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COST OF CAPITAL AND CLIMATE RISK IN THE INDONESIAN BONDS MARKET

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ABSTRACT

This study analyzes the impact of climate risk, cost of capital, and macroeconomic variables on the Indonesian bond market, focusing on non- environmental and social (ESG)-aware and ESG-aware bonds. The findings reveal the growing significance of ESG factors in the Indonesian bond market, with climate risk negatively impacting ESG-aware bond yields. Our study suggests that policymakers should prioritize initiatives that incentivize green investments and make the industry more aware of ESG factors. Overall, this study provides valuable insights for policymakers and investors on navigating the Indonesian bond market and implementing strategies that align with ESG values.

Keywords: Cost of capital; Green investment; Climate risk; Tax incentive.
JEL Classifications: D24; G12; G28; Q5.

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I. INTRODUCTION

The Indonesian bond market has experienced significant growth in recent years due to stable economic conditions and attractive interest rates. It is influenced by various factors, especially since Indonesia is a net oil and gas importer. Thus, it leads to fossil fuel-related volatility in global industries, which affects the bond market (Sianturi and Sihombing, 2020). With the increased focus on climate change and its possible impact on the Indonesian economy, there is a growing need to incentivize green investments by adopting tax incentives that affect the cost of capital of bond issuers.

Recent studies have highlighted that the bond and stock markets are the primary channels for transmitting climate shocks, making financial asset prices more vulnerable (Lontzek *et al*., 2023; Mao *et al*., 2023). It has been shown that such hazards can increase the cost of capital for developing countries, further exacerbating their economic challenges (see, (United Nations Environment Programme, 2018). Although several studies have analyzed the impact of climate risk and capital costs on financial markets, more research is needed on the Indonesian bond market. As an emerging country, Indonesia is also at risk from climate-related hazards. Therefore, our study aims to fill this research gap by analyzing the influence of climate risk and capital costs on Indonesian bonds due to the country's uniqueness of its dependency on global fossil-fuel-related vulnerabilities. Additionally, it has been found that climate sentiment risk plays a significant role within financial markets (see, for example, Bessec and Fouquau, 2021; Bua *et al*., 2022; and Engle *et al*., 2020 among others). These studies documented that the adverse effects of climate sentiment can decrease firms that are non-aware of environmental factors (ESG non-aware companies). However, previous research has provided limited insights into the complex dynamics of climate risk sentiments in bond yield, especially in emerging markets. In this study, we use text analysis to develop a climate risk indicator and categorize bonds based on their verifiable ESG issuer reports. By doing so, we hope to provide policymakers with valuable insights and recommendations on how to incentivize green investment and make the industry more aware of ESG factors, which can ultimately contribute to the growth of the Indonesian economy.

Our research focuses on the impact of climate risk and capital costs on Indonesian bonds. To create a climate risk index, we utilized a method proposed by Bessec and Fouquau (2021) and Engle *et al*. (2020), which involves analyzing scientific literature on climate change. This approach allows us to capture potential long-term risks associated with climate change, such as natural disasters, rising sea levels, and extreme weather events. To adjust the language used, we refer to a dictionary build by Bessec and Fouquau (2021), who analyzed a corpus of environmental issues-related from the Factiva news archive. The rationale behind this approach is that news coverage on environmental issues may reflect or influence public sentiment towards green issues, particularly related to climate change topics. By reporting these events, the bond market can become more aware of these risks, potentially leading to a shift toward "greener" investments.

Our climate risk indicator spikes when there is significant news coverage on commodities linked to deforestation, such as palm oil and coal mining media outlets. We conduct empirical analyses to examine the effect of climate risk and

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cost of capital on bond yields covering the period of January 2018 to December 2022. This time span is selected because it coincides with the rise of green bonds in the Indonesian market since it was introduced in March 2018. We use the panel data fixed effects model for our empirical analysis where bonds yield to maturity is regressed on the cost of capital and climate risk variables. We also included macroeconomic indicators such as changes in Consumer Price Index (CPI) and money supply (M2) as control variables in our regression model.

Our study provides important insights into the Indonesian bond market and its unique characteristics. We find that the cost of capital has a negative and statistically significant impact on bond yields, indicating the need for policymakers to focus on initiatives that can lower the cost of capital for investors. Additionally, the inflation rate has a positive and statistically significant impact on non-ESG-aware bonds. Moreover, our study reveals that ESG factors are becoming increasingly important in the Indonesian bond market, as climate risk is found to be negatively significant on ESG-aware bonds. These findings provide valuable insights for policymakers and investors in navigating the Indonesian bond market and implementing strategies that align with environmental and social values.

This paper is part of a growing body of research that seeks to understand the impact of climate risks on asset prices. Recent work by Giglio *et al*. (2021) has shown that climate risk can affect a range of asset classes, including real estate, equities, and fixed-income securities. Jacobsen *et al*. (2021) suggest that incorporating climate change scenarios into ass*et al*location decisions is crucial for building robust portfolios. Another study by Mastouri *et al*. (2022) proved that climate change can have a material impact on the value of corporate bonds, potentially affecting bondholders and other creditors. However, there is still much to learn about the relationship between bond returns and climate risk due to the uncertainty of climate-related risks, such as abrupt changes in climate policies, which could affect bond pricing and the issuer's credit quality (BIS, 2021). Furthermore, climate change news risk is priced in corporate bonds, with bonds issued by firms with better environmental performance commanding higher prices (Huynh and Xia, 2021). These findings highlight the importance of considering climate change risk in bond pricing and the potential for incorporating sentiment risk in the future.

This paper contributes to the climate finance literature that employs text-based analysis to measure climate risks (Bua *et al*., 2022; Engle *et al*., 2020; Meinerding *et al*., 2020). Another related study by Aversa (2023) employs data mining and qualitative content analysis to analyze scenario analysis and climate change, providing a comprehensive overview. Text analysis offers several benefits for measuring climate risks. It can detect real-time and latent information on climate risk exposure, even when not mentioned in other sources like bank reports (Gostlow, 2019). Moreover, text analysis enables the analysis of climate-related disclosures and the evolution of climate risk awareness over time. While these studies focus on identifying risks in high-income countries, our research takes a different approach by focusing on an emerging country, Indonesia, which is still grappling with climate change issues. It also allows us to explore the framing of climate change in media outlets, such as print and online media, which can help identify dominant frames and understand how the issue is portrayed to the public. Furthermore, text analysis of online mass media can shed light on how climate

change impacts the Indonesian economy, helping to identify gaps in information and areas where public awareness can be improved. In this study, our modified vocabularies also allow us to capture climate issues specific to Indonesia, such as deforestation, crude palm oil, and fossil fuel.

The remainder of the paper is organized as follows. Section II reviews the related literature. Section III provides a discussion of data followed by a commentary on the main findings in Section IV. Section V delivers concluding remarks.

II. LITERATURE REVIEW

Climate risk has a significant implication for financial markets. Its impact is not limited to individual needs and can lead to risk co-movement by exacerbating systemic financial risks (Mao *et al*., 2023; Zhou *et al*., 2023). Climate shocks impact the bond and stock markets more than the currency and commodity markets. Climate-related information has a more pronounced effect on the latter two markets (Mao *et al*., 2023). In contrast, Faccini *et al*. (2021) found that only climate policy is priced in the stock market, while the direct risk from climate change itself still needs to be clarified. These findings emphasize the need for comprehensive and accurate pricing of climate risks in financial markets, including policy-related and direct risks from climate change.

Previous studies have shown that the bond market has been identified as one of the primary transmitters of climate shocks (Mao *et al*., 2023). Additionally, the vulnerability of financial asset price fluctuations to climate risk changes over time, indicating the dynamic relationship between climate risk and bond markets (Jan Reinders *et al*., 2022). When the carbon tax was introduced, Lontzek *et al*. (2023) found that a carbon tax shock can lead to declines in the market value of banks' assets, including debt instruments, impacting bond markets.[1] Allman (2022) shows that climate risk affects the bond's yield. Municipal and corporate bonds, in particular, indicate higher yield spreads and higher conditional expected returns in regions with greater exposure to heat stress. This effect is more pronounced for lower-quality and longer-maturity bonds (Acharya *et al*., 2022). However, there is a lack of research specifically addressing the impact of climate sentiment risk and its relationship with bond yield performances.

Climate sentiment is becoming increasingly important in the financial context due to the growing awareness of the impact of climate change on businesses and financial markets. Investors and stakeholders are now paying more attention to how companies manage their environmental risks and opportunities. Textual analysis of media coverage on climate issues shows that green sentiment significantly impacts stock returns (Bessec and Fouquau, 2021). The effect varies across sectors, with a negative impact in the energy and materials sectors and a positive impact in the real estate and utilities sectors. The effect is related to the environmental performance of companies (Santi, 2023). This study was inspired by Bessec and Fouquau (2021), who found a significant impact of green sentiment

[1] Carbon tax is a Pigouvian tax levied on carbon dioxide for the purpose of mitigating global climate change. CO2 emitted from the burning of fossil fuels (such as coal, oil, and natural gas) is a major source of global carbon dioxide, and considering the practical operability, the carbon tax is usually taxed on the carbon content share of the fossil fuels (Zhang *et al*., 2016).

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on stock returns in the United States. Therefore, it is crucial to impose climate sentiment in the financial context to ensure that companies are held accountable for their environmental impact and that financial institutions make informed decisions considering their investments' long-term sustainability.

The cost of capital is a fundamental concept in the bond market. It refers to the cost of obtaining funds through capital markets and is a critical factor in determining investment decisions (Gilchrist and Zakrajsek, 2007). Understanding the cost of capital is crucial for bond markets as it helps determine the required return rate on risky corporate bonds (Haley and Schall, 1978). Variation in interest rates affects the cost of capital. It is also determined by the internal rate of return that equates the present value of future cash outflows with the funds originally received, and it is influenced by the time value of money and the appropriate risk premium (Lee *et al*., 1996; Lusztig and Schwab, 1988). These studies prove that understanding the cost of capital is important in performance measurement and capital structure optimization.

In Indonesia, there is a complex relationship between the cost of capital and bond markets, influenced by factors such as international trading, interest rates, inflation, default rates, and corporate disclosure. Vitriya and Marciano (2020) found that multinational firms in Indonesia have a lower cost of capital, including the cost of equity and debt, than domestic firms. Siahaan and Panahatan (2020) analyzed the impacts of Bank Indonesia, the Fed, and inflation rates on government bond prices in Indonesia. They found that these factors have a negative effect on bond prices. Regarding the macroeconomic impact, Santosa (2021) shows that the cost of capital in the Indonesian bond market is influenced by macroeconomic factors such as the BI rate, inflation rate, and oil prices. Given the country's uniqueness, the lack of investment in upstream oil and gas industries in Indonesia has led to the country being a net importer of oil and gas, resulting in high energy expenditure compared to revenues. This indicates the importance of Foreign Direct Investment (FDI) in increasing upstream oil and gas operations in Indonesia, which can impact the bond market (Sianturi and Sihombing, 2020). Given that fossil-fuel-related industries influence the cost of capital in Indonesia, climate change could significantly impact the cost of capital. As a result, investors may reassess the climate risk as it plays a role in shaping the dynamics of the Indonesian bond market.

Regarding the relationship between climate risk and the cost of capital, several studies suggest that better environmental performance leads to a lower cost of capital. For example, Ahmad *et al*. (2023) showed that exposure to climate risk is negatively associated with working capital, especially in carbon-intensive industries and financially distressed firms. Zhou *et al*. (2023) document that climate risk can increase the cost of capital for financial institutions, affecting their profitability and stability. However, the cost of capital determinants differs between regions since lowering the cost of capital for low-carbon technologies can accelerate the achievement of net-zero emissions in particular regions (Ameli *et al*., 2021). Given this fact, further research is still needed to understand the specific factors and mechanisms underlying the relationship between climate risk and the cost of capital, including the country's uniqueness and the influence of government policies.

We conclude that several hypotheses can be formulated based on the literature review above. First, we believe that climate risk has a significant impact on Indonesian bond yields. Second, we try to prove whether there is any difference in the impact of climate risk between firms with good environmental awareness compared to those with low awareness of environmental issues regarding their bond yield performance. We aim to fill this research gap by examining the impact of climate sentiment risk on bond yield performances.

III. DATA AND METHODOLOGY

A. Text Analysis

To determine if a bond's yield is affected by the cost of capital and climate risk, we must have proxies to measure the risk, specifically climate change risk measurement. To obtain these proxies, we have utilized newspaper content to identify negative news sentiment as an indicator of climate risk, much like Bua *et al*. (2022) and Engle *et al*. (2020). We have used a range of articles published in all publications that Factiva can retrieve in the Indonesian region in English. We filtered the following keywords: *climate change* and *economic* in economic, commodity/financial market, and corporate/industrial news subject. We noted that some media outlets, such as The Jakarta Post, LKBN Antara, Indonesia Government News, Global Government News, and Reuters, are relevant to Indonesia's situation.[2] We have selected these articles as their content is more likely to impact the environmental sensitivity of investors and influence their decision-making process (Bessec and Fouquau, 2021). Our article collection spans from January 2018 to December 2022 and features 2,192 articles after removing 18 identical replicates.

To construct climate risk vocabularies, we follow these steps. First, we used a dictionary-based approach by Bessec and Fouquau (2021). We add specific climate-related keywords from the ClimaBert model, a pre-trained language model designed to identify climate change-related language and concepts. The complete list of texts is summarised in the Appendix.

To analyze climate risk documents and news sources, we need to compile two lists of unique stemmed terms, including unigrams, bigrams, and trigrams. These lists come with their respective term frequency (*tf*) scores. We also need to generate a similar list of terms and frequencies from our news source, which compiles real-time news into daily documents. Then, we convert the terms into term frequency-inverse document frequency (*tf-idf*) scores using the climate risk document. High *tf-idf* score terms represent the individual text, meaning they are frequent within the document (*high tf*) and infrequent among other documents (*high idf*). Conversely, low *tf-idf* score terms are either common to many documents (*low idf*) or infrequent within the document (*low tf*), making them less effective in representing the content of the individual text. Engle *et al*. (2020) and Gentzkow *et al*. (2019) provide a detailed discussion of this methodology.

[2] These national newspapers are distributed daily on weekdays. Some of them come out on weekends as well. They capture the number of climate news stories each day as their negativity and focus on risk.

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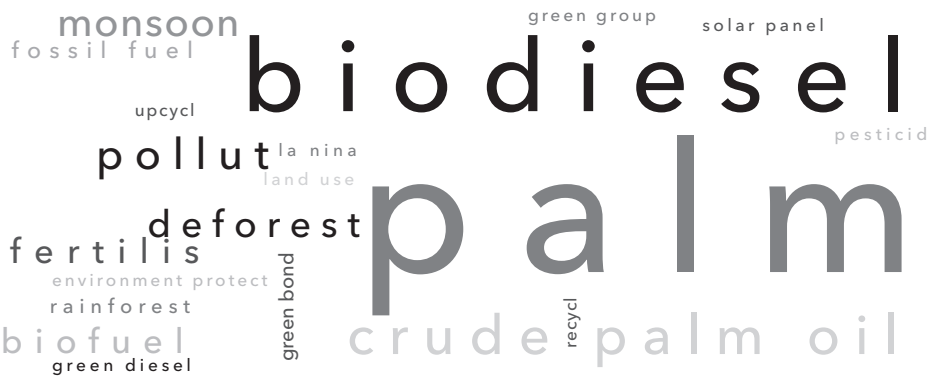
After analyzing the climate risk documents and a collection of news, we were able to rank the vocabularies by term relevance. The vocabulary terms used in the paper are listed in Table A1. of the Appendix. Here, we multiply the *tf* scores of the documents with their relative *idf* scores, and these results are displayed in Figure 1 as word clouds. The size of each term corresponds to its *tf-idf* score, and we find that "*crude palm oil*," "*deforestation*," and "*biodiesel*" are among the most relevant terms. These terms represent Indonesia's climate risk topic and highlight the importance of addressing these issues.

Figure 1.
Word Clouds Summary for Climate Risk Vocabularies

This figure reports the word cloud summaries for the climate risk vocabularies to showcase the most important terms based on their tf-idf score.



We determine our climate risk indicator using a series of news media concerns that assess climate risk. This method compares the *tf-idf* vector of each news document to our climate risk vocabulary vector using a text-analysis technique called cosine similarity. Cosine similarity calculates the similarity between pairs of texts, and the closer they are, the smaller their angular distance, the higher the cosine, and the more similar they are. As a result, the higher the cosine similarity value between a news document and our climate risk vocabulary vector, the more relevant it is to Indonesia's climate risks.

We calculate each date's average negative sentiment score to evaluate the potential risks associated with climate change news. Negative sentiment can significantly impact a bank's reputation, shareholder confidence, and market performance (Erhemjamts *et al*., 2022). We followed the approach taken by Ardia *et al*. (2020) and Engle *et al*. (2020) by filtering only the negative sentiment to determine the risk. Then, we determine the monthly score for the climate risk indicator by averaging the daily values. To assess any unexpected changes in climate risk, we construct the climate risk indicator as residuals from autoregressive processes of order 1 (AR(1)). This approach allows us to accurately gauge and analyze potential climate risks and make informed decisions accordingly. Our approach takes the following form:

$$sentiment_{t,Risk} = c_{Risk} + \phi_{Risk} sentiment_{t-1} + Climate_{Risk} \quad (1)$$

Figure 2 displays the calculated climate risk indicator alongside the mean negative sentiment score for climate change news. Notably, the climate risk indicator tends to spike in response to significant climate events, such as crude palm oil volatility in the global market and the expectation of commodity trading related to climate change. Table 1 summarizes the AR(1) estimates obtained from estimating Equation (1). Climate risk time series depict positive drifts (C_{Risk}=49.94%), showing that the news coverage on climate risk tends to increase over time. A similar point of view on media sentiment with ϕ = 3.711.

Figure 2.
Climate Risk Sentiment 2018 – 2022

This figure shows monthly climate risk sentiment with the significant risk topics from 2018 – 2022.

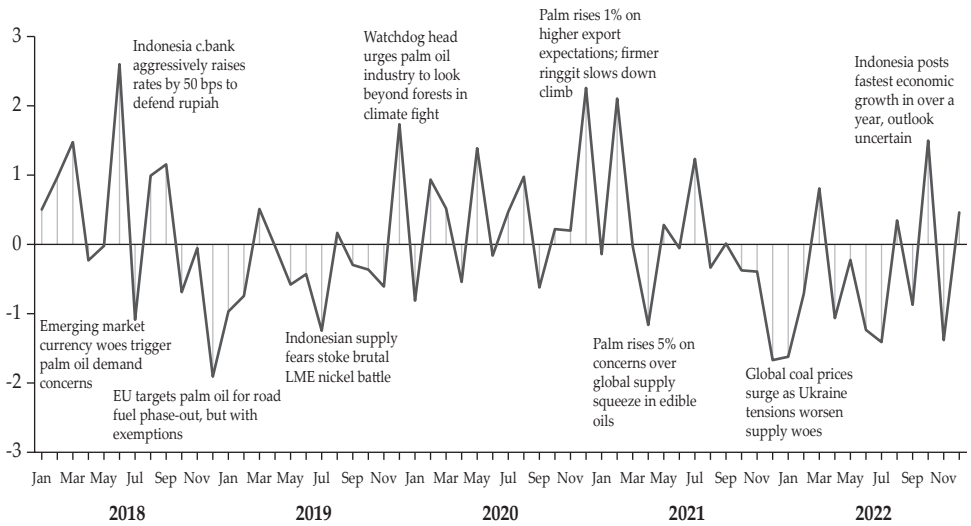


Table 1.
AR(1) Estimates of Climate Risk Sentiment

This table reports results from the AR(1) model as depicted in Equation (1). Standard errors are given in parentheses.

	$sentiment_{t,Risk}$×100
Drift *c*	49.494
	(0.059)
ϕ	3.711
	(0.108)

B. Climate Risk Pricing and Cost of Capital in Indonesian Bond Markets

To compute a firm's cost of capital or WACC, we follow a study by Drobetz et al. (2018) :

$$WACC = LEV \times K_{Debt} \times (1 - TAX) + (1 - LEV) \times K_{Equity} \quad (2)$$

where *LEV* is the firm's leverage, which is equal to total debt as a fraction of total assets; K_{Debt} is the firm's average cost of debt, which is equal to interest expenses divided by total debt; *TAX* is the firm's corporate tax rate, which is equal to income tax expenses divided by net income; and K_{Equity} is the firm's ex-ante cost of equity capital. All data is sourced from the database Refinitiv. In this study, we expect that the climate risk and cost of capital will have a negative relationship with Indonesia's bond yield, implying that bond yields decrease or become more attractive to investors as climate risk and cost of capital increase.

Additionally, we use macroeconomic indicators such as the Consumer Price Index (CPI) and money supply (M2) as control variables to gauge the bond's yield sensitivities to the cost of capital and climate change risk. Macroeconomic variables such as interest rate, exchange rate, and CPI explain a significant portion of sovereign bond yields (Tjandrasa, 2017). When there is an increase in the supply of longer-term debt, bond yields tend to rise, especially during periods of high-risk aversion (Strohsal, 2017).

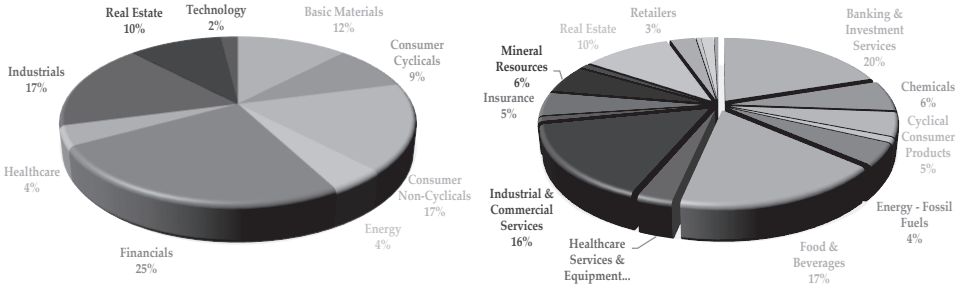
We sort the bond's issuer from non-ESG-aware companies to ESG-aware companies according to their ESG reports and group them into two different portfolios to compare the performance of each group. This will impact on our analysis since the ESG performance of firms has an impact on bond yields. Higher ESG performance is associated with lower bond credit spreads, indicating that ESG-aware firms positively influence bond yields (Amiraslani *et al*., 2017; Lian *et al*., 2023). We retrieve the indicator of ESG awareness from Refinitiv ESG Score based on publicly available data and company disclosures. We then include our climate risk and cost of capital into a regression model, which takes the following form:

$$yield^{y}_{pi,t} = c_p + \beta WACC_t + \gamma Climate_{Risk} + \delta X_t + \epsilon_t \quad (3)$$

$yield^{y}_{pi,t}$ denotes the yield to maturity at time t for non-ESG-aware or ESG-aware portfolios. c_p is the constant term. $WACC_t$ is the firm's cost of capital, it represents the baseline return expected by investors, and β indicates the sensitivity of the bond's yield to changes in the *WACC*. An increase in the *WACC* typically leads to a higher bond yield. $Climate_{Risk}$ is our measurement of climate risk. It reflects the impact of environmental factors, such as climate change-related risks, on the bond's yield. A higher value of γ suggests a stronger effect of climate risk on the bond's yield. Lastly, the vector X_t controls for the macroeconomic factor, Consumer Price Index (CPI) and money supply (M2). A higher δ implies that changes in CPI and M2 have a larger effect on the bond's yield.

Figure 3.
The Composition of Bonds Based on Its ESG-awareness Issuers

This figure shows the sectoral classification of bonds based on its ESG-aware issuers. ESG-aware bonds consist of 204 bonds, while non-ESG-aware bonds consist of 206 bonds.



C. Other Data

We collect the bond's yield to maturity as a proxy for Indonesian bond yield from Bloomberg from January 2018 to December 2022, resulting in 410 bonds based on data availability. Data on firms' ESG awareness and cost of capital are sourced from Refinitiv. The CPI and M2 variables are calculated as change year on year (%YoY). Figure 3 shows the percentage of bonds from ESG-aware and non-ESG-aware issuers used in this study according to the TBRC (The Refinitiv Business Classification) economic sector. As expected, financials and basic materials are among the most economic sectors in both categories, contributing 38% of total entities in ESG-aware firms and 40% in non-ESG-aware firms. In comparison, the energy sector represents the smallest portion with a 4% contribution in both categories.

Table 2.
Descriptive Statistics

This table reports descriptive statistics of data. *Yield* denotes yield in maturity in percentage (%), *WACC* is the cost of capital based on Equation (2). The variables $WACC_{ESG\text{-}aware}$ and $WACC_{non\text{-}ESG\text{-}aware}$ are divided based on bond issuers as in The Refinitiv Business Classification (TBRC) sector classification. $Climate_{Risk}$ is a climate risk indicator based on text analysis (%). M_2 is the percentage of changes year on year of the money supply (%). CPI is the percentage changes year-on-year consumer price index (%).

Variables	Count	Mean	Std	Min	Max
Yield	410	8.940	1.205	-5.492	14.479
$Yield_{ESG\text{-}aware}$	204	6.929	2.008	-7.502	9.741
$Yield_{non\text{-}ESG\text{-}aware}$	206	10.931	37.237	4.250	16.470
WACC	410	7.848	1.402	1.690	15.130
$WACC_{ESG\text{-}aware}$	204	8.628	3.129	2.469	15.685
$WACC_{non\text{-}ESG\text{-}aware}$	206	7.077	3.403	3.774.0	14.358
$Climate_{Risk}$	410	-0.009	0.145	-0.502	0.272
M_2	410	0.098	0.023	0.063	0.136
CPI	410	0.030	0.014	0.013	0.057

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Table 2 provides descriptive statistics of the bond yield, climate risk indicator, and cost of capital for ESG-aware and non-ESG-aware portfolios. We note that the ESG-aware portfolio exhibits a generally lower bond yield and higher cost of capital than non-ESG-aware counterparts. This implies that companies with greater awareness of ESG issues are more likely to have a lower perceived risk and thus attract more investors who value sustainability in their investment strategies.

IV. RESULTS

Our main results are reported in Table 3. Our findings indicate that the cost of capital has a negative and statistically significant effect on bond yields in three models - general bond yield (Model 1), bond yield from non-ESG aware, and bond yield from ESG aware. These findings highlight the importance of policymakers focusing on initiatives that can lower the cost of capital for investors, such as providing tax incentives for sustainable investments and promoting green bonds. Our results support the findings reported by Sarker and Cadman (2022). They document that lowering the cost of capital or transitioning to a low-carbon, smart, and efficient economy is crucial. In the Indonesian context, by doing so, we can increase the demand for green and sustainable investments, which ultimately contribute to the growth of the Indonesian economy. In addition, we note that other variables, such as climate risk, consumer price index, and money supply, have statistically insignificant impacts on bond yields. However, we do observe a negative coefficient for climate risk. Although this relationship is statistically insignificant, it implies that climate risk may negatively impact bond yields in the Indonesian market.

Table 3.
Regression Results

This table provides the parameter estimations and the associated standard errors in parentheses. The last three rows contain the *R*-squared of the mean equation, the Durbin-Watson test, and the Breusch-Godfrey test for autocorrelation, respectively. ***, **, and * denote significance at the 1% level, 5%, and 10% levels, respectively. Standard errors are in parenthesis.

Variable	Model I	Model II	Model III
$Climate_{Risk}$	- 0.981 (0.614)	0.253 (0.584)	-1.819*** (0.5694)
WACC	- 0.052** (0.024)		
$WACC_{non\text{-}ESG}$		-0.075* (0.041)	
$WACC_{ESG}$			-0.020*** (0.021)
CPI	17.092 (3.960)	15.893*** (5.344)	15.930 (4.406)
M2	5.364 (2.658)	6.479 (4.409)	5.283 (3.590)
Constant	8.290*** (0.264)	10.371*** (0.503)	6.055*** (0.322)
R-Squared	0.041	0.043	0.058
Hausman Test	5.21	4.72	15.28

Model II regresses non-ESG-aware bond yields on climate risk, cost of capital, and macroeconomic variables. We find that climate risk is not priced in this segment, as indicated by its insignificant coefficient. Moreover, we observe a positive and statistically significant coefficient of 15.928 at the 1% level for the CPI, demonstrating that the inflation rate strongly influences the financial market, especially the bond market. This is a unique feature of Indonesia, as highlighted by Feunou and Fontaine (2019). Before the mid-1990s, the inflation rate significantly influenced bond yields due to nominal shocks that lifted the output gap and inflation. However, after inflation was anchored, nominal shocks had only a short-lived impact on inflation, an insignificant impact on output, and a small impact on bond yields via the term premium. This result is surprising, considering that Indonesia has anchored its inflation rate within a certain target range. These findings provide valuable insights for policymakers and investors in navigating the Indonesian bond market, particularly concerning the impact of the inflation rate on non-ESG-aware bonds.

Model III focuses on ESG-aware bonds. We find that climate risk is negatively significant at the 1% level. This finding highlights the importance of ESG factors in the Indonesian bond market. It suggests that investors are willing to accept lower yields in exchange for investments that align with their environmental and social values. Our results align with the findings reported by Hacıömeroğlu *et al*. (2022). They report that green bonds have lower yields and more robust demand in the secondary market compared to conventional bonds. Policymakers should, therefore, prioritize initiatives that encourage ESG factors and green investments, such as providing tax incentives for sustainable investment and promoting green bonds, to ensure the growth of the Indonesian economy.

In contrast, our analysis found no significant relationship between macroeconomic variables and ESG-aware bond yield. This implies that macroeconomic events and trends have a relatively weak impact on the pricing of ESG-aware bonds in the Indonesian market. However, further research is needed to confirm this finding and gain a more comprehensive understanding of how macroeconomic variables may impact ESG-aware bonds in the Indonesian bond market.

V. CONCLUSION

This study examines the impact of climate risk, cost of capital, and macroeconomic variables on the Indonesian bond market, particularly non-ESG-aware and ESG-aware bond yields. Our findings highlight the importance of cost of capital and inflation rate for non-ESG-aware bonds, and the growing significance of ESG factors in the Indonesian bond market. Our study also suggests that policymakers should prioritize initiatives that incentivize green investment and make the industry more aware of ESG factors, such as providing tax incentives for sustainable investment and promoting green bonds. These policies can increase the demand for green and sustainable investments, ultimately contributing to the growth of the Indonesian economy.

While macroeconomic variables did not show a statistically significant impact on ESG-aware bonds, further research is necessary to confirm this finding and

gain a more comprehensive understanding of how macroeconomic variables may impact ESG-aware bonds in the Indonesian bond market.

Overall, our study provides valuable insights for policymakers and investors on navigating the Indonesian bond market and implementing strategies that align with environmental and social values.

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APPENDIX

TABLE A1.
Vocabularies

Terms A	Terms B	Terms C	Terms D	Terms E
1.5 degree	abandoned well	acid precipit	acid rain	aerosol
air conditioning air quality	air temperature	air toxic	algae	algal
alternative energ	animal protect	animal wast	anthropogen	anti consumerist
aquifer	asbestos	backyard burn	beach cleansing	ber
biochar	biodegrad	biodiesel	biodivers	bioenerg
bioethic	bio fuel	biofuel	biogas	biohazard
biological agent	biological control	biological reserv	biosphere reserv	biomass
biome	biotic	bird sanctuary	black bin	black tide
brown bin	bye law	cadmium	cap and trade	carbon
carbons	carbonic acid gas	carbonis	carboniz	carcinogen
car pool	carpool	catalytic conver	cfc	cfl bulbs
chemical wast	civic amenity site	clean air	clean coal	clean develop
clean energ	clean power	clean water	climate adapt	climate alterat
climate change	climate damage	climate effect	climate event	climate extrem
climate feedback	climate forc	climate gov	climate justice	climate migra
climate mitigat	climate model	climate neutral	climate project	climate protect
climate refugee	climate regulat	climate resilien	climate response	climate sensitiv
climate system	climate target	climate varia	climatolog	co2
coast protect	coastal erosion	coastal manag	coastal protect	coastal restorat
compost	conference of the parties	conservancy	conservation consumer	wast
contamina	crop spray	cryptosporidium	cumulative emission	cyclone
decarbur	decoke	defolia	deforest	desertification
detrit	digester	dioxin	disafforest	disforest
dispersant	dog day	domestic wast	draught proofing	drift ice
eco	ecocide	ecocit	ecodevelop	ecolabel
ecolog	ecotecture	ecoterrorist	ecotouris	ecotown
effluent	electric car	electric moto	electric truck	electric vehicle
el nino	emission allow	emission control	emission inventor	emission level
emission limit	emission project	emission reduc	emission scenari	emission standard
emission trad	emission trajector	emissions allow	emissions control	emissions inventor
emissions level	emissions limit	emissions project	emissions reduc	emissions regist
emissions scenari	emissions source	emissions standard	emissions trad	emissions trajector
endangered animal	endangered area	endangered bird	endangered fish	endangered plant
endangered species	energy efficien	energy rating	energy sav	energy star
energy waste	engine emi	environment damage	environment friendly	environment protect
environmental	erosion control	eutrophication	exhaust filter	exhaust fume
exhaust gas	extinct species	extreme temperature	extreme weather	fauna

TABLE A1.
Vocabularies (Continued)

Terms A	Terms B	Terms C	Terms D	Terms E
feed in tariff	fertilis	fertiliz	fish kill	fishing preserv
fishing reserv	flood area	flood plain	flood prevent	flood protect
flora restorat	fly ash	food securit	food wast	forest degrad
forest damag	forest destr	forest manag	forest polic	forest preserv
forest protect	forest reserv	forest resource	forest restorat	fossil energ
fossil fuel	frack	freecycle	fuel efficien	fuel povert
garbage	gas emi	geoengineer	geothermal electr	geothermal energ
geothermal gener	geothermal heat	geothermal industr	geothermal invest	geothermal plant
geothermal power	geothermal projectgeothermal sourc	geothermal well	ghg	glacial retreat
glacier	global climate	global temperature	global warming	gray water
green act	green agenda	green alternativ	green asset	green audit
green bank	green behav	green belt	green bin	green bond
green build	green business	green car	green certif	green cit
green climate fund	green compan	green consum	green constr	green corridor
green credential	green credit	green deal	green design	green develop
green diesel	green econom	green electr	green energ	green farm
green fee	green financ	green firm	green fuel	green fund
green group	green grow	green home	green hous	green ind
green infrastructure	green inves	green job	green image	green initiative
green innovat	green label	green leader	green legislat	green loan
green lobb	green measure	green mov	green new deal	green oppo
green part	green plan	green polic	green power	green product
green program	green project	green purchas	green regulat	green residen
green revolution	green roof	green shop	green solution	green source
green space	green stock	green subsid	green tax	green tech
green tide	green touris	green town	green trad	green transport
green vehicle	green wash	greenwash	green work	greener
greenhouse	greenly	greenness	greens	greentailing
grey bin	greyfields	grey water	ground cover	ground water
groundwater	habitat damage	habitat destr	habitat fragment	habitat loss
habitat preserv	habitat restorat	hazardous air	hazardous chemical	hazardous liquid
hazardous material	hazardous	metalhazardous	shipment	hazardous substance
hazardous wast	heat island	heat wave	heatwave	household wast
hurricane	hydraulic power	hydrologic cycle	hydrological cycle	iceberg
icecap	ice loss	ice sheet	ice shelf	incinerat
industrial emi	industrial fume	industrial sludge	industrial wast	invasive species
keystone species	kyoto accord	kyoto agreement	kyoto protocol	kyoto treat
la nina	land damage	land degrad	land erosion	land planning
land preserv	land protect	land restorat	land subsidence	land use
landfill	landscape damage	landscape protect	landscape restorat	leachate

TABLE A1.
Vocabularies (Continued)

Terms A	Terms B	Terms C	Terms D	Terms E
lead level	lead poison	leed	liner material	litter bin
litterbug	localvore	low energ	manure management	marine ecosystem
marine protect	marine reserve	marine snow	mbt	meteorological disaster
meteorological phenomenon	methane	modified organism	monitoring station	monsoon
mountain protect	mudslide	municipal wast	mutagen	natural area
natural disaster	natural park	natural reserve	natural resource	natural variabilit
nature preserv	nature protect	nature reserve	negative emission	niche construct
nitrate	nitrogen cycle	nitrogen oxide	nitrous oxide	non poisonous
nonpoisonous	non toxic	nontoxic	nox	noxious air
noxious cloud	noxious diesel	noxious dust	noxious emi	noxious gas
noxious haze	noxious nutrient	noxious smell	npws	nss
nuclear accident	nuclear disaster	nuclear fallout	nuclear issue	nuclear risk
nuclear safety	nuclear wast	nuclear winter	nutrient remov	ocean acidif
off grid	off the grid	oil residu	oil slick	oil spill
oilspill	organic	organophosphate	overgraz	overpopulat
ozon	pack ice	paris agreement	particulate	pay by weight
peak emission	peak oil	pcb	permafrost	pest
pesticid	photovoltaic	plankton	planning permission	plant protect
plastic bag	point source	poison cloud	pollinat	pollut
preservationist	protected area	protected bird	protected forest	protected land
protected marine	protected species	radiative forcing	radioactiv	radon
rain forest	rainforest	rainwater harvest	rare species	reafforest
re afforest	reclaimab	recycl	reforest	refuse dump
renewab	reprocess	resource damage	resource depletion	resource efficien
resource preserv	resource protect	resource reserve	resource scarc	resource use
resource utiliz	resources damage	resources depletion	resources efficien	resources preserv
resources protect	resources reserve	resourcesscarc	resources utiliz	reusab
reuse	revegetation	reverse osmosis	rewilding	risk species
river basin	salinat	saliniz	sanitation plan	scrap yard
scrapyard	scrub	sea ice	sea level	season creep
seepage	sensitive area	septic tank	sewage	sewer system
sewer water	sewerage system	site protect	site rehabilit	slow cit
smog	smokeless fuel	soil acidificat	soil erosion	soil moisture
soil protect	soil qualit	solar array	solar batter	solar cell
solar compan	solar cycle	solar electr	solar energ	solar farm
solar gener	solar industr	solar invest	solar manuf	solar panel
solar plant	solar power	solar project	solar radiation	solar sourc
solar stock	solid particle	solid wast	soot	species diversit
species extinct	species protect	species reintrod	spillage	sssi

TABLE A1.
Vocabularies (Continued)

Terms A	Terms B	Terms C	Terms D	Terms E
state park	storm water	stormwater	superfund	surface temperature
surface water	sustainable agricultur	sustainable animal	sustainable architect	sustainable build
sustainable cit	sustainable construct	sustainable consum	sustainable cult	sustainable development
sustainable durab	sustainable dwelling	sustainable energ	sustainable farm	sustainable fish
sustainable food	sustainable forest	sustainable fuel	sustainable garden	sustainable industr
sustainable infrastructure	sustainable land	sustainable living	sustainable management	sustainable material
sustainable mobil	sustainable planet	sustainable practice	sustainable produc	sustainable resource
sustainable shopping	sustainable society	sustainable source	sustainable transport	sustainable touris
sustainable urban	sustainable use	sustainable utiliz	sustainable water	throwaway
tidal electr	tidal energy	tidal power	tidy town	tornado
toxic chemical	toxic cloud	toxic dust	toxic emi	toxic fume
toxic gas	toxic substance	toxic wast	toxin	threatened species
tradeable permit	traffic calming	traffic emi	traffic noise	trash
tree hugger	tropospher	tsunami	typhoon	umbrella species
underground stor	unleaded	upcycl	uptake	u valu
vanishing species	vanished species	vehicle emission	vulnerable species	warmer homes scheme
warming ocean	waste avoid	waste disposal	waste dump	waste export
waste gas	waste heat	waste limit	waste import	waste manag
waste minim	waste prevent	waste recover	waste reduc	waste removal
waste stor	waste streamwaste treatment	waste water	wastewater	water column
water cycle	water damage	water efficienc	water manag	water monitor
water polic	water protect	water quality	water resource	water sav
water scarc	water shortage	water stress	water use	wave energ
wave power	weather modif	weed killer	weedkiller	well water
wetland	wildfire	wind electr	wind energ	wind farm
wind gener	wind industr	wind plant	wind power	wind project
wind sourc	wind stock	wind tower	wind turbine	zero emi
earth system governance project	esgp	fridays for future school strike for climate	gggi	ipcc
iucn	united nations environment program	unep	european environment agency	pemsea
eia	epa	bureau of land management	blm	national park service
itec	greenpeace	cerc	earth island institute	nature friends international

TABLE A1.
Vocabularies (Continued)

Terms A	Terms B	Terms C	Terms D	Terms E
global footprint network	nrdc	unfccc	weee	wildlife
world agroforestry centre	worldwatch institute	wwf	crude palm oil	palm
vegetable oil	vegetable	edible oil	million tonne	global vegetable