
R-squared		0.247
Country FE	Yes	Yes
Year FE	Yes	Yes
Wald Chi2	303.35***	
Pseudo R2	0.0632	

Notes: This table reports the results for Heckman two-stage model. In the first stage, natural logarithm of the population of the headquarter city of a bank is used as exogenous variable for the Probit model. Inverse Mills ratio (IMR) is added in the second stage of model which is estimated from the first stage of model, and run a OLS estimation with the same specification as in the baseline model. ***, **, and * represent significance level of 0.01, 0.05, and 0.1, respectively. Robust standard errors are presented in parentheses.

fixed effect, and GMM models including the 1-year and 2-year lagged values of my explanatory variables. The findings largely align with my baseline result, although the significance of the relationship between my board heterogeneity index and bank risk-taking diminishes when using 2-year lagged explanatory variables. Overall, the results suggest that the arguments for the omitted variables and reverse causality issues are weaker.

5 Conclusion

Financial institutions have a unique shareholders-stakeholders conflict that emerges because of the risk-shifting opportunities that allow shareholders to exploit the wealth of stakeholders. One of the factors that could alleviate this conflict is to construct a 'good corporate governance structure' that is able to perform effecting monitoring and advising abilities. An effective board of directors, through effective monitoring and advising abilities, could decrease the overall riskiness of banks and extend the distance to default for financial institutions. On the other hand, I argue that an effective board of directors is also more likely to increase environmental performance by implementing sustainable practices and addressing stakeholders' needs, demands, or concerns. However, higher environmental performance could make banks riskier due to potential overinvestment in environmentally friendly projects or resource constraints associated with implementing sustainable practices. Therefore, the moderating effects of good governance on the relationship between environmental performance and bank risk-taking is a question needed to be addressed. This is the first study exploring how the board of directors composition impacts the risk-taking behaviours in banks and how it moderates the impacts of environmental performance on bank risk-taking.

To achieve these research objectives, a dataset of 619 banks from 52 countries spanning the period between 2010 and 2020 was collected. The study's findings indicate that age and financial expertise diversities within bank boards tend to increase the level of risk, while gender and board tenure diversities act as regulators, mitigating excessive risk-taking tendencies. Based on these relationships, a board heterogeneity index was constructed, which not only reduces the risk-taking behaviour of banks but also assesses its moderating effect on the relationship between environmental performance and risk-taking.

The study's key finding is that directors with less age and financial expertise, along with

Table 27: Additional specification for omitted variables and reverse causality

	Level ZScore	Lag 1 ZScore	Lag 2 ZScore
Panel A: OLS Models			
EnvIns		-0.062**	-0.076**
		(0.029)	(0.031)
BoardHet		0.042*	0.017
		(0.024)	(0.036)
EnvIns*BoardHet		0.0123**	0.021**
		(0.005)	(0.055)
Bank & Country Controls		Yes	Yes
Constant		-0.018	0.0537
		(0.381)	(0.403)
Observations		2381	2055
R-Squared		0.251	0.267
Country & Year FE		Yes	Yes
Panel B: Fixed Effect Models			
EnvIns	-0.081***	-0.078**	-0.088**
	(0.022)	(0.028)	(0.031)
BoardHet	0.058**	0.045**	0.025
	(0.021)	(0.015)	(0.031)
EnvIns*BoardHet	0.011**	0.011***	0.019*
	(0.0038)	(0.003)	(0.009)
Bank & Country Controls	Yes	Yes	Yes
Constant	-2.393***	-0.009	0.081
	(0.262)	(0.171)	(0.252)
Observations	2751	2381	2055
R-Squared	0.232	0.245	0.261
Country & Year FE	No	No	No
Panel C: GMM Models			
EnvironmentalScore	-0.056***	-0.074***	-0.012***
	(0.004)	(0.004)	(0.003)
BoardHet	0.009**	0.058***	0.015**
	(0.004)	(0.002)	(0.006)
EnvIns*BoardHet	0.002**	0.005***	0.007***
	(0.001)	(0.003)	(0.002)
Bank & Country Controls	Yes	Yes	Yes
Constant	0.236	-1.768***	-0.015
	(0.202)	(0.158)	(0.178)
Observations	2590	2367	2043
Country & Year FE	Yes	Yes	Yes
AR(1)-p-value	-4.46***	-5.11***	-4.17
AR(2)-p-value	-1.02	-0.91	-0.53
Hansen J p-value	0.121	0.219	0.559

Notes: This table shows the results of additional tests for the effect of board heterogeneity on bank risk-taking.Panel A reports the results for OLS models in level, Lag 1 and Lag 2. Panel B reports the results of fixed effect models in level, Lag 1 and Lag 2. Panel C reports the results for a dynamic panel data models estimated via the two-step GMM estimator proposed by Blundell and Bond (1998) with Lag 1 and Lag 2. My baseline model already presents the results for the level variables using OLS model and hence, I dont report the level variables in this table Bank and Control Variables include *BoardSize*, *BoardInd*, *CEODuality*, *TotalAssets*, *EquityRatio*, *ROE*, *Deposits*, *Loans*, *FinEfficiency*, *GDP*, and *Inflation* .***, **, and * represent significance level of 0.01, 0.05, and 0.1, respectively. Robust standard errors are presented in parentheses.

more gender and board tenure, help mitigate risk-taking behaviors that may arise due to environmental performance considerations. This research makes a significant contribution to the existing literature by being the first to investigate the moderating role of good governance practices in the relationship between environmental performance and risk-taking behaviour within banks. While previous studies have suggested that good corporate governance can influence risk reduction, there is a need for further research to identify the specific attributes that constitute an effective board of directors.

By shedding light on the moderating effects of board heterogeneity, this study adds to my understanding of how governance mechanisms can shape the risk-taking behaviour of banks, particularly in the context of environmental performance. Further research in this area could explore additional dimensions of good governance and delve deeper into the specific characteristics that contribute to effective board compositions.

The existing literature on board diversity in corporate governance often takes a narrow focus, typically examining only one aspect of diversity, such as gender, expertise, or independence of directors. However, this study goes beyond the limitations of previous research by considering diversity in both relation-oriented and task-oriented dimensions. By including both relation-oriented and task-oriented diversity measures, this study expands the scope of existing literature and offers a more holistic approach to understanding the impact of board diversity on risk-taking behaviours and environmental performance. The findings of this study contribute to a more nuanced understanding of how different dimensions of diversity can influence corporate governance outcomes.

This study acknowledges certain limitations and suggests potential areas for further research. It recognizes that other important diversity factors, such as nationality, culture, ethnicity, and education, were not considered in the investigation. Future studies could incorporate these additional diversity dimensions to gain a more comprehensive understanding of their effects on environmental performance. Furthermore, instead of constructing an index, examining the characteristics separately could provide a more detailed insight into the specific impacts of each diversity factor on the environmental performance of companies. This approach would allow for a deeper exploration of the individual effects and potential interactions among diverse characteristics. In addition, while this study focuses on the char-

acteristics of board members, it acknowledges the significant role of CEOs in shaping the risk-taking attributes of banks and their environmental investment and performance. Investigating the effects of CEO characteristics on environmental investment could provide further insights and enhance the understanding of the topic. By considering these suggestions for future research, the field can benefit from a more comprehensive analysis of diversity factors and their impact on environmental performance, encompassing both board member and CEO characteristics. This would contribute to a more thorough understanding of the relationships between diversity, risk-taking behaviours, and environmental outcomes in corporate settings.

Appendices

Table I: Sample selection process

Screening Criteria	Banks	Obs.	Country
Listed and Delisted Banks	5002	55022	127
Less: Banks without at least 9 years of total assets data	3615	39765	21
Less: Banks from countries where there are fewer than 3 banks	28	30	22
Less: Banks without at least 1-year ESG data is available	737	8107	29
Less: Banks from countries where 2 or fewer banks remaining	3	33	3
Total	619	6809	52

Table J: Variance Inflation Factor (VIF) analysis

Variable	VIF	1/VIF
EnvIns	1.97	0.508
BoardHet	1.10	0.907
BoardSize	1.25	0.798
BoardInd	1.34	0.744
CEODuality	1.17	0.855
TotalAssets	2.46	0.406
EquityRatio	1.35	0.741
ROE	1.33	0.752
Deposits	1.57	0.636
Loans	1.35	0.738
FinEfficiency	1.32	0.761
GDP	1.80	0.555
Inflation	1.27	0.786
Mean VIF	1.48	

Table K: The individual board heterogeneity variables and risk-taking of the banks

	(1)	(2)	(3)	(4)	(5)
Variables	ZScore	ZScore	ZScore	ZScore	ZScore
EnvIns	-0.056**	-0.051**	-0.062***	-0.061***	-0.074***
	(0.022)	(0.022)	(0.022)	(0.021)	(0.021)
SDAge	-0.023***				-0.026***
	(0.008)				(0.007)
SDBoard Tenure		0.037***			0.038***
		(0.006)			(0.006)
BlauGender			0.508***		0.644***
			(0.126)		(0.124)
BlauFinExpert				-0.417***	-0.496***
				(0.139)	(0.142)
BoardSize	-0.216***	-0.304***	-0.256***	-0.207***	-0.248***
	(0.076)	(0.077)	(0.075)	(0.077)	(0.081)
BoardInd	0.109	0.094	-0.007	0.357***	0.163***
	(0.077)	(0.077)	(0.084)	(0.078)	(0.083)
CEODuality	-0.269***	-0.317***	-0.264***	-0.247***	-0.264***
	(0.039)	(0.038)	(0.039)	(0.039)	(0.039)
TotalAssets	0.181***	0.201***	0.183***	0.202***	0.197***
	(0.016)	(0.016)	(0.016)	(0.015)	(0.015)
EquityRatio	-2.612***	-3.173***	-2.738***	-2.462***	-2.719***
	(0.426)	(0.445)	(0.419)	(0.383)	(0.387)
ROE	0.014***	0.012***	0.014***	0.022***	0.022***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Deposits	1.242***	1.295***	1.347***	1.145***	1.027***
	(0.164)	(0.161)	(0.158)	(0.150)	(0.147)
Loans	-0.736***	-0.673***	-0.753***	-0.549***	-0.540***
	(0.151)	(0.149)	(0.149)	(0.141)	(0.140)
FinEfficiency	-0.016	-0.013	-0.013	-0.011	-0.006
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
GDP	0.103***	0.125***	0.112***	0.109***	0.123***
	(0.015)	(0.015)	(0.014)	(0.015)	(0.016)
Inflation	-0.061***	-0.053***	-0.056***	-0.053***	-0.047***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Constant	-1.217**	-2.342***	-1.670***	-2.336***	-2.448***
	(0.565)	(0.559)	(0.544)	(0.562)	(0.590)
Observations	2,819	2,834	2,834	2,766	2,751
R-squared	0.221	0.228	0.223	0.217	0.236
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

Notes: This table presents the relationships between each *BoardHet* components and the dependent variable of this study which is risk-taking proxy *ZScore*. *SD Age* is the standard deviation of the age of the board members, *SD Board Tenure* is the standard deviation of the board tenure of the board members, *BlauGender* is the blau index of gender on the board, and *BlauFinExpert* is the blau index of financial expertise of the board members.***, **, and * represent significance level of 0.01, 0.05, and 0.1, respectively. Robust standard errors are presented in parentheses.

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Conclusions

1 Summary of the Findings

The main objective of this thesis is to shed light on the environmental engagements of financial intermediaries by exploring the factors that motivate them to disclose more information to stakeholders, the financial outcome of providing more climate-related information through the annual reports, and finally the risk aspect of the environmental investment, and the impacts of the characteristics of the members of the board of directors on the relationship of risk and the amount of green investment.

Paper 1 investigates the role of corporate governance on CRD in banks and attempts to draw a comparison between IBs and CBs. In this context, I manually collect the CRD and corporate governance data of 591 banks (169 IBs and 422 CBs) from 24 countries from 2016 through 2019. The findings from the preliminary analysis suggest that higher CGI is significantly associated with higher levels of CRD for CBs, while this relationship turns out to be negative but insignificant in the case of IBs. Accordingly, the similarly structured board of directors in IBs and CBs is found to affect CRD differently. I argue that this difference occurs mainly because of the complexity of corporate governance in IBs and CBs. Since, the priority of the board of directors, SSB, and executives is to maintain Sharia rules and principles in IBs, as well as since IBs construct their corporate governance structure to keep IBs to consistent with Sharia, the reaction rate of the IBs in are slower compared to CBs. While CBs could take necessary decisions and actions quickly for the benefit of shareholders and stakeholders, IBs must always first consider Sharia compliance of the decisions and actions and follow certain procedures to check the Sharia conformity of the decisions and actions such as fatwas from Sharia scholars, which makes these banks to have a rigid and complex corporate governance structure compared to CBs. The findings produce evidence to support this argument by suggesting that CGI different affects CRD in IBs and CBs. Further analyses in which I add the variable of interaction term of CBs dummy and the CGI ($CB{\cdot}CGI$) to measure the effect of CGI on CRD in CBs show that the interaction term has a significant positive impact on CRD while the variables compose of the interaction term, CBs and CGI have a negative effect individually on CRD. Consistent with the extant literature (e. g., Anderson et al. 2004; Chau and Gray 2010; Haniffa and Cooke 2002; Laksmana 2008; Mallin and Ow-Yong 2012), the results argue that better board of directors, measured by the CGI score, leads CBs to

disclose more information on environmental and climate-related issues, measured by CRD.

Healy and Palepu (2001), in their seminal paper, assert that disclosure policy is one effective means the board of directors might utilise to deal with high levels of information asymmetry. My results confirm this argument. Accordingly, a strong corporate governance structure in CBs decreases the information asymmetry proxied using the spread and illiquidity levels of the banks. Moreover, I demonstrate that a strong board of directors increases the level of disclosure when the bank suffers from information asymmetry. Board of directors in banks with a high level of spreads and illiquidity, discloses more information while this mechanism is not used in banks with a low level of information asymmetry.

Paper 2 furthers Paper 1 and compares IBs and CBs in sense of the financial returns of disclosing information regarding environmental and climate-related issues. To explore the relationship between CRD and the accounting performance of the banks proxied by two different performance metrics, ROA and ROE, I use a sample of 591 banks (169 IBs and 422 CBs) from 24 countries from 2016 to 2019. The results show that while the higher level of CRD increases ROA and ROE in CBs which is consistent with stakeholders, legitimacy, and voluntary disclosure theories and literature (e. g., Al-Tuwaijri et al. 2004; Griffin et al. 2017; Kang et al. 2016; Leonidou et al. 2013; Matsumura et al. 2014; Tang et al. 2012; Vishwanathan et al. 2020; Waddock and Graves 1997). However, the opposite relationship is observed in IBs, increasing the disclosure level on climate and environment decreases the profitability of the IBs. A group of researchers (e. g., Barnett and Salomon 2006; Friedman 1970; Hillman and Keim 2001; Jensen 2002; McWilliams and Siegel 1997; Surroca and Tribó 2008) highlight the costliness of engaging environmental and social responsibilities and argue that the returns do not compensate the costs of these actions. Therefore, having a high level of environmental and climate performance would cause disadvantages for that company in a competitive market and worsen the firm's profitability. My analysis of the cost-to-income ratio and CRD demonstrates that IBs' cost increases with higher levels of CRD while this association does not appear for CBs. One reason for these results is that IBs, even in the Muslim majority and Sharia-ruled countries, do not have competitive power as CBs. Therefore, while CBs have the resource and power to perform environmental and climate favour actions and decisions, these actions and decisions reduce the competitive power of IBs

which have already less competitive power and associates with lower returns.

Finally, Paper 3 discusses the effects of environmental investments on the riskiness of the largest banks from all over the world and explores the mediating role of the heterogenous board of directors in this relationship. Consistent with my expectations, the level of environmental investment of banks is associated with the risk-taking behaviours of the banks. This is mainly because currently the green market and investments do not provide sufficient return for the investors relative to the traditional market and investments (Kruse et al., 2020) and only a diminutive proportion of the green and sustainable projects and initiatives achieve their expectations (Davis-Peccoud et al., 2016). Therefore, increasing the level of environmental investment in this environment fuels the riskiness of the banks. On the other hand, I find that with a diverse board of directors, the heterogeneity of the board mitigates the risk-taking behaviours of the banks. Further, I argue that this heterogeneous board of directors would be more stakeholders-friendly and it intensifies environmental engagement to satisfy stakeholders' demands. The result supports this argument, as well as the significant positive coefficient of the interaction term of *EnvIns* and *BoardHet* (*EnvIns·BoardHet*) implies that the heterogeneous board of directors continues to mitigate the risk-taking behaviours of the banks even though the level of engagement to the environmental investment increases. Thus, a board of directors composed of members from different backgrounds, groups, society eliminates the riskiness of environmental investments.

Next, I measure this relationship between *EnvIns*, *BoardHet* as well as the interaction term *EnvIns·BoardHet* and bank risk-taking behaviours in different environments in further analyses. I divide the sample into two different groups according to the levels of banks' environmental scores, banks' size, and the number of citizens affected by environmental disasters. Accordingly, the heterogeneous board of directors moderates the environmental investment and bank risk-taking positively in the banks that have a high level of environmental investments, and that are relatively larger. Moreover, the heterogeneous board of directors in banks continues moderate the relationship between environmental investment and bank risk-taking when the bank from countries that have a relatively higher number of people affected by environmental catastrophes. On the other hand, this moderation effect disappears in the banks from countries the countries that have lower amount people affected by environmental

disasters.

2 Policy Implications

This research provides some insight for practitioners and researchers. First of all, the role of the financial intermediaries in the global warming problem is as important as the companies from other sectors such as oil and gas or manufacturing sectors. Financial institutions do not currently have a suitable and effective policy, determination, or ambition to mitigate global warming and achieve the targets of the Paris Agreement. Indeed, the short and long-term aims of the financial institutions regarding the financed emissions or the policies set by the largest banks in line with the Paris Agreement have shown no promise and goodwill. The achievement of the aims of the Paris Agreement is almost impossible without the contribution of financial institutions. Therefore, the alignment of financial institutions' interests to the Paris Agreement targets is a critical requirement to save our planet.

Paper 1 and Paper 2 provide comparative views on IBs and CBs. One of the noticeable differences between IBs and CBs is their corporate governance structure. Since Sharia-compliant is one the most important factors that maintain the legitimacy and credibility of the IBs, they form another layer in their corporate governance structure which is SSB monitoring and controlling the IBs' actions and decisions in accordance with Sharia principles and rules. While this multi-layer corporate governance structure is necessary, the practice of this corporate governance structure is not always effective, rather it might cause IBs to have a rigid and complex corporate governance structure obstructing them from taking quick decisions and acting quickly. Together with this, the CGI shows that IBs do not have strong boards of directors compared to CBs. Therefore, IBs should revise their corporate governance structure and definitely improve the quality of the board of directors.

Paper 3 demonstrates the direct and moderating effects of the heterogeneous board of directors on the risk-taking behaviours of the banks. Accordingly, especially gender and board tenure diversities help banks to be more stable and to obstruct excessive risk-taking. Some countries have already introduced quotas to achieve board diversity, however, legislation is generally limited to only gender diversity. Although some companies from various sectors have specific quotas for candidates with different backgrounds and from different groups in

society, financial institutions should focus more to improve board heterogeneity.

3 Limitations of the Studies

There are several limitations of this research. One of the important limitations in Paper 1 and Paper 2 is the availability and coverage of the data. The scarcity of data on the IBs and CBs in my sample is a big barrier to performing extended analyses. I mainly use databases such as DataStream, Thomson Reuters Eikon, Bloomberg Terminal, S&P Capital IQ, or BankFocus for financial data of the banks, and BoardEx for the board of directors data. However, almost all of the databases fail to provide sufficient information regarding the banks in my sample, especially for the unlisted banks. Although BoardEx produces some proportion of board data for banks from the "*Rest of World*" section, I observe differences for some banks in board size, independent directors, female directors and other variables after comparing BoardEx data and annual reports of the banks.

I retrieve the majority of the missing data by collecting data manually from the annual reports of the banks. However, some of the banks have published their annual reports in their countries' language rather than English, thus I exclude those reports.

The main source for environmental and climate-related information is the ESG or Sustainability reports for some banks. I have not employed these reports since the majority of the banks have not published such reports, instead, they have used annual reports to provide this kind of information. Therefore, I consider only the annual reports in my analyses. Further, I use banks' data from 2016 to 2019. The main reason for choosing 2016 as a starting date is to capture the effect of TCFD recommendations published in 2017 and the limitations aforementioned.

In Paper 1 and Paper 2, I utilise the NVivo computer software to conduct content analysis. However, the software is not capable to differentiate the synonyms. For example, when the "environment" word is searched in annual reports through this software, the results provide for both meanings of "the air, water, and land in or on which people, animals, and plants live" and "the conditions that people live, work, or spend time in and the way that they influence how they feel, behave, or work". I try to overcome this problem by using the word "environmental" instead of "environment".

The data limitation problem also occurs in Paper 3. I employ the environmental score obtained from Datastream as a proxy of the environmental investments. Even though the database includes variables such as "environmental expenditures investments", "environmental expenditures", "environmental provisions", or "environmental investments initiatives" which might provide a more clear picture of the environmental investment of the banks, only limited data for specific banks are available. Therefore, I use the environmental score which is quite common for many banks, since I expect a correct correlation between environmental investment and the environmental score of the banks.

4 Suggestions for Future Research

Mainly in parallel with the limitations of this research, there are some significant points that future research might improve. First of all, the period employed in Paper 1 and Paper 2 cover 4 years from 2016 and 2019 to assess the effects of the Paris Agreement and the TCFD on the environmental and climate disclosures of the banks. Since I collect the corporate governance data of IBs by hand, the time limitation does not allow me to collect more data from the past. Future studies might cover longer periods.

I do not include the effects of the composition of the SSB in my analysis. Mollah and Zaman (2015) show that SSBs positively impact the performance of the IBs when they perform a supervisory role compared to an advisory role. A similar impact of the SSB with the supervisory role might appear in the case of CRD, either. Therefore, future research might consider the role of the SSBs as well as the compositions of the board regarding environmental and climate-related information delivery.

I use the CRD measure created using the literature and recommendation of the TCFD in Paper 1 and Paper 2 since the existing disclosure indices are insufficient to measure the extent of the disclosure regarding climate-related issues. There are rooms to improve the current index that this study employs.

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General Appendices

A A Global Warming Issue

Climate change and warmer temperature have been showing their negative effects on not only humankind but on all living around the globe. Milankovitch (Orbital) cycles hypothesised by Milutin Milankovitch suggest that the eccentricity (shape of the orbit) of the Earth reaches the maximum (0.058) and the minimum (0.0034) in every 100,000 years, the obliquity (the angle Earth' axis) varies between 22.1" and 24.5" in every 41,000 years, and precession (the direction Earth's axis of rotation, wobble) of the Earth spans in every 23,000 to 26,000 years (Deitrick et al., 2018). Milankovitch cycles have a huge impact on Earth's long-term climate such as leading Earth into a glacial - "snowball" phase when the Earth is so cold and covered by all ice globally (Berger et al., 2005; Spiegel et al., 2010) and interglacial periods when the Earth are warmer, low land ice extent with high sea levels (Berger et al., 2016). The last ice age – the glacial period is believed to last around 100,000 years and ended roughly 18,000 years ago (Hughes et al., 2013). Currently, the earth is in the interglacial period called the Holocene epoch which is believed to start around 15,000 years ago (Walker et al., 2009).

Milankovitch cycles are the primary reason for these climatical periods (Berger, 1988); however, these cycles cannot explain all climate changes for the last 2.5 million years and even more, they fail to explain the rapid temperature increase after the pre-industrial period (around 1850) and especially after mid-20th century (NASA, 2020[1]). Researchers believe that this climate change has been occurring for 200 years are actually closely linked to human actions. Cook et al. (2013) analysed around 12,000 climate-related papers' abstracts with the topics of "global climate change" or "global warming" from the period of 1991-2011 and find that among experts who have expressed their opinions regarding AGW, 97.02% of the experts believe the current status of the high temperatures occur as a result of human actions while 0.89% of the experts are uncertain about the cause of climate change and 2.08% of the experts reject the human-caused global warming. Further, Cook et al. (2016) argue that the consensus among scientists on AGW is overwhelmingly high mainly because of the existence of irrefutable scientific evidence and findings. Currently, studies find that

[1] "Why Milankovitch (Orbital) Cycles Can't Explain Eart's Current Warming" by Alan Buis, Publication, February 27, 2020, available at https://climate.nasa.gov/ask-nasa-climate/2949/why-milankovitch-orbital-cycles-cant-explain-earths-current-warming/ (accessed: 17 Oct 2022).

the Earth's average temperature is 1.1 °C higher compared to the pre-industrial periods (Gillett et al., 2021). Recently, Jenkins et al. (2022) find that the average temperature and AGW have been showing an increasing trend. The study presents that global mean surface temperature almost doubled between 2010-19 (+0.35 °C decade^{-1}) compared to 2000-09 (+0.18°C decade^{-1}), while AGW rose around 30% from +0.19 °C decade^{-1} in 2000-09 to +0.24 °C decade^{-1} in 2010-19.

Given the strong evidence that supports AGW, and the unpleasant near future of the Earth that the strong evidence of AGW foretells, the smartest creature that exists on the Earth has started to take steps to prevent this dark destination. This aim, the most important effort was taken in Paris Agreement (2015)[2] after Kyoto Protocol (1997)[3]. The importance of the Paris Agreement, which has been adopted by 194 members of the UNFCCC as of October 2022, is an international treaty that binds the parties to take the required steps to deal with current emission levels and global warming. The Paris Agreement aims to keep the increase in global temperature to well below 2 °C, preferably to 1.5 °C by 2100, compared to pre-industrial conditions by accomplishing net zero emission by 2050. However, the proposed targets taken by countries are argued as insufficient to accomplish these aims (Sanderson et al., 2016; Schleussner et al., 2016). The projection shows that European Union member countries are expected to decrease net emissions to 41% which is well above the net 55% reduction target, which threatens the net zero emission target by 2050[4]. Considering the fact that the only decrease in the total GHG emission has been seen in only in Europe since 1990[5], accomplishing net zero emission by 2050 seems quite unlikely with current trends.

While the motivation to mitigate climate change is underwhelming at the country level, the data reveals that major GHG emitters are a small proportion of corporate entities

[2]The certified true copy of the agreement is available at https://treaties.un.org/doc/Treaties/2016/02/20160215%2006-03%20PM/Ch_XXVII-7-d.pdf (accessed: 17 Oct 2022).

[3]The certified true copy of the protocol is available at https://unfccc.int/sites/default/files/resource/docs/cop3/l07a01.pdf (accessed: 17 Oct 2022).

[4]Total Greenhouse Gas (GHG) emission trends and projections in Europe Publication, October 26, 2022, available at https://www.eea.europa.eu/ims/total-greenhouse-gas-emission-trends (accessed: 27 Oct 2022).

[5]Total GHG Emission in Gigatonnes of CO_2 Equivalent ($GtCO_2e$) in 1999 World: 32.52, Asia: 9.68, Europe: 8.53, North America: 6.67, South America: 2.97, Africa: 2.15; Total GHG Emission in $GtCO_2e$ in 2019 World: 49.76 (53% upward trend), Asia: 26.05 (169% upward trend), Europe: 5.87 (68.8% downward trend), North America: 7.52 (12.7% upward trend), South America: 3.07 (3.4% upward trend), Africa: 3.75 (74.5% upward trend) (Source: The World Bank Database).

from different sectors. Heede (2014) demonstrates that 63% of cumulative total GHG (915 $GtCO_2e$) has been emitted by only 90 oil, natural gas, coal, and cement producer firms (50 investor-owned firms are responsible for 34.43%-315 $GtCO_2e$ of this emission, 31 state-owned firms are responsible for 31.48%-288 $GtCO_2e$, and 9 nation-state firms are responsible for 34.09%-312 $GtCO_2e$) between 1751 and 2010. Another interesting point is that half of this 914 $GtCO_2e$ cumulative GHG emission accounted for 259 years between 1751 and 2010 has been exhausted since only 1986, for 24 years. The picture has not shown any prospects for the last decade either. CDP Carbon Majors Report (2017) shows that 100 fossil fuel companies account for 71% of global industrial GHG emissions since 1988. Besides, the GHG emission concentration in leading companies exists in other sectors. For example, Meat Atlas Report (2021) presents that the biggest 5 meat-and-milk companies (JBS, Tyson, Cargill, Dairy Farmers of America, and Fonterra) emit more combined emissions in a year compared to major oil companies such as Exxon, Shell, or BP. Further, only 20 livestock companies beat giant economies such as Germany, Britain, or France in the case of GHG emissions in 2018.

The harmful activity done by huge companies to the environment and climate is not limited by only GHG emissions. The Plastic Waste Makers Index (2021) by Minderoo Foundation reveals disturbing and desperate facts regarding single-use plastics. Single-use plastics are everyday essentials in modern lives as they have been used in making from face masks, and other medical equipment to food and non-food bottles, food, film, and sheet packaging, retail, trash, and industrial bags, or caps, closures, cups, and containers. The production of single-use plastics has doubled since 2005 and it is expected to increase another quarter between 2020 and 2025, while the global single-use plastics recycling rates have not changed for over 30 years. The Minderoo Foundation estimates that the thrown away single-use plastics were around 130 million metric tons in 2019; about 35% of this waste was burned, 31% of the waste was buried in managed landfills, and 19% was directly dumped on land or into the ocean in 2019. Only three companies, ExxonMobil, Dow, and Sinopec are responsible for 16% of global single-use plastics waste, 20 polymer producers account for 55% of the waste, and the top 100 polymer companies cause 90% of all single-use plastics waste generated globally. The contribution of single-use plastics to global GHG emissions is expected to increase triple,

which will constitute 5% to 10% of global GHG emissions by 2050. However, the importance of plastic waste is more than GHG emissions. With every piece of plastic thrown on land and into the ocean, the fauna and flora balance is being put in danger. Given that the biggest source of oxygen on Earth is the oceans, 50-80% of the oxygen comes from oceans, the plastic pollution has the potential to unbalance this source.

B The Role of Financial Intermediaries in Global Warming

The direct contributions of financial institutions to global warming or environmental degradation are quite low compared to other sectors such as energy, transport, or agriculture. Nevertheless, financial institutions have a major role in achieving the net zero target, mitigating global warming, and reducing environmental and air pollution. Two extensive reports demonstrate the indirect contributions of financial institutions on climate and the environment. First, the Banking on Climate Chaos (2021) published by RAN presents that the 60 largest commercial and investment banks from all over the world invested a total of $3.8 trillion into fossil fuels companies between 2016 and 2020. Fossil fuel financing demonstrates around a 5% increase every year consistently except a drop of around 9% was experienced in the total amount poured into the fossil fuel sector in 2020, however, this decrease is associated with the falling demand and production as a result of the COVID-19 pandemic rather than environmental and climatic concerns of the banks. The report states that the majority of the total amount, $3.8 trillion, has been used in the expansion of fossil fuel extraction and infrastructure. Approximately $1.5 trillion of the total amount has been utilized by 100 key companies from the sector with the worst fossil fuel expansion plans. Considering the fact that the largest banks from developed countries have pathetic oil and gas, and coal policy scores; significant financial support from the largest banks to the fossil fuel corporations with the worst plans is not very surprising. Out of 200 total policy scores (a combination of oil and gas, and coal policy scores), none of these 60 banks could achieve to exceed 100 and only 6 banks had a score of more than 50 in 2021. Table L summarises the average oil and gas and average coal policy scores of the 60 largest banks. Further, only 17 banks of these 60 expressed their commitment to the "net zero by 2050" principle, while they have not set any strong engagement to the net zero targets yet. Only, 3 banks (Lloyds Bank and NatWest from UK and Nordea from Finland) pledged to cut lending, investments and financing emission from 40% to 50% by 2030 but no important decreases have been observed in their financed emissions. Therefore, the largest banks from the largest economies have not taken any significant steps until now that promise to zeroing out their financed emission by 2050 at the latest.

Table L: Oil and gas, and coal policy scores of banks from different countries and regions

	Average Oil and Gas Policy Score (out of 120	Average Coal Policy Score (out of 80)
13 Largest Chinese Banks	<1	<1
16 Largest European Union Banks	11	38
8 Largest U.S. Banks	5	15
5 Largest Canadian Banks	3	5
5 Largest U.K. Banks	8	23
4 Largest Japanese Banks	1	4
9 Largest Other Banks [6]	3	11

Source: Banking on Climate Chaos Report 2021, by Rainforest Action Network
Notes: This table presents the average oil and gas policy score (out of 120) and average coal policy score (out of 80) of the 60 largest banks from Australia, Canada, China, European Union, Japan, India, Korea, Russia, U.K., U.S., Switzerland.

The other report was published by CDP with the title of The Time to Green Finance (2020). The report presents the investments, risk assessments, and determination of the 332 financial institutions on the financed emissions. Among these 332 finance companies, half of them have not assessed the effects of their portfolio on climate at all. Only 25% of the financial institutions have disclosed their finance emissions, and these 84 financial institutions have a worth of $27 trillion of assets in financed emissions. This means that these financial institutions have caused 700x higher GHG emissions by investment than the reported operational emissions of the financial institutions.

These two reports prepared by different institutions picture not fully but sufficiently enough the indirect effects of the banks on the historical as well as current climate and environmental crises. Further, the reports that investigate the financial institutions' actions and decisiveness regarding climate change and environmental pollution clearly present that the majority of the financial institutions and almost all of the largest banks from different countries and regions have failed to promise any satisfactory commitments to climate issues until now. While the global crises show the importance of financial institutions for all other sectors, the more important question to be answered is the contributions of financial institutions to AGW rather than how well they prepare themselves for the catastrophic results of climate change. The main issue is not whether financial institutions are immune to climate change, but how we can mitigate AGW altogether. To solve this problem efficiently,

[6] 2 Largest Swiss, 4 Largest Australian, 1 Largest Korean, 1 Largest Russian, and 1 Largest Indian Banks.

effectively, timely, and radically, financial institutions must be involved, and their interests must be aligned with the targets set in Paris Agreement. Unless banks do not change their attitudes, and improve their gas and fuel, and coal policy scores, it is hardly to succeed the targets set at Paris Agreement.

C Agency Issues in Islamic and Conventional Banks

The current literature suggests that organizations could face three types of agency issues; conflicts in the interests of shareholders and managers (principal-agent problem), majority shareholders and minority shareholders (principal-principal problem), and shareholders and creditors (principal-creditor problem) are common in CBs. Furthermore, these three types of agency problems are also common in IBs. However, these are not only agency problems for IBs, but unique agency problems can also be observed in IBs mainly arising as a result of the religious orientation of these banks.

I. Type I Agency Problem, Principal-Agent Conflict

Type I agency problem occurs as a result of the intentions of the managers leading them to act according to maximizing their benefits rather than acting according to the best interest of shareholders (Jensen and Meckling, 1976).

The principals and the agents adopt separate risk attitudes; while the agents tend to be risk-averse as a result of their motivation to secure their job, the principals tend to be risk-neutral as a result that they are already diversified their investments (Eisenhardt, 1989). Furthermore, since the perfect and costless monitoring of agents is not possible (Pratt and Zeckhauser, 1985), the principals are not always capable to have complete information regarding the plans and behaviours of the agents and thus principals cannot be assured that the agents act according to the contract which is called "hidden information" by Arrow (1985). To illustrate this, an agent might assert she/he has certain skills, abilities, and experience which affect the decisions of principals while hiring or charging that agent. The problem is that principals do not always have the opportunity to check the characteristics and skills of the agents that are claimed honestly. Consequently, principals might fall into an error in that adverse selection of an individual who presents misleading information about his/her characteristics and abilities over an individual who presents his/her characteristics and abilities truthfully which is better than the other individual in fact (Eisenhardt, 1989).

Another aspect of the agency problem is moral hazard which is labelled as a "hidden action" by Arrow (1985). Principals, as mentioned above, do not have perfect monitoring

abilities and opportunities for the decisions and actions of agents. It is impossible for principals to be sure that the decisions of agents are optimum for the principals as well as agents who put an adequate effort and are as diligent as they can be while serving the best interest of principals without being a shirker (Arrow, 1985; Shapiro, 2005).

II. Type II Agency Problem, Principal-Principal Conflict

Type II agency problems refer to conflicts between the interest of major and minor owners. Major owners are the individuals obtaining the majority of the shares of a firm (usually more than 50% of the shares in the firm), whereas minor owners are the individuals controlling the less portion of the shares of the firm (usually less than 50% of the shares in the firm). The existence of controlling shareholders, alias dictus blockholders, derives some benefits and drawbacks. The shareholders who hold the major portions of the share of the company perform a strict and intense monitoring activity of managers' actions and decisions (Fama and Jensen, 1983). This rigorous observation made by those shareholders on management decreases the opportunistic behaviours of the agents. Therefore, the level of severity of the Type I agency problem, which is a conflict between the interests of principals and agents, might diminish in these companies (Bebchuk and Weisbach, 2012).

In the case where the interests of large shareholders differ from that of the minor shareholders and agents, Type II agency problems arise as well as exacerbate the Type I agency problems. Controlling shareholders hold the power of voting which makes it possible for them to dictate the company by taking decisions and actions which are in favour of their interest but unfavourable to the interests of minor shareholders (Fama and Jensen, 1983). Major owners could influence the company to receive benefits at the expense of other shareholders and managers. They could exploit using their power by deciding to keep the cash flows for themselves as a special dividend instead of allocating to other investors or misuse their power by managing a relationship with other organizations which does not provide any advantages to other investors (Shleifer and Vishny, 1997).

III. Type III Agency Problem, Principal-Creditor Conflict

Type III agency problem assumes that a conflict arises between creditors who provide funds for projects undertaken and shareholders who have the power to make decisions regarding the projects. The main point of this type of agency problem is that the risk attitudes of creditors and owners of the firms differ. The difference comes from the differently shaped pay-off claims of the parties (Srivastav et al., 2018). Shareholders have risk preferences that the riskier projects provide them with a better return; therefore, shareholders' payoffs are convex while a riskier project means a higher probability of loss for creditors while not receiving the payoff to involve riskier project as much as shareholders do since creditors generally make a fixed rate of return (Srivastav and Hagendorff, 2016). In other words, when a riskier project is decided to be funded if the project is successful; shareholders receive a substantial return while creditors are paid the amount parties agreed on when the contract was concluded regardless of the return of the project. However, if the riskier project fails; then creditors would bear some part of the loss.

IV. Agency Issues in Islamic Banks

Sharia law which is the fundamental of IBs is the main factor that makes different IBs from the CBs. One of the important differences between IBs and CBs is agency issues which occur as a result of the religious orientation of IBs. Accordingly, the obligation to follow Sharia principles for IBs can either exacerbate or reduce agency problems in IBs. For example, the SSBs corporate governance mechanism in IBs formed with the aim of overseeing Sharia compliance of the IBs has the power to resolve the agency problems while the unique saving contracts developed by IBs inspired by the Sharia principles and managers who might violate the Sharia principles generate unique agency problems in IBs. Table M presents the main differences between IBs and CBs regarding agency conflict that these institutions could face.

i. Regulatory Compliance

Islamic financial doctrine obligates and forbids certain transactions and financial activities for IBs. IBs must carry out their operation and transaction in line with this doctrine, Sharia, Islamic law. For example, according to the principles of Sharia, IBs are not allowed to involve

Table M: Comparison of agency problems in CBs and IBs

	CBs	**IBs**
Regulations	The priority for managers is to comply with regulations and principles established by banks' governance. Agency problems occur when agents act according to principals' interests.	Managers in IBs need to follow regulations established by banks' supervisors as well as Sharia principles. Therefore, in addition to the self-interested behaviours of agents, violation of Sharia principles is a unique agency problem.
Corporate Governance	The corporate governance structure of CBs includes a board of directors. In some cases, CBs could have a two-tier board structure as they construct a supervisory board besides the board of directors.	IBs compose SSB besides the board of directors. The SSB oversees whether IBs comply with Sharia principles. Since Sharia principles include ethical values, complying with Sharia helps IBs to reduce agency conflicts in IBs by increasing transparency and decreasing the information asymmetry between groups.
Rights of Depositors	Depositors in CBs generally receive a fixed return, do not share the risks with banks, and the fund provided by depositors are guaranteed and classified as assets. Therefore, depositors are not one of the parties of agency issues in CBs.	IAHs share the risk of loss and the loss is borne by IAHs wholly or partly. The funds provided by IAHs are neither considered pure debt nor pure equity. Depositors do not have the rights that shareholders do in IBs. Therefore, depositors are one of the parties to agency problems with principals and agents.

Notes: This table summarises the differences between Conventional and Islamic banks regarding regulations, corporate governance, and right of the depositors.

in any transaction which includes any form of interest (riba), excessive uncertainty (gharar), or gambling (maysir) (Khan, 2010; Lewis, 2001). Sharia also opposes IBs to engage in any financial activities or sectors which potentially create a negative impact on society such as industry of alcohol, illegal drugs, pornography, short selling, tobacco, weapon, and so forth as well as industries and products defined as haram[7] by Sharia such as swine (Hassan and Aliyu, 2018; Imam and Kpodar, 2013). On the other hand, Sharia requires IBs to make a payment annually called zakat to people who are in need (Maali et al., 2006).

Complying with these forbidden and obligated transactions and financial activities, principles of Sharia, is crucial for IBs since one of the reasons for the existence IBs is to maintain Sharia-compliance objectives. Compliance with Sharia principles plays a vital role in the preference of some investors and depositors for IBs over CBs, such that for these customers staying inside of the borders of Sharia is more important than the rate of return provided by banks (Dusuki and Abdullah, 2007; Echchabi and Olaniyi, 2012; Gait and Worthington, 2008; Naser et al., 1999; Rehman and Masood, 2012). Therefore, one of the primary concerns of depositors, investors, and borrowers of IBs is whether all operations, business activities and transactions of IBs are 100% Sharia-compliant (Razak and Taib, 2011; Khan et al., 2007) and whether they can be accomplished by staying away from transactions including for example riba, gharar, maysir or any kind of haram and committing obligated transactions and activities such as zakat. In this sense, in addition to managers who act to gain benefits at expense of shareholders' wealth which is defined as a Type I agency problem occurring in both CBs and IBs, IBs could face a unique agency problem occurring when managers deviate from investing the funds into Sharia-compliant assets (Safieddine, 2009; Zainuldin et al., 2018).

Therefore, the existence of managers who might undervalue or exploit Sharia principles by involving forbidden or not involving obligated transactions and activities by Sharia to obtain advantages against to interests of shareholders, depositors or other customers of IBs is the main source of this unique agency conflicts in IBs.

[7] Cambridge dictionary defines haram as "forbidden for religious reasons or because it is against social custom."

ii. Corporate Governance Structure

The corporate governance structure of IBs is shaped and inspired by the principles of Islamic law which is Sharia. Therefore, the Sharia governance system is very important to explain the corporate governance structure of IBs and its effects on the disclosure policy of the firms. Islamic Financial Services Board (IFSB) published a standard in 2009 which defines Sharia Governance properly for the first time. Accordingly;

> "Sharia Governance System refers to the set of institutional and organization arrangements through which an institution offering Islamic Financial Services (IIFS) ensures that there in effective independent oversight of Sharia compliance over issuance of relevant Sharia pronouncements/resolutions, dissemination of information on such Sharia pronouncement/resolutions to the operative personnel of the IIFS who monitor the day-to-day compliance with the Sharia pronouncement/resolutions vis-à-vis every level of operations and each transaction, an internal Sharia compliance review/audit for verifying that Sharia compliance has been satisfied, during which any incident of non-compliance will be recorded and reported, and as far as possible, addressed and rectified, an annual Sharia compliance review/audit for verifying that the internal Sharia compliance review/audit has been appropriately carried out and its findings have been duly noted by the Sharia board" (IFSB, 2009, IFSB-10, p. 2-4).

To accomplish effective monitoring for the alignment of IBs with Sharia principles, IBs form an additional board besides the board of directors, namely the SSB. In this sense, the definition of SSB is parallel with Sharia Governance. IFSB-3 (2006) points out that "*IIFS shall have in place an appropriate mechanism for obtaining rulings from Sharia scholars, applying fatwas*[8] *and monitoring Sharia compliance in all aspects of their products, operations and activities*" (IFSB, 2006, IFSB-3, Principle 3.1., p. 11) and "IIFS shall comply with the Sharia rules and principles as expressed in the rulings of the IIFS's Sharia scholars. The IIFS shall make these rulings available to the public" (IFSB, 2006, IFSB-3, Principle 3.2., p.12). This mechanism and role are carried out by SSBs and are formed by people who are experts

[8]Fatwa is an official statement or order from an Islamic religious leader.

in Sharia, Sharia scholars.

The main responsibilities of the SSB are well defined by the IFSB guiding principle in 2009. According to this guiding principle, SSB shall apply fatwas and monitoring activities whether followings comply with Sharia principles; "*(i) both ex-ante and ex-post aspects of all financial transactions carried out by the IIFS – that is, to ensure Sharia compliance of the contracts and, later, the performance of obligations under the contracts; and (ii) operations of the IIFS, including aspects such as Sharia compliance review, investment policies, disposal of non-Sharia-compliant income, charitable activities, etc.*" (IFSB, 2006, IFSB-3, 48, p. 11). Farag (2016, p. 266-267) also draws a framework which shows the main responsibilities of SSBs which are "*(i) advising the board of directors on Sharia compliance; (ii) monitoring the application of Sharia policies and practices; (iii)validating new financial products and services; (iv) overseeing the computation and distribution of zakat and other charitable funds; (v)advising other parties, for example, legal counsel and auditors; and (vi) writing reports including opinions provided by the SSB with respect of Sharia compliance.*" Grais and Pellegrini (2006a) define the responsibilities of SSB in five main areas; "*(i) certification of permissible financial instruments through fatwas; (ii) verification of transactions' compliance with issued fatwas; (iii) the calculation and payment of zakat; (iv) disposal of non-Sharia compliant earnings; and (v) advice on the distribution of income or expenses among the bank's shareholders and Investment Account Holder (IAH).*"

The existence of SSB in IBs gives credibility on legitimacy and fairness to all stakeholders regarding the activities of IBs from the Sharia point-of-view (Haniffa and Hudaib, 2007). SSBs function an important role in providing confidence to shareholders, depositors and all other stakeholders by providing more transparency (Garas and Pierce, 2010). Furthermore, Mollah and Zaman (2015) argue that SSBs might be a barrier for the board of directors and management to involve predatory lending and excessive risk-taking activities besides performing the oversight mechanism on whether operations and activities of IBs are fully Sharia-compliant. SSBs carry out these roles because Sharia principles IBs are closely bound up with require them to not engage in any unethical practices (Haniffa and Hudaib, 2007). Islamic approach defines the IBs' perceptions of its all stakeholders including primary stakeholders (shareholders, managers, board of directors, and employees) and derivative stakeholders (suppliers,

buyers/customers, debtors, competitors, and nature) (Beekun and Badawi, 2005). These perceptions are fundamental to Islamic ethical principles. Therefore, the Islamic ethical system is not limited to the following Islamic economical doctrine (e.g., avoiding interest or not involving any transaction and activities related to swine) but also IBs must take into account all stakeholders' interests and present extra cautions, genuine efforts and the best intentions while taking actions and decisions (Quttainah and Almutairi, 2017).

The close relationship between Islamic ethical principles and IBs' ethical identity is what makes Islamic ethical values different from Western or secular ethical values (Quttainah and Almutairi, 2017). Western or secular ethical principles are man-made; thus, the moral codes are transient and alterable rather than permanent as a result of the principles created and designed by humankind which separate ethics and religion. On the other hand, Islamic ethical values are based on the values of Sharia principles and stress the tie between humankind and God. Therefore, the fundamental ethical value of IBs is Sharia law (Haniffa and Hudaib, 2007). In this sense, the ethical values of IBs inspired by Islamic ethical values play an ultimate decisive role in the relationship between IB and its stakeholders. Some researchers argue that one of the reasons for the better performance of IBs compared to CBs during financial crises is because of the ethical values of IBs (Chapra, 2011). SSB is the most important corporate governance mechanism that acts as an agent of ethics in IBs (Quttainah and Almutairi, 2017).

SSBs in IBs might undertake either an advisory role or a supervisory role (Mollah and Zaman, 2015). The supervisory role of SSBs includes controlling, monitoring and supervising whether IBs comply with Sharia principles, while under the advisory role SSBs undertake a duty of analysing and evaluating activities of IBs from both Sharia and ethical perspective (Quttainah and Almutairi, 2017). In this sense, SSBs boost the engagement of IBs in ethical behaviours and values. Quttainah and Almutairi (2017) suggest that the presence of SSBs in IBs provides a huge benefit to those banks as a result that SSBs help IBs to shape and improve their daily business activities, decision-making processes, management styles, and financial products and services in the basis of ethical aspect. Quttainah et al. (2013) document that SSBs reduce the intentions of the managers in involving the actions serving their own benefit at the expense of shareholders' wealth. Furthermore, Quttainah and Almutairi (2017)

argue that the existence of SSBs in IBs constrains managers and the board of directors from in engaging unethical behaviours such as earnings management and expense-preference behaviours. Sharia principles and SSBs have IBs to improve and perform better ethical standards while limiting the freedom of agents in involving any action opposed to Sharia.

The position of depositors in IBs exacerbates a unique agency problem, managers have more power and freedom while managing the funds provided by IAH which might result in incentivizing the managers to diverge from utilizing the firm's resources in an optimum way and directing managers to engage unethical behaviours. One of the most important functions of the SSBs to ensure to not have these kinds of problems by aligning the activities and practices of IBs with Islamic ethical values. Therefore, I expect a positive relationship between the presence of SSBs in IBs and the disclosure policy of the IBs. SSB might promote better communication between IBs and depositors and encourage banks to increase transparency while decreasing the information asymmetry between banks and IAH and other stakeholders to comply with Islamic ethical values.

iii. The Nature of the Savings Contracts

According to Sharia, not involving any transactions that include receiving or paying interest is one of the important principles of the Islamic financial system. The primary source of Islam, The Holy Quran mentions that all Muslims should stay away from any form of interest several times as a requirement of faith (The Holy Qur'an, Al-Baraqah 2:275, 276, 277, 278, 279, 280, 281; Ali 'Imran 3:130; An-Nisa 4:161; Ar-Rum 30:39). Therefore, IBs are not allowed to offer traditional saving accounts which offer generally a fixed rate of return to the depositors provided by CBs. Instead, IBs have developed unique saving contracts for their depositors; namely Musharaka (profit- and loss-sharing) and Mudaraba (profit-sharing). The subject of these contracts is not either pure debt or equity (Safieddine, 2009). The investment accounts in IBs are formed based on the concepts of equity participation (Farag and Mallin, 2017) and therefore the fund providers are not referred to as depositors but as IAHs. Under these contracts, contrary to traditional saving accounts in CBs in which depositors receive a certain amount of interest for an agreed period, IAHs share the risk of investment with IBs.

In Musharaka, equity participation contracts, IAHs and IBs share the profit according

to a ratio the parties agreed on when the contracts are concluded while the loss is shared according to the ratio the parties contribute to the investment. The important point here is that if parties do not decide upon the ratio of profit distribution between parties, then the contract becomes invalid according to Sharia. While the loss is distributed between the parties according to the proportion of contribution they make to the investment, the profit distribution ratio must be agreed between parties as the parties are not allowed to receive a fixed rate of payment or a rate according to their contribution on the investment. Therefore, the profit is shared on an agreed ratio, but the loss is based on the ratio of investment contribution under a Musharaka contract. On the other hand, under Mudaraba contracts, and trustee finance contracts, the profit is distributed according to a ratio pre-agreed between parties. However, in case of loss, the only party of the contract is responsible for the loss is IAHs. IBs do not bear any part of the loss under a Mudaraba contract when the loss occurs from the investment. To illustrate these contracts, imagine a situation where depositors provide £90,000 and the bank provides £10,000 into an investment pool of a total £100,000 and assume that the investment provides £20,000 profit. Under these contracts, the first IBs separate the ratio representing its own contribution to the pool which is 10% (£10,000/£100,000) in my example; £2,000 (10% $\cdot$ £20,000). So, the remaining profit which is £18,000 is available for distribution. This amount is distributed between the bank as an investor of the capital (Mudarib) and depositors as an investor (Rab-ul Mal). Assume that the parties had agreed on a ratio of profit distribution of 40% for the bank and 60% for depositors. Therefore, the remaining profit which is £18,000 is distributed according to these ratios; the bank receives £7,200 (%40 $\cdot$ 18,000) and the depositors receive £10,800 (%60 $\cdot$ £18,000). On the other hand, in case of loss, under Musharaka contracts, assuming the investment provides a negative £20,000 return, each party bear the loss according to the ratio they contribute to the investment pool, in my cases, the bank is responsible for £2,000 (10% $\cdot$ £20,000) and the depositors bear 90% of the loss which is £18,000 (90% $\cdot$ £20,000). Under Mudaraba contracts, the loss is deducted from the fund provided by depositors, and IBs do not bear any part of the loss.

The depositors who invest their funds into a saving account in CBs are generally informed of the amount of return for a period. The investors receive a fixed rate of return with a

certain level of deposit insurance (Safieddine, 2009) and without facing a risk of negative return from the investment in CBs. In IBs, these are not the case and IAHs who invest their funds into an investment account in IBs are subjected to loss and share the risk of negative return of an investment with the bank in Musharaka contracts while the loss is completely borne by IAHs in Mudaraba contracts. Therefore, funds providers in IBs, and IAHs, are similar to shareholders from this perspective. IAHs have no power to intervene in how the funds are managed by managers. Management of IBs has complete freedom in managing the funds provided by IAHs (Zainuldin et al., 2018). However, IAHs do not have the rights that shareholders have in IBs (Archer et al., 1998). IAHs cannot have a voice in appointing or dismissing the members of the board of directors, SSB, the management, or the external auditors (Archer et al., 1998; Farag, 2016; Farag et al., 2018), therefore, IAHs do not have any power to monitor and control management in IBs (Archer et al., 1998; Karim, 2001); IAHs do not have any representative in both the board of directors level or management level (Grais and Pellegrini, 2006a); and IAHs do not have any communication tool to express their concerns, opinions, or views (Grais and Pellegrini, 2006b). The only action they can take is to withdraw their deposits from the IBs. Consequently, from the IAHs perspective, unique agency issues arise due to the separation of cash flow rights and control rights for depositors and investors (Safieddine, 2009), besides the agency problems for shareholders which are common in IBs and CBs because of the separation of control and ownership. This limited control rights for depositors in IBs puts less pressure on managers to not involve opportunistic actions related to IAHs and not exploit IAHs' rights to obtain advantages at the expense of their wealth; for instance, managers may avoid devoting necessary attempts while managing funds allocated by IAHS, manipulating and reporting a low level of profits, or exploiting advantages at the expense of IAHS (Dar and Presley, 2000; Safieddine, 2009).

While shareholders are capable to utilize monitoring and controlling mechanisms to mitigate agency problems that occur between the principals and the agents in CBs and IBs, IBs do not allow IAHs to involve any monitoring and controlling activities to mitigate agency problems between IAHs and agents. Therefore, IAHs have a completely different position from the depositors in CBs who have deposit insurance and earn fixed returns (Safieddine, 2009) as well as the shareholders who are able to monitor and control managers to mitigate

conflicts between the principals and the agents in CBs and IBs (Farag et al., 2018). As a result, the relationship between IAHs and managers is a unique agency relationship peculiar to IBs, and in turn, unique agency problems can be observed between the IAHs, depositors, and the manager peculiar to IBs arise from the separation of cash flow rights and control rights. This multiple principal structures intensifies the agency problem in IBs, as actions of an agent, and a manager, in IBs affects two different principals; IAHs who entrust their funds to that agent, and shareholders who appoint or dismiss the agents and are able to carry out monitoring and controlling activities. In case of a conflict between the interest of IAHs and shareholders in IBs, the manager might be faced with a real dilemma. When the benefits of these two groups vary, the contradiction might put managers under significant pressure to decide on which group's interest they are pursuing. The manager might sometimes avoid taking the optimum decisions or actions to satisfy one of these groups as well as to gain personal advantages in IBs.

The agency relationship in IBs becomes more complex when the authority of the managers granted by IBs is considered. As a result of that IAHs can be subjected the part of the loss or the whole loss, IBs create specific reserves to minimize the risk of participating loss for IAHs and to maintain their competitiveness with other IBs and CBs since it would be impossible to attract depositors and their funds when they are charged with a loss by IBs. These reserves are generally called Profit Equalization Reserves (PER) or Investment Risk Reserves (IRR). IBs may hold a certain proportion of profit before allocating it between shareholders and IAHs through PER, whereas IBs may set aside a certain amount of profit that belongs to IAH after shareholders are distributed (Archer and Karim, 2006). The main purposes of these reserves are to stabilize and smooth the profit and reduce the volatility for PER and a caution reserve against the loss that might occur in the future. Allocating some part of the profit to PER affects both shareholders and IAHs while the only party that is the subject of IRR is IAHs. Therefore, the use of PER might cause a conflict between the interest of shareholders and IAHs. Furthermore, since PER allows managers to smooth earnings, these practices lower the level of transparency and quality of the disclosures and mislead investors presenting an illusory financial situation (Safieddine, 2009).

The agency problems between multiple groups, IAHs, shareholders and management in

IBs is different from Type I agency problem resulting from the separation of control and ownership which is also common in IBs. However, Type II and Type III agency conflict is akin to this agency problem with multiple principals in IBs. Nevertheless, in Type II agency conflict, minority shareholders and Type III agency conflict, creditors have some sort of protections and mechanisms they might use to mitigate agency problems. For instance, sophisticated legal protection would be provided by a policymaker or minor shareholder could always go to court to protect their rights (Shleifer and Vishny, 1997), and creditors might negotiate the terms in the contracts and decrease the level of agency costs while increasing the efficiency of the contract (Armstrong et al., 2010). On the other hand, IAHs have no these kinds of power to mitigate agency problems; they cannot involve in appointing or dismissing process on the member of the board of directors, SSB or management, and they do not have a communication tool to express their interests, or they do not perform effective monitoring and controlling activity on management. The only action they can take is to withdraw their funds, and this is not always a profitable and feasible movement for IAHs. Therefore, the position of IAHs in IBs leads to unique agency problems in these organizations. I argue IBs might be more transparent and might need to decrease information asymmetry between IAHs, shareholders, and managers, and to do so IBs might reveal more information through disclosures since it is the almost only tool of communication of IAHs.

Studies have proposed different solutions to deal with agency problems such as establishing an efficient corporate governance mechanism that might align the interests of two groups, shareholders and managers, due to increased monitoring and controlling activities on the decision-makers (Fama and Jensen, 1983), or motivating executives with incentives that align their interest with shareholders' (Haugen and Senbet, 1981; Eisenhardt, 1989). In addition to these solutions, researchers consider the disclosure policy of the firms as a powerful tool to mitigate the agent-principal problem in the firms. Stiglitz and Weiss (1981) note that revealing extensive information decreases agency costs. Kanodia and Lee (1998) find that periodic performance reports such as earning statements play a disciplinary role in managerial decisions. Managers generally make their important decisions according to information that is unattainable to the public. The decisions can be observed, but the underlying motivation for those decisions might not be observable to the public. The people who do not obtain pri-

vate information might misjudge the decisions, in turn, discourage the managers from taking effective decisions. Performance reports might make the managers take a decision after a careful consideration process as well as alleviate the pressure on managers by displaying the positive results of their decisions. Healy and Palepu (2001) propose that disclosing relevant information is one of the solutions to agency problems. Accordingly, disclosure enables investors to monitor and control firms' operations strictly and to evaluate their resources and funds are managed in their best interests of them. Finally, Huang and Zhang (2012) suggest that disclosing less information exacerbates the conflict of interest between principals and agents. They argue that in opaque firms, the monitoring and controlling ability of the shareholders on the management become more limited, and thereby, managers are more likely to exhibit behaviours that bring benefits to them which result in a loss in investors' wealth. In conclusion, increasing the informativeness of the financial disclosures and the transparency level of disclosures could be used to mitigate agency problems in corporations.

Consequently, I expect to observe some differences in the disclosure policy of the IBs and CBs, IBs might disclose more information to deal with peculiar agency issues and they have an additional board in the corporate governance setting which might promote transparency and decrease the information asymmetry between agents, principals, and depositors.

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