RemittancesReview
April2024,
Volume: 9, No: 2, pp.1997-2029
ISSN:2059-6588(Print)|ISSN2059-6596(Online)

Received : 15 February 2024, Accepted: 20 March 2024

DOI: https://doi.org/10.33282/rr.vx9i2.106

Role of Green Finance in Determining the Financial Performance and Credit Risk in Banking Sector of Pakistan: Moderating Role of Capital Structure

Dr. Muhammad Abbas[1], Sohaib us Sabah[2]

[1]Associate Professor, Air University Islamabad- Pakistan, Multan Campus

[2]MS Management Sciences Scholar, Air University Islamabad- Pakistan, Multan Campus

Abstract

As the world grapples with the challenges of climate change and environmental degradation, the role of green finance has gained significant attention as a mean to promote sustainable development. Environmental degradation has increased due to population growth, large-scale production, and impulsive buying behaviors. Financial sector is responsible for introducing environmental protection strategies. Pakistan faces environmental challenges such as air pollution, ozone-depleting substances, inefficient energy use, increased road usage, and careless burning of solid waste. Transitioning towards a sustainable green economy is crucial for ecological economic growth. Green financing is emerging as a strategy to stimulate sustainable development and mitigate environmental risks. This study examines the impact of green financing on financial performance and credit risk in Pakistan's banking sector with the focus on the moderating role of capital structure. This study aims to provide insights into the dynamics of green finance in the context of the Pakistani banking sector. By exploring the interplay between green finance, financial performance, credit risk, and capital structure, this study seeks to contribute to the growing body of knowledge on sustainable finance and its implications for banking institutions in Pakistan. Annual data of the time period 2017 to 2022 is collected about these variables from the audited reports of 25 scheduled banks of Pakistan. Panel GMM model is applied for the hypotheses testing. This study finds that green loans significantly impact the return on assets (ROA) and return on equity (ROE) of banks, with the impact influenced by a company's capital structure. Green financing can optimize financial performance by strategically utilizing green loans, highlighting the complex

relationship between sustainable financing and corporate finance strategy. The capital structure of a financial institution also influences the impact of green loans on non-performing loans (NPLs). Green projects carry a lower credit risk compared to traditional projects, reducing default and NPLs. Financial institutions should consider incorporating green financing into their risk management strategies to mitigate credit risk and improve asset quality. The integration of ecological aspects in monetary decisions can help build an adaptable future for future generations.

Keywords: Green Finance, ROA, ROE, Credit Risk

1. Introduction

Over the past few decades, technological improvements have given rise to various environmental problems, the solution to which came around with the notion of sustainable finance. The postulates of this theory hold that the public and private sectors should link innovation and technical advancement to introduce financial products and services that play their role in environmental protection. Environmental protection has become issue of great concern for every county and international organizations. Goal number 7, 9, 11 & 12 of UNDP Sustainable Development Goals are focused towards protection of environment and sustainable economic activities. Green finance is a step towards achievement of these goals. Under the agenda of UNDP every country has focused on putting green financial strategies into priorities. Environmental protection act of 1997 highlights the need for focused towards implementation of environmental protection technologies in all the industries. Similarly State Bank of Pakistan Green Banking Guidelines 2017 were introduced to encourage industries for the adoption of technologies to modernize their processes for minimizing the environmental degradation (SBP-GBG 2017).

Transition towards sustainable green economy is threatened by environmental concerns. Sustainable finance is crucial for tackling these issues and achieving ecological economic growth. Pakistan, like other developing countries, is facing challenges in implementing sustainable financial practices. Green financing is emerging as a strategy to stimulate sustainable development and mitigate environmental risks.

1.1 Introduction to Green Finance

Investment decisions that involve environmental, social, and governance (ESG) considerations are referred to as green finance, also known as sustainable finance or environmental finance. These criteria seek to promote sustainable development, by taking social and environmental effects into account in addition to financial returns. Green finance is a term used to describe a variety of financial instruments, including green bonds, green loans, and sustainability-linked loans (SLLs), that allocate funds to eco-friendly initiatives, like energy efficiency, sustainable energy, as well as climate adaptation.

1.2 Importance of Green Finance in Pakistan

Pakistan is experiencing numerous environmental issues such as deforestation, pollution of the air and water, and is highly prone to the impediments of global warming, such as dry spells and floods. These issues threaten to disrupt the economy by impacting segments including infrastructure, public health and agriculture. Understanding the need of sustainable solutions, the government of Pakistan has made arrangements to support green finance projects. In order to encourage banks to incorporate ESG codes in their business and trading ventures, the State Bank of Pakistan (SBP), the state's principal regulatory body, has introduced policies and guidelines. Moreover, in an effort to improve accountability and transparency in corporate governance, certain regulations are implemented by the Securities and Exchange Commission of Pakistan (SECP) to encourage sustainability reporting by listed companies.

1.3 Historical Background of Green Development in Pakistan

Pakistan is implementing measures to establish climate and green funding guidelines and policies to promote sustainable development. The strategies and course of action taken by Pakistan explicate that the state's studious stance towards its obligation of sustainable development and global warming challenges, however the domains of execution and enforcement, as well as the development of a comprehensive green financing framework still needs to be worked upon more rigorously.

Pakistan has introduced multiple policies and action plan towards sustainable development e.g. The National Climate Change Policy (2012), The National Financial Inclusion Strategy (2015), The State Bank of Pakistan (SBP) Green Banking Guidelines (2017), The SECP Guidelines for Sustainable Bonds circulation in Pakistan and The National Electric Vehicle Policy (2019). A **National Action Plan** has been devised by Pakistan regarding the challenges of Global Warming that it faces. The plan aims to mitigate greenhouse gas emissions, propagate the use of green energy, and endorse sustainable agriculture practices, energy and woodland preservation. Pakistan Vision 2025, ratification of Paris Agreement on Climate Change, membership of South Asia Co-operative Environment Programme (SACEP) and Pakistan's Nationally Determined Contributions 2021 (NDC) aim for sustainable economic growth and poverty reduction, focusing on education, healthcare, and environmental sustainability, among other goals.

1.4 Green Finance and Financial Performance

Relationship of Green Finance and financial performance has been a subject of substantial debate. A group of theorists are of the view that introducing ecological, societal, and governance (ESG) considerations in business assessments can bring in improved longstanding financial revenues by reducing risks associated with regulatory compliance, reputational damage and environmental liabilities. Additionally, funding sustainable initiatives can open up new commercial avenues and earning opportunities, fostering competitiveness and innovation. Critics, however, express concerns that might be a trade-off between financial returns and sustainability goals i.e., that green investments might result in lower returns or higher short-term costs.

1.5 Green Finance and Credit Risk

Credit risk management in green finance involves balancing environmental sustainability with financial stability, addressing both potential risks and opportunities arising from environmental factors. The global economy is increasingly addressing climate change and resource diminution, obliging the integration of environmental considerations into credit risk assessment. Green finance initiatives aim to allocate capital towards ecologically sustainable projects, thereby extenuating the negative effects of climate change and fostering ecological resilience. However,

credit risk assessment in the context of green finance is somehow complex, requiring a multidimensional strategy that takes into account social and environmental factors in addition to conventional financial risk assessment.

1.6 Research Objectives

In lieu with the aforementioned perspective, the current study intends to probe the role of sustainable investment in fiscal outcomes and credit risk's valuation in Banking Sector of Pakistan, with a particular emphasis on the moderating role of capital structure.

1.7 Significance of the Study

This research adds to the existing body of knowledge about environmental finance and sustainable banking by displaying realistic proof from the Pakistani context. The examining of the interaction among green finance, capital structure, financial performance, and credit risk, can be of significant assistance as the findings can enlighten legislators, administrators, and monetarist bodies about the probable profits and setbacks of integrating sustainability into banking practices. Moreover, the study offers practical insights for banks seeking to develop strategies for sustainable finance, including the adoption of green lending principles, the initiation of sustainable bonds, and the implementation of ecological risk management frameworks.

Recently the awareness regarding the interplay between environmental sustainability and financial performance in the banking sector worldwide has witnessed an exponential rise. Pakistan, like many other countries, faces pressing ecological challenges alongside the overbearing demand for green financial growth. In this context, the role of environmental finance has emerged as a crucial factor not only in fostering environmental sustainability but also in determining the financial performance and credit risk of banks. Moreover, the role of capital structure adds another dimension to this dynamic relationship.

2. Literature Review

Over the geological time scales, Earth's climate has naturally fluctuated, but the current trend of global warming and climate change is largely attributed to the increased earth's temperature.

Global warming can undoubtedly be singled out as world's highly momentous challenges (Ngwenya & Simatele, 2020). In the event that these problems are not resolved, climate change will continue to have negative effects on the world at large (Andrić, Koc, & Al-Ghamdi, 2019; Z. Dou, Dierenfeld, Wang, Chen, & Shurson, 2024). Human activities, particularly due to extensive industrialization and the consumption of earth's non-renewable energy reservoirs have discharged large amounts of carbon dioxide in the air (Szulczewski, MacMinn, Herzog, & Juanes, 2012). Wu et al. (2021) investigated the relationship between ten distinct countries' economic growth and environmental degradation. In order to overcome the issue of global warming and climate change, lot of international organizations and economies are moving toward sustainable growth and development strategies (Nordhaus & Yang, 1996; Liu et al., 2018). Over the course of the past two decades, the concept of charging for carbon dioxide emissions has gained global traction as a means of combating climate change (Migliorelli & Dessertine, 2018). Therefore, this issue has gained the attraction of researchers since last few decades.

2.1 Green Finance

According to the G20 study, green finance is any financial investment made with the intention of improving the environment as part of the global effort to achieve environmentally sustainable development. (Long & Blok, 2021). Considering this, a number of countries with both developed and developing economies have launched programs to minimize the greenhouse gas emissions into the atmosphere and to accelerate the flow of funding to clean and sustainable projects (Jasse, Berry, Aleixandre-Tudo, & Poblete-Echeverría, 2021). Mohsin, Kamran, Nawaz, Hussain, & Dahri, (2021) investigated the effect of FDIs on carbon dioxide emissions. Their findings directed that developed economies worldwide invest more in developing nations by providing newly developed technologies and environmental solutions that assist those developing economies in reducing environmental degradation. Thus, several nations are putting their maximum efforts to lower their emissions of greenhouse gases (GHGs) and making investments in switching towards renewable energy sources, and by developing green credit policy for funding green loans to businesses and industries for their environmentally beneficial projects. These loans comes with advantageous terms and conditions, such as longer repayment terms or reduced interest rates.

Hence, this is understood that to promote the green practices and to invigorate the sustainable global economy, green finance is essential. Numerous studies has already been done in the past, which have emphasized on significance of green finance. Pindyck (2013), has examined the climate change and models that need to be adopted to mitigate the issue, foregrounding the notion that in order to protect the aspect of progressive financial manufacturing against the damages afflicted by global warming, we need to employ our financial assets in sustainable and green projects. Another study by Falcone & Sica (2019), also stressed that the adoption of a green agenda, at the national and international levels, that includes Green Finance is required. Considering the significance of both the climate change issue and green finance, it is imperative to develop a comprehensive policy that addresses all facts of promoting and implementing green finance. In other words, green credit policy serves as a link between financial institutions and the green industry. (T. Zhang et al., 2020).

However, there are numerous barriers and impediments that keep businesses from engaging in green finance, and as a result, they avoid putting green credit policies into practice correctly. Since the primary goal of the businesses is to achieve maximum profit and green finance is generally considered as expensive products due to incentives offered or due to reason, that adopting alternative sustainable practices is typically associated with higher costs. Businesses are inherently more focused on making profits, even if the products they produce aggravate the environment (Moore & Manring, 2009). Firms incur significant costs as a result of their social commitments, which include reducing carbon emissions, investing in renewable energy, and cleaning up production waste. Only profitable businesses may be able to afford to make such significant expenditures in order to fully embrace an environmentally friendly transition (Gilchrist & Chooi, 2021). Mumtaz & Smith (2019), therefore suggested that the influence of financing constraints on a business's environmental routine in developing nations is an arising phenomenon of research.

According to Islam & Das (2013), banks hold the position to perform a highly prominent part in supporting the financing of ecological infrastructure projects like pure aquatic resources, detritus usage vegetation, power ventures, and bio inoculant vegetation. Similarly Raberto, Ozel, Ponta, Teglio, & Cincotti (2019), stated that the banking industry also bears a major portion of the responsibility for environmental preservation, by implementing sustainable business behaviors

and eco-friendly sponsoring strategies. Moreover; few studies also associated the importance of participation of banks in green loans for their survival. Krueger, Sautner, & Starks (2020), has discussed the effect of climate change on businesses and concluded that climate change will restrict the bank assets growth, reduce the growth of the bank's liabilities, and the quality of loans given to certain industries that are strongly affected by climate change has a tendency to decline. Zhou et al. (2021), suggested that since social and environmental awareness is growing all the time, commercial banks are better able to build green credit businesses and actively engage in social responsibilities that will enhance their reputation.

Despite such colossal implications, banks continued to perform averagely and didn't focus on green lending. Certain previous studies explicate that the reason for this low output are certain barriers that are encountered in real market scenarios. Raihan (2019), has claimed that the high operating costs of green initiatives outweigh their benefits. Another study of (Azad et al. 2022) established that it is essential to review how green finance and sustainable finance are currently being disbursed. Though numerous work has been done in the past few years to scrutinize the correlation of sustainable finance on profitability of banks, and on credit risk of their portfolios, the initial idea for the current research was generated from the same thought process, but it draws a new tangent to it with the intent of adding significantly to the existing body of literature.

2.2 Green Finance in Pakistan

According to the Global Climate Risk Index, Pakistan is the fifth highest susceptible country to the damages caused by global warming. This suggests that the nation will encounter increasingly severe extreme weather events, such as the devastating floods that occurred in 2022 (UN-HABITAT 2023). To deal with the above problems and to encourage green financing, the State Bank of Pakistan (SBP) in 2017 introduced comprehensive guidelines related to green banking. The Green Banking Guidelines (GBG) aimed to reduce banks vulnerability to environmental risks, carry out their environmental protection duties, and provide the funding necessary to restructure the economy to one that is resource-efficient and climate resilient (SBP-GBG 2017).

Banks and other financial institutions are bound to strictly adhere the said guidelines in order to assimilate communal and ecological risk management in their lending practices. The banks were

further instructed by these guidelines to take the lead and establish green banking offices and mandated banks to provide green loans for environmental protection and it is from there on that the number of ecology conscious and green ventures has accelerated. (Zhou, Tang, & Zhang, 2020).

Pakistan's banking industry has been instrumental in assisting to reach its sustainable development objectives by providing low-interest green loans. Since most of modes of green financing are incentivized and are regulated by SBP therefore there is a growing concern of banks related to their profitability which is also discussed by Rehman, Ullah, et al. (2021), stating that, while banks also create and depend on other revenue streams, therefore presuming that expansion in sustainable economic loan would have a constructive influence on the bank's business is really farfetched and hard.

2.3 Green Finance and Financial Performance

Nakamura (2011) determined that investing in environmental issues can significantly enhance company's value. (Martin and Moser 2016) revealed that companies that actively disclose their environmental governance impact, rather than solely focusing on investment costs, tend to receive more favorable responses from investors. Research on ESG and ecological attainment has shown a prominent effect on business worth (Martin & Moser, 2016; Pekovic et al., 2018) (Hoepner et al., 2020). Pekovic et al. (2018) analyzed the correlation amid ecological attainment and venture's market worth focusing on a section of French registered corporations. They revealed that enhancing ecological attainment can significantly enhance the worth of an enterprise. (Gerged et al. 2021) examined the correlation between firm value and corporate environmental disclosure (CED) in GCC nations, where corporate environmental disclosure CED is increasing from historically low point. Mohammad, Barbash and Creasy (2019) suggests that businesses with strong ESG practices have a relatively stable market value and more resilient stock prices amidst severe risks like the international economic crunch and the COVID-19 pandemic.

Pursuant to the above, since bank being business ventures are also cautious on their income, therefore their involvement in environmental performance is crucial for maintaining market

reputation. Jatana and Jain (2020) stated, that commercial banks are increasingly uniformly operating, producing more credit products and intermediary businesses related to green credits, which could lead to new sources of profit growth and improve their financial performance. In recent years, global regulators and legislators have shifted their focus towards the implementation of corporate social responsibility and environmental governance. According to (Z.-Y. Dou et al., 2022) & (Ren, Zhang, Yan, & Gozgor, 2022) Green Credit aims to promote coordinated advancements in finance and environmental conservation by allocating credit funds through distinct credit offerings. (Su et al., 2022) demonstrated that commercial banks can upsurge their current revenue by investing in green credit funds. Particularly, commercial banks' green credit funds can potentially increase profit margins, but more comprehensive evaluation of their effectiveness is necessary.

2.4 Credit Risk

The 2008-2009 international economic crunch threatened the stability of the global economic structure, with credit risk (CR) as the initial kind that can endanger a bank's existence and solidity, as every country's economic growth relies on its financial system's constancy (Caruso et al., 2021). The GFC has increased the focus on non-performing loans (NPLs) by regulators and commercial banks, as they pose a risk to bank stability and potential financial collapse (Naili & Lahrichi, 2022), (Ghosh, 2015). According to (Caruso et al., 2021), the bank's earnings are typically determined by the interest earned on borrowed money. Banks must confirm borrowers can reimburse the principal expanse plus interest, which is a challenging process and sometimes results may not always be achieved as intended. (Adebola, Yusoff, & Dahalan, 2011) proposed that the financial crisis and collapse are believed to be primarily caused by an increasing ratio of non-performing loans (NPLs), and due to the same reason there has been a significant increase in studying and finding causes of Non-Profitable Loans (NPLs). Since after the Asian Financial Crisis of 1997, most research on credit risk in the banking industry has primarily focused on impaired loans, also known as non-performing loans (NPL), which is used as common variable to determine credit risk. (Ariff, Skully, & Ahmad, 2007); (Shehzad, De Haan, & Scholtens, 2010); (J. Zhang et al., 2016). Previous studies have also identified several factors that influence and determine non-performing loans (NPLs); however, this is beyond the scope of our current investigation. Since we are currently investigating how credit risk is effected by green finance

and for this purpose, we have employed ratio of non-performing loans as a major indicator of credit risk, as established by the majority of earlier studies. (Ludlow, 2018).

Credit risk is the potential loss resulting from borrowers failing to meet their repayment obligations in banking and financial activities. Also known as default or counterparty risk, is a significant challenge for banks and other financial institutions, requiring understanding to ensure financial stability, profitability, and stakeholder protection. Henceforth, comprehending the main idea of credit risk, its sources, and implications by financial institutions before delving deeper into our research topic is extremely significant.

The international economic crunch of 2007-2008 highlighted the systemic prominence of credit risk management failures, prompting regulatory reforms to strengthen financial stability and enhance risk management practices, influenced by evolving market dynamics, regulatory frameworks, and technological advancements. Regulatory initiatives like Basel III framework and stress testing have increased capital adequacy standards, improved risk transparency, and improved financial institution risk governance. Furthermore, the employing of large records analytics, mechanized acquiring of knowledge, and Artificial Intelligence machineries has significantly improved credit risk assessment and monitoring, enabling more accurate scoring, early warning systems, and predictive analytics for risk-return trade-offs.

2.5 Green Finance & Credit Risk in Banks

Raberto et al. (2019) explains how banks engage in sustainable economic ventures to discover novice corporate prospects, manage loan and compliance risks, and enhance their company reputation. Researchers also have discovered a correlation between loan risk and the long-term performance of borrowers (Falcone & Sica, 2019). Zhou et al. (2022) examined the relationship between bank risk and green lending and discovers that it is dependent on ownership structure and size. Krueger et al. (2020) find that traditional automakers are likely to face disruptions from the development of electric vehicles when environmental policies shift to net zero and therefore they might have to face default risk in future. According to (Afridi et al., 2022) green financing presents low-risk business opportunities for new enterprises. Moreover, green loans are becoming more widely available products, whose issuance boosts company expansion and

lowers the loan portfolio's default risk. Therefore, we can draw the conclusion that there is a correlation amid ecological finance and credit risk. From the perspective of banks in Pakistan, no such study has yet found to determine the correlation amid sustainable finance and bank credit risk, thus we find it appropriate to proceed in this direction.

2.6 Capital Structure

A company's capital structure consists of debt and equity as primary funding sources for operations and investments (Villadsen, Vilbert, Harris, & Kolbe, 2017). The capital structure refers to the precise ratio of debt to equity used by a business to fund its operations and assets. (Nguyen Kim, 2023). The choice of capital structure or financial leverage should be evaluated based on its impact on a firm's value. Leverage enhances financial performance in favorable economic conditions, but it also increases shareholders' financial risk, making it difficult to predict its value. A firm prefers a capital structure that maximizes market value. According to Modigliani Miller, Capital structure in finance refers to a company's financing strategy that involves a combination of debt, equity, and hybrid securities. The capital structure of a business is the combination of debt and equity reflecting in its balance sheet. It helps to assess a company's ownership by determining the proportion of debt in the form of short-term and long-term loans, and equity in the form of preferred stock, common stock, and retained earnings.

According to the argument of Grossman & Hart (1982), Jensen (1986) and Williams (1987), increasing debt capital could potentially reduce agency costs by putting managers under pressure to generate cash flow and potentially threatening liquidation, potentially causing personal losses and reputational damage. The argument suggests that higher leverage generally leads to lower agency costs and better firm performance, while additional leverage increases can result in significant agency costs like bankruptcy or financial distress, negatively impacting performance (Berger & Di Patti, 2006). (Harris & Raviv, 1991) claim that the capital structure's debt instruments provide investors with an advantage, enabling them to discipline management by restricting their control over the company's free cash flow. This reasoning leads to the conclusion that leveraging is a suitable strategy for resolving disputes between managers and shareholders and lowering agency costs (Cheffins, 2021). The corporate finance literature has primarily focused on capital structure financing decisions and their impact on financial performance. As a

result, many studies have tried to look into the connection between capital structure and financial performance in banking sector. However, there is still need for more research and analysis on the impact of capital structure on financial performance, particularly in the banking sector.

2.7 Hypotheses Development

In recent years, there has been a significant increase in the focus on the impact of sustainable investment on a company's overall profitability (Smith et al., 2019); (Johnson et al., 2020). The relationship between sustainable investment and financial performance in Pakistani banks is crucial for investors and stakeholders (Ahmed & Kassem, 2018). Furthermore, ESG factors and disclosure practices are increasingly important in evaluating bank financial performance and investor appeal (Khan, Zia-ul-haq, Umar, & Yu, 2021); (Rahman et al., 2022). However, a detailed investigation and evaluation of the impact of sustainable investment on financial performance and investor appeal of Pakistani banks are needed.

In addition to the above there are number of studies that determine role of capital structure on firms performance and credit risk as well. The capital structure of a firm is influenced by factors such as size, asset tangibility, and private credit, while also considering profitability, growth prospects, GDP growth rate, and stock market capitalization (Hamouda, Hamzaoui, & Jilani, 2023). The leverage ratio is positively influenced by profitability, tangibility, and liquidity, with profitability having the most significant impact (Benyamin & Soekarno, 2023). Similarly, the empirical findings of (Nasimi, Nasimi, & Basit, 2018) presented that the capital structure of firms in Pakistan is largely determined by factors profitability and tangibility. According to (Nalwade & Mote, 2017) in every company, the capital structure is a critical decision that can significantly impact a company's financial operations, and extensive empirical research has shown the impact of climate finance and credit risk (e.g., (Raberto et al., 2019), (Falcone & Sica, 2019), (Afridi et al., 2022) recent studies have demonstrated a correlation between credit risk and capital structure e.g., (Reza et al., 2023), (Bakkar, 2023) however; there is still much debate about the role of Capital Structure while examining the effect of green finance on profitability, market value & credit risk. No known study has yet found related to the said issue and therefore, the purpose of this study is to ascertain how sustainable investment affects financial performance of Pakistani banks including investor appeal & credit risk and how capital structure playing

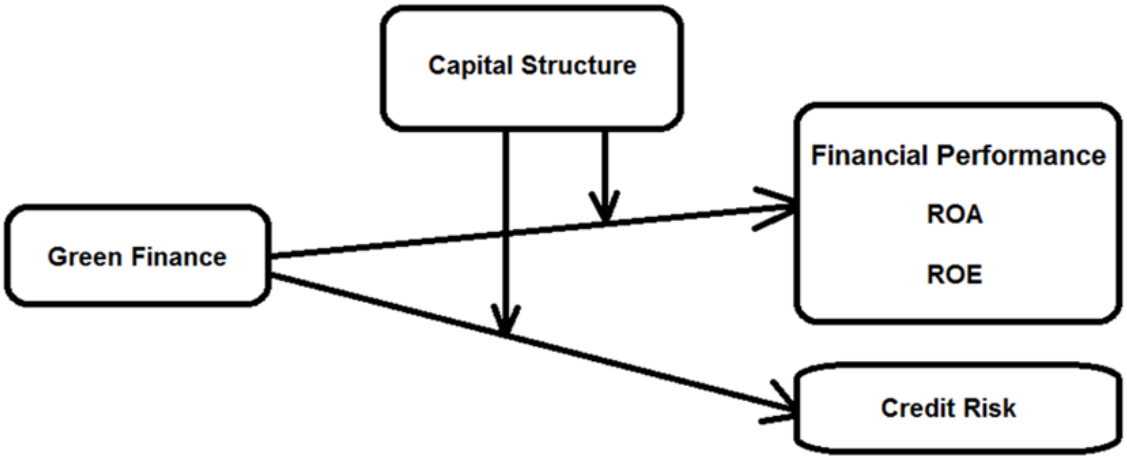
moderating role in decision making of sustainable investment and overall impact on financial performance of the banks. Based on the study of the aforementioned literature, the main hypotheses have been framed as follows;

- H1: Green Financing significantly impacts the ROA of listed Banks of Pakistan
- H2: Capital Structure of the Banks significantly moderates the relationship between Green Finance and ROA
- H3: Green Financing significantly impacts the ROE of listed Banks of Pakistan
- H4: Capital Structure of the Banks significantly moderates the relationship between Green Finance and ROE
- H5: Green Financing significantly impacts the Credit Risk in Listed Banks of Pakistan
- H6: Capital Structure of the Banks significantly moderates the relationship between Green Finance and Credit Risk

2.8 Theoretical Framework

Three theories serve as the foundation for this study i.e. Stakeholder Theory, Environmental Risk Management Theory & "Modigliani Miller" work on capital structure. Environmental Risk Management Theory and Stakeholder Theory have become vital in order to explain how green loans distress the profitability in mainstream banking. Several empirical investigations have additionally furnished the foundation for examining the impact of eco-friendly credit on the financial profitability of corporate banks from multiple angles. Stakeholder theory suggests that companies must prioritize all stakeholders' benefits in decision-making, instead of solely focusing on shareholder wealth. This includes thefirm, board of directors, management, shareholders, and the government, and should consider both social and financial aspects (Lee, Sirgy, Larsen, & Wright, 2002). Positive environmental management and satisfactory environmental outcomes can enhance stakeholders' expectations, corporate image, and reputation (Jones, 1995). Stakeholder theory suggests that involving variety of stakeholders in organizational decision-making is a tactical asset and ethical requirement that enhances an administration's competitive advantage.

According to the theory of environmental risk management, bank risk includes the risk of default resulting from environmental issues. The transfer of environmental risk from mortgagor nonpayment to corporate banks through loans can lead to ecological risks in these banks. Corporate banks must manage environmental risk, as environmental factors can pressure debtors to pay off debt, and this risk can be influenced by borrower attributes like reputation, leverage, earnings, and collateral (Caouette, Altman, & Narayanan, 1998). Corporate banks assess mortgagors' ecological credit risk to minimize the possibility of nonpayment associated with ecological threat supervision (Caouette et al., 1998; McKenzie, Middleton, Hall, DeMulder, & Bremer, 2004).



3. Methodology

3.1 Data and Sample

The study encompasses the following prominent banks in Pakistan and the sample used for this study includes 25 Pakistani public and private banks from 2017 to 2022, or 6 years. List of Banks are given below;

Sr.	Name of Banks	Sr.	Name of Banks
1	First Women Bank Limited	13	Habib Bank Limited
2	National Bank of Pakistan	14	United Bank Limited
3	The Bank of Punjab	15	MCB Bank Limited
4	The Bank of Khyber	16	Bank Al-Falah Limited

5	Sindh Bank Limited	17	Habib Metropolitan Bank Limited
6	Meezan Bank Limited	18	Faysal Bank Limited
7	Bank Islami Pakistan Limited	19	Askari Bank Limited
8	Dubai Islamic Bank Pakistan	20	SILKBANK Limited
9	Al-Baraka Bank (Pakistan) Limited	21	Samba Bank Limited
10	MCB Islamic Bank Limited	22	Allied Bank limited
11	Soneri Bank Limited	23	Bank Al-Habib Limited
12	Summit Bank Limited	24	JS Bank Limited
		25	Standard Chartered Bank (Pakistan) Limited

3.2 Operationalization of Variables

3.2.1 Dependent Variable

Ratio of Green Finance Portfolio (GF) over the Total Loan Portfolio of the Banks is taken as depended variable.

GF = (Green Finance / Total Loans) x 100 %

3.2.2 Independent Variables

Return on Assets (ROA):

ROA = (Net Income / Total Assets) x 100 %

Return on Equity (ROE):

ROE = (Net Income / Shareholders' Equity) x 100 %

Credit Risk (CR):

CR = NPLs (year-end) / Total loans outstanding (year-end) x 100 %

Moderator: Capital Structure (CS):

Capital Structure (CS) = (Total Debt / Total Equity) x 100 %

3.3 Econometric Models

$ROAit = \alpha + \beta1\ GFit + \beta2\ CSit + \beta3\ GF_{it} * CS_{it} + \varepsilon it$

$ROEit = \alpha + \beta1\ GFit + \beta2\ CSit + \beta3\ GF_{it} * CS_{it} + \varepsilon it$

$CRit = \alpha + \beta1\ GFit + \beta2\ CSit + \beta3\ GF_{it} * Cs_{it} + \varepsilon it$

3.4 Econometric Tools

Generalized method of moments (GMM) approach for panel data analysis is used in this study. Lu and Wooldridge, (2020) proposed that The GMM estimator is asymptotically as effective as weighted least squares (WLS) and ordinary least squares (OLS). (Barros et al., 2019) stated that Endogeneity issues, prevalent in corporate finance, can potentially lead to discrepancies in conventional OLS, RE, and FE estimators. Conversely, the researchers can use GMM estimation methods for panel data, utilizing regressors sequential exogeneity assumptions, to overcome issues related to external instrumental variables. Zsohar (2016) explained that GMM is increasingly popular due to its lower information requirements, making it more resilient to model specification than ML. This is why semi parametric estimation frameworks like GMM allow for only the implied economic theory restrictions.

4. Results and Findings

In order to determine the role of green finance and capital structure on the profoifitability and credit risk of banking sector in Pakistan, this study applied statistical tools for data summarization and hypothesis testing in EViews 9. Table 1 is reporting descriptive statistics (standard deviation, mean, median, kurtosis and skewness) of our variables. Low mean value of green finance is due to multiple factors. First we have found lack of interest of most of the banks towards green loaning. During the period of our study, the banks' total gross advances amounted to Rs. 55.34 trillion; of these, only 245 billion, or 0.44% of the total advances, were in the green financing portfolio. One possible additional explanation could be that most banks began offering green loans in 2019 or 2020. 16 banks out of 25 had a zero portfolio in 2017 and 2018. 13 banks had zero performance in 2019. Since significant progress toward green loaning was made after 2019 which could be the primary factor influencing the mean value of green financing,

Table: 1 **Descriptive Statistics**

	ROE	ROA	GREEN_FINANCE	CREDITRISK	CAPITAL_STRUCTURE
Mean	-0.254450	0.003431	1643926.	0.107784	19.34320
Median	0.130400	0.007600	77474.00	0.068387	15.02829
Maximum	1.035300	0.025800	22468993	0.657757	592.6074
Minimum	-49.78450	-0.089300	0.000000	0.000000	-11.18162
Std. Dev.	4.095147	0.015394	3788477.	0.129030	48.21590
Skewness	-11.99467	-3.488717	3.331480	2.596799	11.40156
Kurtosis	145.5665	18.11090	14.70764	9.356754	135.9492
Jarque-Bera	129758.4	1719.856	1126.587	418.3286	112963.6
Probability	0.000000	0.000000	0.000000	0.000000	0.000000
Sum	-37.91310	0.511200	2.45E+08	16.05988	2882.136
Sum Sq. Dev.	2481.994	0.035071	2.12E+15	2.464022	344066.3
Observations	149	149	149	149	149

The higher value of capital structure equals lower agency costs and better firm performance. On the contrary, when this value rises to a relatively high level, additional increases result in significant agency costs, such as bankruptcy or financial distress, which have a detrimental effect on performance. Since deposits are a part of a bank's liability and are included in debt, therefore the mean, median, and standard deviation of the capital structure in our study are relatively high. Mean value of profitability in term of return on assets has been positive but in terms of return on equity has been negative in the sample period. Mean value of credit risk has been 10.7%.

Table: 2 Correlation Matrix

	ROE	ROA	GREEN_FINANCE	CREDITRISK	CAPITAL_STRUCTURE
ROE	1.000000	0.444617	0.049551	-0.232567	-0.987393
ROA	0.444617	1.000000	0.191438	-0.759113	-0.409418
GREEN_FINANCE	0.049551	0.191438	1.000000	-0.227260	-0.010335
CREDITRISK	-0.232567	-0.759113	-0.227260	1.000000	0.193887
CAPITAL_STRUCTURE	-0.987393	-0.409418	-0.010335	0.193887	1.000000

The correlation matrix is shown in Table 2. Green financing has a positive correlation with ROA and ROE, while capital structure and credit risk have a deleterious correlation. Additionally, it demonstrates the negative correlation between capital structure and credit risk and green financing. It is also important to note that all the independent variables have low correlation with each other. Therefore, there is little chance of multicollinearity problem in the regression analysis.

Table 3 demonstrates the GMM Panel regression results for the determining the role of green finance, capital structure and the interaction of capital structure and green finance. The findings indicate that green financing has a positive and significant influence on profitability (in the form of return on assets). Capital structure (level of indebtedness) has negative and significant impact on the profitability. Interaction term show that that a Bank's level of capital structure affects the association amid green financing and ROA. Negative sign of the interaction term indicates the positive effect of green finance on profitability of banks is dampened. The moderating effect of capital structure also suggests that the Bank's financial structure, specifically its leverage or

debt-to-equity ratio, affects how strong this relationship is. Further according to the capital structure moderation effect, businesses with a certain level of debt or equity may see an increase in the ROA impact of green financing. This suggests that the benefits of green financing could be optimized for increased return on assets (ROA) through the use of an ideal capital structure. To properly take advantage of green financing, businesses might need to manage their capital structure carefully. Table 4 shows the impact of green finance and capital structure on profitability in term of return on equity using GMM panel data analysis technique. Results indicate that contrary to ROA, green finance does not have any significant impact on ROE. Capital Structure has negative and significant impact on ROE. However, the interaction of capital structure and green finance is insignificant.

Table: 3

Dependent Variable: ROA

Method: Panel GMM EGLS (Period SUR)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GREEN_FINANCE	2.19E-09	1.01E-09	2.162668	0.0322
CAPITAL_STRUCTURE*GREEN_FINANCE	-8.26E-11	4.89E-11	-1.688752	0.0934
CAPITAL_STRUCTURE	-0.000104	6.96E-06	-14.89650	0.0000

R-squared	0.622872	Mean dependent var	0.117323
Adjusted R-squared	0.617706	S.D. dependent var	1.561606
Durbin-Watson stat	1.963927	J-statistic	13.31960

Table: 4

Dependent Variable: ROE

Method: Panel GMM EGLS (Period SUR)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GREEN_FINANCE	-5.53E-08	7.88E-08	-0.701336	0.4842
CAPITAL_STRUCTURE*GREEN_FINANCE	4.88E-09	3.88E-09	1.256120	0.2111
CAPITAL_STRUCTURE	-0.078425	0.001453	-53.95814	0.0000
			Mean dependent var	-0.051477
R-squared	0.968221			
			S.D. dependent var	4.508122
Adjusted R-squared	0.967786			
				47.76071
Durbin-Watson stat	1.850595		J-statistic	

Table 5 explains the impact of green finance and capital structure on credit risk. Results indicate that Green financing is negatively and significantly effecting credit risk. Negative relationship between credit risk and green finance suggest that banks involved in green finance have lower levels of credit risk related to their operations or investments potentially resulting in increased investor confidence, capital accessibility, and financial stability. Improved resource efficiency, increased regulatory compliance, and decreased exposure to environmental liabilities could all be contributing factors. Moreover; Table 5 also shows the positive and significant association of Credit Risk and Capital Structure which implies that higher levels of debt financing may be linked to higher credit risk. Due to increased financial leverage from certain level, banks with higher leverage ratios (i.e. more debt compared to equity) may be more vulnerable to credit risk. This is due to the fact that a banks ability to meet its financial obligations may be strained as a result of higher debt levels, which also increase interest payments and debt servicing costs.

Moreover, creditors and investors may view companies with higher debt levels in their capital structure as less stable financially. A company that has more debt is more susceptible to unfavorable financial events like recessions, increases in interest rates, or drops in cash flow. This may raise the probability of financial difficulties and credit defaults, which would raise credit risk. Overall, a positive relation between capital structure and credit risk suggests that businesses that finance more debt may be more vulnerable to unfavorable financial events and have higher levels of financial leverage. It emphasizes how crucial capital structure monitoring and management are to successfully reducing credit risk and preserving financial stability. To properly reduce credit risk, businesses must carefully manage their debt-to-equity ratio. This entails creating a stability amid the advantages of debt financing, such as tax benefits and leverage, and the risks involved. To reduce credit risk and guarantee financial stability, prudent capital structure management entails keeping an ideal ratio between debt and equity financing.

Table: 5

Dependent Variable: CREDITRISK
Method: Panel GMM EGLS (Period SUR)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GREEN_FINANCE	-2.30E-09	1.20E-09	-1.921215	0.0567
CAPITAL_STRUCTURE	0.000369	6.23E-05	5.924735	0.0000
C	0.088315	0.010150	8.701324	0.0000
R-squared	0.276552	Mean dependent var		0.579694
Adjusted R-squared	0.266642	S.D. dependent var		1.073303
Durbin-Watson stat	1.913546	J-statistic		4.76E-30

Table 6 shows that Green financing has negative but insignificant impact on Credit Risk when Capital Structure is acting as Moderator in the model. Interaction term is also insignificant showing the irrelevance of capital structure in the relationship of green finance and credit risk.

Table 6

Dependent Variable: CREDITRISK

Method: Panel GMM EGLS (Period SUR)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GREEN_FINANCE	-7.18E-09	5.98E-09	-1.199059	0.2324
CAPITAL_STRUCTURE*GREEN_FINANCE	2.60E-10	2.95E-10	0.879167	0.3808
C	0.094276	0.010140	9.297483	0.0000
R-squared	0.032864	Mean dependent var		0.573644
Adjusted R-squared	0.019616	S.D. dependent var		0.924984
Durbin-Watson stat	1.966373	J-statistic		3.221871

5. Conclusion & Policy Implications

Green loans significantly impact the return on assets (ROA) and return on equity (ROE), which demonstrates that green loan impacts on the financial performance of the banks in a momentous and progressive manner. Further, impact of green finance on return on assets (ROA) is influenced by the capital structure. Put differently, a company's financial performance (ROA) is impacted by green loans, and this impact is determined by the capital structure of the company

and how it finances its operations. Financial performance and green loans are moderated by a company's capital structure, which consists of its debt and equity financing mix. Green financing impacts ROA and ROE differently depending on a company's financial structure, allowing them to optimize their financial performance by strategically utilizing green financing. Further; the use of green financing affects a financial institution's non-performing loans (NPLs), which is influenced by the institution's structure of its financing mix. NPLs are significantly influenced by green financing which implies that green projects, which prioritize environment friendly and sustainable practices, may carry a lower credit risk compared to traditional projects. As a result, there may be a lower risk of default and reduced non-performing loans (NPLs). Green projects offer consistent, potential cash flows, enhancing debt satisfaction, and decreasing NPLs and loan defaults frequency among borrowers. Green loans may receive special consideration or incentives from regulators in some countries, thereby lowering default and non-performing loan (NPL) rates. The capital structure of a financial institution influences the impact of green loans on non-performing loans (NPLs). Conservative institutions with higher equity and less leverage may see a more noticeable decline in NPLs from green loans due to their better ability to withstand potential losses. High-leveraged institutions may still benefit from green loans in reducing non-performing loans, but this effect may be diminished due to the higher financial risk associated with greater leverage. Financial institutions should consider incorporating green financing into their risk management strategies to mitigate credit risk and improve asset quality. The scenario suggests that financial goals like managing credit risk and reducing non-performing loans may align with environmental goals like promoting sustainability through green financing. In conclusion, if capital structure acts as a mediator between green loans and NPLs, then there may be a chance for financial institutions to incorporate sustainability concerns into their lending procedures in order to improve risk-adjusted returns and foster financial stability. Green financing significantly impacts Pakistan's banking sector's financial performance and credit risk. By adopting green finance initiatives, banks can contribute to environmental sustainability and reveal growth opportunities. Strategic financial management is fundamental in navigating the complexities of sustainable banking. Leveraging green finance will help shape a more resilient and prosperous banking sector for Pakistan's sustainable development journey.

6. Future Recommendations

The current study focuses on the banking industry in Pakistan's environmental, social, and economic sustainability, but other sectors of the country may be the subject of future research. Future research may focus on the implementation of Green Financial System Policy Framework. Comparison of green finance effectiveness in the developing and developed nations is another potential area of research.

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