Eduvest – Journal of Universal Studies
Volume 6, Number 4, April, 2026
p- ISSN 2775-3735- e-ISSN 2775-3727

The Effect of Green Bond Issuance on the Cost of Capital of Stated Owned Banks in Indonesia

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Keywords
Green Bonds; Cost of Capital; Stated Owned Banks; Indonesia; Difference-in-Differences

ABSTRACT
This study examines the impact of green bond issuance on capital costs in Indonesian state-owned banks, focusing on whether green bonds reduce the cost of debt (CoD), cost of equity (CoE), and weighted average cost of capital (WACC) for the issuing bank. This study uses *PT Bank Negara Indonesia (Persero) Tbk* (BNI) as the treated firm and *PT Bank Tabungan Negara (Persero) Tbk* (BTN) as the control firm, employing a Difference-in-Differences (DiD) methodology. The analysis is based on 16 quarters of data, comprising 8 quarters prior to and 8 quarters following BNI's green bond issuance in 2022, covering the period from 2020Q2 to 2024Q2. The empirical findings indicate that the issuance of green bonds does not significantly lower BNI's CoD, CoE, or WACC. The treatment effect on CoD is positive and not significant, indicating a lack of debt-pricing advantage. The treatment effect on CoE is negative but not significant, suggesting no substantial change in equity investors' required returns. Additionally, the treatment effect on WACC is slightly positive and statistically not significant. The findings indicate that the Indonesian financial market has not incorporated the sustainability attributes of green bonds into the capital costs of issuers. Factors including the nascent state of Indonesia's green finance ecosystem, limited involvement from global ESG-focused investors, transitional issuance expenses, and volatility associated with COVID-19 may contribute to these outcomes. This study adds to the existing literature by presenting empirical evidence from an emerging market. It points out the necessity for enhanced disclosure, increased investor engagement, and more robust integration of sustainability in banking operations to improve the financial effectiveness of green bonds.

INTRODUCTION

Sustainable finance has increasingly become an essential component of global efforts to transition toward a low-carbon and climate-resilient economy. Financial markets now play a crucial role in mobilizing capital to support environmentally responsible activities, and among the instruments designed for this purpose, green bonds have gained substantial prominence. These securities are specifically structured to fund environmentally beneficial projects, including renewable energy development, energy-efficient infrastructure, sustainable transportation, and climate adaptation initiatives. Their rapid growth is attributed not only to rising environmental awareness but also to the instrument's potential economic advantage, particularly the expectation that green bond issuance may reduce an issuer's cost of capital (Wenling Li & Duca, 2024; Zerbib, 2019; Zhang et al., 2021).

A growing body of research indicates that green bonds may trade at lower yields, a phenomenon often referred to as the greenium, as investors demonstrate a willingness to accept marginally lower financial returns in exchange for environmental impact (Flammer, 2021; Zerbib, 2019). Other studies suggest that green bond issuance may reduce information asymmetry and broaden the investor base, thereby influencing the cost of equity (Tang & Zhang, 2020). Despite these insights, empirical findings are far from conclusive. While some markets exhibit clear pricing benefits, others show minimal or no financial advantage, suggesting that the impact of green bonds on the cost of capital is highly context-dependent (Etikan et al., 2016; Gertler et al., 2016; Palinkas et al., 2015).

In emerging markets, the evidence is notably mixed and remains understudied. Prior research highlights that the effectiveness of green bond issuance in lowering financing costs is influenced by market maturity, investor preferences, regulatory support, and the credibility of sustainability disclosures (Li & Duca, 2024; MacAskill et al., 2021). The mechanisms through which cost-of-capital reductions might occur—such as improved liquidity, lower perceived risk, or enhanced transparency—may not fully materialize in developing economies where sustainability frameworks are still evolving. Thus, examining the financial implications of green bonds within the Indonesian market offers both theoretical and practical relevance.

Indonesia has made considerable progress in establishing a regulatory foundation for sustainable finance, most notably through POJK 51/2017 on the implementation of sustainable finance and POJK 18/2023, which strengthens the governance of sustainability-based debt securities and sukuk. These regulations signal the government's commitment to accelerating the integration of environmental considerations into financial decision-making and encouraging the issuance of sustainability-oriented financial instruments. However, regulatory support alone does not guarantee measurable financial benefits for issuers.

As shown in Figure 1.1, the corporate bond market consistently records annual issuances between approximately Rp90 trillion and Rp150 trillion, reflecting its importance as a mainstream financing channel. However, green bond issuance remains extremely small relative to the broader market, consistently contributing less than 10% of total annual issuance. Even in 2022 and 2023, which recorded the highest overall corporate bond activity, green bonds accounted for only a fraction of total issuance.

This stark disparity suggests that while the regulatory ecosystem supports sustainable finance, the adoption of green bonds among Indonesian corporates remains limited. Several factors may explain this gap, including higher issuance and compliance costs, limited investor demand for sustainability-themed instruments, uncertainty about pricing benefits, and the nascent stage of ESG integration in Indonesia's financial markets (Khurram et al., 2023; Makpotche et al., 2024; Wang et al., 2020). As a result, issuers may question whether the financial incentives associated with green bonds sufficiently justify the additional administrative and verification requirements.

Against this backdrop, the issuance of PT Bank Negara Indonesia (Persero) Tbk (BNI)'s green bond in 2022 represents a significant milestone within Indonesia's banking industry. As one of the first state-owned banks to issue a corporate green bond, BNI provides an ideal case to examine whether the Indonesian financial market internalizes sustainability attributes in bond pricing and capital cost dynamics (Imbierowicz & Rauch, 2014; Warjiyo & Juhro, 2019; Zhang et al., 2021). Specifically, it remains unclear whether green bond issuance leads to

reductions in the cost of debt (CoD), cost of equity (CoE), or weighted average cost of capital (WACC), especially given Indonesia's evolving sustainable finance landscape. As Indonesia's green bond market is still in an early developmental stage, empirical investigation is essential to assess the extent to which sustainability-related features are valued by investors.

Therefore, empirical investigation is essential to assess whether green bonds deliver tangible financial benefits to issuing banks. This research is expected to contribute to the understanding of sustainable finance in Indonesia by evaluating whether green bond issuance affects the cost of capital of state-owned banks. The findings will offer insights for issuers considering green financing strategies, for investors assessing risk-return dynamics in green instruments, and for policymakers seeking to evaluate and refine the effectiveness of sustainable finance regulations.

Based on the business issues and contextual considerations outlined above, this study formulates research questions and objectives aimed at examining whether the issuance of a green bond reduces the issuing bank's cost of debt (CoD), cost of equity (CoE), and overall weighted average cost of capital (WACC). Accordingly, the research seeks to determine the impact of green bond issuance on these three components of financing costs by assessing whether such issuance leads to a decrease in CoD, evaluating its effect on CoE, and analyzing whether it contributes to a reduction in the bank's overall WACC.

METHOD

The research followed a structured design that began with identifying the business issue related to the economic effects of green bond issuance. This issue was then formulated into research questions and objectives, followed by a comprehensive literature review to establish the theoretical foundation and synthesize prior empirical findings. The literature review informed the development of hypotheses that described the expected relationship between green bond issuance and the issuing bank's cost of capital. Afterward, the methodological approach was determined, including variable selection, data collection strategy, and analytical techniques for hypothesis testing.

Data collection relied on secondary sources such as financial statements, regulatory reports, market data, stock prices, and other publicly available documents. The study used purposive sampling, selecting BNI as the treated bank because it issued a green bond in 2022Q2, and BTN as the control bank due to its similar characteristics but absence of green bond issuance during the observation period. The validity of the Difference-in-Differences (DiD) approach was supported by testing the parallel-trends assumption, while additional covariates such as profitability, size, credit risk, liquidity, inflation, and the BI Rate were incorporated to reduce structural bias in the estimation.

The analysis employed quantitative methods through panel data regression, allowing the integration of cross-sectional and time-series information. This approach was suitable for accounting for unobserved heterogeneity and improving estimation efficiency. DiD served as the primary identification strategy by comparing pre- and post-issuance changes in cost of debt, cost of equity, and WACC between the treated and control banks. All statistical procedures were conducted using Stata to ensure the robustness and accuracy of the empirical findings.

Before estimating the model, assumption tests were performed to meet the BLUE (Best Linear Unbiased Estimator) criteria, including checks for heteroskedasticity, multicollinearity,

and the parallel-trends requirement. Heteroskedasticity was examined using the Breusch–Pagan/Cook–Weisberg test, while multicollinearity was assessed through the Variance Inflation Factor (VIF). The DiD model incorporated treatment and time dummy variables, their interaction term, and additional covariates to isolate the causal effect of green bond issuance. The resulting estimates formed the basis for conclusions regarding the financial impact of green bond issuance on the cost of capital for Indonesian banks.

RESULT AND DISCUSSION

Analysis

The analysis consists of descriptive statistic, heteroscedacuty test, multicollinearity test, parallel trend assumption, difference in differences analysis, and hypothesis test.

1. Descriptive Statistics

This study uses two corporations as research samples, PT Bank Negara Indonesia (Persero) Tbk as the treatment group and PT Bank Tabungan Negara (Persero) Tbk as the control group. The collected data is employed for descriptive statistical analysis, with each variable measured through its mean, median, standard deviation, minimum, and maximum values. The results of this descriptive analysis are presented below.

Table 1. Descriptive Statistics 6

Variable	Observation	Mean	Std. dev.	Min	Max
Independence (Dummy) Variable					
GB	32	0.25	0.439941	0	1
Dependence Variable					
CoD	32	0.05738	0.034049	0.01112	0.14711
CoE	32	0.046229	0.009911	0.03253	0.06013
WACC	32	0.056956	0.032117	0.01454	0.14173
Covariate Variable					
ROA	32	0.014572	0.007188	0.0054	0.0267
NPL	32	0.033856	0.007149	0.0198	0.0471
LDR	32	0.910019	0.059726	0.7971	1.1127
BIRate	32	0.046719	0.010988	0.035	0.0625
Inflation	32	0.027669	0.014664	0.0133	0.0595
ln_Size	32	27.14105	0.469789	26.4746	27.7141

Source: Processed secondary data from BNI and BTN quarterly financial statements, Bank Indonesia, and IDX, 2020Q2–2024Q2

Table 1 presents the descriptive statistics for all variables used in this study, comprising 32 quarterly observations from BNI as the treatment group and BTN as the control group. The observation window includes eight quarters prior to and eight quarters after the green bond issuance by BNI in 2022 Q2, enabling a balanced Difference-in-Differences (DiD) framework to compare the dynamics between treated and untreated banks over time.

The green bond (GB) dummy variable yields a mean value of 0.25, indicating that 25% of total observations correspond to the post-treatment period for BNI. The binary nature of this variable is reflected in the standard deviation of 0.4399, which is consistent with the structure of the DiD setup, where BTN never receives the treatment.

Regarding funding structure, the Cost of Debt (CoD) averages 5.74%, with a standard deviation of 0.0340, suggesting a reasonable degree of fluctuation in debt financing costs for both banks across the sample period. The range from 1.11% to 14.71% implies that both macroeconomic movements and bank-specific conditions influenced borrowing costs over time. Similarly, the Cost of Equity (CoE) has a mean value of 4.62% and low dispersion, indicating stable risk pricing in equity markets for BNI and BTN. The aggregate Weighted Average Cost of Capital (WACC) averages 5.70%, which aligns with the combined effects of both the cost of debt and cost of equity.

In terms of profitability, Return on Assets (ROA) demonstrates a mean of 1.46%, with values ranging between 0.54% and 2.67%. This variation reflects the underlying operational performance differences between BNI and BTN across the sample horizon.

Risk and liquidity indicators also show expected patterns for large Indonesian banks. The Non-Performing Loan (NPL) ratio averages 3.39%, indicating moderate credit risk exposure, while the Loan-to-Deposit Ratio (LDR) has a mean value of 91%, in line with the lending intensity typical in the banking sector. The policy-related variables, namely the BI Rate (mean 4.67%) and Inflation (mean 2.77%), capture the macroeconomic environment affecting both banks' cost structures and credit activities.

Firm size, proxied by ln_Size, averages 27.14, showing relatively low variation (standard deviation 0.47). This stability is expected, given that BNI and BTN are established state-owned banks with consistent asset bases.

2. Heteroscedasticity Test

Table 2. Heteroscedasticity Test

Statistic	CoE	CoD	WACC
Chi-Squared	1.11	7.03	8.12
Probability Value	0.2932	0.008	0.0044

Source: Processed by the author using STATA based on secondary data from BNI and BTN, 2020Q2–2024Q2

Table 2 presents the results of the heteroskedasticity test for the CoE, CoD, and WACC regression models. The Chi-Squared statistics and their corresponding probability values (p-values) indicate whether the residual variances are constant across observations.

For the CoE model, the p-value is 0.2932, which is greater than 5% significance level. This result suggests that the null hypothesis of homoskedasticity cannot be rejected, implying that the residuals in the CoE regression are homoskedastic, or have constant variance. Therefore, heteroskedasticity does not pose a concern for this model.

In contrast, the CoD and WACC models show p-values of 0.008 and 0.0044, respectively, both below 5% threshold. These results indicate that the null hypothesis of homoskedasticity is rejected, meaning that the residuals exhibit heteroskedasticity. When heteroskedasticity is present, standard errors may be biased, potentially leading to incorrect inference.

To address this issue, the study employs heteroskedasticity-robust standard errors, which correct the bias and ensure valid statistical inference. Using robust standard errors is a standard remedy recommended in econometric literature when heteroskedasticity is detected (Wooldridge, 2015).

3. Multicollinearity Test

Table 3. Multicollinearity Test 8

Variable	VIF	1/VIF
ROA	10.11	0.09893
GB	6.6	0.15163
NPL	6.01	0.16642
ln_Size	4.88	0.20473
BIRate	3.97	0.25199
LDR	3.02	0.33067
Inflation	1.55	0.64537
Mean VIF		**5.16**

Source: Processed by the author using STATA based on secondary data from BNI and BTN, 2020Q2–2024Q2

Table 3 presents the results of the multicollinearity test for all independent variables using the Variance Inflation Factor (VIF). Multicollinearity occurs when two or more explanatory variables are highly correlated, which can inflate standard errors and weaken the statistical significance of regression estimates (Wooldridge, 2015). According to Gujarati (2009) and Wooldridge (2015), a VIF value above 10 typically indicates a high degree of multicollinearity.

In this study, one variable exhibit VIF values above the recommended threshold. Specifically, ROA (10.11) show the highest VIF values, suggesting that this variable have relatively strong correlations with other explanatory variables in the model. Other variables such as GB (6.6) and NPL (6.01) also display moderately high VIF values, though still within a tolerable range. Variables such as LDR (3.02 and Inflation (1.55) show low VIF values, indicating minimal multicollinearity concerns.

The Mean VIF of 5.16 suggests that the overall level of multicollinearity in the model is moderate but does not exceed critical levels that would compromise model estimation. Importantly, multicollinearity does not bias coefficient estimates, it only affects the precision of standard errors (Wooldridge, 2015). Therefore, as long as the variables are theoretically justified within the model, the presence of moderate multicollinearity is acceptable and does not undermine the validity of the regression results.

Furthermore, in Difference-in-Differences (DiD) models, multicollinearity is generally expected because the structure includes fixed effects (Treatment) and time-based indicators (Time), which tend to increase correlations among covariates. As such, the observed multicollinearity is not unusual and remains within reasonable methodological bounds.

4. Parallel Trend Assumption

A key identification assumption in the Difference-in-Differences (DiD) method is that the treatment and control groups must follow parallel trends in the outcome variables before the intervention occurs. In this study, the intervention is BNI's issuance of a green bond in 2022Q2, and BTN serves as the control group. To validate this assumption, graphical based parallel trend tests were conducted.

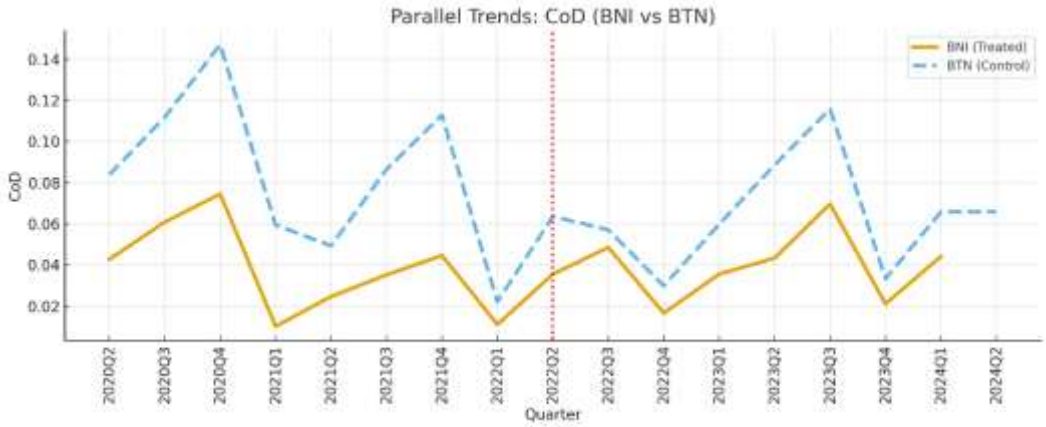

Figure 1. Cost of Debt parallel trends 4

Source: Processed by the author based on BNI and BTN quarterly financial statements, 2020Q2–2024Q2

Figure IV.1 illustrates the trends of Cost of Debt (CoD) for BNI (treated bank) and BTN (control bank) from 2020Q2 to 2024Q2, with the vertical red dashed line marking the treatment period (2022Q2). Prior to the green bond issuance, the CoD trajectories of both banks display similar directional patterns, even though their CoD levels differ.

During the pre-treatment period both banks experience a rise in CoD during late 2020, accompanied by tightening financial conditions across the banking sector. In 2021, CoD for both banks fluctuates modestly but follows a common pattern of mild increase and subsequent stabilization. Leading up to 2022Q1, both banks experience slight reductions in CoD, reflecting easing monetary pressures prior to policy normalization.

The key observation is that both BNI and BTN exhibit similar slopes and turning points before the green bond issuance. Although BTN consistently presents higher CoD levels, owing to its funding structure and risk premium, the co-movement of trends confirms that both banks are influenced by comparable macroeconomic factors and industry-wide conditions.

After the treatment period, divergence becomes more visible, BNI's CoD shows an upward movement, while BTN's CoD fluctuates more sharply. This divergence represents the treatment effect window, which the DiD model quantifies statistically.

Therefore, the graph confirms that the parallel trends assumption for CoD is satisfied, enabling a valid Difference-in-Differences estimation of the impact of green bond issuance on BNI’s cost of debt.

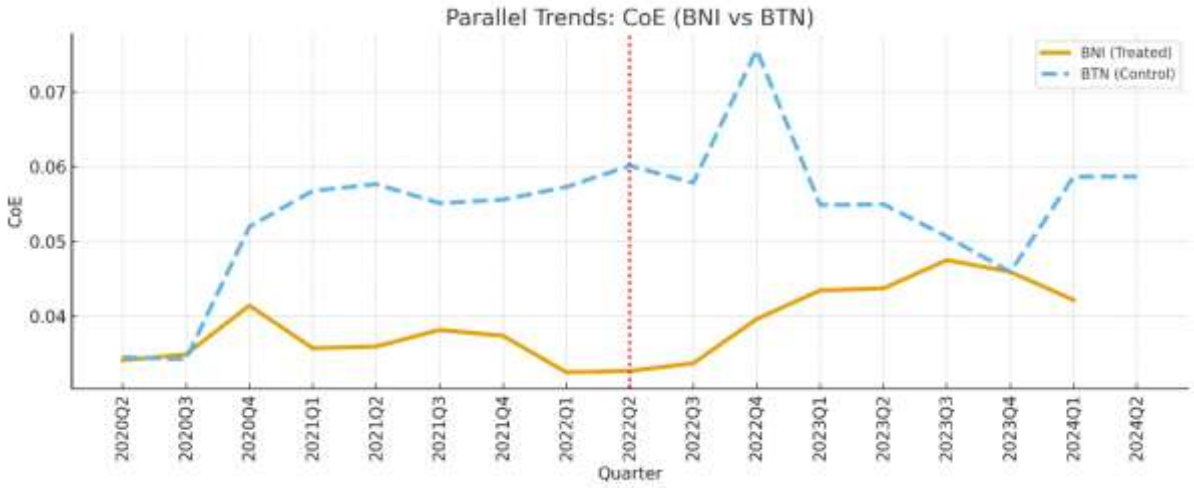

Figure 2. Cost of Equity parallel trends 5

Source: Processed by the author based on BNI and BTN quarterly financial statements, Bloomberg, and IDX market data, 2020Q2–2024Q2

As show in Figure 2 the general directions of CoE for both banks remain broadly similar, although not perfectly aligned. For example, both banks experienced slight fluctuations during 2020 - 2021 as equity markets responded to pandemic-related uncertainty. CoE stabilizes for both banks in 2021Q3 - 2022Q1, indicating a convergence of market-implied risk premium before treatment.

However, certain quarters show offset movements, a common occurrence in equity-based measures due to their higher responsiveness to market dynamics. This explains why formal pre-trend regression shows a statistically significant interaction term for CoE, even though the visual trend remains broadly comparable.

After treatment (2022Q2 onward), the CoE trends continue to move within a similar range for both banks, indicating that the equity market did not strongly differentiate between BNI and BTN following the green bond issuance.

Despite minor deviations due to market volatility typical in equity pricing, the graphical evidence suggests that BNI and BTN move in broadly comparable trajectories, supporting the validity of DiD estimation while noting that CoE is more sensitive to market noise than bank-specific fundamentals.

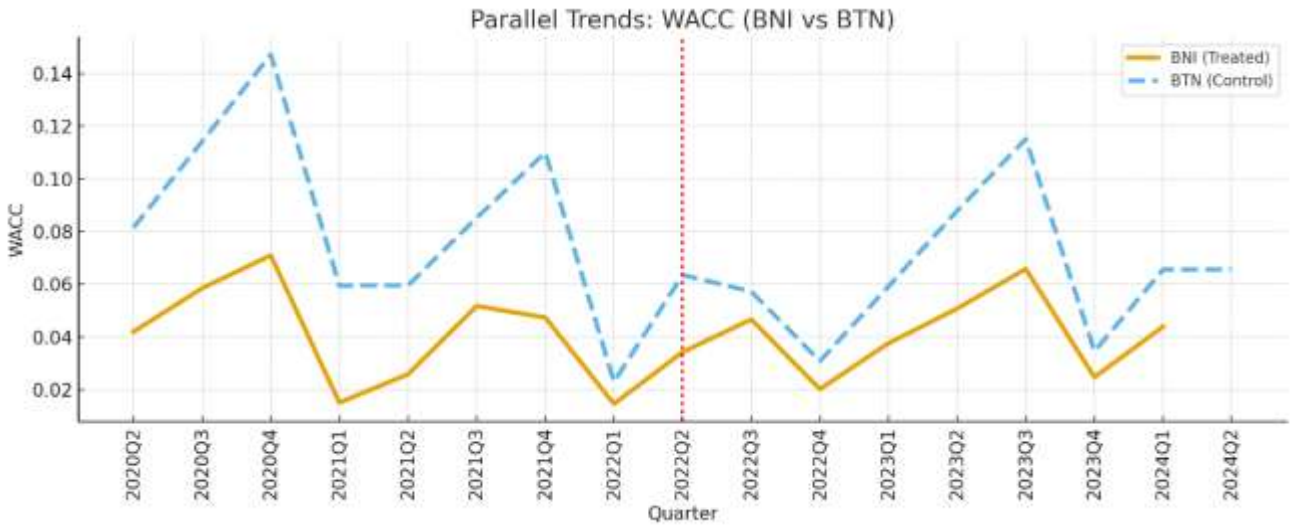

Figure 3. Weighted Average Cost of Capital parallel trends 6

Source: Processed by the author based on BNI and BTN quarterly financial statements, Bloomberg, and IDX market data, 2020Q2–2024Q2

Figure 3 presents both BNI and BTN exhibit similar movements in WACC, as indicated by the generally parallel trajectories between the two series. Although BTN consistently maintains a higher WACC than BNI due to structural differences in funding composition and risk exposure, the quarter-to-quarter changes follow comparable directions. For instance, both banks show an increase in WACC around late 2020, stabilization during 2021Q1–Q2, and a mild decline towards early 2022.

These shared directional shifts indicate that both banks were responding similarly to broader macroeconomic and financial conditions, fulfilling the parallel pre-trend requirement of the Difference-in-Differences (DiD) method.

Following the treatment in 2022Q2, the graph shows a visual divergence where BNI's WACC begins a gradual upward trend, while BTN's WACC fluctuates more sharply. This divergence reflects the post-treatment effect, which the DiD model is designed to capture and estimate.

Overall, the graph supports DiD's key assumption that BNI and BTN followed parallel trends before the green bond issuance. This makes BTN a valid comparison group for estimating the causal impact of BNI's green bond on its WACC.

Difference in Differences Analysis

a. Cost of Debt (CoD)

Based on model as follows:

$$CoD_{i,t} = 4.7171 + 0.1042Treatment_{i,t} + 0.0213Time_{i,t} + 0.0580GB_{i,t} - 3.8053ROA_{i,t} - 0.4518NPL_{i,t} - 0.1651ln\_Size_{i,t} + -0.1930LDR_{i,t} - 0.8556Inflation_{i,t} + 0.3098BI\ Rate_{i,t} + \varepsilon_{i,t}$$

Below the table CoD DiD result:

Table 4. CoD DiD Result

CoD	Coefficient	Robust std. err.	t	P>t	[95% conf. interval]
ATET GB	0.0579922	0.005212	11.13	0.057	-0.0082328 to 0.1242173

Note: ATET estimate adjusted for covariates, group effects, and time.

Source: Processed by the author using STATA based on secondary data from BNI and BTN, 2020Q2–2024Q2

Difference-in-Differences (DiD) estimation results for the Cost of Debt (CoD) as shown in Table 4. indicate that the estimated Average Treatment Effect on the Treated (ATET) coefficient is 0.0579, it means, after controlling covariates, group fixed effects, and time effects, BNI's Cost of Debt increased by approximately 5.8% following the issuance of its green bond, compared to the control bank (BTN) over the same period. This positive coefficient suggests that the financing costs associated with debt became higher for the treated bank after the intervention. However, the p-value of 0.058 slightly exceeds the 5% significance threshold, indicating that the increase in CoD is not insignificant at 0.05 level.

The results imply that green bond issuance is associated with an increase in the Cost of Debt for the treated bank, although the statistical support is modest. This finding may reflect transitional costs, market perception effects, or adjustments in risk premiums following the introduction of a sustainability linked instrument.

b. Cost of Quity (CoE)

Based on model as follows:

$$CoE_{i,t} = 0.2579 - 0.0148Treatment_{i,t} - 0.0148Time_{i,t} - 0.0043GB_{i,t} - 0.2791ROA_{i,t} - 0.8918NPL_{i,t} - 0.0040ln\_Size_{i,t} - 0.0425LDR_{i,t} - 0.1978Inflation_{i,t} - 0.5311BI\ Rate_{i,t} + \varepsilon_{i,t}$$

Below the table CoE DiD result:

Table 5. CoE DiD Result 10

CoD	Coefficient	Robust std. err.	t	P>t	[95% conf. interval]
ATET GB	-0.0042729	0.0070285	-0.61	0.652	-0.093578 to 0.0850321

Note: ATET estimate adjusted for covariates, group effects, and time.

Source: Processed by the author using STATA based on secondary data from BNI and BTN, 2020Q2–2024Q2

Table 5 reports that the estimated ATET coefficient is –0.0042729, indicating that the issuance of a green bond is associated with a 0.43% decrease in CoE for the treated bank. However, this effect is not significant statistically, as reflected by the p-value of 0.652, which is substantially higher than the thresholds of 5%.

These results suggest that, unlike the Cost of Debt (CoD), the Cost of Equity did not exhibit a measurable or statistically reliable response to BNI's green bond issuance during the observation period. In other words, equity investors did not significantly revise their required return following the introduction of the bank's green financing instrument.

c. Aggregate Weighted Average Cost of Capital (WACC)

Based on model as follows:

$$WACC_{i,t} = 4.5295 - 0.0987Treatment_{i,t} + 0.0199Time_{i,t} + 0.0524GB_{i,t} - 3.3350ROA_{i,t} - 0.3782NPL_{i,t} - 0.1588ln\_Size_{i,t} - 0.1845LDR_{i,t} - 0.8149Inflation_{i,t} - 0.3469BI\ Rate_{i,t} + \varepsilon_{i,t}$$

Below the table WACC DiD result:

Table 6. WACC DiD Result 11

CoD	Coefficient	Robust std. err.	t	P>t	[95% conf. interval]
ATET GB	0.0524063	0.0043484	12.05	0.053	-0.0028451 to 0.1076577

Note: ATET estimate adjusted for covariates, group effects, and time.

Source: Processed by the author using STATA based on secondary data from BNI and BTN, 2020Q2–2024Q2

Table 6 presents the ATET coefficient is 0.0524063, indicating that WACC increased by approximately 5.24% for the treated bank following the issuance of the green bond. This positive estimate suggests that the intervention led to a higher overall cost of capital, largely reflecting the combined effect of debt and equity financing costs. However, the associated p-value of 0.053 is above the 5% threshold|. Therefore, while the evidence is not strong enough to confirm significance at 5%, it still provides moderate statistical support that green bond issuance increased WACC for the treated bank.

Overall, the results imply that BNI's issuance of green bonds was associated with a upward shift in its cost of capital, although the statistical evidence remains not significant. This pattern aligns with findings from several prior studies suggesting that the transition toward sustainable financing may, in some cases, lead to short-term increases in capital costs due to market adjustments, evolving risk perceptions, or liquidity constraints within the green bond market. Tang and Zhang (2020) find that while stock market reactions to green bond announcements are generally positive, green bonds do not always produce an immediate reduction in financing costs for issuers, indicating potential short-term pricing frictions.

Similarly, Zhang, Li, and Liu (2021) highlight that the benefits of green financing depend on market maturity and information transparency, where transitional phases may involve higher perceived risks or limited liquidity, potentially increasing capital costs in the near term. In addition, Li and Duca (2024) note that the effect of green bond issuance on the weighted average cost of capital (WACC) varies across firms and markets, and in some contexts, adjustments in investor expectations may temporarily elevate required returns before longer-term benefits emerge.

5. Hypothesis Test

Table 7. Summary of Hypothesis Test12

Hypothesis	Expected Effect	Empirical Direction	Significance	Decision
H1: Green bond reduces CoD	Negative	Positive	Not significant (p=0.058)	Rejected
H2: Green bond reduces CoE	Negative	Negative	Not significant (p=0.652)	Rejected

H3: Green bond reduces WACC	Negative	Positive	Not significant (p=0.053)	Rejected

Source: Compiled by the author based on Difference-in-Differences estimation results, 2020Q2–2024Q2

1) H1: Green bond issuance reduces an issuer's cost of debt (CoD).

The DiD results show that the treatment coefficient for the cost of debt (CoD) is positive but not significant statistically (p = 0.058). This indicates issuing green bonds did not measurably reduce BNI's CoD during the observation period. While the effect indicates a increase in borrowing costs, the coefficient does not meet the conventional 5% significance threshold.

This outcome may reflect transitional dynamics commonly observed in the early stages of sustainable financing, such as certification expenses, reputational adjustments, or temporary increases in perceived risk that elevate short-term debt premiums. Previous studies have also noted that green bond pricing advantages, or "greenium," are not consistently evident for all issuers or in less mature markets, especially during the initial phases after issuance (Tang & Zhang, 2020; Larcker & Watts, 2020). Furthermore, Li and Duca (2024) argue that meaningful reductions in debt financing costs typically emerge in more developed green bond markets and may not be detectable within a limited, firm-specific timeframe. This reinforces the conclusion that the green bond issuance did not significantly lower BNI's CoD. Accordingly, H1 is rejected.

2) H2: Green bond issuance reduces an issuer's cost of equity (CoE).

The empirical results show that DiD coefficient for the cost of equity (CoE) is negative, aligning with the hypothesized direction. However, the effect is not significant statistically (p = 0.652), indicating that the issuance of green bonds did not measurably reduce BNI's equity financing costs. Although the negative sign suggests that equity investors may have perceived a slight improvement in the bank's sustainability profile, potentially due to lower information asymmetry or enhanced liquidity effects, as noted by Zhang, Li, and Liu (2021), the high p-value confirms that this effect is not significant statistically. This outcome is consistent with prior studies showing mixed evidence of equity market responses to green bond issuance. Although some research finds positive stock market reactions following green bond announcements, adjustments in required equity returns primarily materialize in markets with mature ESG investor bases and well-developed sustainable finance ecosystems (Flammer, 2021; Tang & Zhang, 2020). Considering Indonesia's developing green bond market and the banking sector's concentrated ownership structures, the absence of a significant CoE response is theoretically expected. Accordingly, H2 is rejected because the observed reduction in CoE is not statistically significant.

3) H3: Green bond issuance reduces an issuer's weighted average cost of capital (WACC).

The empirical results show that DiD treatment effect for the weighted average cost of capital (WACC) is positive but not significant statistically (p = 0.053). This indicates that the issuance of green bonds did not lead to the expected decline in overall capital costs. Therefore, H3 is not supported. While the coefficient is close to the 10% significance level, its positive value suggests a slight increase in WACC rather than a decrease. This outcome likely reflects the combined influence of a temporary increase in the cost of debt, a modest but not significant

statistically decrease in the cost of equity, macroeconomic volatility during the period of the pandemic, limited penetration of ESG-oriented investors in Indonesia, and the single treated unit nature of the study, which focuses exclusively on BNI. Generally, international evidence shows that reductions in WACC emerge in broader, multi firm, or cross-country samples, where deeper and more mature markets allow cost of capital effects to materialize more clearly (Li & Duca, 2024; Zhang, Li, & Liu, 2021). In the context of a single issuer operating within an emerging green finance ecosystem, the absence of a significant WACC reduction is both empirically consistent and theoretically plausible. Accordingly, H3 is rejected.

The hypothesis testing reveals that the issuance of BNI's green bond did not result in statistically significant reductions in the cost of debt, cost of equity, or weighted average cost of capital. Although the directions of the CoE effect align with theoretical expectations, the effects on CoD and WACC move contrary to the hypothesized relationships. The absence of significance indicates that, within the owned stated owned banks context and the study's observation window, the market did not materially adjust its valuation of BNI's financing costs after the green bond issuance.

These findings are consistent with literature suggesting that cost of capital benefits are more likely to arise within larger, diversified samples and more mature green financial markets (Li & Duca, 2024; Zhang, Li & Liu, 2021). They also support prior evidence showing that green bond benefits may manifest more strongly through investor base expansion and reputational gains rather than immediate pricing advantages (Tang & Zhang, 2020; Flammer, 2021).

Business Solution

The empirical results of this study indicate that the issuance of BNI's green bond did not generate a statistically significant reduction in the bank's cost of debt, cost of equity, or weighted average cost of capital. This outcome suggests that while green bonds represent an important instrument for supporting sustainable development, their financial benefits are not automatically realized in emerging markets without complementary strategic initiatives. Consequently, BNI must implement a series of targeted measures designed to strengthen the market's perception of its sustainability commitments and enhance the value proposition of green financing. These measures should begin with reinforcing the bank's ESG signaling through more comprehensive and frequent sustainability disclosures, the adoption of independent external verification, and the deployment of transparent reporting dashboards. Prior research demonstrates that enhanced transparency reduces information asymmetry and improves investor confidence, thereby increasing the likelihood of favorable market reactions (Flammer, 2021; Tang & Zhang, 2020).

In addition to strengthening transparency, BNI should broaden its access to global pools of ESG oriented capital. This can be achieved through proactive investor engagement strategies, such as conducting international roadshows targeted at sustainable investment funds, issuing multi currency green bonds aligned with international best practices, and integrating ICMA Green Bond Principles into its issuance framework. Such initiatives are essential because international evidence indicates that deeper engagement with global ESG investors increases demand for green financial instruments and may contribute to lower debt financing costs over time, particularly in markets with more established sustainable finance ecosystems

(Li & Duca, 2024). By expanding its investor base, BNI can position itself to capture long term advantages such as improved pricing efficiency, stronger liquidity, and potential access to green bond premia.

To ensure that sustainability is not perceived merely as a compliance driven activity, BNI should also integrate green financing deeper into its core business model. This includes expanding its portfolio of green loans, introducing preferential rate sustainable credit products for retail and corporate clients, and embedding ESG considerations into credit risk assessment processes. Evidence from the literature suggests that firms demonstrating a consistent and substantive commitment to environmental and social objectives are more likely to benefit from lower perceived risk and improved market valuations (Zhang, Li & Liu, 2021). Embedding sustainability into BNI's operational and lending functions therefore represents a strategic investment that supports both long term competitiveness and alignment with Indonesia's national transition toward a low carbon economy.

Furthermore, BNI should pursue strategic partnerships to mitigate the structural costs associated with green bond issuance, including certification, monitoring, and reporting requirements. Collaborations with government agencies, multilateral development banks, and industry partners can facilitate blended finance arrangements, credit enhancement structures, or cofunding schemes that reduce the effective cost of capital for green projects. Such partnerships are consistent with global sustainable finance practices and can significantly strengthen the economic feasibility of future green issuances. Additionally, the development of sustainability linked financial products, such as KPI based loans, green supply chain financing, and transition financing mechanisms, can generate new revenue streams while supporting clients in meeting their sustainability targets. These product innovations may further enhance BNI's market differentiation and strengthen its role in driving Indonesia's sustainable finance ecosystem.

Finally, to ensure effective implementation of these business solutions, BNI must maintain strong alignment with OJK's regulatory framework for sustainable finance, particularly POJK 51/2017 and POJK 18/2023. This entails establishing a centralized sustainable finance governance unit, implementing climate-risk stress testing methodologies, and digitalizing ESG data collection and reporting processes to enhance operational efficiency and compliance. In addition, BNI should contribute to broader market development through investor education initiatives and collaborations with regulatory bodies, industry associations, and academic institutions to improve domestic understanding of sustainable finance. Collectively, these initiatives can help BNI realize the long-term financial and strategic benefits of green financing while supporting Indonesia's transition toward a more resilient and environmentally sustainable financial sector.

Implementation Plan & Justification

BNI shall implement a comprehensive Sustainable Finance Enhancement Program, consisting of four core initiatives: (i) strengthening ESG transparency and reporting frequency; (ii) expanding engagement with global ESG investors; (iii) integrating sustainability considerations into the bank's core lending and credit risk frameworks; and (iv) forming strategic partnerships with governmental, multilateral, and corporate entities to reduce the structural costs of green financing. These initiatives collectively aim to improve market

perception, attract a broader investor base, and support long-term reductions in the bank's cost of capital. The proposed actions are consistent with global best practices and supported by empirical evidence that emphasizes the role of transparency, investor engagement, and internal ESG integration in driving financial outcomes.

The justification for this implementation plan is grounded in the empirical findings of this study, which demonstrate the absence of a statistically significant impact of BNI's green bond issuance on its cost of debt, cost of equity, and WACC. These results indicate that internal and external market mechanisms have not yet responded optimally to the bank's sustainability initiatives. Therefore, a more comprehensive and proactive strategy is required to strengthen the signaling effect of sustainability commitments, reduce information asymmetry, and enhance investor confidence, factors widely recognized in the literature as key determinants of green financing effectiveness (Flammer, 2021; Li & Duca, 2024). Additionally, the proposed plan directly supports national priorities under POJK 51/2017 and POJK 18/2023, ensuring regulatory compliance and alignment with Indonesia's Sustainable Finance Roadmap.

The implementation shall be executed in three phases. The short-term phase (0 - 12 months) will prioritize enhancements in ESG transparency, including quarterly sustainability reporting and adoption of third-party verification standards. The medium-term phase (1 - 3 years) will focus on deepening investor engagement through international roadshows, multi currency green issuances, and strategic partnerships to reduce issuance related costs. The long term phase (beyond 3 years) will institutionalize sustainable finance integration across all business units by embedding ESG considerations into credit risk assessments and scaling up sustainability linked financing products. This phased timeline is designed to ensure operational feasibility and allow sufficient time for stakeholder adaptation, capacity building, and system integration.

Implementation will occur across BNI's key operational and strategic functions. ESG reporting improvements will be undertaken primarily within the Corporate Secretary, Sustainability Division, and Investor Relations Department. Investor engagement initiatives will be coordinated through the Treasury and Capital Markets Division, supported by the International Banking Division. Integration of sustainability into lending and credit processes will be executed through the Wholesale Banking, Retail Banking, and Risk Management units. Partnership development will involve collaboration between BNI's Business Development Division and external stakeholders including OJK, Ministry of Finance, International Finance Corporation (IFC), (Asian Development Bank) ADB, and corporate clients. This organizational mapping ensures that each initiative is anchored within the appropriate functional areas.

The primary responsibility for overseeing the implementation lies with BNI's Board of Directors, particularly the Director for Risk Management & Compliance and the Director for Treasury & International Banking. A dedicated Sustainable Finance Steering Committee should be established to coordinate initiatives across business lines. Key internal stakeholders include the Sustainability Division, Risk Management Unit, Corporate Planning, Investor Relations, and Business Development teams. External stakeholders such as OJK, IDX, Ministry of Finance, multilateral institutions, and ESG rating agencies, will play critical roles in validation, support, and partnership development. Their involvement is justified by the need

for regulatory alignment, market credibility, and access to specialized expertise in sustainable finance.

Implementation will be carried out through a structured governance and monitoring framework. BNI will develop a Sustainable Finance Implementation Blueprint that details procedural steps, performance indicators, resource allocations, and timelines. Quarterly progress reviews will be conducted to evaluate implementation effectiveness, supported by measurable KPIs such as ESG disclosure quality, investor participation levels, green loan growth, and cost of capital trends. Digital tools, including ESG reporting platforms and risk assessment systems, will be deployed to enhance efficiency and accuracy. Furthermore, BNI will adopt a continuous learning approach through capacity building initiatives, staff training, and benchmarking against international sustainable finance leaders. This systematic approach ensures operational consistency, regulatory compliance, and alignment with long term strategic objectives.

In conclusion, the proposed implementation plan provides a structured and justified roadmap for enabling BNI to realize the financial and strategic benefits of green financing. By integrating enhanced transparency, investor engagement, internal ESG integration, and strategic partnerships, the bank will be better positioned to strengthen its market competitiveness and support Indonesia's transition toward a more sustainable financial ecosystem.

CONCLUSION

This study investigated whether green bond issuance reduced the cost of debt (CoD), cost of equity (CoE), and weighted average cost of capital (WACC) using a Difference-in-Differences (DiD) approach, comparing BNI as the treated firm with BTN as the control over an eight-quarter pre- and post-issuance period. The results indicated no statistically significant reductions across all three measures: CoD showed a positive and insignificant effect, suggesting no debt-pricing benefit; CoE exhibited a negative but insignificant coefficient, implying limited equity market response; and WACC also remained unaffected, with a positive and insignificant result. Overall, the findings suggested that BNI's 2022 green bond issuance did not yield measurable financial benefits in lowering its cost of capital, indicating that sustainability attributes have not yet been fully priced by market participants in Indonesia's state-owned banking sector. Future research could extend the observation period, incorporate a larger sample of issuers across sectors, or examine the role of ESG disclosure quality and investor composition to better understand the conditions under which green bonds may influence financing costs.

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