Al-Kharaj: Journal of Islamic Economic and Business
Volume 8 (2), 2026
P-ISSN: 2686-262X; E-ISSN: 2685-9300

The Effect of Sustainability Report Disclosure and Leverage on Stock Price Discovery Efficiency with Institutional Ownership as a Moderating Variable

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Keywords:
Market Efficiency, ESG, Institutional Ownership, Leverage, Price Timeliness

Abstract

This study aims to analyze the effects of sustainability disclosure and leverage on stock price discovery efficiency, as measured by price timeliness. In addition, this study examines the role of institutional ownership as a moderating variable in the relationship between ESG disclosure and leverage and stock price discovery efficiency in infrastructure sector companies listed on the Indonesia Stock Exchange during the 2022–2024 period. This research employs a quantitative approach with a causal-comparative research design. The population consists of all infrastructure sector companies listed on the Indonesia Stock Exchange, with samples selected using purposive sampling techniques. The data used are secondary data obtained from financial statements, sustainability reports, and stock trading data. Data collection was conducted through documentation. Data analysis includes descriptive statistics, classical assumption tests, and moderated regression analysis (MRA). The results indicate that ESG disclosure has a positive and significant effect on price timeliness, while leverage has a negative and significant effect. Institutional ownership strengthens the effect of ESG disclosure on price timeliness but does not moderate the relationship between leverage and price timeliness. These findings confirm that ESG transparency enhances market efficiency, whereas debt-related risk remains a dominant factor contributing to delays in stock price adjustment.

INTRODUCTION

Price discovery efficiency indicates the extent to which stock prices are able to accurately reflect all available information in a timely manner. This process is influenced by market participants and the level of integration of information, both financial and non-financial, into stock prices (Morri et al., 2023). One relevant piece of non-financial information is environmental, social, and governance (ESG) disclosure, which is gaining attention in the Indonesian capital market. Although the OJK has issued regulations such as POJK No. 51/POJK.03/2017 and POJK No. 8 of 2023 to encourage ESG integration, many companies still view it as a formal obligation rather than a long-term strategy. As a result, limited ESG disclosure makes it difficult for investors to assess the risks and sustainable prospects of issuers, so that non-financial information is not fully reflected in stock prices.

In addition to challenges in ESG disclosure, the efficiency of stock price discovery is also influenced by financial information, one of which is related to high leverage. The more debt used to generate profits, the greater the financial leverage. The greater the financial leverage used by a company, the higher the risk and the lower the expected return. According to Zhang and Zhou (2020), financial leverage is a ratio that reflects the risk factors faced by investors.

This is in line with portfolio theory, which states that there is a linear relationship between risk and return on an investment instrument, where low risk generally results in low returns, while high risk is followed by high returns. Therefore, investors need to be careful not to experience losses (Diatmika et al., 2024). Furthermore, Astawa and Sinarwati (2024) add that companies with high leverage have greater liabilities than assets, which puts significant pressure on the company's financial condition.

This debt-dominated capital structure increases financial risk and causes investors to be more cautious in absorbing new information. High leverage can have a negative impact on financial performance and customer satisfaction, which ultimately affects market perception and price adjustments (Parkhi et al., 2023). Companies with high leverage often face limitations in responding effectively to market changes, thereby slowing down price adjustments.

When information is limited or delayed, inefficiency occurs in the stock price discovery process, as investors cannot accurately assess asset values (Delantar, 2024). The problem that arises from low transparency and information delays in the capital market is increased information asymmetry. Information asymmetry causes various problems in the capital market, especially related to stock price instability.

The difference in information possessed by companies and stakeholders encourages companies to convey signals that help external parties assess the company's prospects (Purnamawati et al., 2023). When some market participants have more complete and accurate information than others, there is an imbalance in investment decision-making.

This condition encourages high stock price volatility, because uneven information causes the market to overreact to certain news or events (Damayanti & Maryanti, 2023). In recent years, the infrastructure sector has shown a fairly high level of stock price volatility compared to other sectors.

Table 1. Stock Volatility for the Period 2022-2024

	Annual Volatility			
Year	**Raw Materials Sector**	**Infrastructure Sector**	**Health Sector**	**Financial Sector**
2022	18%	17%	9%	13%
2023	27%	42%	10%	9%
2024	14%	15%	13%	14%
Average	**20%**	**25%**	**11%**	**12%**

(Source: Processed Data, 2025)

Based on annual volatility data for the 2022–2024 period, the infrastructure sector consistently shows higher volatility than most other sectors, with an average of 25%, surpassing the raw materials (20%), health (11%), and finance (12%) sectors, and reaching a peak of 42% in 2023. This high fluctuation indicates the potential for market inefficiency in absorbing information, causing stock prices to reflect the fundamental value of the company late. One example is the delay in the submission of PT Waskita Karya (WSKT) financial reports in 2022 (Katadata, 2023), which triggered uncertainty and increased price delay, reflecting price discovery inefficiencies in the infrastructure sector and increasing information asymmetry that can affect stock liquidity and volatility (Madjid, 2023). Interestingly, WSKT is an issuer with a majority government ownership of around 73% IDNFinancials (2025), which shows that institutional

ownership dominance does not automatically guarantee transparency and timeliness of information disclosure, so the effectiveness of its role as a supervisory mechanism needs to be further examined. In conditions of information asymmetry, investors tend to be speculative or follow the behavior of the majority (herding), which increases the risk of mispricing, disrupts market efficiency, reduces investor confidence, and has the potential to increase a company's cost of capital.

The urgency of this research is even greater considering that the infrastructure sector plays an important role in driving national development, with promising prospects in the capital market. Infrastructure itself is a key element of economic development, as it is able to support economic and social development by increasing efficiency and effectiveness in business activities and community life (Andriyani & Chasanah, 2024)). Inefficiencies in stock price discovery, such as delays in market response to financial and non-financial information, have the potential to reduce the attractiveness of this sector in the eyes of investors, especially institutional investors who rely on accurate and timely information for decision making. In the context of global competition and long-term funding needs, such inefficiencies can result in a reduction in capital flows to this strategic sector, thereby hampering vital development projects.

This research is also important because it combines three key interrelated aspects: ESG disclosure, leverage, and institutional ownership. ESG disclosure plays a role in enriching the information available in the market, thereby reducing information asymmetry and increasing price discovery efficiency. Meanwhile, high leverage can be an obstacle for companies to react quickly to new information, thereby slowing down the price adjustment process. Institutional ownership has the potential to moderate this relationship by encouraging governance discipline and improving the quality of disclosed information. If these issues are not researched and addressed, the Indonesian capital market, particularly in the infrastructure sector, risks experiencing high volatility, low investor confidence, and increased capital costs.

Previous research on leverage in price discovery Hebous and Zimmermann (2021) generally focuses on the integration of equity and credit markets, rather than on the dimension of price timeliness, which measures the speed of information integration into stock prices. Furthermore, although institutional ownership has been shown to increase price informativeness Ariantini and Purnamawati (2025), no study has examined its moderating role in the relationship between ESG disclosure and price timeliness. Most previous studies also use general price efficiency indicators such as mispricing or price delay Ruan et al (2024), so there is still a need for studies that focus on price timeliness as a specific indicator of the speed of the market in responding to relevant information.

Furthermore, this study makes an important contribution to the ESG disclosure literature by responding to Zhang et al (2023) research suggestion to conduct further studies on how ESG disclosure regulations affect the quality of financial and ESG disclosures at the company level, as well as the channels through which these regulations can improve price discovery efficiency. The novelty of this study lies in the Indonesian context, where sustainability disclosure regulations are governed by the Financial Services Authority (OJK). Thus, this study not only expands the literature, which mostly focuses on developed countries, but also provides empirical evidence on the effectiveness of OJK regulations in promoting transparency, good governance, and capital market efficiency in Indonesia. Therefore, this study fills a gap by examining the effect of ESG disclosure and leverage on stock price discovery with institutional ownership as a moderating variable in infrastructure sector companies on the Indonesia Stock Exchange. Broadly speaking,

this study aims to explore how non-financial information transparency and capital structure affect the speed at which stock prices respond to new information, as well as to assess the extent to which supervision by institutional investors can moderate this relationship in the context of Indonesia's developing capital market.

LITERATURE REVIEW

Signaling Theory

Signaling Theory explains how companies convey information to investors to reduce information asymmetry between management and stakeholders. The information conveyed can take various forms of signals, such as dividend policy, company announcements, digital orientation, or technology investment, which can influence market perceptions and investor behavior (Okpanum, 2023)

According to Purnamawati et al (2023) the difference in information possessed by companies and stakeholders encourages companies to provide signals that can help stakeholders assess the company's prospects. These signals are reflected in the company's performance as an effort to meet stakeholder expectations. This is in line with the main objective of signaling theory, which is to provide reliable indications of a company's prospects and quality, thereby reducing market uncertainty.

In the context of capital markets, the signals conveyed by management aim to provide an indication of the quality of the company's prospects. For example, the frequency of announcements and the highest offer amount in crowdfunding can increase the chances of successful funding, while actions such as earnings management serve as an implicit guarantee of the company's quality (Velte, 2023). In fact, in the digital era, a company's digital orientation can influence analyst recommendations and ultimately influence investor behavior (Zhu et al., 2024). In addition, research also shows that signals can influence investment decision-making, such as dividend announcements that trigger market reactions in accordance with the signal theory framework ((Prayudi et al., 2023). Digital transformation has also been shown to provide a signaling effect that increases analyst optimism (Guo et al., 2025).

Corporate governance theory

Corporate governance theory is a multidimensional concept that encompasses the systems, rules, and processes used to direct and control a company. This concept regulates the distribution of rights and responsibilities among the board of directors, managers, shareholders, and other stakeholders, as well as establishing rules and procedures for decision-making in corporate affairs (Bezo & Dibra, 2020). The implementation of effective governance aims to create a balance between the interests of various parties, ensure transparency, and minimize conflicts of interest.

Several key theories form the basis for understanding corporate governance. Agency theory highlights the conflict of interest between management and shareholders and emphasizes the importance of mechanisms that can align the interests of both parties to reduce agency problems (Principale, 2023)). In line with this view, companies that seek to separate governance and ownership functions are more likely to experience agency conflicts (Purnamawati & Hatane, 2022). This confirms that the separation of management and ownership functions without

adequate oversight mechanisms can increase the potential for differences in interests between managers and shareholders.

On the other hand, stakeholder theory expands the focus of corporate management from the interests of shareholders alone to the interests of all stakeholders, including employees, customers, suppliers, and the community, with the aim of creating value for all parties (Principale, 2023). Resource dependence theory argues that the board of directors provides resources and external connections that are important for the success of the company (Quang, 2022).

Market efficiency theory

The efficient market hypothesis (EMH) is a fundamental theory in modern finance which states that capital markets are information efficient, meaning that security prices fully reflect all available information at a given time (Silva, 2025). This concept implies that it is impossible for investors to consistently obtain abnormal returns through market timing or the selection of certain stocks, because any new information will be quickly reflected in asset prices. According to Zhu et al (2024), EMH is classified into three main forms:

1. Weak Form: Stock prices reflect all historical information, so technical analysis based on past price and volume data cannot consistently generate abnormal returns (Gupta & Yang, 2011).
2. Semi-Strong Form: Stock prices reflect all public information, including financial reports and news, so fundamental analysis also cannot provide above-average returns.
3. Strong Form: Stock prices reflect all information, both public and private, so that even insider information cannot be used to gain an investment advantage (Jairath, 2015; Kartašova et al., 2014).

Although the Efficient Market Hypothesis (EMH) provides a strong theoretical framework for explaining price formation, its application is often questioned due to empirical evidence of market anomalies such as speculative bubbles, excess volatility, calendar effects, and seasonal patterns (Astawa & Sinarwati, 2024). In response to these limitations, the behavioral finance approach offers an alternative explanation by highlighting the influence of cognitive biases and irrational investor behavior that can cause stock prices to deviate from their fundamental value (Parkhi et al., 2023).

Hypothesis Development

The effect of ESG disclosure on stock price discovery efficiency (price timeliness)

Theoretically, ESG disclosure improves the quality of market information, thereby reducing information asymmetry and accelerating the integration of information into stock prices. This is in line with signaling theory, where ESG serves as a positive signal of a company's commitment to sustainability, governance, and transparency, enabling investors to make more rational decisions and stock prices to more quickly reflect fundamental value. Within the triple bottom line (TBL) framework, ESG disclosure represents a balance between economic, social, and environmental aspects to maintain sustainability and stakeholder trust (Andriyani & Chasanah, 2024).

Empirical evidence supports this argument. A number of previous studies have shown that ESG disclosure has a positive effect on stock price discovery efficiency. Zhang et al (2023) show that mandatory ESG disclosure policies improve the accuracy of stock prices in reflecting

company-specific information. Similarly, other studies find that ESG disclosure reduces trading noise ((Ruan et al., 2024), increases stock price informativeness Silva (2025), and reduces information asymmetry ((Chen, 2024).

There is a research gap because most studies on ESG and market efficiency have been conducted in countries with mature market systems and regulations, such as China, Europe, and North America, and have emphasized country-level institutional structures rather than sectoral analysis, so the findings may not necessarily be generalizable to developing countries. In the context of Indonesia, particularly the infrastructure sector, which has unique disclosure and governance characteristics, the effectiveness of ESG disclosure on stock price discovery efficiency still needs to be tested, especially after the enactment of POJK No. 8 of 2023, which requires sustainability reports and has not been empirically evaluated. Based on the theoretical framework, empirical evidence, research gaps, and contextual relevance, the following hypothesis is proposed:
H1: ESG disclosure has a positive and significant effect on stock price discovery efficiency (price timeliness).

The effect of leverage on stock price discovery efficiency (price timeliness)

Companies with high leverage tend to rely more on external financing. This dependence increases financial risk and worsens information asymmetry between management and investors (Velte, 2023). This condition implies a delay in the reflection of information in stock prices, which ultimately reduces price discovery efficiency (price timeliness).

Empirical evidence supports this explanation. Ariantini and Purnamawati (2025) found that the debt to equity ratio (DER) has a positive but insignificant effect on stock prices in the banking sector, indicating that leverage is not always a major factor in determining market value, but it still has the potential to influence investor risk perception and the speed of stock price adjustment. Other studies also highlight that leverage can increase bankruptcy risk and worsen financial performance, thereby impacting the delay in prices reflecting new information (X. Zhang & Zhou, 2020).

However, most previous studies have emphasized the relationship between leverage and bankruptcy risk or corporate financial performance, rather than the specific aspect of stock price discovery efficiency. The relationship between leverage and price timeliness has been rarely explored, especially in sectors with unique financial characteristics such as infrastructure. This indicates a research gap that needs to be filled.

This issue is relevant in Indonesia because infrastructure companies, especially state-owned enterprises, generally have high leverage to finance capital-intensive long-term projects. High debt makes investors more cautious in responding to new information, thereby potentially slowing down the integration of information into stock prices. Thus, leverage not only reflects financial risk but also affects price discovery efficiency. Based on the theoretical foundation, empirical evidence, and context, the hypothesis proposed is as follows:
H2: Leverage has a negative and significant effect on stock price discovery efficiency (price timeliness).

Institutional ownership moderates the effect of ESG disclosure on stock price discovery efficiency (price timeliness)

Theoretically, institutional ownership is seen as an effective corporate governance mechanism in supervising management and encouraging more transparent and accountable

information disclosure. Institutional investors generally have high analytical capacity and a long-term orientation, thereby enhancing the credibility of companies in the market (Zhang & Zhou, 2020). From a signaling theory perspective, institutional ownership can also strengthen ESG disclosure as a positive signal that accelerates the integration of information into stock prices.

Empirically, Velte (2023) found that institutional ownership has a positive effect on the quality of sustainability reports, indicating that the greater the proportion, the higher the quality and accuracy of information disclosure. However, most previous studies have focused more on the impact of ESG on company value or financial performance, while studies on its role in improving price discovery efficiency (price timeliness), particularly with the moderation of institutional ownership, are still limited.

In the Indonesian context, especially in the capital-intensive infrastructure sector with high ESG risk, the combination of ESG disclosure and institutional ownership has the potential to strengthen market discipline and improve stock price discovery efficiency. Based on the theoretical foundation, empirical evidence, and research gap, the following hypothesis is proposed

H3: Institutional ownership can moderate (strengthen) the effect of ESG disclosure on stock price discovery efficiency (price timeliness).

Institutional ownership moderates the effect of leverage on stock price discovery efficiency (price timeliness)

Theoretically, high leverage increases financial risk and uncertainty in stock price formation, thereby potentially reducing price discovery efficiency (price timeliness). From an Agency Theory perspective, excessive leverage can exacerbate conflicts of interest between managers and shareholders because it encourages risky decision-making. However, institutional investors can act as a supervisory mechanism that suppresses opportunistic behavior and reduces the negative impact of leverage on price efficiency.

Widiani et al (2023) show that high institutional ownership is associated with lower stock volatility, especially in highly leveraged companies, while Bezo and Dibra (2020) emphasize that institutional oversight limits opportunistic management practices. Prayudi et al (2023) also emphasize the importance of control mechanisms in balancing short-term pressures and long-term sustainability.

However, previous studies have generally focused on the direct influence of leverage on market performance or risk, and few have examined the moderating role of institutional ownership on price discovery efficiency. In the Indonesian context, particularly in the capital-intensive and highly leveraged infrastructure sector, the role of institutional investors is crucial in strengthening oversight, increasing transparency, and supporting the efficiency of stock price discovery. Based

on the theoretical foundation, empirical evidence, and research gap, the hypothesis proposed is as follows:

H4: Institutional ownership can moderate (weaken) the effect of leverage on stock price discovery efficiency (price timeliness).

Conceptual Framework

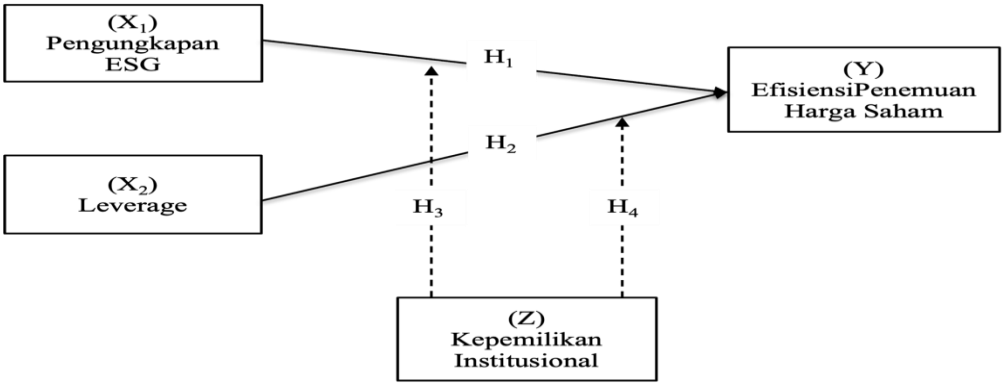

Figure 1. Conceptual Framework

RESEARCH METHOD

This study uses a quantitative approach to examine a specific population or sample using research instruments and numerical or statistical data analysis to test predetermined hypotheses (Sugiyono, 2018). With a causal-comparative design, this study examines the relationship between ESG disclosure, leverage, and stock price discovery efficiency (price timeliness), as well as the role of institutional ownership as a moderating variable. The data used is secondary data obtained from annual reports and sustainability reports of infrastructure sector companies listed on the Indonesia Stock Exchange during a certain period.

The analysis was conducted using multiple regression to test the direct effect of independent variables on dependent variables, as well as Moderated Regression Analysis (MRA) to test the moderating effect. Using this approach, the study aims to provide empirical evidence on how financial and non-financial factors affect stock price efficiency in the capital market, thereby providing insights for investors, regulators, and company management in strategic decision-making.

This research is not limited to a specific location because it uses secondary data in the form of digital files, so it can be conducted from anywhere. The research period runs from April 2025 to December 2025.

The population in this study is all infrastructure sector companies listed on the Indonesia Stock Exchange (IDX) during the period 2022 to 2024. The research sample will be selected using the purposive sampling method, which is a sample determination technique with specific considerations because this research has specific criteria, such as companies that consistently publish financial reports during the 2022-2024 period. The urgency of this sample selection is based on the characteristics of companies that generally have large-scale projects and high debt-based financing. In addition, these companies also have fairly high public information exposure, enabling relevant testing of the price timeliness and institutional ownership moderation variables. Based on the determination of the characteristics or criteria of the research sample, the following sample size was found

Table 2. Number of Companies Included in the Research Sample

Description	Total of Companies
Infrastructure sector companies listed on the IDX for the 2022-2024 period	70
Infrastructure sector companies whose financial reports for the 2022–2024 period could not be found by the author on the IDX.	11
Total companies that meet the research criteria	59
Number of Observations (59 x 3 years)	**177**

Source: Data processed by researchers

This study uses two main data collection techniques, namely documentation study and literature study. In the documentation study, the data collected includes financial reports and sustainability reports of companies listed on the Indonesia Stock Exchange. These reports are analyzed in depth to obtain relevant information that will be used as a basis for answering the research questions. This analysis process aims to explore data related to ESG information disclosure, leverage, and institutional ownership that may affect stock price discovery efficiency. This documentation study was conducted to obtain secondary data that could provide a more complete picture of the performance of the companies under study.

In addition, this study also relies on literature studies to explore theories and previous research relevant to the topic. The literature sources used include textbooks, scientific articles, published research results, as well as journals and other references that provide a deeper perspective on ESG, leverage, and market efficiency. Unlike studies that use research instruments such as questionnaires, this study does not require instrument tests such as validity or reliability tests because the data used is secondary and comes from reliable sources. In this study, the data analysis technique used is a quantitative statistical approach with the help of STATA software. This analysis aims to determine the effect of ESG Disclosure and Leverage on Stock Price Timeliness, as well as to test the role of Institutional Ownership as a moderating variable by considering economic growth (GDP Growth) as a control variable.

RESULT AND DISCUSSION

Results

Descriptive statistical test results

Standard deviation is used to measure how wide or how far the data deviates from its mean value. The results of the descriptive statistical analysis are presented in Table 3:

Table 3. Results of Descriptive Statistical Analysis of Continuous Variables

	Obs	Mean	Std. Deviasi	Minimum	Maximum
Efficiency of Stock Price Discovery	177	93.20024	119.0995	-0.5	733.46
Leverage	177	0.6093616	4.216981	-34.93	8.79
IO	177	0.6580966	0.2575153	0	0.999
GDP	3	5.128855	0.1266957	5.030344	5.307197

Source: Processed data, 2025

Based on the results of descriptive statistical analysis in Table 3, it can be seen that the total observation data in this study is 177 data points obtained from 59 company samples during the 3-year research period from 2022 to 2024. Based on the results of descriptive statistical analysis, it can be explained as follows:

1) Dependent Variable: Stock Price Discovery Efficiency (Y)
   The Stock Price Discovery Efficiency variable, measured using Price Timeliness across 177 observations of construction sector companies listed on the IDX during 2022–2024, has an average value of 93.20024 and a standard deviation of 119.0995, indicating high variation between companies. The minimum value of –0.5 shows very low efficiency, while the maximum value of 733.46 indicates very high efficiency where information is quickly reflected in stock prices.
2) Independent Variable: Leverage (X2)
   The Leverage variable has an average value of 0.6093616 with a standard deviation of 4.216981, which is much higher than the average, indicating a very large variation in debt levels among companies in the construction sector for the 2022–2024 period. The minimum value of –34.93 indicates extreme financial structures in some companies, while the maximum value of 8.79 shows that there are companies with very high levels of debt dependence. This reflects significant differences in funding policies in the construction sector.
3) Moderation Variable: Institutional Ownership
   The Institutional Ownership variable has an average of 0.6580966 with a standard deviation of 0.2575153, indicating that the share ownership of construction sector companies in the 2022–2024 period is generally dominated by institutional investors and is relatively evenly distributed among companies. A minimum value of 0 indicates that there are companies without institutional ownership, while a maximum value of 0.999 indicates that almost all shares are owned by institutions, reflecting a very strong level of external supervision.
4) Control Variable: Gross Domestic Product (GDP)
   The GDP variable has an average of 5.128855 with a standard deviation of 0.1266957, indicating relatively small variations during the 2022–2024 period. The minimum value of 5.030344 and maximum value of 5.307197 reflect that national economic growth was within a narrow range, indicating that macroeconomic conditions during the study period were relatively stable.

Table 4. Results of Descriptive Statistical Analysis of Dummy Variables

Value	Description	Frequency	Percentage
0	Non-disclosure of ESG	142	80%
1	ESG Disclosure	35	20%
Total		**177**	**100%**

Source: Processed data, 2025

1) Independent Variable: ESG (X1)
   The ESG variable is a dummy variable (0 = not disclosed, 1 = disclosed). A total of 80% of observations did not disclose ESG information, while 20% disclosed it during 2022–2024. The dominance of the value 0 indicates that transparency and sustainability implementation in the construction sector are still low, even though some companies have begun to show a commitment to non-financial reporting.

Results of classical assumption testing

The purpose of this test is to ensure that the model or equation being tested does not violate these assumptions (Ghozali, 2018). This test was conducted to prove that the results obtained were BLUE (Best Linear Unbiased Estimator). Classical assumption tests include

normality tests, multicollinearity tests, heteroscedasticity tests, and autocorrelation tests. Each classical assumption test is described as follows:

Normality Test Results

The normality test aims to test whether the disturbance variable or residual in the regression model has a normal distribution or not. A good regression model has a normal or near-normal distribution (Ghozali, 2018). The normality test results of this study were obtained using the Kolmogorov-Smirnov Test, with the following results:

Table 5. Normality Test Results

	Obs	P value	Conclusion
Kolmogorov-Smirnov Test	177	0,473	Passed Normality Test

Source: Processed data, 2025

The normality test results show that the probability value in the Kolmogorov-Smirnov Test is 0.473, which is greater than 0.05, so it can be concluded that the data is normally distributed.

Multicollinearity Test Results

The multicollinearity test aims to examine correlations among independent variables in the regression model using Variance Inflation Factor (VIF) and correlation values. The model is considered free from multicollinearity if VIF < 10 and the correlation value < 0.8 (Ghozali, 2018). The results of the multicollinearity test are presented in Table 6.

Table 6. Multicollinearity Test Results

Variable	VIF	Correlation	Description
Environmental, Social, and Governance (ESG)	1,05	0,0423	Free of multicollinearity
Leverage	1,01	0,0358	Free of multicollinearity
Institutional Ownership (IO)	1,05	0,0517	Free of multicollinearity
Gross Domestic Product (GDP)	1,00	–0,1112	Free of multicollinearity

Source: Processed data, 2025

The multicollinearity test results show that all independent variables have VIF values < 10 and correlations < 0.8, so it can be concluded that the regression model does not experience multicollinearity and is suitable for use. Thus, there is no strong relationship between the independent variables in the model.

Heteroscedasticity Test Results

The heteroscedasticity test aims to determine whether there are differences in residual variance in the regression model. This study uses the Breusch–Pagan test, where a probability > 0.05 indicates no heteroscedasticity, and < 0.05 indicates heteroscedasticity. The test results are presented in Table 7.

Table 7. Heteroscedasticity Test Results

Chi2(1)	Probability	Description
0,95	0,3303	Passed Heteroscedasticity

Source: Processed data, 2025

The results in Table 7 show that the probability value of the research variable is 0.3303, which is greater than 0.05. Therefore, it can be concluded that there is no heteroscedasticity in the panel data tested.

Autocorrelation Test Results

This test aims to detect autocorrelation, which is the correlation between the current and previous period errors in the regression model. The Breusch–Godfrey test in STATA is used to

detect autocorrelation, particularly in time series data. If the significance value is > 0.05, the model is declared to be free of autocorrelation; conversely, a value < 0.05 indicates the presence of autocorrelation. The Breusch–Godfrey test results are presented in Table 8.

Table 8. Breusch–Godfrey Test Results

Types of Statistics	Statistical Values	P-value	Descrirption
F – statistic	2,91	0,0907	Pass Autocorrelation
t-statistic (ehat_lag)	1,71	0,0910	Pass Autocorrelation

Source: Processed data, 2025

Based on Table 8, the Breusch–Godfrey test produced an F-statistic of 2.91 (df = 1;116) with Prob > F of 0.0907 and a residual lag t-statistic probability value of 0.091. Since all probability values are greater than 0.05, it can be concluded that the regression model does not contain autocorrelation and has met the classical assumptions of linear regression.

Results of multiple regression analysis with moderating variables

The results of the panel data regression test processed using STATA software are shown in Table 9:

Table 9. Moderating Regression Analysis Results

Variable	*Coef.*	*Std. Err*	*t-Statistic*	*Prob.*
(Constant)	**3. 089879**	**0,3716747**	**8,31**	**0,000**
ESG	**0.8469366**	**0,1879982**	**4,51**	**0,000**
Leverage	**-0,3470461**	**0,1032689**	**-3,36**	**0,001**
IO	**0,2374393**	**0,1713398**	**1,39**	**0,168**
GDP	**0,0700576**	**0,1657602**	**0,42**	**0,673**
ESG.IO	**0,1509268**	**0,0694326**	**2,17**	**0,031**
Leverage.IO	**-0,0149265**	**0,0521951**	**-0,29**	**0,775**

Source: Data processed, 2025

Based on the results of panel data regression tests processed using STATA software, the results of the moderation regression analysis are presented in the research results table. The regression equation model used in this study is as follows:

$$\text{Timeliness} = \alpha + \beta 1\text{ESG} + \beta 2\text{Leverage} + \beta 3\text{IO} + \beta 4\text{GDP} + \beta 5(\text{ESG}\times\text{IO}) + \beta 6(\text{Leverage}\times\text{IO}) + \varepsilon$$

$$\text{Timeliness} = 3{,}089879 + 0{,}8469366\text{ESG} - 0{,}3470461\text{Leverage} + 0{,}2374393\text{IO} + 0{,}070056\text{GDP} + 0{,}150926(\text{ESG}\times\text{IO}) - 0{,}0149265(\text{Leverage}\times\text{IO}) + \varepsilon$$

Based on the probability value (p-value), the variables ESG, Leverage, and ESG.IO interaction have values less than 0.05, thus significantly affecting Timeliness. Meanwhile, the variables IO, GDP, and Leverage.IO interaction do not significantly affect Timeliness because they have probability values greater than 0.05. Therefore, the regression equation can be explained as follows:

a. The constant value of 3.089879 indicates that if the ESG, Leverage, IO, GDP, and interaction variables are considered constant or zero, then the Timeliness value is 3.089879.
b. The β_1 coefficient value of 0.8469366 indicates that there is a positive direction of influence between ESG and Timeliness. This means that every one-unit increase in ESG will increase Timeliness by 0.8469366, assuming other variables remain constant. The p-

value of 0.000 (< 0.05) indicates that the effect of ESG on Timeliness is statistically significant.

c. The coefficient value of β_2 is –0.3470461, indicating that there is a negative effect of Leverage on Timeliness. This means that every one-unit increase in Leverage will decrease Timeliness by 0.3470461, assuming other variables remain constant. The p-value of 0.001 (< 0.05) indicates that the effect of Leverage on Timeliness is statistically significant.
d. The β_3 coefficient value of 0.2374393 indicates that IO has a positive effect on Timeliness. However, the p-value of 0.168 (> 0.05) indicates that the effect of IO on Timeliness is not statistically significant.
e. The β_4 coefficient value of 0.0700576 indicates that GDP has a positive effect on Timeliness. However, the p-value of 0.673 (> 0.05) indicates that the effect of GDP on Timeliness is not statistically significant.
f. The coefficient value of β_5 is 0.1509268, indicating that the institutional ownership (IO) variable moderates the effect of ESG on Timeliness in a positive direction. This means that the existence of institutional ownership strengthens the influence of ESG on Timeliness. The p-value of 0.031 (< 0.05) indicates that the moderating effect is statistically significant.
g. The β_6 coefficient value of –0.0149265 indicates that the interaction between Leverage and IO has a negative effect on Timeliness. However, the p-value of 0.775 (> 0.05) indicates that the interaction variable is not statistically significant, so institutional ownership does not moderate the effect of Leverage on Timeliness.

Parametric test results

Model Feasibility Test Results (F Test)

The simultaneous test aims to determine whether all identified variables are appropriate for predicting Price Timeliness together. This test is often referred to as the F test. The F test results in this study can be seen in Table 10:

Table 10. F Test Results

F statistic (6,170)	Probability F	Description
8,87	0,0000	Feasible Model (fit)

Source: Processed data, 2025

The F-test results show a Prob > F value of 0.0000 (< 0.05), indicating that the regression model is valid (fit). This means that the variables ESG, Leverage, Institutional Ownership (IO), GDP, and the interaction variables X1Z and X2Z simultaneously have a significant effect and are able to explain the variation in Timeliness, so that the model can be used for further analysis.

Determination Coefficient Test Results (R^2)

The coefficient of determination (R^2) is used to determine and measure the model's ability to explain the variation in independent variables. The following are the test results:

Table 11. Results of the Coefficient of Determination Test (R^2)

R Squared	Adjusted R Square	Description
0,2384	0,2115	Feasible Model (fit)

Source: Processed data, 2025

Based on Table 11, the R-squared value of 0.2384 indicates that 23.84% of the variation in Timeliness can be explained by ESG, Leverage, IO, GDP, and interaction variables, while 76.16% is influenced by other factors outside the model. The Adjusted R-squared value of 0.2115 indicates

that the explanatory power of the model remains quite good after adjustment. Thus, the model is feasible to use even though there are other variables that also affect Timeliness.

Hypothesis test results (t-test)

Partial effect testing was performed using Moderated Regression Analysis (MRA) by looking at the z probability value. The hypothesis is accepted if the prob. z value is < 0.05 or the calculated z is > the table z, which indicates that the independent variable has a significant effect on the dependent variable. The probability test results are presented in Table 12:

Table 12. Hypothesis Test Results

Variable	Coefficient	t-statistic	Probability	Description
ESG (X1)	0.8469366	4.51	0.000	Positive and Significant
Leverage (X2)	-0.3470461	-3.36	0.001	Negative and Significant
Institutional Ownership (Z)	0.2374393	1.39	0.168	Not Significantly Influential
GDP (C1)	0.0700576	0.42	0.673	Not Significantly Influential
ESG Interaction × IO (X1Z)	0.1509268	2.17	0.031	Positive and Significant
Leverage Interaction × IO (X2Z)	-0.0149265	-0.29	0.775	Not Significantly Influential

Source: Processed data, 2025

a. **The Effect of ESG Disclosure on Stock Price Discovery Efficiency (Price Timeliness)**
The results of the t-test show that the ESG disclosure variable (X1) has a regression coefficient value of 0.8469366 with a significance level of 0.000, which is less than 0.050, and a positive t-statistic value of 4.51. These results indicate that ESG disclosure has a positive and significant effect on stock price discovery efficiency (price timeliness). Thus, the higher the level of ESG disclosure by a company, the more efficient the stock price discovery process in the market.

b. **The Effect of Leverage on Stock Price Discovery Efficiency (Price Timeliness)**
Based on the t-test results, the leverage variable (X2) has a regression coefficient value of −0.3470461 with a significance level of 0.001, which is smaller than 0.050, and a negative t-statistic value of −3.36. This indicates that leverage has a negative and significant effect on stock price discovery efficiency (price timeliness). This means that the higher the company's leverage level, the more stock price discovery efficiency tends to decline.

c. **The Effect of Institutional Ownership on Stock Price Timeliness**
The test results show that the institutional ownership variable (Z) has a regression coefficient value of 0.2374393 with a significance level of 0.168, which is greater than 0.050, and a t-statistic value of 1.39. These results indicate that institutional ownership does not have a significant effect on stock price discovery efficiency (price timeliness). Thus, the size of institutional ownership is not yet able to directly affect the level of stock price discovery efficiency.

d. **The Effect of Gross Domestic Product (GDP) on Stock Price Discovery Efficiency (Price Timeliness)**
Based on the t-test results, the GDP variable has a regression coefficient value of 0.0700576 with a significance level of 0.673, which is greater than 0.050, and a t-statistic value of 0.42. This indicates that GDP does not have a significant effect on stock price discovery efficiency (price timeliness). Thus, macroeconomic conditions proxied by GDP

have not been able to influence stock price discovery efficiency in the sample companies in this study.

e. The Role of Institutional Ownership in Moderating the Effect of ESG Disclosure on Stock Price Timeliness

The results of testing the interaction variable between ESG disclosure and institutional ownership (X1Z) show a regression coefficient value of 0.1509268 with a significance level of 0.031, which is less than 0.050, and a positive t-statistic value of 2.17. These results indicate that institutional ownership can moderate and strengthen the effect of ESG disclosure on stock price discovery efficiency (price timeliness). This means that the existence of high institutional ownership can increase the effectiveness of ESG disclosure in accelerating the process of stock price discovery in the market.

f. The Role of Institutional Ownership in Moderating the Effect of Leverage on Stock Price Timeliness

Based on the t-test results, the interaction variable between leverage and institutional ownership (X2Z) has a regression coefficient value of −0.0149265 with a significance level of 0.775, which is greater than 0.050, and a t-statistic value of −0.29. These results indicate that institutional ownership is unable to moderate the effect of leverage on stock price discovery efficiency (price timeliness). Thus, the presence of institutional ownership neither strengthens nor weakens the relationship between leverage and stock price discovery efficiency**.**

Discussion

The effect of ESG disclosure on stock price discovery efficiency (price timeliness)

The results show that ESG disclosure has a positive and significant effect on price timeliness. This is indicated by a regression coefficient value of 0.8469366 with a positive t-statistic value of 4.51 and a significance level of 0.000, which is less than 0.05. A positive coefficient value indicates that an increase in the level of ESG disclosure is followed by an increase in stock price discovery efficiency, while a low significance value indicates that the relationship has strong empirical support in the research model. Thus, ESG disclosure is proven to be one of the factors contributing to the speed of stock prices in reflecting company information in the market.

This finding is consistent with the theoretical framework described in the theoretical basis. Theoretically, ESG disclosure functions as a positive signal (signaling theory) regarding the company's commitment to sustainability, governance, and transparency (Okpanum, 2023). The wider availability of ESG information improves the quality of public information and reduces information asymmetry between management and investors. The reduction in information asymmetry allows investors to respond to fundamental information more quickly, so that the process of integrating information into stock prices is more efficient, which is reflected in increased price timeliness.

This finding is also in line with the Triple Bottom Line (TBL) concept, which emphasizes the balance of economic, social, and environmental aspects in company performance. The implementation of TBL through ESG disclosure provides a more comprehensive picture of the sustainability of company activities, strengthens investor confidence, and improves the quality of information available in the market. These conditions support the formation of more informative stock prices because the market has a more complete information base in assessing company value. Empirically, the results of this study support the studies by (Ruan et al., 2024; Silva, 2025; Q. Zhang et al., 2023), which conclude that ESG disclosure increases stock price informativeness and reduces trading noise. In the Indonesian context, particularly in the infrastructure sector facing regulatory pressure from POJK No. 8 of 2023, these findings show that ESG disclosure not only serves as a fulfillment of reporting obligations but also plays a role in improving market efficiency through the acceleration of information reflection in stock prices.

The effect of leverage on stock price discovery efficiency (price timeliness)

The results show that leverage has a negative and significant effect on price timeliness, thus accepting H2. This finding is supported by the leverage regression coefficient value of −0.3470461 with a t-statistic value of −3.36 and a significance level of 0.001, which is less than 0.05. The negative direction of the coefficient indicates that an increase in leverage is followed by a decrease in stock price discovery efficiency, while the low significance level indicates that leverage is a variable that empirically plays a role in explaining the variation in price timeliness in the research model. This indicates that debt-based funding structures affect the speed at which the market integrates company information into stock prices.

These findings are consistent with the theory and empirical evidence discussed in the theoretical framework. Based on the Pecking Order Theory (Myers & Majluf, 1984) in (Damayanti & Maryanti, 2023), companies with high leverage tend to face greater financial risk and increased information asymmetry between management and investors. High debt obligations increase uncertainty regarding the company's ability to meet its financial commitments, so investors tend to be more cautious in interpreting the information published by the company. This condition causes the process of integrating information into stock prices to take longer, which ultimately reduces the efficiency of stock price discovery.

Previous studies such as Zhang & Zhou (2020) show that high leverage is associated with increased bankruptcy risk and potential decline in financial performance, which in turn hinders market response to new information. The findings of this study confirm this empirical evidence by showing that an increase in leverage correlates with a decline in the speed of information reflection in stock prices.

In the context of the infrastructure sector in Indonesia, these results are relevant given the industry's characteristics, which are synonymous with long-term projects and dependence on debt-based financing. High leverage increases the complexity of project risk and cash flow uncertainty, requiring investors to spend more time evaluating company information. Thus, the acceptance of H2 reinforces the understanding that leverage not only serves as an indicator of financial risk but also as a factor that can hinder market efficiency in absorbing company information, as reflected in a decline in price timeliness.

Institutional ownership moderates the effect of ESG disclosure on stock price discovery efficiency (price timeliness)

The results show that institutional ownership plays a role in strengthening the positive effect of ESG disclosure on price timeliness, thus accepting H3. Directly, the institutional ownership variable has a regression coefficient of 0.2374393 with a t-statistic value of 1.39 and a significance level of 0.168, which is greater than 0.05, thus showing no significant effect on price timeliness. Although the positive coefficient direction indicates a tendency for increased stock price discovery efficiency as institutional ownership increases, the results show that institutional ownership has not been able to directly influence price efficiency. However, its role becomes significant when interacting with ESG disclosure, which indicates a moderating function in the relationship.

Theoretically, institutional ownership is a corporate governance mechanism that can improve the quality of disclosure and encourage information transparency. Institutional investors generally have higher analytical capabilities, more effective monitoring capacity, and a long-term investment orientation, thereby encouraging companies to maintain the credibility and consistency of ESG reports submitted to the public (Velte, 2023). In this context, the presence of institutional investors does not directly accelerate price efficiency, but it does increase the effectiveness of the ESG information published by companies.

Within the framework of signaling theory, high-quality ESG disclosure is further strengthened by institutional investor oversight, so that signals regarding corporate sustainability and governance quality are received by the market with a higher level of confidence. The strengthening of these signals enables investors to respond to ESG information more quickly, making the process of integrating information into stock prices more efficient. Thus, institutional ownership serves as a factor that strengthens the transmission of ESG information to the price formation mechanism in the capital market.

This finding is in line with the research by Afsari, Damayanti & Maryanti (2023), which shows that institutional ownership can improve the quality of sustainability reports through a stronger monitoring function. This high monitoring capacity increases the positive impact of ESG disclosure on price timeliness, as the information disclosed by companies is considered more credible by the market.

In the Indonesian context, particularly in the infrastructure sector which faces relatively high sustainability and governance risks, the moderating role of institutional ownership becomes increasingly relevant. The combination of good ESG disclosure and a strong institutional ownership structure encourages the creation of a more credible and transparent information environment, thereby increasing information efficiency in the capital market (Widiani et al., 2023). The acceptance of H3 shows that ESG disclosure does not work independently, but rather its effectiveness in improving stock price efficiency is influenced by corporate governance mechanisms through institutional ownership structures.

Institutional ownership moderates the effect of leverage on stock price discovery efficiency (price timeliness)

The results show that institutional ownership is unable to moderate the effect of leverage on price timeliness, thus rejecting H4. This is reflected in the results of testing the interaction variable of leverage and institutional ownership, which did not show statistical significance at the 5% confidence level, indicating that the existence of institutional ownership has not been able to change the direction or strength of the negative influence of leverage on stock price discovery efficiency. Thus, although leverage has been proven to reduce price timeliness, an increase in the proportion of institutional ownership does not significantly reduce this impact in the research model.

From an agency theory perspective, high leverage increases the risk of bankruptcy and the potential for agency conflicts between management and shareholders. Theoretically, institutional investors are expected to act as a monitoring mechanism capable of suppressing the risk of excessive financial decision-making (Ariantini & Purnamawati, 2025). However, the results of this study show that this supervisory function is not yet strong enough to mitigate the information and financial risks caused by high debt usage, so that the negative impact of leverage on stock price discovery efficiency continues.

These findings are in line with the research by Chung and Wang (2014), which found that the role of institutional investors in capital structure policy and debt risk management is limited and not always effective. Velte (2023) also emphasizes that the effectiveness of institutional ownership monitoring is heterogeneous and highly dependent on investor characteristics, so it is not consistently able to improve market efficiency. In addition, Wahal (1996) and Bushee (2001) show that some institutional investors tend to be passive and short-term oriented, so their involvement in monitoring corporate financial policies is relatively limited (Silva, 2025). This condition means that institutional ownership is not always able to reduce the risks arising from leverage decisions made by management.

In line with these findings, research by Bezo and Dibra (2020)hows that capital markets tend to respond to objective and quantitative financial information, such as leverage, directly and independently of corporate governance mechanisms. Leverage is a financial risk indicator that is easily observable through financial reports, so this information is quickly integrated into stock

prices by market mechanisms. Therefore, even with a high level of institutional ownership, the negative effect of leverage on price timeliness still occurs because debt risk signals have already been processed by investors without the need for reinforcement from institutional monitoring mechanisms.

Thus, the results of this study indicate that the moderating role of institutional ownership is contextual. Institutional ownership can strengthen the effectiveness of non-financial information such as ESG disclosure, but it is not effective enough in reducing the impact of financial risk originating from the company's leverage structure on stock price discovery efficiency.

CONCLUSION

Based on the results and discussion, it was found that ESG disclosure has a positive and significant effect on price timeliness, indicating that ESG disclosure serves as a positive signal in reducing information asymmetry and accelerating the integration of fundamental information into stock prices, thereby increasing capital market efficiency, particularly in the infrastructure sector in Indonesia. Conversely, leverage has a negative and significant effect on price timeliness, as high debt levels increase risk and uncertainty, thereby slowing the market's response to information. In addition, institutional ownership has been shown to moderate and strengthen the relationship between ESG disclosure and price timeliness, confirming its role as a governance mechanism that enhances the credibility and effectiveness of ESG information. However, institutional ownership is unable to moderate the negative effect of leverage on price timeliness, indicating that debt risk remains a dominant factor affecting the speed of stock price adjustment despite institutional oversight.

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