



GREEN FINANCING INSTRUMENTS AND CAPITAL STRUCTURE OPTIMISATION BY LISTED COMMERCIAL BANKS AT THE NAIROBI SECURITIES EXCHANGE, KENYA

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ABSTRACT

Commercial banks play a key role in economic development by facilitating financial inclusion and sustainable environment which significantly contribute to the success of financial institutions and the entire economy. The adoption of green financing for sustainable environment has transformed the financial sector, offering convenience and efficiency to the financial institutions and customers. Despite the evolution of green financing, which has transformed sustainable environment there is still challenges with their capital structure optimization. This research focused on examining the effect of green financing on capital structure optimization of listed commercial banks in Kenya. Precise objectives involved investigating the effect of green bond, green loan and green equity on capital structure optimization of listed commercial banks in Kenya. It also looked at the mediating effect of banks risk appetite as well as the moderating effect of green regulatory environment on the relationship between green financing and capital structure optimization of listed commercial banks in Kenya. Theories of static trade off, signaling theory, stakeholder theory and pecking order theory informed the literature of the study. The research utilized a causal comparative effect design. The target population was 10 listed commercial banks in Kenya. Census approach was utilized since population was small. Descriptive statistics of mean and inferential statistics of panel regression analysis was applied. STATA version 16 was used as the analytical instrument. The regression model for the study was panel regression. In addition, the diagnostic tests were done. The analyzed data was displayed in tables. Besides, the research adhered to ethical standards. The study found that green bond, green loan and green equity both had statistical significant effect on capital structure optimization of listed commercial banks and concluded that green financing constructs were statistically significant and both hypotheses were rejected. It was also found that banks risk appetite provide a partial mediation effect and green regulatory environment provided a moderation effect on the relationship between green financing and capital structure optimization. The study concludes that GBR exerts a structurally destabilizing influence on the banking system, as sustained disclosure heightens systemic fragility. It also concludes that GLR significantly undermines capital structure optimization by constraining the ability of banks to meet obligations and sustain lending operations. It further concludes that well-managed green equity issuance can function as a resilience-enhancing factor within the banking sector, as it promotes diversification and reduces exposure to stranded asset risks. Similarly, it concludes that banks risk appetite is a critical transmission mechanism in the green finance nexus, as instability in returns magnifies the vulnerability of banks to external shocks. Finally, it concludes that moderation analysis showed that GRE had a negative moderating influence on green financing variable. The study recommends that the CBK and the National Treasury revise prudential guidelines to require integration green bond issuance guidelines into credit portfolio risk weighting. It also recommended that banks should utilize green loans since they provide financial incentives for borrowers to adopt sustainable practices, which can lead to cost savings and improved reputation for the bank. Besides, it is recommended that banks should utilize green equity financing since its superior ESG performance can elevate the bank capital ratio, particularly from environmental and social initiatives. Furthermore, it recommends that banks should have the risk appetite since it significantly influences its capital structure by determining the level of risk it is willing to accept in pursuit of its strategic objectives. Finally, it was recommended that banks should adopt the regulatory frameworks since green initiatives improve risk management by addressing environmental risks and ensuring compliance with regulations.

KEY WORDS: Green Bond, Green Loan, Green Equity, Green Financing, Green Regulatory Environment, Capital Structure Optimization, Banks Risk Appetite.

INTRODUCTION

The financial arena continues to experience a paradigm shift, according to (Chen et al., 2022). This transformation has been driven by the growing recognition of increased environmental sustainability and the desire to mitigate climate change. Therefore, people, planet and profit are becoming very crucial to the corporate strategy of financial institutions which has resulted in the embracing of green



financial instruments. Green financing refers to the apportionment of capital to developments or investments that result to environmental benefits. In the financial sector, there is developing emphasis on sustainability considerations which has necessitated deployment for focused green financing tools, among them green bonds, sustainability connected loans, and green equity (Sarma & Roy, 2021). At the International level, the impetus for green finance has been enhanced by the Paris settlement and the UN sustainable development initiative goals advocacy by 2030. Recent studies suggest that green finance instruments significantly vary organizations financing mix. For developing economies, issuing of green bonds lower the cost of debt due to the yield discount for green securities which allows firms to optimize their leverage without accelerating financial distress risks (Desalegn & Tangl, 2022). Zhang et al., (2021) posits that green financing play a signaling mechanism role that attracts low-cost institutional capital, effectively lowering the average cost of capital for the institutions. Africa, this transition has gained pace but faces distinctive structural and policy hurdles.

According to Ngwenya and Simatele (2020) posits that while a small number of states like South Africa, Kenya and Nigeria lead the continent in green bond initiatives, the broader African market remains in the formative stages and faces imperative challenges which among others include institutional ability and lack elaborate national legal frameworks. Therefore, the challenge for African financial institutions is harmonizing the urgent need for climate-related initiatives with the reality of underdeveloped sustainable financial landscapes. ESG practices are increasingly becoming critical business factors that commercial banks cannot ignore. In Kenya, several major changes have taken place both in the legislative and regulatory frameworks. The central bank of Kenya introduced guidelines for addressing climate connected matters in October 2021. Recently the Kenya green finance taxonomy (2025) categorization system that identifies and categorizes which investment plans are environmentally sustainable and those that are not. It defines the ideal set of assets, projects, activities, and sectors that qualify to be defined as "green" in line with internationally acceptable best practice and national focus. For listed firms, achieving an optimal structure is critical due to the high interest rate environment and market volatility. According to Li and Duca (2024), green finance instruments offer a distinct plan to optimization through access to lower cost, climate aligned capital which is not available in the traditional domestic debt markets.

Statement of the Problem

The Kenyan financial services industry is emerging as a regional front-runner in sustainability, with the culmination of the Kenya green finance taxonomy (KGFT) in April 2025 by the central bank of Kenya (CBK) and the Climate risk disclosure framework (CRDF). These instruments have standardized the classification of 'green' activities to prevent green washing with indistinct and consistent framework of reporting. According to CBK, at the end of 2025, 100% of commercial banks had adopted sustainable finance principles with an additional 83% of these institutions using the disclosure prototypes. Nevertheless, one of the key challenge for financial institutions remains Capital Structure Optimization. As opined by the Trade-off Theory, entities seek an ideal blend of leverage to equity to reduce their weighted average cost of capital (WACC). In the local context, banks like KCB, Standard Chartered, and Equity banks have incorporated green debt into their balance sheets, yet it remains indeterminate if these instruments actually lead to superior practical capital efficiency in relation to traditional debt. The interplay between regulatory compliance, institutional risk appetite, and market liquidity creates a complex environment where the "optimal" capital mix is continuously shifting.

From the above, it is evident that sustainability has gained a lot of impetus. However, it remains unclear if green finance instruments lead to an optimal capital structure or simply leads to increased compliance costs. Traditional models like the Trade-off Theory has not expounded for the "Greenium" (lower yields for green debt). According to the Kenya Bankers Association (KBA) sustainability report (2024), noted that while 100% of banks have adopted sustainable principles, more needs to be done to aid capital mobilization and address green washing. This report underscores a gap where institutional policy exists but yet to fully be converted to yield desired long term debt equity mix of these banks. Febriyantoro (2025) posits that in order for banks to ensure sustainable operations and safeguard profitability, they must approach financing with due care and also limit long term debt and favour equity based composition. In their study, Kambuche et al., (2023) found that higher debt ratio lead to lower ROE therefore supporting for more equity addition for sustainable operations. This provides for firms to come up with plans to optimize their capital structure.

According to Kamau and Murori (2024), established that entity's listed at the bourse with higher market capitalization and net assets are significantly more probable to embrace the modern sustainability drivers which further influences their capital structure decisions. In their analysis examining green banking, Sino et al., (2025) which focused on green banking effect on financial performance, found that ROA/ROE is currently positive but statistically insignificant, indicating an implementation gap. Without empirical evidence on how Green Financial Instruments affect the WACC in Kenya under the new 2025 Regulatory Framework, financial institutions face a "green financing paradox" that risks inefficient capital allocation. Most existing literature on green finance and capital structure optimization is centered on developed markets with limited empirical and longitudinal research that precisely examines how the NSE-listed financial institutions integrate these instruments to attain their targeted capital structure, that provide a balance between sustainability and financial returns (Ngunjiri, 2023). Several studies focus more on the consequence of green banking on performance without key focus shift to the impact of green financial instruments on capital structure for listed financial institutions in Kenya.



From the contextual unexplored research areas identified above, this study seeks to analyze the impact of green finance instruments on capital structure optimization of financial institutions in Kenya. The researcher focuses on the listed financial entities listed at Nairobi securities exchange between 2017 after the release of the Kenya Green Bond program and 2025.

Objective of the Study

To ascertain the influence of green financing on capital structure optimization of listed commercial banks in Kenya.

Specific Objective

- i) To determine the effect of green bond issuance on capital structure optimization of listed commercial banks in Kenya.
- ii) To evaluate the effect of green loan financing on capital structure optimization of listed commercial banks in Kenya.
- iii) To analyze the effect of green equity financing on capital structure optimization of listed commercial banks in Kenya.
- iv) To establish the mediating effect of banks risk appetite on the relationship between green financing and capital structure optimization of listed commercial banks in Kenya.
- v) To assess the moderating effect of green regulatory environment on the relationship between green financing and capital structure optimization of listed commercial banks in Kenya.

THEORETICAL REVIEW

Static Trade off Theory

This was brought forth by Kraus and Lichtenberger in 1973. The theory suggests that firms achieve an 'ideal' capital structure by counteracting the tax benefits of debt against potential financial distress constraints leading to bankruptcy. The theory is therefore extended to include green tax shields. In the Kenyan Financial System, the certified green bonds are regularly exempt from withholding tax. This in turn improves the tax-shield benefit relative to traditional debt. Ngunjiri, (2025) notes that the choice of specific green instruments at the Nairobi securities exchange is tailored to lower the weighted average cost of capital by leveraging the fiscal incentives. However, this theory posits that as the financial institutions at the bourse increase their green debt (leverage), the risk of financial distress increases. Optimization therefore, occurs at the point where the marginal benefit from green tax shield break even with the marginal cost of financial distress. This study uses this theory to explain why listed commercial banks may prefer green debt over equity up to a specific threshold.

Pecking order Theory

It was introduced by Myers and Majluf in (1984). The theory posits that firms follow an order of financing sources abating information asymmetry with preference for internal equity first, then debt, and finally external equity as final recourse. In sustainable finance landscape, information asymmetry is a significant obstacle as the investors often fear greenwashing. Sarma and Roy (2021) argues that green instruments act as a reliable signaling mechanism. By following a "Green Pecking Order," a listed firm at the NSE might first use retained earnings to fund the small projects defined as 'green projects', then issue Green Bonds (debt) to signal assurance to the market, and only then seek equity (green equity) as the last resort.

According to Muganyi et al., (2021) financial institutions that embrace sustainable financing measures often start with internal allocation of green credit before moving to green bonds, which is external therefore confirming a pecking order sequence. Zhang et al., (2025) noted that firms with high environmental transparency have a relatively 'shorter' pecking order as they have easier access to external green equity since there is less investor improbability. This theory explains the behavior of Kenyan financial institutions that are currently using their own capital (retained earnings) to test green lending programs before approaching the capital markets to issue extensive green bonds. It justifies the study's focus on how these instruments lower the cost of external financing by providing verified information to the market. This theory guides the framework for anchoring the process in which this study selects the green finance instruments.

Stakeholder Theory

Propounded by Edward Freeman in 1984. It argues that a business resolve is creating value for all stakeholders (suppliers, regulators/legal, customers, and others in the environment), not just shareholders for long term feat. Edward Freeman argued that meritoriously balancing these diverse interests often leads to better performance, enhanced trust and greater organizational durability than a sole focus on shareholder profit. It stresses upon the long term sustainability, moral management and intersected relationships for corporate success. Ahmed and Khalaf (2025) noted that firms that satisfy stakeholders through green initiatives, typically create long term shareholder value by stabilizing the firm's market locus and reducing volatility of its equity. For bourse listed commercial banks, the shift to green capital is a means for legitimacy.

Abuatwan (2023) reiterates that adopting green finance instruments fulfils the demands of international lenders and local regulators case in point the CBK, this eventually catalyzes capital structure of these institutions. For listed firms at the NSE, enactment of green finance instruments is a deliberate move to gain social acceptance. This translates into lower risk premiums from global investors who prioritize ESG compliance (Elarabi & Khalifa, 2025). By aligning with the NSE ESG disclosure guidance manual, listed institutions are called



upon to build social capital. This credibility supports reduce the risk premium called for by investors, effectively lowering the cost of equity and debt. This theory therefore, justifies the addition of regulatory role as a moderator, as it represents the outside pressure from stakeholders that obligates firms toward an optimal, sustainable capital mix. This theory provides and guides the regulatory alignment within the Kenyan financial system.

Signaling Theory

It was put forth by Akerlof and Arrow in 1970 and later developed by Spence in 1974. It posits that high-quality firms can segregate from lower-quality ones by conveying clear, positive signals to the market in which they operate. This theory is rooted in the presence of skewed information availability, where firm managers are privy to additional information about a firm's true value and risk profile than external stakeholders. In the NSE, the issuance of a green bond or sustainability related credit is a potential signal. Therefore, firms that show compliance with the bourse disclosure guidance manual and the CBK Green finance taxonomy serves as a regulatory signal. Firms that provide these disclosures signal their readiness for future climate-related regulations, thereby lowering their transition risk and improving their creditworthiness in the eyes of lenders.

Empirical literature Review

Green Bond and Capital Structure Optimization

According to (Ngunjiri, (2025) in their study on listed firms, noted that green revenue, project and proceeds bonds have significant positive effect on financial performance of listed financial institutions in Kenya. The findings concluded a green bonds proliferate financial structure's explanatory power of 5%. Sino et al., (2025) in their study noted that sustainable financing has positive but statistically insignificant effect on the Return on Equity for listed commercial banks in Kenya. This suggests that influence is yet to evolve. Most studies are premised on how the green bond components affect financial performance with limited analysis on how the capital structure is optimized by these instruments by commercial banks in Kenya.

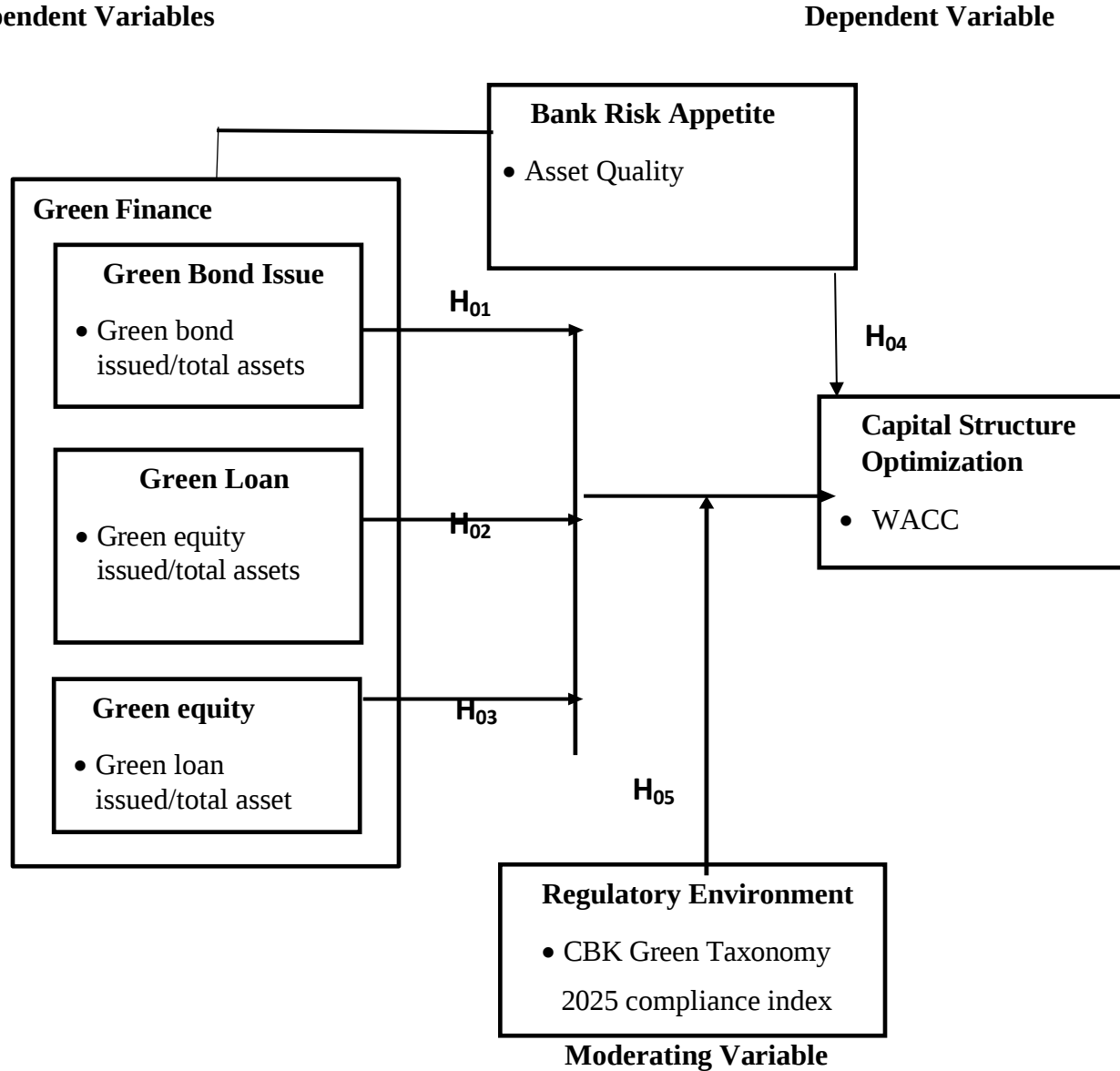
Green Loan and Capital Structure Optimization

According to Alcarva et al., (2026), green banking, including green bonds and credit are progressively connected to financial stability and cost efficiency. These tools promote sustainability, strengthen bank resilience, and reduce non-performing loans which in turn offers better risk management and profitability compared to traditional lending. Their research highlights that green loans and bonds directly support the cost of debt while creating desirable environmental outcomes. They suggest that incorporating environmental, social and governance considerations especially green credit, there is improved overall efficiency and risk management. With risk mitigation which has gaining momentum in financial practice, higher green lending ratios supports a bank's financial stability by reducing defaults risks especially when strict environmental criterion is used to guide credit decisions.

Green equity and Capital Structure Optimization

In their study, Sino et al., (2025) posits that green financing practices including green equity, have positive impact on equity return of listed commercial banks, although their effect is currently nascent ($\beta=0.114; p=0.103$). According to Nazir et al., (2025), sustainable financing interacts positively with corporate reputation, which can drive up stock prices hence supporting firms to raise capital with less dilution of investment and therefore optimizing the equity portion of their capital structure. For many listed commercial banks, the goal of optimization is to reach a 'target' capital structure that reduces risk while maximizing value.

Figure 1: Conceptual Framework



Source: Researcher (2026)

Research Philosophy

The study upheld a Positivist Research Philosophy. The choice is justified because the research is hinged on quantifiable, objective panel data to test hypotheses derived from existing theories (Pecking Order, Trade-off, and Stakeholder Theories). The philosophy is suitable for financial studies at the NSE that utilize secondary panel data (Creswell, 2009). The study sought to establish causal relationships through statistical regularity (Park et al., 2020).

Research Design

The design indicates a plan to collect data, measure and undertake analysis. This study adopted causal-comparative research design. Preference for causal-comparative research design allows the researcher to determine the cause-effect relationship between the green finance instruments and capital structure optimization (Cooper & Schindler, 2024).

Target Population

The target population consist of the 10 listed commercial banks at the Nairobi securities exchange as of 31st December 2025.



Sampling Design

The study utilized census approach given that the population of listed commercial banks in Kenya is small with data readily available. All eligible firms were included to ensure maximum representation and statistical rigor.

Data Collection Instruments.

A secondary Data review guide was utilized to obtain longitudinal information contained in audited financial reports of these listed commercial banks, NSE handbooks and CMA guidelines.

Data Collection Procedure

Data was collected over an 8-year period (2018-2025). A permit to conduct research was requested from NACOSTI, and introduction letter by Kenya bankers' association (KBA), the umbrella body and advocacy group for commercial banks in Kenya.

Data Analysis and Presentation

The researcher cleaned, edited, coded the collected data and ran data entry. The data was analyzed utilizing STATA version 16 and presented in multiple tables and graphs to visually convey the results. The study utilized descriptive as well as inferential statistics. This involved deployment of the measures such as mean, standard deviation and panel regression.

The panel analytical model used by the researcher was:

Direct-Effect Panel Regression Model

$$Y_{it} = \beta_0 + \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 X_{3it} + \varepsilon_{it}$$

where Y_{it} denotes the capital structure optimization of listed banks i in year t ; X_{1it} through X_{3it} denote green bond, green loan, green equity respectively; β_0 is the constant; β_1 - β_3 are the coefficients to be estimated; and ε_{it} is the error term.

Mediation Model (Banks Risk Appetite)

The Hayes (2020) process model was used with a three step approach where bank risk appetite (M_2) was regressed on green financing with the model:

$$Y_{it} = \beta_0 + \beta_1 X_{1it} + \beta_2 M_{2it} + e_{it}$$

Moderation Model (Green Regulatory Environment)

Following the change in green regulatory environment through the newly enacted central bank of Kenya green taxonomy, the model tests if the regulation strengthens the relationship;

$$Y_{it} = \beta_0 + \beta_1 X_{1it} + \beta_2 M_{2it} + \beta_3 (X_{it} \times M_{it}) + e_{it}$$

If β_3 is significant, moderation is confirmed.

RESEARCH FINDINGS AND DISCUSSIONS

Table 1: Descriptive Statistics

Variable	Mean	Maximum	Minimum	Std. Dev.	Observations (n)
GBR	0.567	1.000	0.000	0.496	80
GLR	0.569	1.000	0.000	0.495	80
GER	0.516	1.000	0.000	0.500	80
BRA	0.014	0.060	0.001	0.010	80
GRE	5.122	8.100	0.300	1.591	80
CSO	17.583	27.000	9.800	3.588	80

Source: Field Study (2026)

The descriptive statistics in table 1 are based on 80 bank observations from an unbalanced panel covering the period 2018–2025. The mean values indicate that banks experienced an average green bond ratio score of 0.567 and green loan ratio of 0.569, both slightly above 50%, signifying moderate exposure to high green financing by banks impacting. Green equity was somewhat lower, with a mean of 0.516. Capital structure optimization, proxied by the WACC, recorded a healthy average of 17.583, while banks risk appetite averaged 0.0142, indicating relatively low variability across banks. Green regulatory environment, serving as a moderating green taxonomy, had a mean of 5.122% during the study period.

Regression Analysis

To examine the effect of green financing instruments on the capital structure of listed commercial banks in Kenya, a fixed effect panel regression model was estimated.

Table 2: Fixed Effect Regression Results

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Fixed-effects (within) regression		Number of obs =			80	
Group variable: bank_id		Number of groups =			10	
R-sq: within = 0.5413 between = 0.4876 overall = 0.5284						
F(3,198) = 77.783 Prob > F = 0.0000						
CSO	Coef.	Std.Err.	t	P> t	[95% Conf.interval]	
GBR	-4.3207	0.8935	-4.84	0.000	-6.0827, -2.5587	
GLR	-2.4119	0.8532	-2.83	0.005	-4.0944	-0.7294
GER	1.3598	0.6829	1.99	0.047	0.0131,	2.7065
_cons	14.7415	0.4441	33.20	0.000	13.8657	15.6173
F test that all u_i = 0: F(17,198) = 3.17 Prob > F = 0.0000						

Source: Field Study (2026)

The regression output findings demonstrate that the R-square is 0.5284, signifying that 52.84% of the variations in capital structure optimization was attributable to changes in green financing. The remaining changes amounting to 47.16%, were attributable to factors outside this researcher model. The model's overall F-statistic (77.783) with a probability value of 0.0000 confirms that the estimated coefficients are equally substantial, indicating a well-fitted regression model. The intercept term ($\beta_0 = 14.7415$, $p < 0.001$) represents the baseline level of capital structure optimization when all green financing instruments are neutral, reflecting the underlying resilience of the banking sector after accounting for green financing effect. This interpretation aligns with StataCorp (2023) and the econometric principles described by Wooldridge (2020). The results presented in Table 2 were obtained from a fixed-effects regression model estimated in Stata using a panel dataset organized by banks and years. The fixed effects regression model was estimated to assess the influence of GBR, GLR, and GER on CSO of listed commercial banks in Kenya. Substituting the estimated coefficients yields the fitted model:

$$CSO_{it} = 14.7415 - 4.3207GBR_{it} - 2.4119GLR_{it} + 1.3598GER_{it} + \varepsilon_{it}$$

Green Bond and capital structure optimization

The fixed effects regression results indicate that GBR has a highly significant and adverse effect on the capital structure optimization of Kenyan commercial banks ($\beta = -4.3207$; $p < 0.000$). This infers that, holding all else constant, a one-unit rise in GBR is associated with a 4.32-unit decline in the WACC. These findings align with the work of Ngunjiri, (2025) in their study on listed firms, who noted that green revenue, project and proceeds bonds have significant positive effect on financial performance of listed financial institutions in Kenya. It contradicts the findings by Sino et al., (2025) in their study who noted that sustainable financing has positive but statistically insignificant effect on the Return on Equity for listed commercial banks in Kenya.

Green Loan and capital structure optimization

The regression analysis revealed that GLR exerts a statistically significant and adverse effect on the capital structure optimization of commercial banks in Kenya. The coefficient for GLR was estimated at $\beta = -2.4119$ with a p-value of 0.005, indicating significance at the 5% level. This negative sign implies that an increase in GLR corresponds to a deterioration in capital structure optimization. The magnitude of the beta coefficient suggests that, holding other variables constant, a one-unit rise in GLR is associated with an average decline of approximately 2.41 units in the WACC. These findings align with the findings by Alcarva et al., (2026) who found that green banking, including green bonds and credit are progressively connected to financial stability and cost efficiency. Their research highlights that green loans and bonds directly support the cost of debt while creating desirable environmental outcomes. They suggest that incorporating environmental, social and governance considerations especially green credit, there is improved overall efficiency and risk management.

Green Equity and Capital Structure Optimization

The regression results indicate that green equity has a statistically substantial favorable effect on the capital structure optimization of Kenyan commercial banks. The coefficient for green equity was $\beta = 1.3598$ with a p-value of 0.047, signifying significance at the 5% level. The positive sign of the coefficient suggests that, contrary to traditional expectations, increased exposure to green equity may enhance capital structure optimization. This effect could reflect the benefits of early policy compliance, strategic portfolio diversification, or improved risk governance triggered by proactive engagement with green regulations. The beta estimate implies that a one-unit increase in green equity is associated with a 1.36 unit rise in the WACC, indicating improved resilience and a lower probability of insolvency. This outcome agree with findings by Sino et al., (2025) who posits that green financing practices including green equity,

have positive impact on equity return of listed commercial banks. It also agrees with the findings by Nazir et al., (2025) who found that sustainable financing interacts positively with corporate reputation, which can drive up stock prices hence supporting firms to raise capital with less dilution of investment and therefore optimizing the equity portion of their capital structure partially supported by existing empirical literature.

Mediation Effect of Banks Risk Appetite on the relationship between green financing and capital structure optimization

This section presents the mediation analysis of Banks Risk Appetite in the connection between green financing and capital structure optimization of Kenya's commercial banks. Guided by the Baron and Kenny (1986) framework, the analysis follows a three-step structure and is applied to green financing.

Table 3: Mediation Effect of Banks Risk Appetite on the Relationship between green financing and capital structure optimization

Type	Step 1: Direct Effect on CSO (β , p)	Step 2: Effect on BRA (β , p)	Step 3: BRA Effect on CSO (β , p)	Mediation Type
Green financing	-4.3207, p = 0.000	+0.5314, p = 0.026	-2.3546, p = 0.041	Partial Mediation

Source: Research data, 2026

Table 3 presents the results of the mediation analysis that examined whether bank risk appetite acts as an intervening variable between green financing and capital structure optimization. The table reports the coefficients and corresponding p-values for the three stages of the Baron and Kenny (1986) procedure: the direct influence of each green financing on capital structure optimization in the first step, the influence of green financing on banks risk appetite in the second step, and the joint influence of banks risk appetite and the respective green financing on capital structure optimization in the third step. The results show that banks risk appetite partially mediates the relationship in all three cases, meaning that it explains part but not the whole effect of GBR, GLR, and GER on the capital structure optimization of commercial banks in Kenya.

The first step of the mediation analysis examined the direct connection between green financing and capital structure optimization. The results indicated a statistically significant negative effect ($\beta = -4.3207$, $p = 0.000$), implying that an increase in green financing significantly undermines the capital structure optimization of commercial banks. This findings agree with findings by Nazir et al, (2025) who investigated the mediating role of corporate reputation in the relationship between green finance and the entity's value and found that green financing significantly improves corporate reputation, which in turn lowers the perceived risk by equity investors, lowering equity cost by improving the capital mix

Moderation Effects of Green Regulatory Environment on the Relationship between Green Financing and Capital Structure Optimization

This section presents the results of the moderation analysis, in which GRE was evaluated as a moderator of the connection between green financing and capital structure of listed commercial banks in Kenya. Moderation analysis identifies whether the effect of an independent variable on a dependent variable varies depending on the level of a third variable (Whisman & McClelland, 2005; Aiken & West, 1991; Hayes, 2018). The analysis was conducted in three stages: first, estimating the direct effect of each green financing variable on capital structure optimization; second, introducing GRE to test its independent contribution; and finally, incorporating interaction terms between GRE and each green financing variable to test for moderation. A significant interaction coefficient indicates that the connection between a specific green financing instrument and capital structure optimization changes with variations in GRE. The consolidated results of the moderation analysis are exhibited in table 4, which combines the fixed-effects estimates for all three green financing instruments: GBR, GLR and GER to enhance brevity and facilitate comparison across models.

Table 4: Moderation Effects of Green Regulation Environment

	Coef.	P> t
GF variable	-0.9832	0.018
GRE	0.4127	0.025
GF $\times$ GRE	0.2918	0.041
_cons	13.8471	0.000
Observations	80	
Groups (banks)	10	
R-squared	0.5490	
F-statistic	80.273	
Prob > F	0.000	

Source: Research data, 2026



Table 4 exhibits the fixed-effects regression results for the moderation of GRE on the connection between green financing and capital structure optimization. The overall R-squared value 0.5490 is appropriate for fixed-effects estimation because it captures the proportion of variation in capital structure optimization explained by banks over time, after controlling for unobserved individual effects. The significant F-statistics and corresponding p-value ($p < 0.000$) further confirm that the model is statistically valid and well-fitted. Table 4 shows that GRE exerts a negative and statistically significant effect on capital structure optimization ($\beta = -0.9832$, $p = 0.018$), suggesting that GRE weakens banks' capacity to maintain stable capital positions. However, the favorable and significant GRE coefficient ($\beta = 0.4127$, $p = 0.025$) and the positive interaction term ($\beta = 0.2918$, $p = 0.041$) confirm that GRE moderates this relationship.

CONCLUSION AND RECOMMENDATIONS

Conclusion

The first study goal was to establish the effect of GBR on capital structure optimization of listed Kenyan commercial banks. The regression analysis revealed a statistically significant adverse effect, confirming that higher disclosure corresponded with reduced WACC. The study concludes that GBR exerts a structurally destabilizing influence on the banking system, as sustained disclosure heightens systemic fragility. The second goal was to analyze the effect of GLR on capital structure optimization of listed Kenya's commercial banks. The regression results indicated a statistically substantial negative relationship, demonstrating that GLR is associated with lower WACC. The study concludes that GLR significantly undermines capital structure optimization by constraining the ability of banks to meet obligations and sustain lending operations.

The third goal was to evaluate the effect of GER on capital structure optimization of listed Kenya's commercial banks. The regression analysis established a statistically significant positive effect, suggesting that banks exposed to regulatory and policy-driven portfolio adjustments achieved higher WACC scores. This indicates that the strategic reallocation of capital strengthens balance sheets over the long term and reduces vulnerability to future regulatory or market disruptions. The study concludes that well-managed green equity issuance can function as a resilience-enhancing factor within the banking sector, as it promotes diversification and reduces exposure to stranded asset risks.

The fourth objective was to assess the mediating role of banks risk appetite in the connection between green financing and capital structure optimization. Mediation analysis confirmed that banks risk appetite significantly mediated the effects of green financing, with a negative mediation effect. This indicates that fluctuations in WACC transmit and amplify the destabilizing influence of green financing. The study concludes that banks risk appetite is a critical transmission mechanism in the green finance nexus, as instability in returns magnifies the vulnerability of banks to external shocks. The fifth goal was to establish the moderating effect of green regulatory environment on the connection between green financing and capital structure optimization. Moderation analysis showed that GRE had a negative moderating influence on green financing variable.

Recommendations

Firstly, the study recommended that the CBK and the National Treasury revise prudential guidelines to require integration of green bond issuance guidelines into credit portfolio risk weighting since green bonds offer banks financial, reputational, and strategic advantages by funding sustainable projects and attracting ESG-focused investors. Secondly, it is recommended that banks should utilize green loans since they provide financial incentives for borrowers to adopt sustainable practices, which can lead to cost savings and improved reputation for the bank. Thirdly, it is recommended that banks should utilize green equity financing since its superior ESG performance can elevate the bank capital ratio, particularly from environmental and social initiatives. Fourthly, it recommends that banks should have the risk appetite since it significantly influences its capital structure by determining the level of risk it is willing to accept in pursuit of its strategic objectives. This aligns the risks taken with the bank's financial goals and capacity to manage those risks. A well-defined risk appetite helps banks optimize their capital allocation, ensuring they have sufficient buffers to weather adverse events. Finally, it was recommended that banks should adopt the regulatory frameworks since green initiatives improve risk management by addressing environmental risks and ensuring compliance with regulations.

REFERENCES

1. Abuatwan, N. (2023). *The Impact of Green Finance on the Sustainability Performance of the Banking Sector in Palestine: The Moderating Role of Female Presence*. *Economies*, 11(10), 247.
2. Abuzayed, B., & Al-Fayoumi, N. (2023). *Diversification and hedging strategies of green bonds in financial asset portfolios during the COVID-19 pandemic*. *Applied Economics*, 55(36), 4228–4238.
3. Agrawal, R., Agrawal, S., Samadhiya, A., Kumar, A., Luthra, S., & Jain, V. (2024). *Adoption of green finance and green innovation for achieving circularity: An exploratory review and future directions*. *Geoscience Frontiers*, 15(4), 101669.
4. Ahmed, O., & Abu Khalaf, B. (2025). *The impact of ESG on firm value: The moderating role of cash holdings*. *Heliyon*, 11(2), e41868.
5. Alcarva, P., Pinto, J., Pacheco, L., Madaleno, M., & Barros, T. (2026). *Green Bonds and Green Banking Loans: A Systematic Literature*



- Review. Sustainability*, 18(2), 898.
6. Arhinful, R., Amin, H. I. M., Mensah, L., Gyamfi, B. A., & Obeng, H. A. (2025). Determining an optimal capital structure and its impact on financial performance. *Insight from the firms listed on the New York Stock Exchange*. *Cogent Economics & Finance*, 13(1), 2571401.
 7. Charles Guandaru Kamau & Christine Kanana Murori. (2024). Characteristics of creative accounting: A Multifaceted Literature Analysis. *World Journal of Advanced Research and Reviews*, 23(1), 2035–2043.
 8. Chen, J., Siddik, A., Zheng, G.-W., Masukujjaman, M., & Bekhzod, S. (2022). The Effect of Green Banking Practices on Banks' Environmental Performance and Green Financing: An Empirical Study. *Energies*, 15(4), 1292.
 9. Damodar N Gujarati and Dawn C Porter. (2009). *Basic Econometrics* (Fifth edition).
 10. Desalegn, G., & Tangl, A. (2022). Developing Countries in the Lead: A Bibliometric Approach to Green Finance. *Energies*, 15(12), 4436.
 11. Elarabi, H. A. O., & Khalifa, W. (2025). Impact of Sustainable Finance on Business Financial Performance: Insight from London Stock Exchange Firms. *Sustainability*, 17(11), 4898.
 12. Escobar-Saldívar, L. J., Villarreal-Samaniego, D., & Santillán-Salgado, R. J. (2026). ESG and Its Components: Impact on Stock Returns across Firm Sizes in Europe and the United States. *Risks*, 14(1), 4.
 13. Ezekwe, C. I. (2025). *International Journal of Research and Innovation in Social Science (Ijriiss)*. SSRN Electronic Journal.
 14. Febriyantor, M. T. (2025). Current Ratio and Debt-to-Equity Ratio as Determinants of Return on Equity in Food and Beverage Companies. 6(2).
 15. Fiordelisi, F., Ricci, O., & Santilli, G. (2023). Environmental engagement and stock price crash risk: Evidence from the European banking industry. *International Review of Financial Analysis*, 88, 102689.
 16. Flammer, C. (2021). Corporate green bonds. *Journal of Financial Economics*, 142(2), 499–516.
 17. Kaouml;lbil, J., & Lambillon, A.-P. (2022). Who Pays for Sustainability? An Analysis of Sustainability-Linked Bonds. SSRN Electronic Journal.
 18. Li, W., & Duca, J. V. (2024). Corporate Green Bonds and the Cost of Capital. In S. Boubaker & T.-H. Le, *Transformations in Banking, Finance and Regulation* (Vol. 11, pp. 37–81). World Scientific (Europe).
 19. Li, Z., & Chen, P. (2024). Sustainable Finance Meets FinTech: Amplifying Green Credit's Benefits for Banks. *Sustainability*, 16(18), 7901.
 20. Martin, V. (2023). Green Finance: Regulation and Instruments¹. *Journal of Central Banking Theory and Practice*, 12(2), 185–209.
 21. Muganyi, T., Yan, L., & Sun, H. (2021). Green finance, fintech and environmental protection: Evidence from China. *Environmental Science and Ecotechnology*, 7, 100107.
 22. Nazir, M. W., Fahad, M., Ali, M., & Zaman, L. (2025). Impact of Green Financing on Corporate Reputation and Performance: The Mediating Role of Sustainability Practices. *The Regional Tribune*, 4(1), 44–55.
 23. Ngwenya, N., & Simatele, M. D. (2020). Unbundling of the green bond market in the economic hubs of Africa: Case study of Kenya, Nigeria and South Africa. *Development Southern Africa*, 37(6), 888–903.
 24. Omuhaya, M. N., & Malenya (Ph.D), Dr. A. (2020). Effects of Capital Structure on Financial Performance: A Case of Selected Manufacturing Companies on the Nairobi Securities Exchange. *Strategic Journal of Business & Change Management*, 7(3).
 25. Oneya, S. D., & Jemaiyo, B. (2025). Green Financing, Corporate governance and Financial Performance of Commercial Banks in Kenya: A Review of Literature. *European Journal of Accounting, Auditing and Finance Research*, 13(1), 110–122.
 26. Park, Y. S., Konge, L., & Artino, A. R. (2020). The Positivism Paradigm of Research. *Academic Medicine*, 95(5), 690–694.
 27. Rahman, Md. H., Rahman, J., Tanchangya, T., & Esquivias, M. A. (2023). Green banking initiatives and sustainability: A comparative analysis between Bangladesh and India. *Research in Globalization*, 7, 100184.
 28. Sarma, P., & Roy, A. (2021). A Scientometric analysis of literature on Green Banking (1995–March 2019). *Journal of Sustainable Finance & Investment*, 11(2), 143–162.
 29. Sebastião, A. M., Tavares, M. C., & Azevedo, G. (2024). Evolution and Challenges of Sustainability Reporting in the Banking Sector: A Systematic Literature Review. *Administrative Sciences*, 14(12), 333.
 30. Sino, D., Baraza, E., & Monari, F. (2025). Green Financing and the Financial Performance of Commercial Banks Listed on the Nairobi Securities Exchange: Empirical Evidence from Sustainable Financial Innovations. *International Journal of Finance and Accounting*, 10(7), 57–64.
 31. Vierescu, E.-M., Rusu, A.-G., Bozagi, A. M., & Călin, A. E. (2025). The ESG Effect: Unveiling Its Influence on Capital Structure in Finance. *Proceedings of the International Conference on Business Excellence*, 19(1), 3017–3027.
 32. Wang, P., & Lu, Z. (2024). The effect of collateral-based monetary policy on green finance: Evidence from China. *Oeconomia Copernicana*, 15(4), 1223–1262.
 33. Yu, D., Meng, T., Zheng, M., & Ma, R. (2024). ESG uncertainty, investor attention and stock price crash risk in China: Evidence from PVAR model analysis. *Humanities and Social Sciences Communications*, 11(1), 1152.
 34. Zhang, C., Ma, Y., & Zhang, E. (2025). Does green innovation promote financial performance of Chinese listed companies? *Journal of Innovation & Knowledge*, 10(4), 100740.
 35. Zhang, R., Li, Y., & Liu, Y. (2021). Green Bond Issuances and Corporate Cost of Capital. SSRN Electronic Journal.
 36. Zheng, G.-W., Siddik, A. B., Masukujjaman, M., & Fatema, N. (2021). Factors Affecting the Sustainability Performance of Financial Institutions in Bangladesh: The Role of Green Finance. *Sustainability*, 13(18), 10165.