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Article

Exploring the causality relationship between bank's ESG performance and loan portfolio quality in emerging markets

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Abstract: This study explores the causal relationship between Environmental, Social, and Governance (ESG) performance and loan portfolio quality (LLP) in banks within emerging markets using a Granger causality framework. Analyzing annual data from 153 banks across 12 countries during 2010–2023, the study provides strong evidence of ESG's predictive power over LLP and key financial indicators, including ROA, NIM, bank size, TIER1 capital adequacy, and GDP growth. Higher ESG scores enhance loan portfolio quality through improved credit risk management, reflecting stronger governance and sustainability-driven operations. ESG also exhibits instantaneous causality, highlighting its immediate impact on loan portfolio quality and financial performance. Conversely, LLP does not Granger-cause ESG but shows instantaneous associations influenced by external factors. These findings emphasize ESG integration as vital for mitigating risk and achieving financial stability in banks. The study advocates proactive ESG adoption in credit risk frameworks and sustainability-incentivizing policies, offering actionable insights for sustainable banking practices.

Keywords: causality relationship; ESG performance; loan portfolio quality; emerging markets

1. Introduction

In recent years, the integration of Environmental, Social, and Governance (ESG) factors into banking operations has garnered significant attention, particularly in emerging markets where financial systems are evolving and regulatory frameworks remain relatively lax. ESG considerations have been widely recognized as a means to promote sustainable development and mitigate risks associated with secured ethical practices for stake holders (Shakil et al., 2019; Miralles-Quirós et al., 2019) and lower risk-taking activities (Chiaramonte et al., 2021; Gangi et al., 2018; Tommaso and Thornton, 2020). While extensive research has explored the impact of ESG on corporate financial performance across various industries, its influence on banks' loan portfolio quality remains underexplored, particularly in the context of emerging markets.

Loan portfolio quality is a critical determinant of a bank's financial health, as it reflects the ability of borrowers to meet their obligations and the bank's capacity to manage credit risk. Poor loan quality, often measured by indicators such as non-performing loans, loan loss provisions, and default rates, poses significant challenges to banking stability. Given the banking industry's inherently narrow profit margins and heavy regulatory oversight (Costello et al., 2019; Ferreira and Modesto, 2021; Islam and Nishiyama, 2016; Klein and Weill, 2022), understanding the relationship between ESG performance and loan quality is vital for stakeholders aiming to

enhance risk management and profitability.

ESG initiatives are often viewed as mechanisms to enhance a bank's risk management capabilities. A higher ESG score may signal stronger governance, more responsible environmental policies, and better stakeholder engagement, all of which could reduce default risk among borrowers and improve loan portfolio quality. Conversely, loan quality could influence ESG performance. Banks with a strong loan portfolio and low NPL ratios may have greater financial flexibility to invest in ESG initiatives. These banks may also face less regulatory scrutiny and have a stronger reputation, enabling them to allocate resources toward sustainability and governance improvements.

Despite the growing adoption of ESG practices in the banking sector, the existing literature primarily focuses on developed markets in USA (Liu et al., 2023), European (Bătae et al., 2021; Buro and Lagasio, 2021), Asia (Chang et al., 2021) or GCC countries (Radhi et al., 2024), where regulatory frameworks and market structures differ significantly from those in emerging economies. These studies often overlook the unique challenges faced by banks in emerging markets, such as higher systemic risks, less mature financial markets, and limited regulatory enforcement of ESG standards. This gap in the literature underscores the need for a focused analysis on how ESG performance interacts with loan portfolio quality in Emerging banks, where ESG initiatives may provide a competitive edge and improve risk-adjusted returns.

This study aims to fill this critical gap by employing a Granger causality framework (Granger, 1969) to investigate the causal relationship between ESG performance and loan portfolio quality in banks operating in emerging markets. While prior studies have established correlations between ESG activities and financial performance, the directionality of this relationship remains ambiguous, particularly in the context of credit risk. By focusing on causality, this research provides deeper insights into whether ESG initiatives directly influence loan quality or merely reflect broader financial stability measures.

Moreover, the study's emphasis on emerging markets offers a novel perspective, as these regions present a unique setting where regulatory constraints on ESG compliance are lower, allowing for greater variability in ESG implementation. This variability enables a more nuanced analysis of how ESG performance can drive improvements in loan portfolio quality or vice versa. Additionally, the research contributes to the broader debate on whether ESG practices serve as a risk mitigation tool or introduce agency costs that could offset their potential benefits in the banking industry.

The findings of this study are expected to provide valuable implications for policymakers, regulators, and banking institutions in emerging markets. By elucidating the causal dynamics between ESG and loan quality, this research offers actionable insights on how banks can leverage ESG strategies to enhance credit risk management, improve financial stability and align with global sustainability goals. In doing so, it contributes to the growing body of literature on ESG in finance, offering a fresh perspective that bridges the gap between theory and practice in a rapidly evolving market context.

The remainder of this study is proceeded as follows: Section 2 provides a

review of relevant literature and develops research hypotheses. Section 3 details the research methodology and data collection. Section 4 presents the findings and offers a discussion of the results, while Section 5 concludes the study.

2. Literature review and hypotheses developed

2.1. Literatures on impact of ESG performance on bank's loan quality

The relationship between a bank's ESG performance and the quality of its loan portfolio is increasingly recognized as a critical area of research in the financial sector. This relationship can be understood through various dimensions, including credit risk, financial performance, and regulatory compliance. A synthesis of recent literature reveals a complex interplay between these factors, suggesting that enhanced ESG performance can lead to improved loan portfolio quality, primarily by mitigating credit risk and enhancing financial stability. Numerous studies indicate a positive correlation between banks' ESG performance and their credit risk profiles. Study of Pan (2024) showed effective ESG integration can mitigate potential losses from non-performing loans. Besides, Niedziółka (2023) highlighted that improved ESG ratings are associated with a reduction in credit risk, suggesting that banks with higher ESG scores are less likely to be classified as high or medium risk. These findings are supported by Tóth et al. (2021), who demonstrated that better ESG performance correlates with a decrease in non-performing loans and positively impacts regulatory capital. The implication is that banks that prioritize ESG factors may experience lower credit risk, which in turn enhances the quality of their loan portfolios. Moreover, the integration of ESG factors into credit risk assessment is increasingly viewed as a necessary strategy for banks. Brogi et al. (2022) argued that higher ESG awareness among banks is strongly associated with better creditworthiness, as measured by the Altman Z-score. This suggests that banks that incorporate ESG considerations into their lending practices are likely to experience lower default rates among borrowers, thereby improving the overall quality of their loan portfolios. Similarly, Ahmed et al. (2018) emphasized that banks that proactively consider ESG factors in their lending decisions tend to achieve better financial performance, further reinforcing the notion that ESG performance is linked to credit risk management.

The impact of ESG performance on financial stability is another critical aspect of this relationship. Lupu et al. (2022) conducted a comprehensive analysis of European banks and found that enhanced ESG performance is associated with a decrease in non-performing loans, which contributes to overall financial stability. This finding is echoed by Liu (2024), who posited that improved ESG performance can mitigate liquidity risk in commercial banks by reducing the proportion of non-performing loans. The reduction in non-performing loans not only enhances the quality of the loan portfolio but also stabilizes the bank's financial standing, allowing for more sustainable growth. Additionally, the regulatory environment surrounding ESG performance is evolving, with increasing pressure on banks to disclose their ESG practices and integrate them into their risk management frameworks. Kosztowniak (2024) discussed how ESG regulations are influencing the credit process in commercial banks, indicating that banks that fail to adapt to these

regulations may face higher servicing costs and increased risk exposure. This regulatory pressure underscores the importance of ESG performance in maintaining a high-quality loan portfolio, as banks that align with ESG standards are likely to benefit from lower risk and better reputational standing.

The COVID-19 pandemic has also highlighted the importance of ESG performance in managing credit risk. Sari and Wardhani (2023) indicated that the pandemic exacerbated financial difficulties for borrowers, leading to an increase in non-performing loans. However, banks with strong ESG performance were better positioned to navigate these challenges, as their risk management frameworks were more robust and adaptable to changing circumstances. This adaptability further emphasizes the link between ESG performance and loan portfolio quality, as banks that prioritize sustainability are likely to be more resilient in times of crisis.

2.2. Literatures on impact of loan portfolio on bank's ESG performance

One of the primary ways in which loan portfolio quality influences ESG performance is through the management of credit risk. Mahyoub and Said Mahyoub and Said (2021) highlight that poor loan quality, characterized by high levels of non-performing loans, poses significant risks to banks. This deterioration in loan quality can lead to increased scrutiny from regulators and investors, who may view high NPL ratios as indicative of poor governance and risk management practices. Consequently, banks with declining loan quality may find it challenging to maintain or improve their ESG ratings, as stakeholders increasingly demand transparency and accountability in risk management practices.

Furthermore, the relationship between loan portfolio quality and ESG performance is also reflected in the regulatory landscape. Kosztowniak (2024) discusses how banks that engage in lending to high-environmental-impact industries may face higher servicing costs and regulatory penalties, which can negatively impact their ESG performance. As banks struggle with deteriorating loan quality, particularly in sectors that are environmentally or socially detrimental, they may incur additional costs associated with compliance and remediation efforts. This situation can create a vicious cycle where poor loan quality leads to increased ESG risks, further exacerbating the bank's overall performance.

The influence of macroeconomic factors on loan portfolio quality also plays a crucial role in this relationship. Festić et al. (2011) noted that systemic risks stemming from macroeconomic conditions can significantly affect the quality of loan portfolios, which in turn impacts banks' financial stability and ESG performance. For instance, during economic downturns, banks may experience higher default rates, leading to an increase in non-performing loans. This deterioration can trigger a reevaluation of the bank's ESG practices, as stakeholders may perceive a lack of commitment to sustainable lending practices in the face of rising credit risk.

Moreover, the impact of loan portfolio quality on ESG performance can be seen in the context of corporate governance. He et al. (2021) argued that incidents related to ESG factors can influence bank loan contracts, suggesting that banks with poor loan quality may face higher costs of capital and stricter loan terms. This relationship underscores the importance of maintaining high loan quality to ensure favorable

lending conditions and uphold ESG commitments. As banks grapple with the repercussions of poor loan quality, their ability to attract investment and maintain a positive public image may be compromised. Additionally, the role of corruption in influencing loan portfolio quality cannot be overlooked. Murta (2023) highlighted that corruption can lead to inefficient resource allocation, resulting in poor loan performance. This misallocation can further diminish a bank's ESG performance, as stakeholders increasingly scrutinize the ethical implications of lending practices. Banks that fail to address corruption-related issues within their loan portfolios may find themselves facing reputational damage and regulatory challenges, ultimately impacting their ESG ratings.

In summary, the evidence suggests a strong causal relationship between a bank's ESG performance and the quality of its loan portfolio. Enhanced ESG practices lead to reduced credit risk, improved financial stability, and better regulatory compliance, all of which contribute to a healthier loan portfolio. As the financial landscape continues to evolve, it is imperative for banks to integrate ESG considerations into their operational and strategic frameworks to ensure sustainable growth and mitigate risks associated with their lending activities. On the other hand, the impacts of loan portfolio quality on banks' ESG performance are multifaceted and influenced by various factors, including credit risk management, regulatory compliance, macroeconomic conditions, and corporate governance. Deteriorating loan quality can lead to increased scrutiny and costs, adversely affecting a bank's ESG performance. As the financial landscape evolves, it is imperative for banks to prioritize loan quality to enhance their ESG standing and ensure sustainable growth.

From the current literature, two primary hypotheses can be proposed as below:

H1: ESG performance causes improved loan portfolio quality.

H2: Increasing loan quality causes enhanced ESG performance.

3. Data and methodology

To test these hypotheses, a Granger causality test (Granger, 1969) is applied. The Granger causality test is a widely utilized statistical method for exploring the causal relationships between two variables, particularly in time series data. This concept is rooted in the notion of temporal precedence, which asserts that a cause must precede its effect in time (Siew et al., 2023). In this study, this statistical method is employed to provide insights into the directionality of the relationship between bank's ESG performance and loan portfolio quality. The regression framework for the Granger causality detections between variables as in **Figure 1** below:

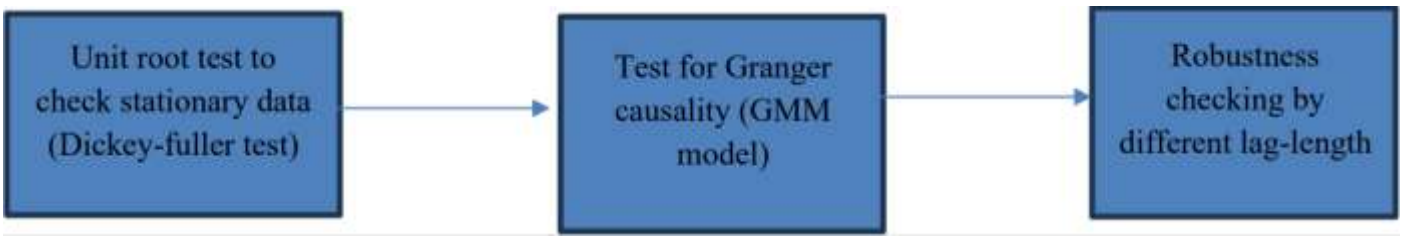

Figure 1. Regression framework in this study.

Source: The author.

Initially, the unit root test is essential for Granger causality analysis in this study because it determines whether the time series data are stationary. Stationarity is a key assumption in Granger causality tests, as non-stationary data can lead to spurious results, making the causal relationship between variables unreliable (Engle and Granger, 1987). Then, the author choses the Panel Vector Autoregression (PVAR) model for Granger causality test with panel data in this study. PVAR models extend the standard Vector Autoregression (VAR) to panel data, capturing both the time-series and cross-sectional dynamics. Then, to estimate the PVAR, the author employs Generalized Method of Moments (GMM) method with lag time to address potential endogeneity. Moreover, the time-fixed effects are applied in the models to control for common shocks across all banks. Aftermath, the robustness checking by using another lag time is done. The PVAR model specification for each hypothesis is following:

Hypothesis H1: ESG performance causes improved loan portfolio quality

$$LLP_{i,t} = \alpha_i + \sum_{j=1}^{p} \beta_j LLP_{i,t-j} + \sum_{j=1}^{p} \gamma_j ESG_{i,t-j} + \sum_{j=1}^{p} \delta_j X_{i,t-j} + \mu_t + \epsilon_{i,t}$$

where:

- $LLP_{i,t}$: Loan loss provisions of bank i, at time t
- $ESG_{i,t}$: ESG score of bank i, at time t-j
- $X_{i,t-j}$: Control variables for bank i, at time t-j
- α_i: Bank-specific fixed effects.
- μ_t Time-fixed effects (to control for common shocks across all banks).
- β_j,γ_j: Coefficients for lagged loan loss provisions and ESG score, respectively.
- ϵ_i: Error term.
- p: Number of lags

Hypothesis H2: Loan portfolio quality causes enhanced ESG performance

$$ESG_{i,t} = \delta_i + \sum_{j=1}^{p} \theta_j ESG_{i,t-j} + \sum_{j=1}^{p} \phi_j LLP_{i,t-j} + \sum_{j=1}^{p} \lambda_j X_{i,t-j} + \nu_t + \eta_{i,t}$$

where:

- $ESG_{i,t}$: ESG performance for bank i at time t
- $LLP_{i,t-j}$: Lagged loan loss provision for bank i at time t−j
- $X_{i,t-j}$: Control variables for bank i, at time t-j
- δ_i: Bank-specific fixed effects
- ν_t: Time-fixed effects
- θ_j, ϕ_j: Coefficients for lagged ESG and loan quality, respectively
- $\eta_{i,t}$: Error term
- p: Number of lags

For the data collection, the annual data for ESG performances, Loan loss provisions and control variables of bank specific factors including bank profitability (ROA), bank size (Log of total assets), TIER1 ratio (Capital TIER 1 adequacy ratio) are get from SandP Global data base, while annual data for control variable of

macro-economic factor (GDP growth) is subscribed from World bank data base. The annual data from 2010 to 2023 are collected for 153 banks in 12 emerging countries based on MSCI Emerging Markets Index classification, who are: South Africa, Malaysia, Thailand, Turkey, Indonesia, Philippines, India, Colombia, Brazil, Mexico, Pakistan and Chile.

The summary of variables is given in **Table 1** below:

Table 1. Variable interpretation.

Variable name	Source of data	Description
ESG score (ESG)	SandP Global	The score measures a bank's performance on and management of material ESG risks, opportunities, and impacts informed by a combination of company disclosures, media and stakeholder analysis, modeling approaches, and in-depth company engagement via the SandP Global Corporate Sustainability Assessment (CSA). The Corporate Sustainability Assessment includes 62 industry-specific questionaries for banks. This score is measured on a scale of 0–100.
Loan loss provision (LLP)	SandP Global	This indicator represents the amount of funds that banks set aside to cover potential losses from loan defaults or impairments and recognized in a bank's income statement. In this study, the loan loans loss provisions of each bank in USD as percentage of bank's total net loans are collected to avoid the differences in bank's risk exposures.
Control variables		
Return on total asset (ROA)	SandP Global	This indicator measures a bank's profitability relative to its total assets. It reflects the efficiency of a bank in generating profit from its asset base, offering insights into its operational and financial effectiveness
Net interest margin (NIM)	SandP Global	This indicator is a critical indicator of a bank's capacity to earn profit form interest-earning activities, calculated by the difference between interest income generated and interest paid out, relative to its interest-earning assets.
Size (Log_TA)	SandP Global	This indicator represents the logarithmic transformation of a bank's total assets. It serves as a proxy for bank size, providing insights into the bank's scale of operations, market position, and capacity to absorb financial shocks.
TIER1 ratio (TIER1)	SandP Global	The indicator is for assessing the financial health and risk resilience of banks. It measures bank's financial strength, indicating its ability to absorb losses while remaining solvent. This ratio provides insights into the core capital adequacy of banks, which is vital for assessing their stability and compliance with regulatory requirements. The TIER1 capital ratio = TIER 1 capital/Total risk weighted assets.
GDP growth rate (GDP)	World bank	This indicator is annual percentage growth rate of GDP at market prices based on constant local currency for each country.

Source: The author.

4. Empirical findings

The **Table 2** provides the evidences that the dataset is robust for examining the causal relationship between ESG and LLP of sample banks in this research. ESG, ranging from 2.52 to 92.63 with a median of 53.39 and a standard deviation of 18.58, reflect significant variation in the adoption of ESG practices, ensuring sufficient variability for analysis. LLP, the dependent variable, displays a range of 0.01 to 1.76 with a median of 0.01 and a standard deviation of 0.74, indicating a positively skewed distribution where most banks report low provisions, but a few exhibit much higher risk. This variability highlights the relevance of exploring ESG's potential impact on credit risk management practices.

The inclusion of control variables enhances the rigor of the analysis. ROA, ranging from −0.123 to 0.204, and NIM, with a median of 0.038, provide measures of profitability that could influence both ESG practices and LLP. The Log_TA captures bank size, spanning a broad range, reflecting the diversity of the sample and

its potential effect on resource allocation toward ESG initiatives. TIER1, representing the Tier 1 capital adequacy ratio, introduces a dimension of financial stability, while GDP growth controls for macroeconomic fluctuations. Together, these variables help isolate the true relationship between ESG and LLP by accounting for confounding factors.

Table 2. Data description.

Variable	Min	Max	Median	Standard deviation
ESG	2.52	92.63	53.39	18.58
LLP	0.01	1.76	0.01	0.74
ROA	-0.123	0.204	0.013	0.019
NIM	0.013	0.358	0.038	0.026
Log_TA	8.046153	12.59	10.45	2.218
TIER1	0.064	1.182	0.13	0.079
GDP	-0.1093	0.134	0.048	0.037

Source: The author's summary from R.4.4.2 software.

Table 3. Dickey-fuller test results.

Variable	Dickey-Fuller Statistic	Lag Order	*P*-value	Stationary
ESG	−7.141	10	0.01	Yes
LLP	−8.402	10	0.01	Yes
ROA	−5.826	10	0.01	Yes
NIM	−6.770	10	0.01	Yes
Log_TA	−8.634	10	0.01	Yes
TIER1	−5.002	10	0.01	Yes
GDP	−6.744	10	0.01	Yes

Source: The author's summary from R.4.4.2 software.

In the first step, the unit root test by Dickey-fuller test is employed to check the data stationarity. The **Table 3** shows that all variables used in the models have *p*-values < 0.05, indicating that they are stationary at the 5% significance level. The Dickey-Fuller test statistics for each variable also exceed the corresponding critical values, supporting the conclusion that these series do not have a unit root and are suitable for inclusion in the regression models without further processing. The Dickey-Fuller test result above also points out that an optimal lag length is 10, which is critical to ensure the reliability of the regression results.

Table 4. Wald test results with lag = 10.

Cause	Effect	Test type	Statistic	Degrees of Freedom	*P*-value	Conclusion
ESG	LLP, ROA, NIM, Log_TA, TIER1, GDP	Granger causality	$F = 4.9096$	df1 = 60, df2 = 7070	$<2.2e^{-16}$	ESG Granger-causes LLP and others
ESG	LLP, ROA, NIM, Log_TA, TIER1, GDP	Instantaneous causality	Chi-sq = 37.861	df = 6	$1.196e^{-06}$	ESG has instantaneous causality
LLP	ESG, ROA, NIM, Log_TA, TIER1, GDP	Granger causality	$F = 0.78353$	df1 = 60, df2 = 7070	0.8884	LLP does not Granger-cause ESG and others

LLP	ESG, ROA, NIM, Log_TA, TIER1, GDP	Instantaneous causality	Chi-sq = 60.423	df = 6	$3.692e^{-11}$	LLP has instantaneous causality

Source: The author's summary from R.4.4.2 software.

In the next step, the Granger causalities between ESG and LLP are detected by Wald tests. The **Table 4** reveals the significant insights into the causal relationship between ESG and LLP, along with other control variables with lag length of 10. The regression results demonstrates that ESG Granger-causes LLP, ROA, NIM, Log_TA, TIER1 and GDP, with an F-statistic of 4.9096 and a *p*-value < 2.2×10^{-16}, indicating a robust predictive relationship. This suggests that ESG scores, which measure a bank's management of environmental, social, and governance risks and opportunities, play a significant role in influencing credit portfolio quality indicated by loan loss provisions level and other financial outcomes. Additionally, ESG exhibits instantaneous causality with these variables (Chi-sq = 37.861, *p*-value = 1.196×10^{-6}), implying contemporaneous associations that reflect immediate impacts of ESG dynamics within the banking environment. Conversely, LLP does not Granger-cause ESG or other variables (F = 0.78353, *p*-value = 0.8884), indicating that past values of LLP levels do not have predictive power over ESG scores or related outcomes. However, LLP shows significant instantaneous causality with the variables (Chi-sq = 60.423, *p*-value = 3.692×10^{-11}), suggesting immediate interactions that are likely driven by simultaneous external factors. These findings highlight the pivotal role of ESG in driving forward-looking financial stability and performance metrics in banks, while LLP, although showing immediate relationships, lacks a predictive feedback loop on ESG-related metrics. This underscores the need for banks to integrate ESG considerations proactively into their risk and performance frameworks.

Table 5. Lag length selection criteria.

Lag (*n*)	**AIC (*n*)**	**HQ (*n*)**	**SC (*n*)**	**FPE (*n*)**
1	−30.90792	−30.81021	−30.64984	3.7745×10^{-14}
2	−30.88304	−30.69983	−30.39914	3.8696×10^{-14}
3	−30.88199	−30.61328	−30.17226	3.8738×10^{-14}
4	−31.01518	−30.66097	−30.07962	3.3909×10^{-14}
5	−31.01069	−30.57098	−29.84931	3.4065×10^{-14}
6	−30.98201	−30.45680	−29.59481	3.5060×10^{-14}
7	−30.96264	−30.35193	−29.34961	3.5752×10^{-14}
8	−30.92014	−30.22393	−29.08129	3.7312×10^{-14}
9	−30.87244	−30.09072	−28.80776	3.9146×10^{-14}
10	−31.07565	−30.20844	−28.78515	3.1959×10^{-14}

Source: The author's summary from R.4.4.2 software.

In the last step, for robustness checking, the author will calculate the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), or Hannan-Quinn Criterion (HQC) to determine the optimal lag length that minimizes these values. From the results in the **Table 5**, both AIC and FPE criteria suggest lag = 10

as it has the lowest AIC value and the smallest FPE. Otherwise, both HQ and SC criteria favor lag = 1, indicating a more parsimonious model with reduced complexity. Recognizing the importance of balancing short- and long-term dynamics in economic relationships, the author acknowledges the potential impact of varying economic conditions over the study period and have reconsidered our lag structure accordingly. To enhance the robustness of the findings, the author employs a revised approach with a more optimal lag length that accounts for both economic cycles and regulatory shifts in emerging markets. This adjustment ensures that the models in this study better capture the evolving interactions between ESG performance and loan portfolio quality while maintaining statistical rigor and minimizing potential biases. Therefore, the author choose the average value of lag = 5 to recheck the causality relationship.

Table 6. Wald test results with lag = 5.

Cause	Effect	Test type	Statistic	Degrees of Freedom	*P*-value	Conclusion
ESG	LLP, ROA, NIM, Log_TA, TIER1, GDP	Granger causality	F = 7.7782	df1 = 30, df2 = 7350	$<2.2e^{-16}$	ESG Granger-causes LLP and others
ESG	LLP, ROA, NIM, Log_TA, TIER1, GDP	Instantaneous causality	Chi-sq = 56.285	df = 6	$2.549e^{-10}$	ESG has instantaneous causality
LLP	ESG, ROA, NIM, Log_TA, TIER1, GDP	Granger causality	F = 0.64816	df1 = 30, df2 = 7350	0.9299	LLP does not Granger-cause ESG and others
LLP	ESG, ROA, NIM, Log_TA, TIER1, GDP	Instantaneous causality	Chi-sq = 50.811	df = 6	$3.233e^{-09}$	LLP has instantaneous causality

Source: The author's summary from R.4.4.2 software.

The results in the **Table 6** represents ESG Granger-causes LLP and other variables with a highly significant ($p < 2.2e^{-16}$), indicating that ESG scores provide predictive information about LLP and other factors. Whereas, LLP does not Granger-cause ESG or other variables ($p = 0.9299$), suggesting no predictive power of LLP over ESG or related outcomes. These results strongly in line with previous conclusions from regression result in the **Table 4**, suggests that the results are robust.

5. Discussions

The findings of this study provide compelling evidence of the significant role of ESG performance in driving financial stability and operational effectiveness in the banking sector. The Granger causality test reveals that ESG performance Granger-causes loan loss provisions (LLP) and other key financial indicators, including ROA, NIM, Log_TA, TIER1, and GDP. This suggests that ESG scores, which reflect a bank's ability to manage environmental, social, and governance risks and opportunities, are not merely symbolic metrics but hold substantial predictive power for loan quality and overall financial health. Higher ESG scores are likely indicative of stronger governance frameworks, responsible lending practices, and an emphasis on sustainability, which collectively reduce default probabilities and enhance loan portfolio performance.

Furthermore, the analysis of instantaneous causality underscores the immediate influence of ESG on financial outcomes, illustrating its impact on real-time decision-making and operations. This finding highlights ESG's role as a dynamic driver of

both long-term strategic benefits and short-term operational efficiencies. In contrast, the study finds that LLP does not Granger-cause ESG performance, indicating that while loan quality is a critical aspect of financial stability, it does not serve as a predictor or determinant of a bank's ESG initiatives. However, the presence of significant instantaneous causality between LLP and other variables suggests that loan quality interacts contemporaneously with external drivers such as market conditions or regulatory shifts, underscoring its importance in operational resilience. The robustness of these results across different lag lengths further strengthens the validity of the findings. Testing with lags of 10 and 5 consistently demonstrates the causal linkages between ESG and LLP, affirming that the relationships are not dependent on specific temporal assumptions. This robustness adds weight to the conclusion that ESG integration is essential for enhancing credit risk management and achieving sustainable financial performance.

These findings have significant implications for stakeholders in emerging markets, where financial institutions operate in dynamic yet often underregulated environments with varying levels of ESG adoption. Unlike developed economies, many banks in emerging markets face limited regulatory enforcement, lower investor pressure, and inconsistent ESG disclosure standards, making the integration of ESG into financial decision-making both a challenge and an opportunity.

For banks, this study highlights ESG integration as a critical tool for credit risk mitigation. Given that many emerging markets experience higher economic volatility, weaker legal enforcement, and greater exposure to environmental and social risks, banks need to adopt proactive ESG-based credit assessments to enhance loan portfolio quality. Implementing sector-specific ESG risk models, particularly for industries with high environmental and social risks such as mining, agriculture, and infrastructure, can help banks make more informed lending decisions while ensuring long-term portfolio stability. Moreover, in economies where non-performing loans (NPLs) are a systemic challenge, ESG-based risk screening can serve as a preventive measure, reducing credit losses and improving overall financial resilience.

For regulators and policymakers, the study underscores the need to establish clearer ESG reporting frameworks and integrate ESG-related risks into banking supervision. Many emerging markets still lack mandatory ESG disclosure requirements, leading to inconsistencies in how banks assess and report ESG risks. Regulatory bodies should introduce standardized ESG risk assessment guidelines, require banks to report on ESG-linked credit risk exposures, and provide incentives such as tax benefits or preferential capital treatment for financial institutions that adopt sustainable banking practices. Furthermore, given the influence of government-backed financial institutions and state-owned banks in many emerging economies, policymakers can drive ESG adoption by embedding sustainability criteria into public sector lending and investment policies.

For investors, these findings reinforce the importance of ESG as a financial risk indicator in emerging markets. International investors often perceive emerging market banks as high-risk due to regulatory uncertainty and economic instability. However, strong ESG adoption can serve as a signal of lower credit risk and better

governance, making banks in emerging markets more attractive to foreign capital.

Ultimately, in the context of emerging markets, where financial stability remains fragile and economic cycles are unpredictable, the findings of this study suggest that ESG integration is not merely a compliance requirement but a strategic imperative. Strengthening ESG adoption across banking systems can reduce systemic credit risks, improve financial resilience, and enhance long-term economic sustainability—key priorities for both financial institutions and regulators in these rapidly evolving economies.

The study still has some limitations. First, the variability in regulatory frameworks across the 12 emerging countries studied may influence the extent to which banks integrate ESG factors into their risk management and lending practices, then potentially introducing regulatory bias in the causality analysis. Second, while this study highlights the overarching relationship between ESG performance and financial metrics, further research is needed to delve deeper into specific ESG dimensions, such as E, S, G factor, and their unique impacts on loan portfolio quality. Third, comparative analyses across regions or banking systems could provide additional insights into the contextual factors that influence ESG's effectiveness.

6. Conclusions

In conclusion, this study confirms the significant role of ESG performance (ESG) in improving loan portfolio quality (LLP) and financial stability in banks, particularly in emerging markets. The findings emphasize that ESG is not just a compliance requirement but a strategic tool for risk management and sustainable growth. Although LLP does not directly influence ESG initiatives, its contemporaneous interactions with other variables highlight its importance in maintaining operational resilience. By integrating ESG considerations into their frameworks, banks can achieve enhanced financial performance, reduce credit risks, and contribute to long-term sustainability. These insights underscore the necessity of aligning banking practices with ESG principles to build resilient and sustainable financial systems.

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