

The Influence of Environmental, Social, Governance Disclosure and Investment Opportunity Set on Company Value Moderated by Good Governance in the Banking Industry in Indonesia

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ABSTRACT

This study aims to analyze and compare the effects of Environmental, Social, and Governance (ESG) disclosure and the Investment Opportunity Set (IOS) on firm value, while examining the moderating role of Board of Directors (BOD) size in state-owned and private banks. Utilizing a quantitative approach with panel data, the sample comprises 6 state-owned banks and 17 private banks from 2020 to 2025. Data analysis was conducted using panel data regression via EViews 13. The empirical results reveal a significant difference in the impact of ESG disclosure between the two bank categories; ESG disclosure has a significant negative effect on firm value in state-owned banks, whereas it exerts a significant positive effect in private banks. Meanwhile, IOS consistently demonstrates a significant positive impact on firm value across both bank groups, showing no significant difference between them. Regarding the moderating effects, BOD size is found to influence firm value but fails to significantly moderate the relationship between ESG disclosure and firm value in either bank type. Conversely, a significant difference is observed in how BOD size moderates the IOS-firm value relationship; BOD size significantly strengthens (positively moderates) this relationship in state-owned banks, but significantly weakens (negatively moderates) it in private banks

INTRODUCTION

Business competition has become exceptionally fierce. Globally, business competition has evolved into a complex and dynamic phenomenon, heavily driven by advanced technological developments, innovative strategic frameworks, and increasingly diverse market demands. The technological transformations in the Industry 4.0 era enable businesses to expand rapidly, operate cost-effectively, innovate continuously, and deliver superior services. This intensifying global competition forces companies to adapt to business models and strategies that emphasize business sustainability, innovation, and eco-friendly products.

Concurrently, the modern market demands that industries pursue an energy transition that prioritizes environmental responsibility. Sustainable global competition now compels companies to integrate digitalization, advanced technology, circular economy principles, and eco-friendly products to maximize resource efficiency and minimize waste. Furthermore, technological innovation is critical to ensuring sustainable yet highly reliable supply chains (Hamdouna & Khmelyarchuk, 2025).

The banking sector plays a pivotal role in managing systemic risks to safeguard financial system stability; consequently, market sentiment significantly shapes banking operations. By integrating Environmental, Social, and Governance (ESG) principles into banking operations through sustainable business strategies – such as investing in green projects and adopting responsible guidelines in every policy – banks can address the social and environmental impacts of their operations. This integration not only mitigates negative externalities but also enhances investment attractiveness and strengthens market positioning (Daroshka et al., 2023).

Firm value represents a crucial metric in investment decisions, reflecting investors' perceptions of a company's performance and long-term prospects. It serves as a benchmark for investor assessment regarding a firm's operational success and market value creation, which is directly mirrored in stock prices and market ratios. These ratios indicate a company's future prospects, acting as an essential evaluation tool for shareholders (Ningrum, 2021). In the banking sector, firm value is not merely confined to profitability; it is deeply intertwined with maintaining operational stability, securing stakeholder trust, and ensuring business sustainability. Implementing fundamental corporate values and adhering to business sustainability compliance send a vital signal to investors evaluating the future potential of listed issuers. However, the efficacy of these signals depends heavily on how efficiently market sentiment adapts to such information in forming prices. Stock prices serve as an ideal proxy for firm value, as firm value can be viewed as management's capability to maximize shareholder wealth through stock price appreciation (E. S. Utami & Hasan, 2021).

Based on stock price movements within the Infobank15 Index, the stock index experienced a notable decline from 1269.55 to 1033.55 between the second semester of 2023 and the second semester of 2025. This downward trend indicates that the banking sector faced underlying fundamental challenges that issuers struggled to withstand, resulting in diminished investor valuations. Therefore,

when listed issuers cannot structurally halt stock price depreciation based on financial fundamentals alone, supplementary signals are required to guarantee long-term business viability. Highly valued firms typically demonstrate strong reputations and superior performance; thus, comprehensive information disclosure can provide positive signals that guide investors in making buy or sell decisions (Handoko & Michaela, 2021).

One critical signal that banks can leverage is ESG disclosure. ESG disclosure serves as a corporate communication tool through non-financial reports detailing environmental, social, and governance management to inform stakeholders. ESG frameworks are widely utilized to measure and evaluate a company's sustainability performance, comprising three core dimensions: environment, social, and governance (Saini et al., 2025).

Several empirical studies indicate that ESG disclosure exerts a significant positive effect on enhancing firm value (Aditya & Hasnawati, 2025; Machmuddah & Utomo, 2024; Saini et al., 2025; Amirah et al., 2024)). Other studies observe that while ESG positively and significantly affects firm value, its mechanism operates indirectly (Aouadi & Marsat, 2018). Furthermore, ESG scores have been shown to positively influence firm value over the long term (Wedajo et al., 2024). This positive relationship is supported by evidence that ESG integration mitigates risks, optimizes operational efficiency, fosters stakeholder trust, and ultimately drives superior financial performance (Febriantoko et al., 2025). Conversely, contrasting empirical evidence reveals that ESG disclosure can also exert a significant negative impact on firm value (Dihardjo & Hersugondo, 2023; Ningwati et al., 2022; Oktadewi & Diantini, 2025; Dewinda, 2025).

Beyond ESG, another factor hypothesized to influence firm value is the Investment Opportunity Set (IOS). The IOS reflects a firm's prospective opportunities through physical and human capital investments. It is largely embodied in assets-in-place and generated through experience curves and organizational learning-by-doing; hence, a firm's capability is demonstrated by how it creates future value through strategic resource allocation ((Miroshnychenko et al., 2020)). Prior literature has widely examined the relationship between the IOS and firm value, finding that a larger IOS significantly enhances firm value (Alam Afridi et al., 2022; Andaswari et al., 2019; Chabachib et al., 2020; Giriati, 2016; Muadz & Sastradipraja, 2024; Putri & Suzan, 2025; Sudyatno et al., 2023; N. P. Utami & Paramita, 2024; Zenabia & Falih, 2024). However, other studies provide contradicting results, showing that the IOS has a positive but non-significant effect on firm value maximization (Angela & Oktavianti, 2025; Indrayati et al., 2021; Novita et al., 2024; Rismawandi & Martini, 2025)

Additionally, extensive research indicates that good corporate governance (GCG) functions as a robust moderator of firm value. Good governance establishes a set of rules, processes, and structures ensuring that corporate operations are executed accountably to benefit all stakeholders (Rahman & Tiwari, 2021). Several studies demonstrate that GCG positively and significantly enhances firm value. In practice, corporate governance mechanisms—such as board size, board independence, and audit quality—effectively moderate the

impact of ESG disclosure on firm value ((Brogi & Lagasio, 2025; Choi et al., 2024; Moussa & Elmarzouky, 2023; Suranta et al., 2025). The moderating role of GCG on the ESG disclosure-firm value relationship also varies across specific industries. For instance, non-manufacturing firms exhibit a stronger positive moderating relationship compared to manufacturing firms (Hussain et al., 2024). Other empirical findings confirm that GCG directly influences firm value (Azizah et al., 2025). However, in certain cases, GCG mechanisms display a negative interaction with Corporate Social Responsibility (CSR) disclosure; while GCG enhances firm value, this appreciation is not driven by increased CSR disclosures (Worokinasih & Zaini, 2020). Similarly, recent literature demonstrates that board size fails to moderate the effect of ESG disclosure on firm value, whereas audit committee meeting frequency successfully moderates this relationship (Laksmana et al., 2025)). Regarding investment metrics, studies indicate that the interaction between the IOS and GCG mechanisms can maximize firm value, suggesting that firms possessing valuable investment opportunities coupled with stringent GCG practices achieve optimal market valuation (Hsiao et al., 2011). Nonetheless, a counter-narrative suggests that GCG cannot significantly moderate the effect of the IOS on firm value ((Hanum & Zahra, 2025; Suryadi et al., 2024). To address potential specification bias, this study incorporates control variables such as Non-Performing Loans (NPL), given that elevated credit risk in banking can erode corporate profitability and subsequently suppress firm value.

In contrast to prior literature (Hanum & Zahra, 2025; Laksmana et al., 2025; Maryati & Anggraini, 2023; Rupilu & Tanan, 2022; Sari et al., 2025; Suryadi et al., 2024; Truong, 2025; Laksmana et al., 2025) this study focuses specifically on banking institutions listed on the Indonesia Stock Exchange (IDXFinance) over the 2020–2025 period. The sample is restricted to banks within the KBMI 2, 3, and 4 classifications that have consistently reported their ESG activities throughout the 2020–2025 timeframe. Prompted by the aforementioned empirical gaps, this study aims to analyze and compare the effects of Environmental, Social, and Governance (ESG) disclosure and the Investment Opportunity Set (IOS) on firm value, while explicitly examining and comparing the moderating role of Board of Directors (BOD) size between state-owned and private banking institutions.

LITERATURE REVIEW

A. Signaling Theory

Signaling theory explains how decision-makers utilize signaling mechanisms to mitigate uncertainty arising from incomplete and asymmetrically distributed information. In this context, a signal refers to an observable action that conveys information regarding unobservable attributes and potential future outcomes. Fundamentally, this theory argues that companies can enhance investor confidence by proactively disclosing credible corporate governance practices to the market. This action effectively reduces information asymmetry between managers and investors. Consequently, investors routinely base their investment decisions on the signals received from the firm, such as transparent governance practices or information concerning the board of directors ((Quang Trinh, 2022).

B. Agency Theory

Agency theory is a foundational concept in corporate finance, initially formulated by Jensen and Meckling (1976). This theory stems from the modern reality of corporate structures characterized by the separation of ownership and control. Essentially, a firm is viewed as a nexus of contractual relationships among various parties, where conflicts of interest frequently emerge. The primary conflict occurs between the principal (the owners or shareholders) and the agent (the managers authorized to operate the firm) (Principale, 2023).

This conflict arises because the objectives of the agent and the principal are not always aligned. While the principal aims to maximize profitability and investment returns, the agent may be more motivated to increase personal compensation or expand managerial power, even if such actions deviate from the firm's best interests. This divergence creates information asymmetry, wherein agents possess more granular information regarding day-to-day operations than the principals, making it challenging for principals to monitor every managerial action effectively. To mitigate this potential opportunistic behavior, firms must incur agency costs (Quang Trinh, 2022).

C. Firm Value

Firm value represents a vital metric in investment decisions, serving as a reflection of investors' perceptions regarding a company's performance and long-term prospects. It embodies investor assessment of corporate performance and the firm's success in creating market value, which is explicitly mirrored in stock prices and market ratios. These ratios indicate the company's future prospects, acting as an essential benchmark for shareholders (Ningrum, 2021). This implies that firm value serves as a potent signal to investors, which is continuously embedded in the prevailing stock market price.

D. Environmental, Social, and Governance (ESG) Disclosure

ESG disclosure is a corporate communication mechanism utilized to demonstrate a firm's commitment to driving business sustainability. This is achieved by addressing three core dimensions—environmental, social, and governance—and reporting the firm's milestones within these areas. The disclosed information is evaluated by stakeholders to gauge corporate commitment toward sustainability, which ultimately influences stakeholder decisions regarding their interaction with the firm and its ESG initiatives (Khamisu & Paluri, 2024). Prior literature explains that, theoretically, ESG disclosures are reported using a stakeholder perspective; thus, ESG disclosure functions to accommodate and secure stakeholder legitimacy within the firm's operational framework (da Cunha et al., 2025).

E. Investment Opportunity Set (IOS)

According to Myers (1977), as cited in Miroshnychenko et al. (2020), the Investment Opportunity Set (IOS) represents the value of growth prospects that depend on discretionary future investments, which are used to evaluate corporate success in expansions, acquisitions, and product development. The IOS is a concept that illustrates a firm's growth potential driven by its investment

decisions. It reflects prospective opportunities through both physical and human capital investments, largely embodied in assets-in-place and generated through experience curves and organizational learning-by-doing. Consequently, a firm's internal capability is demonstrated by how it generates future value through the strategic deployment of its existing resources ((Miroshnychenko et al., 2020)

F. Good Corporate Governance (GCG)

Corporate governance is defined as a set of relationships linking a company's management, its board, its shareholders, and other stakeholders. Meanwhile, according to the Cadbury Committee, corporate governance is the system by which business corporations are directed and controlled, to balance stakeholder power to ensure business sustainability while maintaining accountability to all stakeholders. Furthermore, as stated by Effendi (2009) in sudarmanto et al. (2021), GCG functions as an internal corporate control system designed to manage significant risks, thereby achieving business objectives by safeguarding corporate assets and maximizing shareholder investment value over the long term.

Based on the theoretical framework, empirical phenomena, and prior research findings, the conceptual framework of this study is structured as follows:

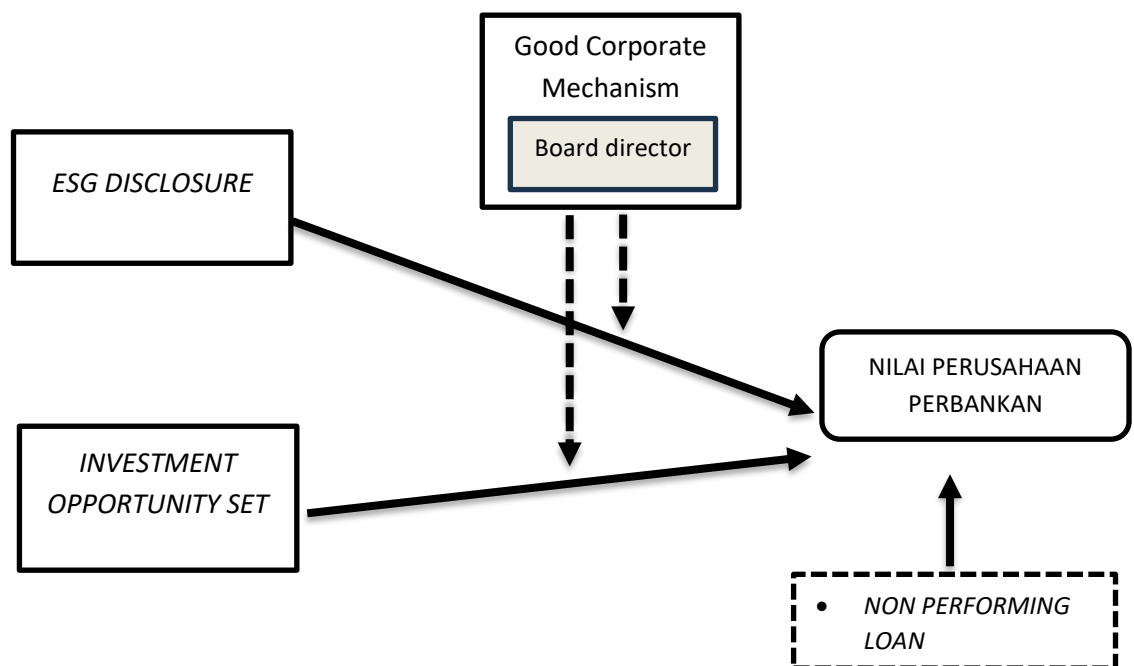


Figure 1. Model Research

Based on the conceptual framework, the hypotheses of this study are formulated as follows:

- H1: ESG disclosure has a significant positive effect on firm value in state-owned banks.
- H2: ESG disclosure has a significant positive effect on firm value in private banks.

- H3: There is a significant difference in the relationship between ESG disclosure and firm value between state-owned and private banks.
- H4: The Investment Opportunity Set (IOS) has a significant positive effect on firm value in state-owned banks.
- H5: The Investment Opportunity Set (IOS) has a significant positive effect on firm value in private banks.
- H6: There is a significant difference in the relationship between the Investment Opportunity Set (IOS) and firm value between state-owned and private banks.
- H7: Board of directors size significantly strengthens the positive relationship between ESG disclosure and firm value in state-owned banks.
- H8: Board of directors size significantly strengthens the positive relationship between ESG disclosure and firm value in private banks.
- H9: There is a significant difference in the moderating effect of Board of Directors size on the relationship between ESG disclosure and firm value between state-owned and private banks.
- H10: Board of directors size significantly strengthens the positive relationship between the Investment Opportunity Set (IOS) and firm value in state-owned banks.
- H11: Board of directors size significantly strengthens the positive relationship between the Investment Opportunity Set (IOS) and firm value in private banks.
- H12: There is a significant difference in the moderating effect of Board of Directors size on the relationship between the Investment Opportunity Set (IOS) and firm value between state-owned and private banks.

METHODOLOGY

This study employs a quantitative approach with an associative research design. The dependent variable is firm value, proxied by Tobin's Q. The independent variables include Environmental, Social, and Governance (ESG) disclosure and the Investment Opportunity Set (IOS). ESG disclosure is evaluated based on the Global Reporting Initiative (GRI) standards, utilizing a dummy variable weighting system derived from the disclosures aligned with the 2016 and 2021 GRI standards. The second independent variable, IOS, is proxied by the market-to-book equity ratio. Good Corporate Governance (GCG) serves as the moderating variable, proxied by the board of directors' size, while Non-Performing Loans (NPL) are incorporated as the control variable.

This study utilizes panel data tracking banking institutions in Indonesia listed on the Indonesia Stock Exchange (IDXFinance). Purposive sampling was implemented based on specific criteria: commercial banks categorized within the KBMI 2, 3, and 4 classifications that consistently issued sustainability or annual reports. Consequently, the final sample consists of 23 banks, comprising 6 state-owned banks and 17 private banks.

Data analysis was conducted using panel data regression models evaluated through EViews 13 software. To identify the most appropriate estimation model among the Common Effect Model (CEM), Fixed Effect Model

(FEM), and Random Effect Model (REM), this study applies the Chow test, Hausman test, and Lagrange Multiplier (LM) test. Classical assumption tests, including normality, heteroskedasticity, multicollinearity, and autocorrelation tests, were also executed to ensure model robustness. Finally, the empirical models were validated using hypothesis testing alongside goodness-of-fit evaluations consisting of the F-test and the coefficient of determination (R²).

RESEARCH RESULTS

A. Panel Data Model Estimation Tests

Model selection is a fundamental procedure in panel data regression analysis, aimed at determining the most appropriate estimation approach. To identify the optimal model, specific econometric evaluations—namely the Chow test and the Hausman test—were conducted. The Chow test is specifically utilized to evaluate and select the superior estimation model between the Fixed Effect Model (FEM) and the Common Effect Model (CEM)/Pooled Regression Model. The empirical results of these model selection tests are detailed below.

Table 1. Uji Estimasi Model Terbaik

Classification	Test Name	Results	Description
Estimation Model for State-Owned Banks	<i>Chow test</i>	Prob > F = 0.0011	Reject H ₀ ; FEM is preferred over CEM.
	<i>Hausman test</i>	Omitted / Unable to compute	Cannot be executed due to insufficient observations.
Estimation Model for Private Banks	<i>Chow Test</i>	Prob > F = 0.0002	Reject H ₀ ; FEM is preferred to CEM.
	<i>Hausman test</i>	Prob > chi ² = 0.020	Reject H ₀ ; FEM is preferred over REM.

Source: Data Diolah (2026)

Based on the econometric evaluations presented in Table 1, the Chow test for the state-owned banks model yields a p-value (Prob > F) of 0.0011, which falls significantly below the standard alpha threshold ($\alpha = 5\%$). This result indicates the rejection of the null hypothesis (H₀), confirming that the Fixed Effect Model (FEM) is statistically superior to the Common Effect Model (CEM). Meanwhile, the Hausman test could not be executed because the software (EViews) was unable to process the calculation due to a limited number of cross-sectional observations relative to the parameters. Consequently, based on the completed selection sequence, the Fixed Effect Model (FEM) is identified as the optimal estimation approach for the state-owned banks dataset.

For the private banks model, the Chow test similarly suggests the utilization of the Fixed Effect Model, as the p-value of 0.0002 is below the 5% significance level, thereby rejecting H₀ in favor of FEM over CEM. Furthermore, the Hausman test yields a p-value (Prob > Chi²) of 0.0200, which is less than $\alpha =$

5%, leading to the rejection of the null hypothesis and confirming that FEM outperforms the Random Effect Model (REM). In summary, the diagnostics indicate that the Fixed Effect Model (FEM) provides the most robust and appropriate estimation framework for both the state-owned and private banking models.

B. Classical Assumption Tests

1. Normality Test

The normality test is performed to determine whether the variables are normally distributed, exhibit zero covariance, or show no correlation, thereby ensuring independence between the variables. In econometric analysis, a dataset is considered normally distributed if the test results are statistically non-significant at a specified significance level (α) (Gujarati & Porter, 2010). The empirical results of the normality evaluation, based on the skewness and kurtosis testing of the predicted residuals, are detailed below.

Table 2. Normality Test Results

Model	Variable	Obs	Pr(Skewness)	Pr(Kurtosis)	Jarque-Bera	Prob > Chi2
State-Owned Banks	Residual	36	0.4345	2.841	1.138	0.05660
Private Banks	Residual	107	-0.3356	3.0641	0.644	0.724

Source: Processed Data (2026)

The normality test results indicate that the error terms in both the state-owned and private banking models are normally distributed. This is evidenced by the Prob > Chi2 (Jarque-Bera probability) values, which exceed the standard significance threshold ($\alpha = 5\%$) recorded at 0.0566 for state-owned banks and 0.7240 for private banks. These statistics demonstrate that the datasets for both models successfully satisfy the classical assumption of normality.

2. Multicollinearity Test

The multicollinearity test is conducted to detect whether high correlations exist among independent variables, which would violate the assumption of predictor independence. Multicollinearity can be evaluated by analyzing the correlation matrix of the independent variables. If the correlation coefficients between variables are below 0.80, it indicates that the model is free from severe multicollinearity.

The empirical results for the multicollinearity assessment show that the data—which underwent mean-centering processing for both the state-owned and private bank models—exhibit no issues with multicollinearity. All correlation coefficients among the independent variables remain well below the 0.80 threshold. This confirms the absence of linear dependencies among the predictors, thereby satisfying the classical assumption for multicollinearity.

3. Heteroskedasticity Test

The heteroskedasticity test is performed to determine whether there is an unequal variance of the residuals across observations. If the variance of the residuals remains constant across observations, the condition is referred to as homoskedasticity. In this study, heteroskedasticity is evaluated using the Glejser test. Based on the Glejser test mechanism, if the independent variables do not significantly affect the absolute residuals (indicated by a p-value > 0.05), the model is considered free from heteroskedasticity issues, thereby satisfying the homoskedasticity assumption (Gujarati & Porter, 2010). The heteroskedasticity test results are presented below.

Based on the Glejser heteroskedasticity test results for the state-owned banks model, none of the independent variables exert a statistically significant effect on the absolute residuals. Thus, it can be concluded that the state-owned banks model is free from heteroskedasticity. Conversely, the private banks model reveals that the variables IOS, BD, ESG*BD, and IOS*BD significantly influence the absolute residuals (p-value < 0.05), indicating the presence of a heteroskedasticity issue. To address this limitation and ensure that the estimation model remains accurate, robust, and valid, the researcher applies the Estimated Generalized Least Squares (EGLS) cross-section weights method.

4. Autocorrelation Test

Autocorrelation is defined as the correlation between members of a series of observations ordered in time. The autocorrelation test is conducted to determine whether a correlation exists between the error term in period t and the error term in period $t-1$ (Gujarati & Porter, 2010). In this study, the Durbin-Watson (DW) test is utilized to detect autocorrelation in the panel data. The dataset is considered free from autocorrelation if it satisfies the criteria of $dU < dW \text{ stat} < 4 - dU$. The empirical results of the autocorrelation evaluation are presented below.

Table 4. Autocorrelation Test Results

Model	Parameter	value
State-Owned Banks	<i>Durbin Watson Stat</i>	1.872
Private banks	<i>Durbin Watson Stat</i>	1.6789

Source: Processed Data (2026)

Based on the results in Table 4, the Durbin-Watson (DW) statistics generally fall within the acceptable threshold of 1.5 to 2.5, recorded at 1.8720 and 1.6789. Specifically, for the state-owned banks model, the equation satisfies the condition of $1.8540 < 1.8720 < 2.1460$ ($dU < dW < 4 - dU$), indicating that there is no positive or negative autocorrelation in the panel regression.

Meanwhile, for the private banks model, the DW statistic falls within the zone of indecision for positive autocorrelation ($dL < dW < dU$), where $1.6750 < 1.6789 < 1.6971$. To mitigate this potential issue, because the private banks model

is estimated using the Estimated Generalized Least Squares (EGLS) approach, the autocorrelation issue is statistically resolved and corrected.

C. Hypothesis Testing (t-Test)

The hypothesis test, or t-test, is conducted to evaluate the partial effects of the independent variables on the dependent variable. In this study, hypothesis testing is executed separately for the state-owned and private banking models. This dual-model approach aims to distinctly analyze and contrast the individual impacts of the independent variables on firm value across both bank classifications.

1. State-Owned Banks Model

The empirical results of the hypothesis testing for the state-owned banks model, estimated using the Estimated Generalized Least Squares (EGLS) method, evaluate both the direct effects of the independent variables and the interaction effects of the moderating variable on the dependent variable as follows.

Table 6. t-Test Results for the State-Owned Banks Model

<i>Panel EGLS (cross-section Weights)</i>			<i>Number of obs</i>	=	35
			<i>F (9, 16)</i>	=	15.79
			<i>Prob > F</i>	=	0.000
			<i>Adj R- Squared</i>	=	0.7671
			<i>S.E. of regression</i>	=	0.0542
Variabel	<i>Robust</i>			Keterangan	
	<i>coefficient</i>	<i>Std. err.</i>	<i>P > t </i>		
<i>ESG disclosure</i>	-0.2903	0.1820789	0.0819	*	
<i>Investment opportunity set (IOS)</i>	0.8436	0.1355716	0.000	***	
<i>Board director Size (Bd)</i>	0.0151	0.003125	0.000	***	
<i>NPL</i>	-2.7710	0.905383	0.0048	***	
<i>ESG*BD</i>	0.0309	0.038828	0.4321	~	
<i>IOS*BD</i>	0.2503	0.036425	0.000	***	
<i>_Cons</i>	1.0314	0.010731	0.000	***	

Source: Processed Data (2026)

(Note: ***, *, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively, based on standard errors)

Based on the t-test results presented in Table 6, the panel data regression equation for the state-owned banks model is formulated as follows:

$$\begin{aligned} \text{Firm Value}_{it} = & 1.0314 - 0.2903 \text{ ESG Disclosure}_{it} + 0.8436 \text{ IOS}_{it} + 0.0151 \text{ BOD Size}_{it} \\ & - 2.7710 \text{ NPL}_{it} + 0.0309 (\text{ESG} \times \text{BD})_{it} + 0.2503 (\text{IOS} \times \text{BD})_{it} \\ & + \varepsilon_{it} \quad \dots (1) \end{aligned}$$

Based on the t-test results presented in Table 6, the constant value is 1.0314 (p-value = 0.0000), indicating that if all independent variables are held constant, the firm value of state-owned banks is projected to be at this level. Partially, ESG disclosure is found to have a significant negative effect at the 10% significance level (coefficient of -0.2903). This implies that every 1% increase in ESG disclosure is responded to by the market with a 29.03% decrease in firm value. Conversely, the Investment Opportunity Set (IOS) exerts a significant positive effect at the 1% significance level ($\alpha = 1\%$, coefficient of 0.8436), where every 1-unit increase in IOS will enhance firm value by 0.8436 units.

Meanwhile, regarding the moderating variable testing, the interaction between ESG disclosure and board of directors size (ESG*BD) shows a positive but non-significant result (p-value = 0.4321). Thus, it is concluded that board size is unable to moderate the effect of ESG disclosure on firm value. However, the interaction between IOS and board size (IOS*BD) has a significant positive effect at the 1% significance level ($\alpha = 1\%$, coefficient of 0.2503), proving that a larger board size significantly strengthens the positive impact of IOS on firm value (Tobin's Q). Finally, the control variable, NPL, is proven to have a significant negative effect at the 5% significance level, confirming its role in ensuring that the relationships among the primary variables are free from omitted variable bias.

2. Private Banks Model

The empirical results of the hypothesis testing for the private banks model, estimated using the Estimated Generalized Least Squares (EGLS) method, evaluate both the direct effects of the independent variables and the interaction effects of the moderating variable on the dependent variable as follows.

Table 7. t-Test Results for the Private Banks Model

Panel EGLS (Cross-section weighted)			Number of obs	=	102
Group variable: bank			Number of groups	=	17
			Prob (10, 16)	=	63,90
			R - Square	=	0.7020
			Adj. R- Square	=	0.6358
			Prob > F	=	0.0000
			(Std. err. adjusted for 17 clusters in bank)		
variabel	coefficient	Robust Std. err.	P > t	Keterangan (*, **, ***)	
ESGD	4.17046	0.7067	0.0020	***	
IOS	0.71875	0.2142	0.0202	**	
Bd	0.02177	0.0642	0.7484	~	
NPL	-34.0608	12.2621	0.0390	**	
ESG_BD	0.5867	0.47535	0.2719	~	
IOS_BD	-0.181273	0.04761	0.0125	**	
_Cons	-1.71888	0.1082	0.000	***	

Source: Processed Data (2026)

((Note: ***, *, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively, based on standard errors)

Based on the t-test results presented in Table 7, the panel data regression equation for the private banks model is formulated as follows:

$$\begin{aligned} \text{Firm Value}_{it} = & -1.7188 + 4.1706 \text{ ESG Disclosure}_{it} + 0.7187 \text{ IOS}_{it} - 0.0217 \text{ BOD Size}_{it} \\ & - 34.0608 \text{ NPL}_{it} + 0.5867 (\text{ESG} \times \text{BD})_{it} - 0.1812 (\text{IOS} \times \text{BD})_{it} \\ & + \varepsilon_{it} \quad \dots (2) \end{aligned}$$

Based on the regression analysis presented in Table 7, the constant value is estimated at -1.7188 and is statistically significant at the 1% level (p -value = 0.0010\$). This indicates that firm value is projected to decrease by 1.7188 units if all independent variables are held constant. Partially, ESG disclosure is proven to have a significant positive effect as a robust predictor of firm value (p -value = 0.0020), where every one-unit increase in ESG disclosure enhances the Tobin's Q value by 4.1704 units. Similarly, the Investment Opportunity Set (IOS) exerts a significant positive influence at the 5% significance level (α = 5%, p -value = 0.0200), with a regression coefficient of 0.71875, demonstrating a meaningful impact on increasing the Tobin's Q value of private banks. Regarding the moderating variable testing, the interaction between ESG disclosure and board of directors size (ESG*BD) is positive but statistically non-significant (P -value = 0.2719). Consequently, it is concluded that board size does not act as a moderating variable in this relationship. Conversely, the interaction between IOS and board size (IOS*BD) has a significant negative effect at the 5% significance level (α =5%, P -value = 0.0125) with a coefficient of -0.181273, indicating that the interaction between these two variables significantly dampens the Tobin's Q value. Finally, the control variable, NPL, shows a significant negative effect at the 5% significance level (α =5%, p -value = 0.0390), where every 1% increase in the NPL ratio is predicted to sharply reduce the Tobin's Q value by 34.06 units.

D. Goodness-of-Fit Tests

1. F-Test (Simultaneous Significance Test)

Based on the F-test results, the model feasibility evaluation demonstrates that the p -value ($\text{Prob} > F$) for both the state-owned and private banking models is 0.0000, which is significantly smaller than the alpha threshold (α = 0.05). Consequently, the null hypothesis (H_0) is rejected. This empirical finding indicates that all independent, moderating, and control variables included in the research model simultaneously and significantly influence firm value (Tobin's Q) across both banking classifications. In other words, the panel regression models constructed in this study are highly appropriate (fit) and possess strong predictive capabilities to explain the variations in firm value within the analyzed banking sectors.

2. Coefficient of Determination (R^2)

The coefficient of determination (R^2) is evaluated to measure the capacity of the combined independent, moderating, and control variables to explain the variance of the dependent variable, namely firm value (Tobin's Q). Based on the

panel regression estimation using the Estimated Generalized Least Squares (EGLS) approach, the results are specified as follows.

For the state-owned banks model, the Adjusted R-squared value is 0.7671. This demonstrates that the collective independent, moderating, and control variables account for 76.71% of the variation in the dependent variable, while the remaining 23.29% is explained by other external factors omitted from the model. Conversely, for the private banks model, the EGLS estimation yields an Adjusted R-squared value of 0.6368. This implies that the entire set of explanatory variables accounts for 63.68% of the variance in firm value, whereas the remaining 36.32% is attributed to variables outside the scope of this research model.

DISCUSSION

A. The Effect of ESG Disclosure on Firm Value

The empirical findings demonstrate that ESG disclosure exerts a significant negative effect on the firm value of state-owned banks, thereby challenging traditional signaling theory, which posits that ESG initiatives inherently generate positive market perceptions ((Hussain et al., 2025; Rastogi et al., 2024)). Although state-owned banks exhibit an exceptionally high average disclosure rate of 91.28%, investors respond negatively due to detrimental costs. These include surges in reporting and operational expenditures, alongside stricter credit screening processes that actively depress current earnings (Prayogo et al., 2025)).

Based on traditional agency theory, diverting managerial focus toward non-financial targets triggers agency conflicts that erode the confidence of short-term, profit-oriented investors, prompting them to reallocate capital to other instruments (Palupi, 2023). Furthermore, massive disclosures by firms with poor environmental or social performance risk exposing internal vulnerabilities to the public and may trigger symbolic greenwashing. This ultimately exacerbates information asymmetry and fuels ESG rating divergence among rating agencies (Zhang et al., 2026). In various regions, such as India and emerging economies within the MENA region, environmental disclosures and overinvestment in social pillars have also been proven to diminish bank value and profitability during lagging periods (last lag). Nevertheless, the social and governance dimensions may reverse into positive outcomes over the long term once they cross a specific threshold score, as characterized by a non-linear U-shaped relationship (Alfalih, 2023; Tamasiga et al., 2024). Overall, the negative impact of ESG disclosure on market value aligns with prior empirical evidence ((Dihardjo & Hersugondo, 2023; Ningwati et al., 2022; Oktadewi & Diantini, 2025; R & Dewinda, 2025)). Hence, it can be concluded that H1 is rejected, and H3 is accepted.

Conversely, the evaluation of private banks indicates that ESG disclosure has a significant positive effect on firm value; thus, H2 is accepted. Analyzed through signaling theory, the transparency of non-financial information successfully serves as a positive signal that shapes investor perceptions regarding the firm's commitment to sustainability and good governance (Hussain et al., 2025; Rastogi et al., 2024). Although private banks, on average, only disclose 82.88% of their ESG frameworks, investors still interpret this as a favorable signal because it reduces information asymmetry and lowers perceived market risks—a phenomenon similarly observed in European firms both before and after stringent

regulatory mandates (Mahmood et al., 2025). Comparable positive impacts have been documented in the hospitality sector, where ESG disclosures reflect lower non-financial risks (Febriantoko et al., 2025), and within the banking sector, where it enhances credibility, reputation, risk management, and social legitimacy among stakeholders (Cahyani et al., 2025). Broadly, the finding that ESG disclosure significantly contributes to capital market appreciation aligns with extensive prior literature (Aditya & Hasnawati, 2025; Machmuddah & Utomo, 2024; Saini et al., 2025; Thifa Amirah et al., 2024).

B. The Effect of the Investment Opportunity Set (IOS) on Firm Value

The partial regression results reveal that the Investment Opportunity Set (IOS) exerts a significant positive effect on firm value in both state-owned and private banks; therefore, H4 and H5 are accepted, while H6 is rejected. Drawing from signaling theory, corporate investment decisions act as a positive indicator to investors concerning a firm's growth potential, competitive advantage, and future performance (Zenabia & Falih, 2024). This positive impact of the IOS on firm value is consistent with Muadz and Sastradipraja (2024), who argue that the IOS mirrors prospective growth that escalates performance expectations. It also supports Chabachib et al. (2020), who suggest that contemporary corporate investment activities are crucial to promising high returns for investors.

Furthermore, optimizing the IOS, supported by robust risk management and effective asset deployment, is proven to enhance corporate profitability and market valuation (Hermawan et al., 2025). When coupled with a large corporate scale, the IOS strengthens operational stability and minimizes risk perceptions among market participants (Afridi et al., 2022). Broadly, the conclusion that the IOS positively contributes to driving firm value is fully backed by numerous prior empirical works (Andaswari et al., 2019; Giriati, 2016; Putri & Suzan, 2025; Sudiyatno et al., 2023; Utami & Paramita, 2024; Zenabia & Falih, 2024).

C. The Moderating Role of Board of Directors Size on the ESG Disclosure-Firm Value Relationship

Based on the overarching empirical diagnostics, the size of the board of directors (BOD size) exhibits a positive but statistically non-significant effect in moderating the relationship between ESG disclosure and firm value in both state-owned banks (H7 is rejected) and private banks (H8 is rejected). Consequently, H9 is also rejected. Theoretically, under agency and signaling theories, a larger board size is expected to tighten managerial oversight while transmitting positive signals to the market regarding sustainability governance commitments. Empirically, however, a large structural board capacity does not automatically translate into high-quality monitoring decisions unless it is accompanied by specific competencies and functional expertise regarding ESG issues among the directors (Chancharat et al., 2026; Tutik Arniati et al., 2025).

In developing economies, the weakness of this moderating impact is exacerbated by a lack of economic incentives from regulators. This leads the market to perceive ESG reporting as a mere compliance formality to fulfill regulatory obligations rather than a competitive strategy to boost market valuation (Gunibala et al., 2025; Tutik Arniati et al., 2025). This condition is further

complicated by the absence of consistent reporting metrics, which leaves information asymmetry unresolved and renders ESG data less credible or relevant to short-term investors, who generally overlook ESG as a core factor in stock pricing (Gunibala et al., 2025). As a result, board intervention with any structural capacity fails to deliver tangible value-added benefits to enhance bank legitimacy or transform into direct financial gains, except within specific social (Alslaibi & Abdelkarim, 2024; Gunibala et al., 2025). Additionally, the non-significant effect stems from a canceling trade-off between the communication efficiency and minimal free-riding risks of smaller boards versus the broader monitoring capacity of larger boards (Chancharat et al., 2026). Thus, the complexity of balancing competing stakeholder demands underscores that structural board size does not guarantee substantive sustainability oversight; banking governance should pivot toward establishing optimal composition, functional expertise, and board quality (Alslaibi & Abdelkarim, 2024; Chancharat et al., 2026).

D. The Moderating Role of Board of Directors Size on the IOS-Firm Value Relationship

The empirical outcomes demonstrate that board of directors size significantly strengthens the relationship between the Investment Opportunity Set (IOS) and firm value in state-owned banking institutions; thus, H10 is accepted. Grounded in agency theory, an optimal board size tightens managerial oversight, ensuring that corporate business activities maximize shareholder value creation. A larger board capacity brings diverse expertise, varied perspectives, and institutional experience that support strategic decision-making, enhance financial reporting transparency, and foster investor confidence (Ngadin & Prastyantini, 2025)). Furthermore, an adequate expansion of directorship size improves corporate governance quality through efficient monitoring processes and enriched strategic insights. Aligned with signaling theory, this robust board framework is captured by the market as "good news," successfully driving stock price appreciation and escalating overall entity valuation (Omenihu & Nwafor, 2025; Resandy & Marsono, 2025; Shalini et al., 2025)

Conversely, testing within private banking institutions reveals that board size exerts a significant negative effect in moderating the relationship between the IOS and firm value, proving that this variable dampens the interaction; thus, H11 is rejected, and H12 is accepted. This finding contradicts traditional signaling assumptions that expanding board capacity reinforces governance and provides informational certainty to the market. Instead, from an agency theory perspective, an oversized board triggers structural frictions, such as delayed strategic decision-making and free-riding behavior, which risk obscuring long-term investment goals without considering stakeholder interests. Large board groups tend to become ineffective due to communication and coordination barriers, unlike smaller boards (optimally around 7 to 8 members) that are more cohesive, adaptive, and productive in monitoring management to reduce agency costs (Tampakoudis et al., 2022)). The operational inefficiency resulting from the internal bureaucracy of a bloated board ultimately hinders private banks from capturing business opportunities swiftly, directly resulting in fundamental performance declines (Rusdi et al., 2021). Overall, an inflated board executing control functions

inadvertently weakens managerial agility and reduces market appreciation toward the firm's investment opportunities (Huang et al., 2023; Kao et al., 2019).

CONCLUSION AND RECOMMENDATION

This study concludes that ESG disclosure yields contrasting effects on firm value between bank ownership types. Its impact is significantly negative in state-owned banks due to market sensitivity toward detrimental operational costs, yet significantly positive in private banks as it successfully reduces information asymmetry. Meanwhile, the Investment Opportunity Set (IOS) consistently exerts a significant positive impact on maximizing firm value across both banking classifications, serving as a robust signal of future growth prospects.

Conversely, the structural size of the board of directors fails to moderate the relationship between ESG disclosure and firm value in either sector, indicating that quantitative board capacity does not guarantee functional oversight quality without specific expertise in sustainability issues. Lastly, board size exhibits a dual, opposing role in moderating the impact of the IOS on firm value; it successfully strengthens the relationship in state-owned banks by enhancing corporate governance quality, but significantly weakens it in private banks due to emerging agency frictions, including bureaucratic red tape, delayed decision-making, and free-riding phenomena.

FUTURE RESEARCH

Based on the limitations and findings of this study, several recommendations are proposed for future research. First, future researchers are encouraged to expand the sample scope beyond the banking sector to include other environmentally and socially sensitive industries to achieve a more comprehensive generalization of the results. Second, given that quantitative board size fails to moderate the impact of ESG disclosure, future studies should pivot from structural traits to the functional characteristics of the board. This can be achieved by examining variables such as green expertise, sustainability-focused educational backgrounds, or the presence of a dedicated ESG committee as more relevant moderating factors.

Third, it is highly recommended to employ non-linear estimation frameworks or incorporate time-lag models when evaluating the impact of environmental and social disclosures, as non-financial investments typically require a gestation period before translating into market valuation gains. Fourth, future research should consider utilizing dynamic panel data estimation methods, such as the Generalized Method of Moments (GMM) or Two-Stage Least Squares (2SLS), to effectively mitigate potential reverse causality and endogeneity bias inherent in agency and corporate signaling dynamics. Finally, adopting a Difference-in-Differences (DiD) approach by leveraging stringent Financial Services Authority (OJK) regulations as an exogenous shock could provide deeper insights into whether market responses to ESG signals shift over time from an operational cost burden to a value-enhancing asset.

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