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The Impact of Green Bond and Green Budget Tagging on Sustainable Development Moderated by Regulatory Quality: Evidence from Indonesia

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Abstract–The challenges of climate change, environmental decline, and growing pressure on natural resources are pushing both public and private financing systems to shift toward more sustainable and eco-friendly activities. The objective of this study is to examine whether Green Bond issuance, Green Budget Tagging, and Regulatory Quality significantly influence Sustainable Development and whether Regulatory Quality strengthens the relationship between Green Bond, Green Budget Tagging, and Sustainable Development. The research was conducted in Indonesia by using time series data covering period 2018-2023. Data were analyzed using multiple linear regression with moderation testing through SPSS 25. To ensure that the data used in the regression model meet the BLUE (Best Linear Unbiased Estimator) criteria, a series of classical assumption tests were conducted, including the normality test, multicollinearity test, heteroscedasticity test, and autocorrelation test. The results show that Green Bond has a significant positive effect on Sustainable Development (sig. 0.000<0.05), while Green Budget Tagging has not shown strong positive impact on Sustainable Development (sig.0.344>0.05). Regulatory Quality has a significant positive effect on Sustainable Development (sig. 0.000<0.05). Simultaneous testing reveals that both variables (Green Bond and Green Budget Tagging) together contribute significantly to Sustainable Development (sig. 0.000<0.05). Regulatory Quality significantly moderates the relationship between Green bond and Sustainable Development (sig. 0.000<0.05). It also significantly moderates the relationship Green Budget Tagging and Sustainable Development (sig. 0.023<0.05). Moreover, the inclusion of Regulatory Quality as a moderating variable increases the adjusted R^2 value from 0.847 to 0.865, indicating that regulatory quality strengthens the explanatory power of the model. These findings emphasize that the combination of green financing instruments and strong regulatory frameworks plays a crucial role in accelerating Indonesia's sustainable development agenda.

Keywords: Green Bond; Green Budget Tagging; Regulatory Quality; Sustainable Development

1. INTRODUCTION

Climate change, environmental degradation, and increasing pressure on natural resources are driving the need to transform both public and private financing structures toward more environmentally friendly activities. Green financial instruments such as green bonds (GB) and budgeting practices that integrate environmental considerations, like green budget tagging (GBT) have emerged as critical mechanisms for channeling capital flows into low-carbon initiatives and climate adaptation projects. In many developing countries, including Indonesia, the adoption of these instruments is seen as part of a broader effort to achieve the Sustainable Development Goals (SDGs) while supporting national climate mitigation and adaptation targets. However, the effectiveness of these tools depends heavily on the quality of regulations and the institutional capacity that underpin the issuance and utilization of green funds (Zhu et al., 2020), (Lee, 2020)

Indonesia has placed green economic growth and climate resilience at the core of its national development agenda. The National Medium-Term Development Plan (RPJMN) 2020–2024 incorporates low-carbon economic priorities and strengthened resilience to disasters and climate change as key pillars in realizing Indonesia's 2045 vision (Wardhana & Prawira, 2024). As such, fiscal policies and financing frameworks are increasingly directed toward supporting the green transition. The implementation of GBT has also been introduced in several ministries and agencies as a way to identify and direct public expenditure toward initiatives that generate positive climate and social impacts (Rakatama et al., 2023). On the capital market side, the issuance of GBs by the central government, local governments, and corporations signals the potential of domestic financial markets as a funding source for sustainable projects. However, the tangible impact of these instruments on national sustainable development indicators has yet to be comprehensively measured (Tavares et al., 2024); (Ali et al., 2025).

Green investments allocated through green bonds, complemented by green budget tagging, hold significant potential to accelerate the achievement of relevant SustainableDevelopment Goals (SDGs) for instance, SDG 7 (Affordable and Clean Energy), SDG 9 (Industry, Innovation, and Infrastructure), and SDG 13 (Climate Action) (Tavares et al., 2024); (Raman et al., 2024). However, this potential can only be realized if supported by robust governance and accountability mechanisms that ensure measurable environmental and social impacts, thereby preventing the risk of mere "greenwashing" (Kolcava, 2023); (Scanlan et al., 2022). Consequently, gaining empirical insights into the relationship between green financing instruments and sustainable development outcomes and understanding how regulatory quality moderates this relationship is critical for informing both fiscal policy and capital market strategies in Indonesian.

The literature indicates that green bonds function as a mechanism for mobilizing capital toward environmentally friendly projects and are often associated with improvements in corporate or issuer environmental performance indicators, reductions in certain capital costs, or the signaling of ESG credibility (Maaloul et al., 2023). However,

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several studies have also identified heterogeneity in their effectiveness, which depends on the integrity of reporting frameworks, third-party verification, and the extent of public policy support (Park & Brorson, 2005). Meanwhile, research on green budget tagging (GBT) highlights its role as a fiscal tool for mapping expenditures that contribute to climate objectives and for informing decisions on the allocation of public resources (Kurniawan et al., 2020); (Awudu et al., 2024); (Desdiani et al., 2021); (Maulidiyah & Akhmadi, 2024). In the Indonesian context, a number of descriptive and policy-oriented studies have examined the adoption of GBT and the issuance of green bonds. Nevertheless, the simultaneous integration of market-based instruments (green bonds) and fiscal instruments (GBT) within a single empirical framework to assess their impact on sustainable development outcomes remains relatively unexplored in the Indonesian academic literature.

Several studies in Indonesia have examined the determinants of green bond yields, the dynamics of green financing markets and policies, or the technical aspects of GBT implementation (Maulidiyah & Akhmadi, 2024), (Rakatama et al., 2023). However, the research gap addressed by this study lies in three areas: (1) conducting a comprehensive empirical analysis of the impact of both financing instruments namely green bonds and GBT on sustainable development outcomes at the national and sub-national levels; (2) testing the moderating role of regulatory quality in either strengthening or weakening this relationship; and (3) employing measurable sustainable development indicators integrating environmental, economic, and social dimensions to evaluate the effectiveness of green financing instruments in the context of Indonesia's National Medium Term Development Plan (RPJMN) and SDG targets.

The novelty of this research can be summarized in three key contributions: (1) integrating green bonds and green budget tagging into a single analytical framework, recognizing them as complementary financing channels; (2) explicitly incorporating regulatory quality as a moderating variable to capture institutional conditions that shape the effectiveness of green financing; and (3) adopting a composite sustainable development indicator that combines environmental, economic, and social dimensions aligned with RPJMN priorities and SDG objectives, ensuring direct policy relevance. The findings of this study are expected to provide empirical evidence on whether green bonds and GBT effectively promote sustainable development indicators in Indonesia. This evidence will be of substantial value to policymakers, such as the Ministry of Finance, Bappenas, and the Financial Services Authority (OJK) as well as capital market stakeholders and both domestic and international investors. Furthermore, the study will offer concrete policy recommendations on regulatory enhancement, verification and reporting mechanisms, and the integration of fiscal planning with green capital market strategies in Indonesia.

2. RESEARCH METHODOLOGY

2.1 Basic Research Framework

This study employs a quantitative research design, utilizing time series data of Indonesia covering the period from 2018 to 2023. The selection of the research period was based on the availability of accessible data. The dependent variable (Y) in this study is the Sustainable Development Index, which combines Sustainable Development Goals (SDGs) indicators related to clean energy, infrastructure, emissions, and social welfare. The first independent variable (X1) is the volume of green bond issuance, which includes issuances by the central government, local governments, and corporations. The second independent variable (X2) is the green budget tagging implementation index, measured by the percentage of the green-labeled budget relative to the total budget. The moderating variable (M) is the regulatory quality index, derived from Worldwide Governance Indicators data and relevant national policy information.

The data used in this study were sourced from credible national and international institutions to ensure the accuracy and validity of variable measurements. Green Bond data were obtained from the Financial Services Authority (OJK) and the Ministry of Finance. Green Budget Tagging (GBT) data were drawn from official Green/Climate Budget Tagging reports published by Bappenas and the Ministry of Finance. The regulatory quality variable was measured using the World Bank's Worldwide Governance Indicators (WGI), complemented by national regulatory data related to green finance and sustainable development policies. Meanwhile, Sustainable Development indicators were compiled from Statistics Indonesia (BPS) and the UN SDGs database, covering clean energy, infrastructure, emission control, and socio-economic dimensions relevant to sustainable development targets.

Green bonds are debt instruments specifically issued to finance environmentally friendly projects, such as renewable energy, energy efficiency, waste management, green transportation, and natural resource conservation (Bhutta et al., 2022). They offer two primary benefits namely the mobilization of funds at competitive capital costs and the enhancement of the issuer's reputation regarding sustainability commitments (Barokah & Bandiyono, 2025). A study by (Palmieri et al., 2025) found that green bonds can reduce financing costs for issuers with strong environmental governance However, the risk of greenwashing persists if robust verification and reporting mechanisms are not in place.

In Indonesia, the issuance of green sukuk by the government since 2018 has financed a range of sustainable infrastructure projects, yet the quantitative impact on sustainable development indicators has not been systematically measured (Fitrah & Soemitra, 2022). Beyond serving as a financing tool, green bonds also function as policy instruments that can influence market behavior toward more sustainable practices. According to [21], government-issued green bonds not only provide funding for environmental projects but also act as a policy signal that encourages the private sector to adopt Environmental, Social, and Governance (ESG) principles (Zhao et al., 2024). The recent success of oversubscribed global green sukuk issuances reflects strong international investor interest in domestic green

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instruments (Ullah et al., 2025). Nonetheless, key challenges remain, including the limited pipeline of green projects that meet international standards, the need to strengthen the capacity of issuing institutions, and the alignment of reporting standards with the Green Bond Principles (GBP) and the ASEAN Green Bond Standards (AGBS).

Green Budget Tagging (GBT) is a method of labeling and categorizing government budgets according to their contribution to environmental and climate objectives (Kurniawan et al., 2020). The OECD highlights that GBT can enhance fiscal transparency, strengthen public accountability, and assist policymakers in prioritizing expenditures that advance environmental goals. In Indonesia, Climate Budget Tagging (CBT) was first introduced in 2016 by the Ministry of Finance, and in 2020, it was expanded into Green Budget Tagging across various ministries and agencies (Maulidiyah & Akhmadi, 2024). Research (Wardhana & Prawira, 2024) indicates that GBT can help identify funding gaps for green projects and facilitate cross-sectoral coordination. The implementation GBT serves not only as a budget labeling tool but also as a fiscal performance management instrument that enables the evaluation of government spending effectiveness in supporting the green transition. According to (Kurniawan et al., 2020) effective GBT requires full integration into the budget cycle from planning and allocation to execution and evaluation. This approach ensures that budget allocations are not merely declarative but genuinely reflect sustainable development priorities. In practice, countries such as France and Nepal have successfully employed GBT to systematically identify climate relevant expenditures, thereby improving the efficiency of public spending and reducing program overlaps (Wardhana & Prawira, 2024) . In Indonesia, although GBT has begun to be adopted through initiatives led by the Ministry of Finance, challenges remain, including limited sectoral data, insufficien interministerial coordination, and inconsistent application of green budget classification codes across regions (Salahudin et al., 2025).

Regulatory quality refers to the extent to which government policies and regulations are effective in promoting economic activities that are efficient, transparent, and free from market distortions. In the context of green finance, high regulatory quality encompasses clear standards for green bond issuance, robust project verification mechanisms, comprehensive impact reporting, and the integration of fiscal policies with environmental strategies. Research (Tan, 2022) indicates that strong regulatory quality acts as a critical driver for sustainable investment, particularly in developing countries.

High-quality regulation ensures that policies are developed transparently, grounded in evidence-based decision-making, and capable of fostering a competitive and sustainable business environment (Khan & Shah, 2025)t . In green financing, this includes the establishment of emission standards, requirements for environmental impact reporting, and the provision of both fiscal and non-fiscal incentives for businesses investing in the green sector. Countries with stronger regulatory frameworks tend to enjoy greater investor confidence, thereby attracting more capital for sustainable projects (Opoku et al., 2022). Conversely, weak or inconsistent regulations can hinder the development of green financial markets by creating policy uncertainty.

Regulatory quality also serves as a safeguard against the risks of green washing, which can undermine the credibility of green financial instruments such as green bonds (Buttigieg & Pulis, 2024). A study (Maulidiyah & Akhmadi, 2024)found that the successful implementation of green budget tagging in several countries largely depends on the clarity of technical guidelines, effective inter-agency coordination, and the involvement of independent audit institutions. In Indonesia, efforts to strengthen regulatory quality in green financing have been undertaken through the issuance of the Green Bond and Green Sukuk Framework by the Ministry of Finance and the Financial Services Authority's (OJK) regulations on the issuance of environmentally friendly securities. Nevertheless, greater harmonization between fiscal, capital market, and environmental regulations remains necessary to optimize and measure the effectiveness of green financing.

Sustainable development is defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Haqqi, 2022). Within the framework of the Sustainable Development Goals (SDGs), there are 17 objectives encompassing environmental, social, and economic dimensions. The relationship between green financing instruments and SDG achievement has been widely discussed in the literature, although the results vary depending on governance structures and institutional capacity (Tavares et al., 2024).

Sustainable development goes beyond the environmental dimension, encompassing interconnected social and economic dimensions as well. Under the Triple Bottom Line concept, sustainability is achieved through a balance between the planet (environment), people (society), and profit (economy) (Halimatussadiah, 2020) . The 2030 Agenda for Sustainable Development, adopted by the United Nations, outlines 17 goals and 169 targets that serve as a global roadmap for development planning (Bappenas, 2021). In Indonesia, these targets are integrated into the National Medium-Term Development Plan (RPJMN) 2020–2024, which positions the green economy and climate resilience as strategic pillars. Consequently, measuring sustainable development performance cannot be confined to a single sector; it requires indicators that capture cross-sector linkages, such as the connection between renewable energy investment, emission reduction, green job creation, and equitable prosperity(Hendrati et al., 2025) .

In developing countries, achieving sustainable development often faces challenges such as limited financing, regulatory uncertainty, and weak inter-agency coordination. Research (Tavares et al., 2024) highlights that integrating green financing into fiscal policy and capital markets can accelerate progress toward SDG targets, particularly in sectors such as clean energy, sustainable transportation, and waste management. Green bonds and green budget tagging, when implemented consistently and supported by an effective regulatory framework, can act as catalysts for achieving these goals. Therefore, understanding the causal relationship between green financing instruments, regulatory quality, and sustainable development outcomes is crucial, both for evaluating policy performance and formulating future national

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development strategies. Based on this literature review, the conceptual framework for this study is presented in Figure 1. Recent empirical studies emphasize that the effectiveness of sustainable development initiatives depends not only on the availability of green financing instruments but also on the quality of governance that regulates their implementation. High regulatory quality ensures transparency, accountability, and consistency in environmental policies, thereby enhancing investor confidence and promoting long-term sustainability outcomes. Moreover, regulatory quality acts as a mediating factor between financial innovation and environmental performance, facilitating efficient resource allocation and minimizing greenwashing risks. In this context, Indonesia's efforts to strengthen environmental governance through institutional reforms and regulatory harmonization are essential to maximize the impact of green finance on achieving the Sustainable Development Goals (SDGs).

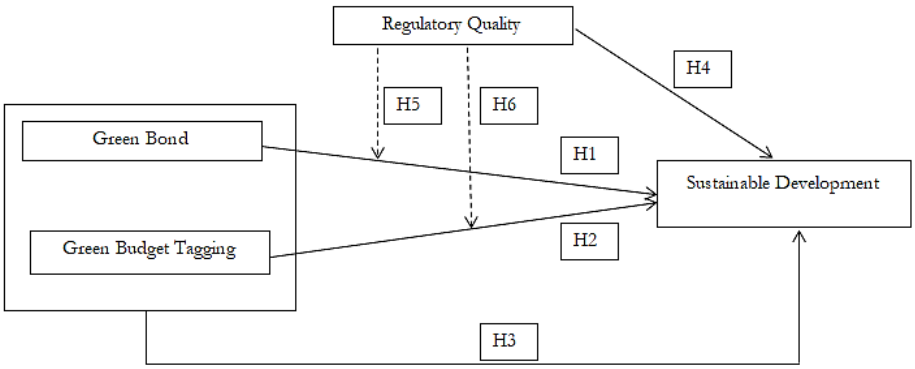

Figure 1. Research Framework

The figure illustrates the relationship between Green Bonds and Green Budget Tagging as independent variables, Regulatory Quality as a moderating variable, and Sustainable Development as the dependent variable. Accordingly, the research hypotheses are formulated as follows:

1. H1: Green bonds partially have a positive and signifikan effect on sustainable development in Indonesia.
2. H2: Green Budget Tagging partially have a positive and signifikan effect on sustainable development in Indonesia.
3. H3: Green bonds and green budget tagging simultaneously have a positive effect on sustainable development in Indonesia.
4. H4: Regulatory quality partially has a positive and signifikan effect on sustainable development in Indonesia.
5. H5: Regulatory Quality significantly moderates the relationship between Green Bonds and sustainable development in Indonesia, strengthening the positive effect.
6. H6:Regulatory Quality significantly moderates the relationship between Green Budget Tagging and sustainable development in Indonesia, strengthening the positive effect.

2.2 Research Model

Moderated Regression Analysis was employed in this study, utilizing the following model:

$$Y = \beta_0 + \beta 1X_1 + \beta_2X_2 + \beta_3Z + \beta_4(X1\times Z) + \beta_5(X2\times Z) + \varepsilon \quad (1)$$

$$SDit_{it} = \beta 0 + B1GBond_{it} + \beta 2GBT_{it} + \beta 3RQ_{it} + \beta 4(Gbond_{it} \text{ x } RQ_{it} + \beta 5\ (GBT_{it} \text{ x } RQ_{it}) + \varepsilon_{it} \quad (2)$$

The equation explains the relationship between the Sustainable Development Index (SDit) and several key explanatory variables over time. The SDit represents the level of sustainable development achieved at a given time *t*, serving as the dependent variable in the model. The GBondit denotes the volume of green bonds issued at time *t*, reflecting a country's financial commitment to environmentally responsible investments. Similarly, GBTit refers to the volume of green budget tagging issued at time *t*, indicating how fiscal allocations are directed toward sustainability-oriented projects. The RQit, or Regulatory Quality Index at time *t*, measures the effectiveness and strength of governance and regulatory frameworks that support sustainable practices. Finally, the εit represents the error term, capturing all other unobserved factors that may influence the sustainable development index but are not explicitly included in the model. Together, these variables aim to evaluate how financial instruments and institutional quality contribute to advancing sustainable development outcomes.

2.3 Data Analysis

The data analysis in this study was conducted using the Moderated Regression Analysis (MRA) model to examine the role of regulatory quality as a moderating variable in the relationship between green bonds and green budget tagging on sustainable development. The analytical process began with classical assumption testing, which included a normality test to ensure that the residuals were normally distributed, a multicollinearity test to detect potential high correlations among independent variables, a heteroscedasticity test to check the consistency of residual variances, and an autocorrelation test to confirm the absence of serial correlation within the panel data.

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Once all assumptions were satisfied, hypothesis testing was carried out through partial tests (t-tests) to assess the individual effect of each variable, and simultaneous tests (F-tests) to evaluate the collective influence of the independent variables on the dependent variable. In addition, the coefficient of determination (R^2) was employed to measure the proportion of variance in sustainable development that could be explained by the research model.

3. RESULTS AND DISCUSSION

3.1 Descriptive Stattistics

The descriptive statistical results are presented in Table 1.

Tabel 1. Descriptive Statitstics

	N	Minimum	Maximum	Mean	Std. Deviation
Green Bond (GB)	6	8.35	29.00	15.0450	8.01724
GBT	6	73.88	104.46	85.6533	11.83015
RQI	6	.02	.53	.2500	.16697
SD	6	67.70	72.86	69.3783	1.81125
Valid N (listwise)	6				

The Green Bond (GB) variable recorded a minimum value of 8.35 and a maximum of 29.00, with a mean of 15.0450 and a standard deviation of 8.01724. This indicates that the issuance of green bonds during the study period and across regions exhibited considerable variation, as reflected in the relatively high standard deviation compared to the mean.

The Green Budget Tagging (GBT) variable showed a minimum value of 73.88% and a maximum of 104.46%, with an average of 85.6533% and a standard deviation of 11.83015. The relatively high average suggests that the proportion of budget allocated for green objectives was fairly significant, although variations existed across different periods or regions.

The Regulatory Quality Index (RQI) variable ranged from a minimum of 0.02 to a maximum of 0.53, with a mean of 0.2500 and a standard deviation of 0.16697. These figures indicate that regulatory quality varied among regions or across the study period, with some areas demonstrating above-average regulatory standards, while others fell below this benchmark.

3.2 Normality Test

The results of the normality test using the One-Sample Kolmogorov-Smirnov Test method as presented in Table 2 show a significance value (Asymp. Sig. 2-tailed) of 0.130 > the significance level used ($\alpha = 0.05$), so it can be concluded that the residual data is normally distributed. Thus, the normality assumption is met so that the data is suitable for further regression analysis.

Tabel 2. Normality Test's Result

		Unstandardized Residuals
N		6
Normal Parameters[a,b]	Mean	0.0000000
	Std.Devia tion	0.43930182
Most Extreme Differences	Absolute	0.288
	Positive	0.188
	Negative	-0.288
Kolmogorov-Smirnov Z		0.288
Asymp. Sig. (2-tailed)		0.130[c]

3.3 Multicollinearity Test

Based on the multicollinearity test results presented in Table 3, the Tolerance values fortGreen Bond (0.123), Green Budget Tagging (0.163), and Regulatory Quality (0.504) are all greater than 0.10. This indicates that there is no serious multicollinearity problem among the independent variables.

However, the Variance Inflation Factor (VIF) values for Green Bond (8.104) and Regulatory Quality (8.650) are relatively close to the threshold of 10, suggesting a moderate correlation among some independent variables, though still within the acceptable range (VIF < 10). Meanwhile, Green Budget Tagging shows a VIF value of 6.118, which also falls below the critical threshold, confirming the absence of excessive multicollinearity.

Therefore, it can be concluded that the regression model meets the assumption of no multicollinearity, and the independent variables can be used in further regression analysis.

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Table 3. Multicollinearity Test's Result

Variable	Tolerance	VIF
Green Bond	0.123	8,104
Green Budget Tagging	0.163	6.118
Requlatory Quality	0.504	8.650

3.4 Heteroscedasticity Test

Based on the result of scatterplot of the heteroscedasticity test on the dependent variable Sustainable Development as presented in Figure 1, it can be seen that the residual points are randomly spread above and below zero on the Y-axis and do not form a pattern. This random distribution of points indicates that the variance of the residuals is constant (homoscedasticity). Thus, it can be concluded that in this regression model there is no symptom of heteroscedasticity. This means that the regression model is suitable for use because one of the classical assumptions regarding the equality of residual variances has been met.

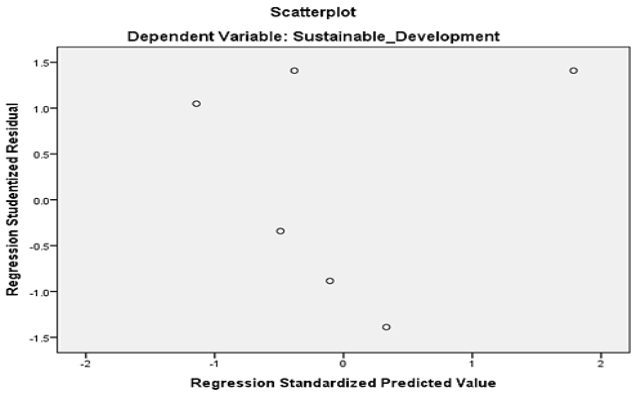

Figure 2. Result of Heteroscedasticity Test

3.5 Autocorelation Test

Based on the model summary output, the resulting Durbin-Watson (DW) value is 2.086 (Table This value is within the ideal range of 1.5 to 2.5, indicating that there is no autocorrelation problem in the regression model. The absence of autocorrelation means that the residuals of the model are independent between observations, so the estimated regression coefficients can be considered valid and unbiased by residual correlation. This confirms that the model is suitable for further hypothesis testing.

Table 3. Autocorrelation Test

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.971[a]	.943	.857	.68512	2.086

a. Predictors: (Constant), Quality_Regulatory, Green_Budget_Tagging, Green_Bond
b. Dependent Variable: Sustainable_Development

3.6 Partial t- Test

T-test results presented in Table 4.

Table 4. t-test Result

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	63.269	4.232		15.036	.000
	Green Bond	.187	.040	.384	4.676	.000
	Green Budget Tagging	.061	.055	.245	1.120	.344
	Regulatory Quality	5.195	.755	.474	6.882	.000
	GreenBond*Regulatory Quality	.537	.094	1.614	5.714	.000
	GreenBudgetTagging *Requlatory Quality	.086	.030	.041	2.868.	.023

a. Dependent Variable: Sustainable_Development

Based on summary in the Table 4, the following explanations can be obtained:

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1. Green Bonds have a significance value of 0.000 (<0.05) with a t-value of 4.676, thus accepting H1. This means that Green Bonds have a positive and significant effect on Sustainable Development.
2. Green Budget Tagging has a significance value of 0.344 (>0.05) with a t-value of 1.120, thus rejecting H2. This means that Green Budget Tagging does not have a significant effect on Sustainable Development.
3. Regulatory Quality shows a significance value of 0.000 (<0.05) with a t-value of 6.882, thus accepting H4. This means that Regulatory Quality has a positive and significant effect on Sustainable Development.
4. The Green Bond × Regulatory Quality interaction has a significance value of 0.000 (<0.05) with a t-value of 5.714, thus H5 is accepted. This means that this interaction significantly strengthens the influence of Green Bonds on Sustainable Development.
5. The Green Budget Tagging × Regulatory Quality interaction has a significance value of 0.023 (<0.05) with a t-value of 2.868, thus H6 is accepted, meaning this interaction also significantly moderates the relationship between Green Budget Tagging and Sustainable Development.

3.6.1 Green Bond and Sustainable Development

The analysis results show that Green Bonds have a positive coefficient of 0.187 with a significance value of 0.000, indicating that this variable has a positive and significant effect on Sustainable Development. This finding aligns with research by (Tavares et al., 2024) which states that green bonds are a financial instrument capable of significantly encouraging financing for environmentally friendly projects, including in the renewable energy, green transportation, and energy efficiency sectors. The study of (Flammer et al., 2021) also found that issuing green bonds improves corporate environmental performance and makes a significant contribution to achieving the SDGs, particularly goals 7 (Affordable and Clean Energy) and 13 (Addressing Climate Change).

Theoretically, these results can be explained through Stakeholder Theory which states that companies or governments need to consider the interests of all stakeholders, including investors who have a preference for environmental sustainability. With the existence of green bonds, investors have an investment channel that directly funds sustainable projects. In addition, according to the research results of (Fu et al., 2023), the green bond market also shows better resilience to market volatility, which in turn provides long-term financing stability for sustainable development.

3.6.2 Green Budget Tagging and Sustainable Development

The Green Budget Tagging variable has a positive coefficient of 0.061, but it is not significant (sig. 0.344). These results indicate that, despite the positive direction of the relationship, the implementation of green budget tagging in this study sample has not yet significantly impacted Sustainable Development. This aligns with findings from (Bappenas, 2021), which showed that budget tagging in Indonesia still faces challenges, such as limited scope of tagged programs, weak coordination between ministries/agencies, and a lack of mechanisms for evaluating the environmental performance of public spending. A study by (Salahudin et al., 2025) also emphasized that identifying environmentally friendly budgets alone is insufficient to guarantee a direct impact on sustainable development without effective program implementation.

From a public policy theoretical perspective, this situation can be explained through Policy Implementation Theory, which emphasizes that the quality of policy implementation is highly dependent on clarity of objectives, resources, and oversight mechanisms. In the context of green budget tagging, even if a green budget identification system exists, its benefits for sustainable development will be limited if the tagging is not accompanied by targeted project execution and accountable outcome measurement. Therefore, to increase the effectiveness of green budget tagging, stronger integration is needed between budget planning, implementation, and monitoring of environmental results (Rakatama et al., 2023)

3.6.3 Regulatory Quality and Sustainable Development

Regulatory Quality shows a very large positive coefficient (5.195) with a significance level of 0.000, indicating a positive and significant impact on Sustainable Development. This result is consistent with the findings of (Damak & Güngör, 2025), which state that high regulatory quality that characterized by clear, consistent, and predictable policies tend to increases the effectiveness of sustainable development program implementation. Research by(Ong et al., 2022) also demonstrates that countries with good regulatory governance tend to have higher environmental performance because strong rules encourage innovation and economic actors' compliance with environmental standards.

This finding can be explained by institutional theory, which emphasizes that institutional quality, including regulations, plays a crucial role in determining the success of public policy. Clear and consistent regulations create a conducive investment climate, reduce uncertainty, and facilitate the adoption of environmentally friendly technologies. In the Indonesian context, improving regulatory quality not only helps the distribution of green funds such as green bonds but also ensures that government spending labeled as environmentally friendly actually contributes to the achievement of sustainable development targets.

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3.6.4 Regulatory Quality Moderated the Green Bond and Sustainable Development

The interaction between Green Bonds and Regulatory Quality has a positive coefficient of 0.537 with a significance level of 0.000, indicating that regulatory quality strengthens the influence of green bonds on sustainable development. This finding is consistent with (Flammer et al., 2021) who found that green bond markets are more developed and have a significant impact in countries with strong legal and oversight frameworks, as quality regulations increase transparency, accountability, and investor confidence. Research by (Rivera, 2022) also confirms that the presence of clear regulations accelerates the adoption of green bonds and reduces the risk of greenwashing.

From the perspective of Good Governance theory, quality regulations serve as a controlling mechanism that ensures that green bond funds are allocated to projects that genuinely meet sustainability criteria. This reduces information asymmetry between issuers and investors, increases project legitimacy, and encourages the growth of a healthy green finance market. Therefore, these results indicate that the synergy between green finance instruments and strong regulations is a key factor in accelerating the achievement of sustainable development goals(Boyd, 2002).

3.6.5 Regulatory Quality Moderated the Green Budget Tagging and Sustainable Development

The interaction between Green Budget Tagging and Regulatory Quality has a positive coefficient of 0.086 with a significance level of 0.023, indicating that quality regulations can strengthen the influence of green budget tagging on sustainable development. This result aligns with (Fernandez et al., 2024) report, which emphasizes that an environmental budget tagging system is only effective when supported by a clear regulatory framework, transparent reporting mechanisms, and strict oversight. A study by (Islam, 2025) also shows that budget tagging integrated with high-quality regulations can increase the effectiveness of public budget allocations for environmentally friendly programs.

This finding aligns with the Policy Coherence for Sustainable Development framework, which states that coordination between budget instruments and regulatory policies is key to ensuring policy consistency and achieving SDG targets (Shawoo et al., 2023). In this context, strong regulations ensure that budget tagging is not merely administrative but also has real implications for the effectiveness of funded programs. This emphasizes that the success of green budget tagging in promoting sustainable development is strongly influenced by the quality of the regulations governing it.

3.7 Simultaneous Test (F Test)

The F-test results in the ANOVA (Table 5) show a calculated F-value of 36.479 with a significance level of 0.000 ($p < 0.05$), indicating that the Green Bond and Green Budget Tagging variables simultaneously have a significant effect on Sustainable Development. This indicates that the combination of green financing instruments and green budget tagging mechanisms plays a crucial role in promoting the achievement of sustainable development targets. Green Bonds, for example, provide a financing mechanism with a bond scheme dedicated to environmentally friendly projects, such as renewable energy, energy efficiency, waste management, and natural resource conservation. This instrument not only provides funding for project implementation but also creates incentives for both the public and private sectors to integrate sustainability principles into their investment planning. (Rivera, 2022) notes that Green Bonds increase transparency and accountability in the use of funds, giving investors confidence that their contributions have a tangible environmental impact, ultimately driving the achievement of the SDGs.

Meanwhile, Green Budget Tagging (GBT) plays a crucial role in systematically directing government budgets toward activities that support the sustainability agenda. GBTs enable the identification, tracking, and reporting of government spending that has a positive environmental impact, thereby preventing budget leakage and ensuring that public funds are used effectively to reduce environmental degradation and improve people's quality of life. According to the (Fernandez et al., 2024), the implementation of GBTs in several developing countries has helped governments formulate development priorities aligned with climate targets and the SDGs, strengthened inter-ministerial coordination, and enhanced fiscal accountability. The combination of Green Bonds and GBTs creates synergy between funding sources and sustainability-oriented budget management, thereby strengthening the country's capacity to achieve sustainable development holistically.

These findings support Sustainable Finance theory, which emphasizes the importance of synergy between green financial market instruments and fiscal policy to achieve environmental and social targets (Wardhana & Prawira, 2024). Research by (Flammer et al., 2021) also found that the success of sustainable development is significantly influenced by the integration of environmentally friendly fiscal policies and green financing instruments.

Table 5. F-test Result

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	16.403	5	9.281	36.479.	.000[b]
	Residual	1.834	2	.		
	Total	18.237	7			

a. Dependent Variable: Sustainable_Development

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b. Predictors: (Constant), GreenBudgetTagging_RequlatoryQuality, Green_Bond, Green_Budget_Tagging, GreenBond_RegulatoryQuality, Quality_Regulatory

3.8 Coefficient of Determination Test

The results of the coefficient of determination test show an improvement in the model's explanatory power after including Regulatory Quality as a moderating variable.

As displayed in the Table 6, before the moderating variable was introduced, the Adjusted R Square value was 0.847, indicating that 84.7% of the variation in sustainable development could be explained by the independent variables Green Bond and Green Budget Tagging, while the remaining 15.3% was influenced by other factors outside the model.

Table 6. Coefficient of Determination Test's Result without Moderated Variable

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.953[a]	.908	.847	.70952

Predictors: (Constant), Green_Budget_Taggging, Green_Bond, Requlatory Quality

After incorporating Regulatory Quality as a moderating variable, the Adjusted R Square increased to 0.865 (Table 7). This suggests that regulatory quality strengthens the relationship between green bonds, green budget tagging, and sustainable development, making the model more robust in explaining the observed variability. In other words, regulatory quality plays a crucial role in enhancing the effectiveness of green financing instruments in driving sustainable development outcomes.

Table 7. Coefficient of Determination Test's Result With Moderated Variable

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.986[a]	.955	.865.	.80657

a. Predictors: (Constant), GreenBudgetTagging_RequlatoryQuality, Green_Bond, Green_Budget_Tagging, GreenBond_RegulatoryQuality, Quality_Regulatory

The increase in the Adjusted R Square value reinforces the notion that sound and effective regulations are key to ensuring the optimal implementation of green bonds and green budget tagging, thereby contributing significantly to the achievement of sustainable development goals.

4. CONCLUSION

Based on the results of data processing, it can be concluded that this study supports the role of green financing instruments in promoting sustainable development in Indonesia. First, Green Bonds have been shown to have a significant effect. Second, Green Budget Tagging has not shown a strong partial effect. Third, Regulatory Quality has a significant impact and strengthens the effectiveness of both instruments. Fourth, Green Bonds and Green Budget Tagging simultaneously contribute to sustainable development. Fifth, the increase in Adjusted R Square from 84.7% to 86.5% after incorporating Regulatory Quality demonstrates that regulatory quality plays a key role in ensuring the success of green financing. The results of this study imply that green financing instruments, particularly Green Bonds, can be a strategic alternative in supporting the sustainable development agenda in Indonesia. The government and financial market authorities need to strengthen regulations and expand Green Bond issuance to ensure a more tangible impact on achieving the SDGs. Furthermore, the implementation of Green Budget Tagging must be strengthened through fiscal policy harmonization, institutional capacity building, and governance improvements to more effectively direct public spending to environmentally sound projects. Regulatory quality has been proven to be a key factor in strengthening the effectiveness of green financing instruments, thus requiring continued improvement in policies that are more consistent, transparent, and integrated across sectors. Research Limitations This study has several limitations. First, the data coverage is limited to the period 2018–2023, so the results cannot capture the long-term dynamics of green financing instrument implementation. Second, the variables used focus only on Green Bonds, Green Budget Tagging, and Regulatory Quality, thus failing to capture other factors that could potentially influence sustainable development, such as foreign direct investment (FDI), green technology innovation, or socio-political factors. Future research is recommended to expand the observation period to capture the long-term influence of green financing policies on sustainable development. Additional variables, such as private investment, renewable energy innovation, or the role of international institutions, could also be included to provide a more comprehensive understanding.

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