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GREEN BANKING DISCLOSURE AND PERFORMANCE: EVIDENCE FROM VIETNAMESE COMMERCIAL BANKS

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ABSTRACT

Information transparency and sustainable development have become critical imperatives for Vietnam's banking sector. Green banking encompasses banking activities, policies and initiatives that incorporate environmental and social considerations into business strategy, credit allocation, risk management and internal operations. The dual objectives are to minimize negative environmental impacts and to promote sustainable economic development. In practice, green banking is implemented and communicated to stakeholders primarily through green banking information disclosure. This study examines the impact of green banking information disclosure on the financial performance of 20 Vietnamese commercial banks over the period 2016 - 2024. A Green Banking Disclosure Index (GBDI) is constructed through content analysis of annual reports and related documents based on 15 unweighted criteria. Using panel data regression models and controlling for bank characteristics (size, cost-to-income ratio, and capital adequacy ratio), the study investigates the relationship between the level of green disclosure and financial outcomes. The findings provide empirical evidence on the relationship between green banking information disclosure and banks' financial performance, highlighting the role of green transparency not only in regulatory compliance but also as a driver of operational efficiency and market value. Based on the results, the study offers governance implications and policy recommendations to enhance the quality of green information disclosure, thereby improving financial performance and supporting sustainable development of Vietnam's commercial banking system.

KEYWORDS: Commercial banks, financial performance, GBDI, green banking.

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1.0 INTRODUCTION

The banking system plays a pivotal role in the mobilisation and allocation of financial resources for economic development (Levine, 2005). Within this system, commercial banks assume a pivotal role

in translating national sustainability commitments into concrete lending, investment, and disclosure practices (UNEP FI, 2019). In the context of escalating climate change and environmental degradation, the concept of “greening” the banking sector has emerged as a global priority, with a particular emphasis on the implementation of green banking practices (Weber, 2017; UNEP FI, 2019).

Green banking is defined as the integration of environmental and social considerations into the core business strategy, credit allocation, risk management, and internal operations of financial institutions (Bahl, 2012; Islam & Das, 2013). The overarching objective of green banking is twofold: firstly, to mitigate adverse environmental impacts, and secondly, to foster sustainable economic development. Green banking can be considered to comprise two complementary dimensions. Firstly, there are the external practices, which include green credit, environmental and social risk assessment in lending, and green capital market activities. Secondly, there are the internal practices, which include paper reduction, energy efficiency, digital banking solutions that lower carbon emissions, employee training on sustainability, and resource management (Ginovsky, 2009; Lalon, 2015; Weber & Feltmate, 2016).

The dissemination of information regarding these practices is predominantly effected through the medium of green banking disclosure. Disclosure has been demonstrated to reduce information asymmetry, signal management quality and long-term orientation enhance legitimacy in the eyes of regulators and society, and strengthen relationships with investors and customers (Spence, 1973; Suchman, 1995; Freeman, 1984). Empirical studies across emerging markets have demonstrated that increased levels of green banking disclosure are associated with enhanced bank reputation, reduced perceived risk, and, in numerous instances, superior financial outcomes measured by profitability and market valuation (Rahman et al., 2021; Rahmamita & Kahar, 2020; Bose et al., 2018; Putri Nur Mutiara Rahma & Linda Kusumaning Wedari, 2024). Nevertheless, the strength and direction of this relationship are context-dependent and are not uniformly confirmed across all performance metrics or institutional settings.

In Vietnam, the policy framework has been proactive in promoting the adoption of environmentally sustainable banking practices. The State Bank of Vietnam's Decision 1604/QĐ-NHNN (2018) on the Green Banking Development Project, in conjunction with Circulars 155/2015/TT-BTC and 96/2020/TT-BTC on information disclosure has prompted commercial banks to extend green credit and enhance transparency. Recent estimates suggest that in excess of 70% of commercial banks offer green credit products, with outstanding green credit reaching approximately VND 300 trillion (approximately 10% of system-wide credit). However, disclosure practices remain inconsistent, with many banks still relying on general policy statements rather than verifiable, quantitative information on green credit volumes, environmental risk management processes, or measurable environmental performance (Tran Nguyen Sa & Ha Thi Thieu Dao, 2023; Bui Thi Thu Loan, Tran Thi Lan Anh & Hoang T., 2024). The discrepancy between the policy objectives and the quality of financial disclosure raises a significant empirical question: does greater transparency in green banking information actually result in improved financial performance?

A substantial body of prior domestic research has been dedicated to the description of the current state of green banking disclosure or the examination of the effects of green credit itself. The extant literature provides only limited quantitative evidence on the direct impact of green banking information disclosure on financial performance, particularly for the period 2016–2024, when the regulatory framework for sustainability reporting was progressively strengthened. International studies, while more abundant, report a combination of findings and rarely focus on the Vietnamese institutional context.

The present study addresses this lacuna by examining the impact of green banking information disclosure on the financial performance of 20 Vietnamese commercial banks over the period 2016–2024. The Green Banking Disclosure Index (GBDI) has been developed for the purpose of measuring green banking disclosure. The index is constructed through content analysis of annual reports and related documents, and is based on 15 unweighted criteria. These criteria cover green policy and orientation, green credit and financing activities, internal eco-friendly operations, and compliance transparency. The financial performance of a company is assessed from two complementary perspectives: accounting-based measures (ROA and ROE) that capture realised operational profitability, and a market-based measure (Tobin's Q) that reflects investor expectations of future value. The panel regression models are controlled for bank-specific characteristics (size, cost-to-income ratio, and capital adequacy ratio).

The study differentiates these performance lenses and tests the hypothesis that green transparency matters differently for internal operational efficiency versus market perception. The study contributes empirical evidence relevant to both bank management and regulators seeking to strengthen the link between sustainable practices, transparent disclosure, and financial outcomes in Vietnam's commercial banking system.

2.0 RESEARCH OVERVIEW AND THEORETICAL BASIC

2.1. Literature Review

2.1.1. Green Banking and Green Banking Information Disclosure

Green banking, also known as sustainable banking refers to a banking model that systematically integrates environmental and social considerations into business strategy, credit risk management, investment decisions, and daily operations. According to Bahl (2012), green banking goes beyond offering environmentally friendly financial products to include the incorporation of environmental and social factors into the overall governance and operational framework of banks.

In practice, green banking comprises two complementary dimensions. The external dimension involves the bank's intermediation role, including the provision of green credit, financing for renewable energy and clean technology projects, and the integration of environmental and social risk assessment into lending decisions (Islam & Das, 2013; Ragupathi & Sujatha, 2016). The internal dimension focuses on reducing the bank's own environmental footprint through digitalization, paper reduction, energy efficiency, employee training on sustainability, and the cultivation of a green organizational culture (Ginovsky, 2009; Lalon, 2015; Weber & Feltmate, 2016).

In Vietnam, the concept has been formally promoted through Decision No. 1604/QĐ-NHNN (2018) of the State Bank of Vietnam, which emphasizes the development of green credit, environmental and social risk management, and commercial banks' responsibility toward sustainable development. Green banking information disclosure (GBID) as a critical mechanism for reducing information asymmetry, signaling managerial quality and long-term orientation, and enhancing organizational legitimacy (Spence, 1973; Suchman, 1995). Most empirical studies measure the level of disclosure through content analysis of annual reports and sustainability reports, constructing a Green Banking Disclosure Index (GBDI) based on a set of predetermined criteria (Bose et al., 2018; Rahman et al., 2021).

In Vietnam, disclosure practices remain uneven. Tran Nguyen Sa and Ha Thi Thieu Dao (2023) found that while an increasing number of listed commercial banks mention green banking in their annual reports, the information is still largely qualitative, with limited quantitative data on green credit volumes or measurable environmental performance. Similar patterns have been observed in broader ESG disclosure studies (Bùi Thị Thu Loan et al., 2024; Nguyen Thi Nguyet Lien et al., 2025).

a. Measuring Green Banking Information Disclosure

To quantify the level of green banking information disclosure, this study develops a **Green Banking Disclosure Index (GBDI)** based on content analysis of banks' annual reports and related documents. Following established approaches in the literature (Bose et al., 2018; Tran Nguyen Sa & Ha Thi Thieu Dao, 2023), the GBDI consists of 15 criteria grouped into four main dimensions: (I) Green banking policy and strategic orientation; (II) Green credit and green finance activities; (III) Internal eco-friendly operations; and (IV) Compliance and transparency of green information. An unweighted binary scoring method is applied: each criterion receives a score of 1 if the bank provides specific and verifiable information in its reports, and 0 otherwise. The GBDI for bank i in year t is calculated as:

$$GBDI_{it} = \frac{\sum_{k=1}^K D_{it}}{K}$$

Where $D_{it} = 1$ if bank i discloses criterion k in year t , 0 otherwise and $K = 15$. The index ranges from 0 to 1, higher index values indicate more comprehensive green banking disclosure.

This measurement approach allows for objective assessment of disclosure quality and serves as the key independent variable in examining its impact on banks' financial performance.

2.1.2. Financial Performance

Financial performance is a core indicator of a commercial bank's success in utilizing its resources to generate profits, manage risks, and create value for shareholders (Berger & Humphrey, 1997; Athanasoglou et al., 2008). It reflects how efficiently a bank performs its intermediation function and is widely used to evaluate both managerial effectiveness and the impact of strategic decisions, including those related to sustainability and disclosure.

In the banking literature, financial performance is typically examined from two complementary perspectives. Accounting-based measures focus on realized profitability and operational efficiency, while market-based measures capture investors' expectations regarding the bank's future growth potential and overall value. Combining both perspectives provides a more comprehensive assessment of performance.

This study employs three widely recognized indicators. Return on Assets (ROA) measures the bank's ability to generate profit from its total assets and is considered a reliable indicator of operational efficiency because it is less affected by financial leverage. Return on Equity (ROE) evaluates the return generated on shareholders' capital and reflects the bank's attractiveness from the investors' perspective. Tobin's Q, as a market-based measure, compares the market value of the bank to the replacement cost of its assets and incorporates forward-looking market expectations (Tobin, 1969; Chung & Pruitt, 1994).

By using ROA, ROE, and Tobin's Q simultaneously, the study is able to examine whether green banking information disclosure affects internal operational efficiency and market valuation differently.

2.1.3. Bank-Specific Factors Affecting Financial Performance

Bank financial performance is also shaped by internal characteristics. To isolate the effect of green banking information disclosure, this study controls for three commonly used bank-specific factors. Bank size (SIZE) reflects economies of scale, resource availability, and the capacity to diversify risks (Berger & Humphrey, 1997). The cost-to-income ratio (CIR) captures operational efficiency, with a lower ratio generally associated with better cost management and higher profitability (Athanasoglou et al., 2008). The capital adequacy ratio (CAR) indicates the bank's financial soundness and ability to absorb potential losses. Controlling these variables helps ensure that the estimated relationship between green banking disclosure and financial performance is not confounded by differences in scale, cost efficiency, or capital strength.

2.1.4. The Relationship between Green Banking Disclosure and Financial Performance

The theoretical link between green banking disclosure and financial performance is grounded in stakeholder theory, legitimacy theory, and signaling theory. Higher-quality disclosure is expected to improve reputation, reduce perceived risk, lower the cost of capital, and enhance both accounting-based and market-based performance.

Empirical evidence, however, remains mixed.

Several studies report positive relationships. Rahman et al. (2021) found that green banking practices positively affected ROA, ROE, and market value among listed banks in Bangladesh. Rahma and Wedari (2024), using a Green Banking Disclosure Index for ASEAN banks, documented a positive effect on ROE, which was strengthened by bank size. Rahmamita and Kahar (2020) showed that green banking disclosure significantly improved Tobin's Q in Indonesian banks. In the Vietnamese context, Bui Thi Thu Loan et al. (2024) found that ESG disclosure, particularly the environmental and governance pillars, positively influenced ROA, ROE, and net interest margin.

In contrast, other studies find non-significant or mixed results. Ikram and Akhtar (2021) reported no statistically significant impact of green banking disclosure on Tobin's Q across SAARC countries. Ernawati and Utami (2024) found no significant relationship between green banking disclosure and either ROA or ROE among regional Islamic banks in Indonesia, attributing the results to low disclosure quality and limited bank size. These findings suggest that the effect of green banking disclosure on financial performance is context-dependent and may vary across performance measures and institutional environments.

2.1.5. Research Gap

Despite growing attention to green banking and sustainability disclosure, several gaps remain. First, few studies specifically examine the impact of *green banking information disclosure* (as distinct from green credit volume or general ESG disclosure) on the financial performance of Vietnamese commercial banks. Second, existing international evidence is inconclusive, with both positive and non-significant results reported. Third, most prior studies in Vietnam have focused on describing disclosure practices rather than testing their quantitative impact on performance using a comprehensive disclosure index and multiple performance measures.

This study addresses these gaps by constructing a 15-criterion Green Banking Disclosure Index (GBDI) and examining its relationship with both accounting-based (ROA, ROE) and market-based (Tobin's Q) performance measures for 20 Vietnamese commercial banks over the period 2016–2024, while controlling for key bank characteristics.

2.2. Theoretical basis

- **Stakeholder Theory** (Freeman, 1984): Banks that actively disclose green banking information demonstrate responsiveness to the expectations of diverse stakeholders (customers, investors, regulators, and communities). Meeting these expectations fosters stronger relationships, enhances legitimacy, and leads to improved financial outcomes.

- **Legitimacy Theory**: Organizations seek to align their actions with societal norms and expectations to maintain their “license to operate.” Comprehensive green banking disclosure helps banks legitimize their operations in the eyes of society, particularly amid growing environmental concerns, thereby reducing regulatory risks and enhancing long-term financial performance.

- **Signaling Theory** (Spence, 1973): In the presence of information asymmetry, high-quality green banking disclosure acts as a credible signal of a bank's commitment to sustainability and strong governance. This positive signal can attract capital, reduce financing costs, and improve market perception, ultimately translating into superior financial performance.

These theoretical perspectives collectively suggest a positive relationship between the level of green banking information disclosure and banks' financial performance.

2.3. Hypothesis Development

Drawing on the three theoretical perspectives and the mixed empirical evidence reviewed above, this study proposes the following hypotheses:

H1: Green banking information disclosure has a positive effect on the financial performance of Vietnamese commercial banks.

In addition, bank-specific characteristics are expected to influence financial performance:

H2: Bank-specific characteristics affect the financial performance of Vietnamese commercial banks.

3.0 RESEARCH MODEL

Data sources are collected from the annual reports, sustainability/ESG reports and audited financial statements (consolidated or separate) of 20 Vietnamese commercial banks listed or registered for trading on the Vietnam stock market (HOSE, HNX, UPCOM), covering the period 2016 - 2024 and forming an initial panel of 180 bank-year observations. Banks were retained in the sample only if they satisfied three conditions: (i) continuous operation throughout the research period, (ii) sufficient publicly available reports to score the GBDI index in every year, and (iii) sufficient financial data to compute the research variables; banks that did not meet these conditions were excluded to preserve the consistency of the panel dataset.

Grounded in stakeholder theory, legitimacy theory and signaling theory, the model evaluates financial performance from both the accounting and market perspectives, using ROA and ROE as accounting-based measures and Tobin's Q as a market-based measure. The independent variable is the Green Banking Disclosure Index (GBDI), quantified through manual content analysis of banks' public disclosures using an unweighted, dichotomous scoring method (1 point if a criterion is disclosed in a given year, 0 otherwise) applied across a set of 15 criteria; this scoring framework builds on prior disclosure-index studies (Bose et al., 2018; Rahman et al., 2021; Rahmamita & Kahar, 2020; Trần Nguyễn Sa & Hạ Thị Thiều Dao, 2023) to fit Vietnam's legal context and banking practices. Three bank-specific control variables - bank size (SIZE), the cost-to-income ratio (CIR), and the capital adequacy ratio (CAR) - are added to prevent the estimated effect of GBDI from being confounded by differences in bank characteristics.

The general panel data regression model is specified as:

$$Y_{it} = \beta_0 + \beta_1 \times GBDI_{it} + \beta_2 \times SIZE_{it} + \beta_3 \times CIR_{it} + \beta_4 \times CAR_{it} + U_{it}$$

Which yields three specific equations corresponding to the three performance measures?

$$ROA_{it} = \beta_0 + \beta_1 \times GBDI_{it} + \beta_2 \times SIZE_{it} + \beta_3 \times CIR_{it} + \beta_4 \times CAR_{it} + U_{it}$$

$$ROE_{it} = \beta_0 + \beta_1 \times GBDI_{it} + \beta_2 \times SIZE_{it} + \beta_3 \times CIR_{it} + \beta_4 \times CAR_{it} + U_{it}$$

$$Tobin'S Q_{it} = \beta_0 + \beta_1 \times GBDI_{it} + \beta_2 \times SIZE_{it} + \beta_3 \times CIR_{it} + \beta_4 \times CAR_{it} + U_{it}$$

Where i denotes the bank, t denotes the observation year, and U_{it} is the random error term.

Table 1: Signs of the expected values of the variables in the model

Variable	Description	Measurement	Sign of Expectation	The studies have used variables
<i>Dependent</i>				
ROA	Return on Assets	$ROA = \frac{\text{Net Income}}{\text{Average Total Assets}}$		Golin and Delhaise (2013), Berger and Humphrey (1997), Dietrich and Wanzenried (2011), (Rose & Hudgins, 2013)
ROE	Return on Equity	$ROE = \frac{\text{Net Income}}{\text{Average Shareholders' Equity}}$		Brealey, Myers and Allen (2017) (Saunders & Cornett, 2019) Goddard and partners (2011)
Tobin's Q	The market value of a firm	$Tobin's\ Q = \frac{\text{Market Value of Equity} + \text{Book Value}}{\text{Book Value of Total Assets}}$		Lindenberg và Ross (1981) Chung và Pruitt (1994)
<i>Independent</i>				
GBDI	Index measuring the level of green banking disclosure at banks		+	Bose et al., 2018; Rahman et al., 2021; Tran Nguyen Sa and Ha Thi Thieu Dao (2023)
<i>Control</i>				
CIR	The Cost-to-Income Ratio	$CIR = \frac{\text{Total Operating Expenses}}{\text{Total Operating Income}} \times 100$	-	Athanasoglou, Brissimis và Delis (2008)
SIZE	Bank size	$SIZE = \ln(\text{Total Assets})$	+	Berger và Humphrey (1997)
CAR	The Capital Adequacy Ratio	$CAR = \frac{\text{Total Regulatory Capital}}{RWA + 12.5 \times (KOR + KMR)}$	+	Benlaria và Mouna (2025)

(Source: Compiled by the authors themselves)

Data on GBDI were compiled from annual reports and sustainability/ESG reports, while ROA, ROE, Tobin's Q and the control variables were computed from audited financial statements; after collection, all data were standardized in unit and recording format and organized into a bank–year

panel structure. The number of valid observations differs slightly across variables - 180 for ROA, ROE, GBDI, SIZE and CIR, 174 for CAR, and 154 for Tobin's Q - due to differences in stock listing history and the availability of market-value data across the 2016-2024 period. Panel data regression, together with the associated diagnostic and correction procedures, was carried out using Stata software.

4.0 RESEARCH RESULTS

4.1. Descriptive Statistics and Correlation Analysis

The dataset consists of balanced panel data for 20 Vietnamese commercial banks over the period 2016–2024, yielding 180 observations. However, the number of valid observations varies across variables due to data availability: Tobin's Q has 154 observations and CAR has 174 observations. Missing values were treated as such and automatically excluded by Stata during model estimation.

Table 2: Descriptive statistics for the variables

Variable	Number of observations	Mean value	Standard deviation	Minimum value	Maximum value
ROA	180	0.0135097	0.0087597	0.0002	0.0745681
ROE	180	0.6426893	2.879528	0.0032482	20.61
Tobin's Q	154	1.046441	0.0934426	0.8988222	1.68
GBDI	180	0.3030709	0.2735001	0	1
SIZE	180	11.25315	2.756055	5.432721	14.83103
CAR	174	0.1176963	0.0197444	0.073	0.1712
CIR	180	0.4411585	0.1361691	0.000000325	0.8962125

(Source: Compiled by the authors themselves)

Table 2 presents the descriptive statistics of the variables. Overall, the variables exhibit reasonable distributions without extreme outliers after data cleaning. The mean ROA is 0.0135 (1.35%), ranging from 0.0002 to 0.0746, which is consistent with the profitability level of Vietnamese commercial banks. The mean ROE is 0.6427, with a wide range reflecting significant variation in equity efficiency across banks. Tobin's Q has a mean of 1.046 (ranging from 0.899 to 1.68), indicating that market values are generally close to or slightly above book values. The Green Banking Disclosure Index (GBDI) averages 0.303, suggesting a moderate level of green banking information disclosure with considerable variation among banks. The control variables (SIZE, CAR, and CIR) also show appropriate variation consistent with the banking sector in Vietnam.

The research team conducted a correlation matrix analysis, and the results showed a low-to-moderate linear relationship among the variables. ROA and ROE were virtually uncorrelated (-0.0182 , $p=0.8088$). Tobin's Q was significantly positively correlated with ROA ($r = 0.2485$, $p = 0.0019$) but not significantly correlated with ROE. GBDI was not significantly correlated with either ROA or ROE. CAR is positively correlated with ROA ($r = 0.2326$, $p = 0.0020$), while SIZE ($r = -0.3265$) and CIR ($r = -0.5273$) are both significantly negatively correlated with ROA. Since the absolute correlation coefficients of the independent variables are less than 0.6, there is no severe multicollinearity, and they can be used simultaneously in the regression model.

4.2. Regression Analysis

To assess the impact of green banking disclosures on financial performance indicators, this study conducted regression analyses using panel data regression methods (Pooled OLS, Fixed Effects, and Random Effects). Model selection tests (Hausman test), multicollinearity tests (VIF, Wooldridge test for autocorrelation), and clustered standard errors were applied. This clarifies the impact of green banking disclosures on various financial indicators, specifically:

4.2.1. Results for ROA

To choose between Fixed Effects (FE) and Random Effects (RE) models, the Hausman test was conducted. The test result is: $\chi^2(4) = 22.28$, $\text{Prob} > \chi^2 = 0.0002$

Since the p-value is less than 0.05, the null hypothesis is rejected. Therefore, the Fixed Effects (FE) model is appropriate for the ROA model.

Multicollinearity Test: The mean Variance Inflation Factor (VIF) is 1.26, with all individual VIF values below 2. There is no multicollinearity problem among the explanatory variables.

Autocorrelation Test (Wooldridge): $F(1, 19) = 79.46$, $\text{Prob} > F = 0.0000 \rightarrow$ There is first-order autocorrelation in the model.

After correcting for autocorrelation using clustered standard errors, the final Fixed Effects regression results for ROA are as follows:

$$ROA_{it} = 0.0202164 + 0.0073429 \times GBDI_{it}$$

In the cluster-adjusted ROA model, only the Green Bank Disclosure Index (GBDI) variable showed a positive and statistically significant impact. This indicates that when the level of green bank disclosure increases by 1 unit, the bank's ROA increases by an average of 0.00734 units, under the condition that other factors remain constant. The control variables, including SIZE, CAR, and CIR, were not statistically significant and therefore were not included in the reduced regression equation. Furthermore, the overall significance test of the model yielded a $\text{Prob} > F = 0.0104$, indicating that the model is statistically significant overall and suitable for analyzing the factors affecting ROA.

4.2.2. Results for ROE

To choose between Fixed Effects (FE) and Random Effects (RE) models, the Hausman test was conducted. The test result is: $\chi^2(4) = 10.23$, $\text{Prob} > \chi^2 = 0.0368$. Since the p-value is less than 0.05, the null hypothesis is rejected. Therefore, the **Fixed Effects (FE) model** is appropriate for the ROE model.

Multicollinearity Test: The mean Variance Inflation Factor (VIF) is 1.28, with all individual VIF values below 2. There is no multicollinearity problem among the explanatory variables.

Autocorrelation Test (Wooldridge): $F(1, 19) = 17719.565$, $\text{Prob} > F = 0.0000 \rightarrow$ There is first-order autocorrelation in the model.

In the cluster-adjusted ROE model, none of the variables (including GBDI, SIZE, CAR, and CIR) were statistically significant. Therefore, there is no empirical evidence to suggest that green banking disclosure or banking characteristics impacted ROE during the study period.

Furthermore, the overall significance test of the model yielded a $\text{Prob} > F = 0.8779$, indicating that the model is not statistically significant overall in explaining the variability of ROE.

4.2.3. Results for Tobin's Q

To choose between Fixed Effects (FE) and Random Effects (RE) models, the Hausman test was conducted. The test result is: $\chi^2(4) = 0.61$, $\text{Prob} > \chi^2(4) = 0.9620$.

Since the p-value is greater than 0.05, the null hypothesis cannot be rejected. Therefore, the **Random Effects (RE) model** is appropriate for the Tobin's Q model.

Multicollinearity Test: The mean Variance Inflation Factor (VIF) is 1.26, with all individual VIF values below 2. There is no multicollinearity problem among the explanatory variables.

Autocorrelation Test (Wooldridge): $F(1, 19) = 0.403$, $\text{Prob} > F = 0.5333 \rightarrow$ There is no first-order autocorrelation in the model.

The final Random Effects regression results for Tobin's Q are as follows:

$$\text{Tobin's } Q_{it} = 1,13018 - 0.11542 \times \text{CIR}_{it}$$

In the Tobin's Q model after adjusting for cluster standard errors, only the CIR variable had a statistically significant and negative impact, while the GBDI, SIZE, and CAR variables were not statistically significant. Therefore, there is no empirical evidence to suggest that green banking information disclosure impacts the market value of banks during the study period.

Furthermore, the overall significance test of the model yielded a $\text{Prob} > \chi^2 = 0.0305$, indicating that the model is statistically significant overall in explaining the variability of Tobin's Q.

Table 3: Summary of Regression Results

Variable	ROA (FE)	ROE (FE)	Tobin's Q (RE)	General Conclusion
GBDI	(0.007349)*	Not significant	Not significant	Only affects ROA
SIZE	Not significant	Not significant	Not significant	No clear effect
CAR	Not significant	Not significant	Not significant	No clear effect

CIR	Not significant	Not significant	(-0.115424)**	Impact on market value
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Note: *** $p < 0.01$; ** $p < 0.05$.

(Source: Compiled by the authors themselves)

The findings of this study indicate that the Green Bank Data Index (GBDI) exerts a significant and substantial influence on the Return on Assets (ROA) metric. It has been demonstrated that enhancing the transparency of financial institutions can improve the efficiency of their operations and enhance their performance.

Notwithstanding, during the research period, no statistical evidence was found to demonstrate the impact of GBDI on ROE and Tobin's Q. This indicates that the impact of the disclosure of financial information by the banking sector may be contingent on the effectiveness of the measures employed to assess its performance. Tobin's Q is a concept that has been utilized to measure the impact of financial market fluctuations on the cost and value of a company's assets. In essence, it functions as a counterbalance to the prevailing financial analysis, offering a novel perspective on the relationship between market efficiency and the financial implications of economic transactions. It is hypothesized that the impact of GBDI on Tobin's Q will require further temporal analysis or additional market conditions conducive to the manifestation of its full implications.

It is evident that the impact of the disclosure of financial information by the banking sector on its financial performance is not uniform across all metrics. The evidence is most clearly demonstrated by the return on assets (ROA) during the examined period.

5.0 DISCUSSIONS AND CONCLUSIONS

5.1. Summary and Discussion

Empirical results indicate that green banking disclosure contributes to improved bank performance. The GBDI variable shows a positive and statistically significant coefficient in the ROA model, whereas its impact on ROE and Tobin's Q is not statistically significant. The GBDI index has a positive and statistically significant effect on ROA at the 1% significance level ($\beta = 0.00734$). The study finds no evidence that GBDI affects Return on Equity (ROE) or market value (Tobin's Q). These findings suggest that enhanced disclosure regarding green banking activities is primarily associated with increased asset efficiency. The lack of a significant impact of GBDI-related green banking practices on Tobin's Q implies that the market has not fully factored green banking disclosures into its valuations. Investors may perceive current disclosures as lacking standardization and comparability, or as focusing more on general commitments than on measurable environmental outcomes. Furthermore, the absence of independent assurance and unified green classification criteria may undermine the credibility of the disclosed information. Consequently, the market may struggle to distinguish between banks that genuinely integrate environmental factors into their business strategies and those that primarily use green disclosures for image-building purposes.

Beside, bank size and the capital adequacy ratio do not have statistically significant effects across the three performance indicators. These results imply that neither scale nor capital adequacy alone

guarantees superior performance. Large banks may benefit from economies of scale but also face higher administrative complexity and operating costs. Likewise, maintaining adequate capital strengthens financial stability, but capital buffers do not automatically generate higher profitability unless they are allocated effectively to productive and well-managed assets.

Moreover, the important result is the negative and statistically significant effect of CIR on Tobin's Q. The Cost-to-Income Ratio (CIR) has a significant negative effect on Tobin's Q, indicating that the market continues to evaluate banks primarily based on their ability to control operating costs. Since a higher CIR represents lower operating efficiency, the result relates to the operating costs. This finding has an important implication for green banking: environmental initiatives should not be implemented as separate, compliance-oriented programmes that increase administrative expenses without producing measurable financial or environmental benefits. Instead, green banking should be integrated into digital transformation, credit risk management, product development, and operational restructuring. Based on these findings, regulators should first establish a standardized green banking disclosure framework with clear definitions, comparable indicators, and measurable outcomes. Disclosures should include green credit volume, financed emissions, environmental risk exposure, non-performing green loans, resource savings, and the financial contribution of green products.

Green banking should be incorporated into corporate strategy and performance management. Banks should establish board-level oversight, assign clear responsibilities, and include green finance indicators in the performance evaluation of relevant departments. They should also invest in environmental data systems and staff capacity to identify, measure, and monitor environmental and climate-related risks. Green products should be developed based on commercial viability, appropriate pricing, and rigorous credit assessment. Last but not least, banks should control the effect of green implementation on CIR by prioritizing digital and process-based solutions. Automated environmental screening, centralized data collection, electronic documentation, and integration of green criteria into existing credit systems can reduce compliance costs.

5.2. Contributions of the study

- *Theoretical Contributions:*

Foundational theoretical framework: The study integrates Stakeholder Theory, Legitimacy Theory, and Signaling Theory to explain the mechanisms through which green disclosure influences financial performance. Development of the GBDI index: A comprehensive index comprising 15 specific criteria grouped into four dimensions (Policies, Core Business Activities, Internal Operations, and Compliance) was developed to suit the Vietnamese regulatory context, including Circular No. 96/2020/TT-BTC. Robust quantitative methodology: The study employs panel data regression models (Fixed Effects and Random Effects) combined with cluster-robust standard errors to ensure the reliability of the empirical findings.

- *Practical Contributions:*

+ For commercial banks: Banks should provide more specific and measurable green disclosures (e.g., the proportion of green loans and emission reduction achievements) rather than relying solely

on general commitments. Integrating ESG considerations into the credit appraisal process can improve asset quality.

+ For regulators: The study recommends improving the regulatory framework for sustainability disclosure, developing a unified Green Taxonomy, and encouraging banks to incorporate ESG risks into their Internal Capital Adequacy Assessment Process (ICAAP).

5.3. Conclusion and Suggestions for Future Research

This research provides quantitative evidence over an extended period (2016–2024). Its key contribution lies in identifying the differentiated effects of green disclosure: while green disclosure has begun to enhance banks' internal operational performance (ROA), it has not yet generated sufficient momentum to alter investor expectations in the capital market, as reflected by Tobin's Q. Despite achieving its core objectives, this study identifies several unresolved boundaries that chart prospective pathways for future investigation: (i) Exploration of Lagged and Endogeneity Effects: Given that sustainable green initiatives are structurally long-term investments, future designs should evaluate the time-lagged effects of disclosure; (ii) Decomposition of the Composite GBDI: Future inquiries should disaggregate the composite GBDI score into its independent components (such as Governance, Product Innovation, or Internal Operations) to isolate which specific dimension yields the most potent driving force for financial returns; (iii) Integration of Macro-Dynamics: Research could expand by examining the role of brand equity, corporate reputation, or customer trust as mediating/moderating variables. Additionally, introducing macro-level controls (e.g., GDP growth, inflation, and interest rate shocks) and performing sub-sample analyses (State-owned vs. Joint-stock banks; Large-scale vs. Small-scale banks) would comprehensively map the strategic adjustments within the banking landscape amidst economic volatility.

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