Utrecht University

School of Economics

Thesis Topic:

Green Bonds: The relationship between ambitions of decarbonization of corporations and the green premium of their green bond

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THESIS (USEMT)

Academic year: 2023-2024

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1. ABSTRACT

Climate change presents a pressing global challenge, necessitating urgent action across all sectors of society. More and more companies are pledging ambitious decarbonization goals. In this context, green bonds have emerged as a significant financial instrument for financing sustainable initiatives, particularly in the corporate sector. This study investigates the relationship between the decarbonization ambitions of private issuers and the "greenium" of corporate green bonds. The greenium refers to the premium or discount associated with these environmentally focused bonds compared to their conventional counterparts. Through a comprehensive literature review, the study examines prior research on climate change urgency, corporate decarbonization efforts, the evolution of the green bond market and how bonds get their green certification. Utilizing a dataset of "Use of Proceed" green bonds issued by private listed companies in the European Union over the past five years, the study employs panel regression analysis to explore the impact of decarbonization targets on the greenium. The findings aim to provide insights for corporate strategies, informing decisions at the nexus of sustainability and financial markets. By contributing empirical evidence to this critical dialogue, the research seeks to advance understanding and facilitate informed action towards a low-carbon future

2. INTRODUCTION

The urgency to combat climate change has never been more palpable, with its far-reaching consequences spanning ecological, socio-economic, and geopolitical landscapes. Industrial activities and the relentless encroachment on natural ecosystems have catapulted greenhouse gas concentrations to unprecedented levels, culminating in rising global temperatures and a host of cascading effects on our planet (United Nations, n.d.). The Paris Agreement of 2015 stands as a beacon of global unity, aiming to curb temperature increases, bolster resilience, and foster low-carbon development across nations (Key Aspects of the Paris Agreement | UNFCCC, n.d.).

In the face of this multidimensional crisis, the role of private corporations emerges as pivotal. These entities, operating at the intersection of economic growth and environmental impact, are increasingly called upon to align their strategies with the imperative of decarbonization. Green bonds, a financial instrument dedicated to funding sustainable initiatives, have surfaced as a significant avenue for financing the transition to a low-carbon future.

However, a critical question looms: How does the ambition of private issuers, reflected in their decarbonization goals, influence the "greenium" of corporate green bonds? The greenium, a premium or discount associated with these environmentally focused bonds compared to their conventional counterparts, holds implications for both issuers and investors alike.

This study delves into this intricate nexus, seeking to dissect the nuanced relationship between corporate decarbonization ambitions and the market perception of green bonds. Through a review of prior literature, ranging from the drivers and barriers of corporate climate action to the evolution of the green bond market, a foundation is laid for empirical inquiry.

Drawing upon a dataset of "Use of Proceed" green bonds issued by private listed companies in the European Union over the past ten years, this research aims to shed light on the impact of decarbonization ambition on the greenium. By employing cross regression analysis, the study aims to guide corporate strategies towards more sustainable and financially prudent pathways.

This study has a few limitations, the most significant being the accessibility and reliability of data. In addition to the absence of various financial variables, there is a lack of standardized sustainability reporting within the European Union. This lack of standardization complicates the process of sourcing comprehensive and accurate data sets. Unlike financial data, which is reported following clear auditing standards such as International Financial Reporting Standards (IFRS) which is used more widely in the EU (*Financial Reporting*, n.d.) and Generally Accepted Accounting Principles (GAAP) which is more widely used in the US McCartney (2024), sustainability goals and targets are not uniformly reported. The challenge of quantifying decarbonization results in the limited data being reported in non-standardized formats, making it difficult to source and compare firms' decarbonization goals.

Despite these challenges, the available financial and sustainability data has been collected as comprehensively as possible from Eikon Refinitiv. The study begins by calculating the greenium through propensity score matching, which matches a green bond to a conventional bond based on carefully selected bond characteristics. After calculating the greenium, the firm's decarbonization ambition is quantified into a composite score. This composite score is then regressed against the calculated normalized greenium to assess if there is a direct correlation between the two.

As nations, organizations, and individuals rally for climate action, understanding the dynamics of green finance becomes not just a matter of environmental stewardship but also one of financial acumen. This research seeks to contribute to this crucial dialogue, offering empirical evidence to inform decisions at the intersection of sustainability and financial markets.

3. PRIOR LITERATURE REVIEW

3.1 Urgency for action against climate change

Climate change, mainly stemming from industrial activities and the destruction of natural ecosystems, results in various environmental changes with profound consequences (United Nations, n.d.). Greenhouse gas (GHG) concentrations, measured as carbon dioxide equivalent (CO2e), have increased significantly since 1750, from 280 parts per million (ppm) to 430 ppm (United Nations, n.d.). One of the most noticeable impacts is the rising global temperatures, leading to cascading effects on ecosystems and societies (United Nations, n.d.). These effects pose immediate threats to human health, safety, and long-term challenges for agriculture, water resources, and infrastructure resilience (United Nations, n.d.).

Climate change's effects present a multidimensional crisis, affecting ecological, socio-economic, and geopolitical realms (United Nations, n.d.). The current trajectory indicates a future marked by worsening environmental degradation and human vulnerability (United Nations, n.d.). Addressing these challenges requires a united global effort, including sustainable practices, fair policies, and innovative mitigation strategies (United Nations, n.d.). The Paris Agreement, a crucial international treaty established in 2015 under the United Nations Framework Convention on Climate Change (UNFCCC), represents a pivotal step towards combating climate change (*Key Aspects of the Paris Agreement | UNFCCC*, n.d.). Signed by 197 parties, it aims to limit global temperature increases to below 2 degrees Celsius above pre-industrial levels, enhance adaptation and resilience in vulnerable countries, and facilitate technology transfer and capacity-building for low-carbon and climate-resilient development in developing nations (*Key Aspects of the Paris Agreement | UNFCCC*, n.d.).

While most studies have emphasized conventional responses with limited mention of significant carbon emission reductions, recent works indicate a growing interest in deep decarbonization as an emerging research field (Johnson et al., 2023). Therefore, there is a heightened need for further investigation into the motivations, actions, and facilitators of deep decarbonization to achieve substantial CO2e reductions, particularly in key industries like energy and transportation (Johnson et al., 2023).

Out of 52 oil and gas companies, 28 have provided quantitative emissions targets allowing projection of their transition pathways (Buettner, 2022). The targets, converted to a common intensity metric, reveal that most aim for a 16.6% reduction by their respective end target years, predominantly set for 2037 (Buettner, 2022). However, the median target reflects a modest 6.4% reduction (Buettner, 2022). Notably, several companies, such as Occidental Petroleum and Royal Dutch Shell, have ambitious targets aiming for net zero or substantial reductions by 2050 (Buettner, 2022). Buettner (2022) compares companies' targets with decarbonization scenarios, highlighting that few align with 2°C or below benchmarks. The analysis finds that major global oil and gas companies often fail to meet their ambitious carbon neutrality goals, despite their declarations (Cherepovitsyna et al., 2023). Quantitative analysis of their 2021 progress reveals that only three out of ten companies are surpassing their targets, with five progressing slower than planned and two showing no progress or negative results (Cherepovitsyna et al., 2023).

3.2 What is corporate decarbonization and the barriers it faces

According to Krishnan et al. (2022) decarbonization strategies encompass shifting from fossil fuels to zero-emissions electricity and low-emissions energy sources like hydrogen, adapting industrial and agricultural processes, enhancing energy efficiency, managing energy demand, implementing circular economy practices, reducing consumption of emissions-intensive goods, deploying carbon capture and storage (CCS) technology, and bolstering greenhouse gas sinks.

More specifically, to ensure long term adoption and transparent reporting practices, (KPMG LLP, 2021) suggests five pillars to decarbonize. First, organizations pursuing low-carbon and net-zero operations must strategically align decarbonization with business strategies, focusing on understanding climate complexities, defining reporting strategies, and adapting capital structures. Second, operationalizing sustainability involves integrating it into organizational culture, while regulatory agility and climate-focused partnerships are essential for compliance and innovation. Third, building trust through transparent, data-backed progress is crucial for stakeholder support. Fourth, embracing technology like cloud computing and blockchain enables effective emissions reporting, a cornerstone for net-zero strategies. Fifth, in the climate action era, robust climate accounting serves as the foundation for organizations to substantiate pledges and comply with regulations, demonstrating measurable progress towards global climate targets.

Corporate actions for climate change involve administrative tasks (e.g., target setting, data collection), practical measures (e.g., energy efficiency, process improvement), communication efforts (e.g., reporting, political activities), and collaborative initiatives (e.g., supply chain coordination, carbon trading). Companies face barriers like regulatory uncertainty, lack of incentives, complexity, consumer resistance, and technological constraints, classified as external (e.g., regulatory uncertainty) and internal (e.g., lack of awareness). Other obstacles include resource limitations, costs, and time-space challenges. Overcoming these hurdles requires top management commitment, ambition, learning, a shared vision, innovation, long-term planning, and engaging stakeholders. External support like public policies, partnerships, and grants also aid corporate climate action. This framework provides a holistic view of how companies engage in climate change mitigation and adaptation efforts.

Zhang et al. (2022) introduce the ESGO framework, aiming to bridge the gap in achieving ambitious emissions reduction goals. It comprises four elements: emissions, sustainability, governance, and operations (ESGO), building upon prior work by Ma et al. (2021). This framework aligns ambition with capabilities, facilitating decarbonization by addressing barriers. Key components involve raising national climate ambitions, acknowledging external and internal influences, and mobilizing various capabilities like techno-economic factors. Effective policy design and interventions are crucial for realizing net-zero goals, requiring immediate actions to develop capacities. The framework emphasizes continuous assessment, stakeholder engagement, and adaptable policies for effective decarbonization.

3.3 Green bonds: A comprehensive investigation of their history and key characteristics

Green bonds, a type of financial instrument, have gained prominence as tools for financing environmentally friendly projects (Fan & Shahbaz, 2023). They represent a type of fixed income investment vehicle offering investors, especially institutional players such as pension funds and insurance companies, the opportunity to contribute to funding environmentally friendly projects aimed at mitigating climate change and adapting to its effects (Maltais & Nykvist, 2020). Issued by governments, financial institutions, and enterprises, these bonds promise interest payments and repayment of principal and interest in accordance with agreed terms (Fan & Shahbaz, 2023). They are distinct from traditional bonds due to their focus on funding projects aimed at environmental protection and sustainability. Green bonds serve as a mutually beneficial financing avenue, both for the issuer as well as the investor, addressing enterprises' green capital needs while reducing financing costs (Hu et al., 2024). Consequently, there is a need to enhance the green bond market system.

The Climate Bonds Initiative (CBI), an internationally recognized not-for-profit organization focused on investors, identifies 2007 as the inception year for the green bond market, highlighted by the AAA-rated issuances of the European Investment Bank and the World Bank (Ünüvar, 2019). However, substantial growth and activity within the green bond market commenced notably in 2013, marked by the inaugural municipal green bond issuance followed by the first corporate green bond issuance in 2014 (Ünüvar, 2019). The initial slow growth has given way to explosive expansion, with the market size reaching 1 trillion euros by 2021 (Fan & Shahbaz, 2023). Despite this growth, the market share of green bonds remains relatively low compared to the overall bond market (Fan & Shahbaz, 2023). This indicates significant potential for further development, offering low-carbon and green financial support for countries striving for sustainable development.

Diverse categories of green bonds exist, categorized by the allocation of proceeds or specific project designations. These variations in green bonds may be delineated by distinct labels such as "Use of Proceeds Bonds," "Project Bonds," or "Revenue Bonds," depending on their earmarked utilization for singular projects or pooled project investments (Ünüvar, 2019). Within the realm of green bonds, a specialized type known as carbon neutral bonds has emerged (Fan & Shahbaz, 2023). These bonds are issued by companies and earmark funds for certified green industries focused on carbon emissions reduction. Notably, only state-holding enterprises with strong credit qualifications typically have the eligibility to issue carbon neutral bonds (Fan & Shahbaz, 2023). Investors are attracted to these bonds due to the issuer's high credit rating, resulting in relatively low-risk investments yielding around 4% (Fan & Shahbaz, 2023). Other green debt financing instruments, such as climate bonds and sustainable bonds, operate similarly to green bonds but with a focus on specific project areas like climate change and long-term sustainability (Sharma & Kautish, 2023).

Green bonds have become attractive to investors due to tax incentives and the premium, known as "greenium", they often command over conventional investments (Sharma & Kautish, 2023). The greenness of these bonds, certified by external reviewers, drives this premium, ranging from 1 to 5 basis points (Sharma & Kautish, 2023). Despite additional transaction costs for certification and monitoring, the savings in interest payments outweigh these costs (Gianfrate & Peri, 2019). It is therefore worth the cost and effort to get the green certification in order to earn the greenium. The strong demand for green bonds reflects investors' interest in funding environmentally beneficial projects, driven by institutional investors' portfolio decarbonization efforts and regulatory requirements in some jurisdictions (Gianfrate & Peri, 2019). This heightened demand and limited supply is one such explanation for this slight yield difference. However, the credibility of green bonds is crucial for investor trust, with risks such as greenwashing and misuse of funds highlighting the need for independent reviewers.

Green bonds, viewed as a method to enhance investments in sustainable infrastructure, are characterized by criteria for labeling as "green" which are often aligned with the Green Bond Principles (GBPs) or similar voluntary standards (Maltais & Nykvist, 2020). The GBPs, supported by financial institutions through the International Capital Markets Association (ICMA), outline renewable energy, energy and resource efficiency, pollution reduction, water and waste management, conservation, and climate adaptation as eligible projects (Maltais & Nykvist, 2020). Additionally, auditing firms like KPMG also conduct assurance on a companies' sustainability practices and fact check whether the claims laid down by the issuer are true and can be trusted before a green bond is released[1].

Over 90% of the green bonds fall under investment grade issuances, indicating strong credit quality ratings (Maltais & Nykvist, 2020). Investing in green bonds offers attractive long-term viability as they potentially provide lower risk, better returns, or improved diversification compared to other assets. Additionally, large institutional investors are motivated to ensure long-term economic sustainability, making green bonds a strategic choice for sustainable finance (Maltais & Nykvist, 2020).

3.4 Greenium

The term "greenium" denotes the perceived premium (positive greenium) or discount (negative greenium) associated with green bonds compared to conventional bonds without an environmental label (Agliardi & Agliardi, 2019). The rise of the green bond market has sparked debates regarding whether these bonds offer issuers a cheaper cost of capital compared to traditional vanilla bonds. However, early in the market's development, anecdotal evidence suggested that green bonds were oversubscribed, potentially resulting in a pricing difference (Harrison et al., 2020). It wasn't until the market matured, providing sufficient data for analysis, that the concept of a greenium gained traction.

This concept has garnered attention amidst the growth of the green bond market, driven by heightened environmental awareness. The theoretical understanding of the greenium varies across bond types. For sovereign or public entity issuances, where green bond proceeds are reinvested in government-backed green projects, the valuation difference is clearer (Agliardi & Agliardi, 2019). However, for corporate bonds, the rationale for the greenium is more complex due to additional uncertainties regarding the realization of green projects (Agliardi & Agliardi, 2019).

Factors contributing to the greenium's existence include the potential for CSR investments to enhance firm resilience against economic shocks and attract environmentally conscious consumers (Agliardi & Agliardi, 2019). The "taste" for green assets among investors, as posited by the Fama and French (2007) effect, also plays a role in shifting equilibrium prices (Agliardi & Agliardi, 2019).

The analysis of U.S. dollar- and euro-denominated green corporate bonds reveals several key findings. These bonds offer a modest borrowing cost advantage, ranging from 3 to 8 basis points, translating to a 2% to 7% reduction in borrowing costs for issuing firms (Caramichael & Rapp, 2024). However, this advantage may diminish due to fees and compliance costs, especially for complex green projects and smaller issuers (Caramichael & Rapp, 2024). The study observes a significant greenium emerging in 2019, tightening to about 10 to 15 basis points in subsequent years, coinciding with increased investor demand for green bonds and EU sustainable finance policies (Caramichael & Rapp, 2024). This greenium is linked to oversubscription and green bond index inclusion, indicating excess demand driving the borrowing cost advantage (Caramichael & Rapp, 2024). The greenium is primarily allocated to local euro and foreign U.S. dollar issuers, with no significant greenium in domestic dollar markets (Caramichael & Rapp, 2024). Additionally, governance and external review influence the greenium, which favors large, investment-grade issuers within the banking sector and developed economies (Caramichael & Rapp, 2024).

Research conducted by Hu et al. (2024) shows that green bonds command a greenium, particularly for short-term bonds and issuers with high ratings. Green-labeled bonds signal environmentally friendly investments, disclose additional information, and consequently enjoy lower financing costs than conventional bonds (Hu et al., 2024). The findings suggest that the extent/credibility of green bonds and the issuer's greenness both contribute to the greenium of labeled green bonds. However, the issuer's greenness emerges as the central attribute, while the former is peripheral (Hu et al., 2024). Overall, green bonds prove to be an effective financing tool for issuers primarily involved in green projects and even for non-green issuers utilizing funds for green projects (Hu et al., 2024). This underscores the importance of companies transitioning to low-carbon practices, not just the greenness of their bond issuances (Hu et al., 2024).

Bachelet et al. (2019) find significant differences between private and institutional green bond issuers, with private issuers showing positive premia in lower liquidity and slightly lower volatility, while institutional issuers exhibit negative premia and higher liquidity and lower volatility. Additionally, private issuers without third-party verification display higher premia and lower liquidity (Bachelet et al., 2019). This suggests that institutional issuers attract large investors interested in climate-related projects, benefiting from transparency rules that reduce informational asymmetries (Bachelet et al., 2019). This study is yet another one highlighting the risk of greenwashing for private issuers, where claims of environmental responsibility may exceed reality, leading to reputational and financial consequences.

In response to systemic risks stemming from greenwashing and the ambiguity surrounding the definition of green or ESG-aligned projects, financial regulators have made substantial efforts to provide clarity through guidelines for green bond initiatives. For projects to qualify for eligibility under the European Union (EU) Green Bond Standard (GBS), issuers are required to demonstrate the specific utilization of the raised capital (Schumacher, 2020). Activities that adhere to the EU Taxonomy are those that significantly contribute to one of the six environmental goals set by the EU, without causing notable harm to the other objectives (Schumacher, 2020). The six environmental objectives are: (a) Climate change mitigation, (b) Climate change adaptation (c) Sustainable use and protection of water and marine resources, (d) Transition to a circular economy, (e) Pollution prevention and control, (f) Protection and restoration of biodiversity and ecosystems (Nasdaq, 2022). These activities must also meet specified social safeguards and adhere to technical screening criteria (Nasdaq, 2022). On the other hand, activities deemed Taxonomy-eligible meet the technical screening standards and are recognized as environmentally sustainable (Nasdaq, 2022). However, these activities might not actively contribute to any of the EU's environmental objectives, or they may only do so to a limited extent.

4. RESEARCH QUESTION AND HYPOTHESIS

Climate change is an inescapable phenomenon that threatens not only the future sustainability and longevity of corporations and financial markets, but also the health of the planet and survival of all those who share it. Destroying, overuse and misuse will have irreversible damage that can affect all the numerous complex ecosystems that depend on one other. It is therefore important that concrete action be taken to decarbonize the planet as quickly as possible to avoid irreversible damage. To do so, funding is paramount and financial instruments such as green bonds are one such solution. Further research to aid and accelerate technologies that decarbonize is of essential importance. Any cost reduction to finance the climate transition can only accelerate it.

The literature presented in section 3.4 indicates the existence of a significant green premium, which can either be positive (premium) or negative (discount) when comparing green bonds to similar conventional bonds. Various factors contribute to this greenium, one of them being the specified use of proceeds or in other words the purpose for which the funds raised from the bond would be used. Research suggests that institutional investors are willing to accept lower returns due to their pro-environmental preferences (Löffler et al., 2021). Additionally, studies by Pietsch & Salakhova (2022) and Bibhudatta (2023) indicate that the greenium can be influenced by the environmental commitments of the issuer and external factors like the firm's dedication to promoting climate finance. Green bonds are favoured due to opportunities for portfolio diversification, corporate mandates to decarbonize investment portfolios, and their perceived lower inherent risks. A reasonable connection can be made between these theories and assume that investors would be more inclined to accept lower returns if issuers demonstrate more ambitious or overreaching sustainability goals. This higher demand could lead to further reduction of the yield to maturity of the green bond and therefore a higher discount for the issuer. Therefore, the question that will be analysed is as follows:

"Do the ambitions and goals for decarbonization of the private issuer in the European Union issuing the green bond have any effect or influence on the greenium of the green bond?"

H0: *The decarbonization ambition of a firm has no influence on the green premium awarded to their green bond*
H1: *The decarbonization ambition of a firm has no influence on the green premium awarded to their green bond*

5. DATA AND METHODOLOGY

The data for this analysis is sourced from Refinitiv Eikon, and the hypothesis testing involves four steps. First, bonds are selected and filtered to include the appropriate data points. Second, these bonds are matched with their conventional peers using propensity score matching, after which the greenium is calculated. Third, a composite ambition score is computed. Lastly, this score is regressed against the greenium.

5.1 Bond Selection

To ensure relevance and data availability, this study is confined to the European Union region, acknowledging that developed regions such as Europe and North America, and more recently developing countries like China, possess more substantial and valuable green bond markets. The analysis examines bonds issued over a decade, from 2013 to 2024, thereby capturing a sufficiently large and inclusive sample set, particularly since the first corporate green bond was issued in November 2013 (Huang et al., 2023). The focus is further narrowed to corporate green bonds issued by publicly listed companies, as decarbonization metrics are more readily available for these entities. The primary objective is to measure the effect of the ambition level of green bonds, necessitating the classification of these ambitions. Municipal green bonds and other sovereign bonds are excluded due to the challenges in quantifying their ambitions, as these bonds often lack specific project definitions or detailed fund allocation information.

The dataset includes two classifications of green bonds: those that have been filtered to include only ICMA-certified green bonds, and those that do not undergo this filtration process. Initially, the dataset comprises 958 green bonds and 11,171 conventional bonds, totaling 12,129 bonds selected for analysis. Bonds without yield to maturity data have been excluded, as calculating the greenium is infeasible without this parameter. Consequently, the dataset has been refined to include 849 green bonds (encompassing both ICMA-certified and non-certified bonds) and 5,816 conventional bonds. After filtering out the non-ICMA green bonds, the dataset consists of 806 exclusively ICMA-certified green bonds.

5.2 Calculating the greenium.

The subsequent step involves calculating the greenium awarded to each green bond using a logistic regression model known as propensity score matching. This method requires several parameters to ensure appropriate matching, which are detailed in Table 1. According to Huang et al. (2023), these specific bond variables are crucial for conducting a proper matching between green bonds and conventional bonds. No further eliminations are conducted to maintain the integrity of the collected dataset.

To execute the propensity score matching using the ‘psmpy’ and ‘pymatch’ packages in Python, each parameter containing an alphanumeric value is converted into a unique numeric code. Columns such as issuer name and currency type are assigned unique numeric values without any order of preference. However, variables like bond seniority, coupon type, and issuer rating are arranged from the least secured bond type (more complex and less predictable payment structures) to the most secured bond type (simpler and more predictable ones). The logistic regression is then run with the green bond as the treatment variable (to find the appropriate match for the green bond), issuer name as the identifier (the connecting variable between a green bond and a conventional bond), using a balanced approach and a caliper of 0.2. An average propensity score of 0.486 and 0.485 is recorded for the purely ICMA-certified green bonds and the all-inclusive subset, respectively.

Table 1: Chosen Bond Characteristics

Variable name	Description
Issuer name	Name of the company
Coupon rate	The (annualized) rate of interest paid by the bond in the current period. (percentage)
Principal currency	Code indicating the currency in which the principal payments are made.
Coupon type	Type of coupon applicable to the bond
Amount Issued (USD)	Amount attracted by the issuing bond by the issuer
Bond Grade	Whether the bond is an investment grade bond or a high yield bond.
Bond Seniority	Order in which bondholders are repaid in the event of the default or bankruptcy
Green Bond*	Whether the bond is a green bond or not.
Yield to Maturity	Total expected return if the bond is held till maturity (% p.a.)
Yield Spread	Difference between YTM of the bond and the OTR treasury bond
Macaulay duration	Measure of interest rate risk. Calculated by taking a present value weighted average of the time until receipt of cash flows using the cash-flow assumptions described in Maturity Average Life.
Modified duration	Measure of interest rate risk. Represents the percentage change in value per unit shift in the yield curve. Calculated using the cash-flow assumptions described in Maturity Average Life.
Use of Proceeds**	Code representing the registrant's planned use of its proceeds from the offering.
Fitch’s issuer rating	Current Fitch’s published or announced rating, Fixed Income.

*Treatment variable
**utilized for future filtration of bonds

Once matching is completed, the dataset is filtered once more to include only those green bonds that have a Use of Proceeds tag directly relating to decarbonization, in accordance with ICMA green bond principles standards (refer to Table 2 for the list of types of Use of Proceeds retained). This refinement results in datasets of 772 ICMA-certified matched green bonds and 813 all-inclusive matched green bonds. Finally, the greenium is calculated by subtracting the yield to maturity of the conventional bonds from that of the green bonds, as shown in the following formula:

$$Greenium = \text{yield to maturity of green bond} - \text{yield to maturity of conventional bond}$$

Table 2: Type of Use of Proceeds bonds selected

Selected use of proceeds bonds directly relating to decarbonization
Clean Transport
Renewable Energy Projects
Environmental Protection Projects
Sustainable Development Projects
To reduce greenhouse gas emissions
Bridges
Carbon reduction through reforestation and avoided deforestation
Funding new technologies to reduce GHS emissions
Climate Change Adaptation
Energy Efficiency
Eligible Green Projects
Green Construction/Buildings
Circular Economy Adapted/Eco-efficient Products, Production Technologies/Processes
Equipment Upgrade/Construction
Alternative Energy
Pollution Prevention & Control

5.3 Calculating the ambition score

Several decarbonization metrics are available on Refinitiv; however, comprehensive data is not uniformly accessible across all green bonds. Therefore, for the scope of this research paper, six specific decarbonization metrics are focused on, as detailed in Table 3. Bonds lacking data in all six metrics are excluded, resulting in a final dataset comprising 272 all-inclusive green bonds and 253 ICMA certified green bonds. While metrics such as reduction targets are instrumental in assessing a company's commitment to decarbonization, it is equally critical to evaluate the financial investments dedication to achieving these goals and the feasibility of their timelines. To determine the years remaining until target attainment (calculated by subtracting the emission reduction target year from 2024), adjustments are made to exclude targets set for 2023 to avoid negative timeframes. Additionally, the emissions score from Refinitiv is utilized to gauge the realism of each decarbonization target. Certain characteristics such as data relating to carbon credits and emissions avoided has not included. Although these activities are components of certain companies' decarbonization plans, they do not have a direct impact their active decarbonization strategies.

Table 3: Decarbonization metrics

Variable	Description	Weightage
Emissions score	Emission category score measures a company's commitment and effectiveness towards reducing environmental emission in the production and operational processes.	0.166
Reduction Target, GHG Emissions Scope 1,2,3 Tones	Seven percent reduction target of greenhouse gas emissions Scope 1, 2, and 3 in tones.	0.166
Reduction Target, GHG Emissions Scope 1,2 Tones	Seven percent reduction target of greenhouse gas emissions Scope 1 and 2 in tones.	0.166
Reduction Target, GHG Emissions Intensity Scope 1,2,3	Seven percent reduction target of greenhouse gas emissions, scope 1, 2, and 3 to million revenues USD.	0.166
Reduction Target, GHG Emissions Intensity Scope 1,2	Seven percent reduction target of greenhouse gas emissions, scope 1 and 2 to million revenues USD.	0.167
Emission reduction target year	The year by which the emission reduction target is set.	
Years left to achieve the target	Emission reduction target year - 2024	0.167

A composite ambition score is derived through a structured approach involving three main steps. First, each decarbonization metric's values, including the greenium (normalized across the data set), are normalized using z-scores, with variations considering normalization across the entire dataset or within specific industry contexts. Some of the TRBC industry sector classification only presented a singular data point, therefore rendering it impossible to normalize it. Therefore, the TRBC sectors have been reclassified into a broader industry (refer to Figure 10 in appendix) in order to maintain the integrity and still adjust the ambition according to the area of operations of the firm. Notably, the z-score for the "years left to achieve the target" metric is inverted to reflect its impact inversely on a company's ambition level. Second, equal weighting is assigned to each of the six metrics. Finally, a weighted average of these normalized variables is computed to establish a consolidated ambition score, reflecting the overall commitment and feasibility of decarbonization efforts across the analyzed green bonds[1].

$$normalised(data\ point) = \frac{[data\ point - \min(data\ point)]}{range(data\ point)}$$

[1] Consultants at KPMG utilize the same method of creating a composite score in their corporate engagements.

$$
\begin{aligned}
ambition\ score = {} & normalised(\text{Reduction Target, GHG Emissions Scope 1,2,3 Tones}) * 0.166 \\
& + normalised(\text{Reduction Target, GHG Emissions Scope 1,2 Tones}) * 0.166 \\
& + normalised(\text{Reduction Target, GHG Emissions Intensity Scope 1,2,3}) * 0.166 \\
& + normalised(\text{Reduction Target, GHG Emissions Intensity Scope 1,2}) * 0.166 \\
& + normalised(\text{Emissions score}) * 0.167 \\
& + \left(1 - normalised(\text{Years left to achieve the target})\right) * 0.167
\end{aligned}
$$

5.4 Conducting a cross-section regression analysis

Following the developed hypothesis, the dependent variable is the normalized greenium, while the independent variable is the ambition score. Initially, four regressions are conducted using combinations of ICMA certified green bonds and all-inclusive green bonds, with the ambition score normalized across the entire dataset and within each industry. Subsequently, the normalized greenium from ICMA certified green bonds is regressed against the industry-adjusted ambition score with the appropriate control variables. Bond characteristic variables serve as control variables, supplemented by industry classification and country of issue as dummy variables to enhance the robustness of the analysis. To mitigate potential correlations that could bias the data, a correlation matrix (refer to Figure 1 in the Appendix) is constructed. This matrix aims to ensure that no variables are excessively correlated, thereby preserving the integrity of the analysis.

6. EMPIRICAL RESULTS

The analysis is structured into four sections. The first section evaluates the effect of all-inclusive green bonds on the greenium, both before and after adjusting the ambition score by industry. The second section repeats this analysis for bonds classified purely as ICMA certified. In the third section, the regression of ICMA certified green bonds with industry-adjusted green bonds incorporates control variables and dummy variables. Finally, the fourth section conducts an additional check to determine if and how the individual decarbonization variables contribute to the greenium. A cross-sectional OLS regression has been conducted for every model as no panel data is included.

6.1 Analysis green bonds based on ICMA certification

The normalised greenium of all-inclusive green bonds is regressed against the ambition score and the industry adjusted ambition score respectively. The descriptive statistics for the greenium, presented in Table 4, provide some insights. The mean greenium is -26.274% p.a., indicating that, on average, green bonds trade at a discount compared to non-green bonds. The large standard deviation of 389.574% p.a. highlights significant variability in greenium values. Most green bonds have a greenium close to zero, as indicated by the median of 0.208% p.a. and the interquartile range (25th percentile at -1.389 and 75th percentile at 2.097). This suggests that half of the greenium values are within a narrow range around zero which corroborates the figures seen in section 3.4. There are notable extremes in the distribution, with a minimum of -6397.9 and a maximum of 17.913, indicating the presence of significant outliers. This can be attributed to suboptimal matching and the absence of higher propensity scores.

Table 4: Descriptive statistics for all-inclusive green bonds

	mean	std	min	1%	5%	25%	50%	75%	95%	99%	max
Greenium	-26,274	389,574	-6397,9	-52,118	-6,545	-1,389	0,208	2,097	4,225	6,696	17,913
Normalized greenium	0,993	0,061	0,000	0,989	0,996	0,997	0,997	0,998	0,998	0,998	1,000
Ambition Score	0,299	0,131	0,005	0,131	0,165	0,232	0,263	0,317	0,700	0,700	0,700
Adj ambition score	0,341	0,185	0,004	0,083	0,137	0,234	0,274	0,388	0,812	0,817	0,922

Table 5: Summary statistics and regressions results for all-inclusive green bonds

	Before Industry adjustment	After Industry adjustment
R-squared	0,035326	0,023438
Adjusted R-squared	0,031753	0,019821
F-statistic	9,887367	6,480238
Prob (F-statistic)	0,00185	0,011464
Log-Likelihood	381,4402	379,7745
AIC	-758,88	-755,549
BIC	-751,669	-748,337

Table 5.1.1 Summary statistics

	Coefficients	Standard Errors	t-values	P-values
const	1,01922	0,00906	112,51619	0,00000
ambition score	-0,08739	0,02779	-3,14442	0,00185

Table 5.2.1 Regression results before industry adjustment in the ambition scores

	Coefficients	Standard Errors	t-values	P-values
const	1,010273	0,007663	131,8312	4,1E-247
ambition score	-0,05026	0,019742	-2,54563	0,011464

Table 5.2.2 Regression results before industry adjustment in the ambition score

The two OLS regression models are analyzed using several metrics and presented in Table 5. Before the adjustment, an R-squared of 0.035326 is observed, explaining 3.53% of the dependent variable's variance. Its adjusted R-squared is 0.031753, slightly lower due to the number of predictors. The F-statistic of 9.887367 confirms significant collective influence of independent variables In contrast, after the industry adjustment, an R-squared of 0.023438 is recorded, explaining 2.34% of variance. The adjusted R-squared is 0.019821, indicating a modest decrease when adjusting for predictors. The F-statistic of 6.480238 suggests statistical significance, albeit weaker.

The statistical analysis reveals that both regression models explain a relatively small portion of the variance in the dependent variable. The adjusted R-squared values suggest that while the predictors contribute somewhat to explaining variance, their combined effect is modest when adjusted for the complexity of the models. Both models exhibit statistical significance based on their respective F-statistics, with the first model demonstrating a stronger overall fit compared to the second one. These findings imply potential avenues for model enhancement, such as incorporating additional predictors or exploring alternative model specifications, to improve both explanatory power and predictive accuracy.

However, despite significant p-values and notably large, negative coefficients for ambition in both regressions, supporting the initial hypothesis, these results could be deemed unreliable. The lack of ICMA certification, raises concerns regarding the reliability of the green bonds used in the analysis. Secondly, the exceedingly low R-squared and adjusted R-squared values indicate poor model fit. This is further underscored by the considerable variability observed in the greenium, suggesting unreliable data and consequently unreliable results. Therefore, data set that only includes ICMA certified green bonds will be analyzed herein forth.

Table 6: Descriptive statistics for ICMA certified green bonds

	mean	std	min	1%	5%	25%	50%	75%	95%	99%	max
Greenium	-1,5172	12,2316	-152,97	-22,286	-7,8491	-2,226	-0,1796	1,9667	4,5860	10,0760	17,4726
Normalized greenium	0,8886	0,0718	0,0000	0,7667	0,8514	0,8844	0,8964	0,9090	0,9244	0,9566	1,0000
Ambition Score	0,3027	0,1344	0,0055	0,1270	0,1646	0,2374	0,2643	0,3174	0,6995	0,6995	0,6995
Adj ambition score	0,3435	0,1895	0,0039	0,0805	0,1368	0,2341	0,2738	0,3879	0,8115	0,8210	0,9242

The normalized greenium derived from ICMA certified bonds is regressed against the ambition before and after industry adjustment without controls yet. The descriptive statistics of the same are shown in Table 6. The first observation from this subset is that the minimum, maximum values as well as the standard deviation of the greenium are much less extreme. Eliminating the non-ICMA certified green bonds has removed the outliers from the data set, resulting in a more uniform sample set. Second, the mean value of -1,5172 while being extremely large in comparison to the industry standard of 3 to 5 bp (which can also be attributed to imperfect matching) is also more aligned with the literature surrounding the values of greenium. It is also seen in Table 7 that the log-likelihood of the model is improved with the industry adjustment which confirms the line of thinking that ambition levels cannot be compared universally must be compared only within their industry sector[2]. Therefore, it can be derived from these tests that only the greenium calculated for ICMA certified green bonds must be regressed against industry adjusted ambition score which is in line with the prior literature and assumptions.

Table 7: Summary statistics and regressions results for ICMA certified green bonds

	Before Industry adjustment	After Industry adjustment
R-squared	0,001209	0,001019
Adjusted R-squared	-0,00277	-0,00296
F-statistic	0,303898	0,256151
Prob (F-statistic)	0,581939	0,613221
Log-Likelihood	-991,856	308,1417
AIC	1987,711	-612,283
BIC	1994,778	0,001019

Table 7.1.2 Summary statistics

	Coefficients	Standard Errors	t-values	P-values
const	-2,47477	1,900134	-1,30242	0,193966
ambition score	3,163744	5,739016	0,551269	0,581939

Table 7.2.1 Regression results before industry adjustment in the ambition scores

	Coefficients	Standard Errors	t-values	P-values
const	0,884436	0,009367	94,42185	4,1E-198
ambition score	0,01209	0,023887	0,506114	0,613221

Table 7.2.1 Regression results before industry adjustment in the ambition scores

6.2 Further analysis of ICMA certified green bonds adjusted for industry

The greenium awarded to purely ICMA certified green bonds is regressed against the industry adjusted ambition score. Several control variables are included to isolate the effect of just the ambition on the greenium. As seen in section 3.4, the rating of the issuer and the duration of the bond can also have an effect of the green premium that is awarded to the green bond. Therefore, these variables coupled with the variables used for the propensity score matching, (refer to Table 1 for variables) apart from issuer name have been utilized to remove their effects on the greenium. Additional dummy variables such as the broader industry classification and the country of issue have also been included as dummy variables to ensure the robustness of the model and ensure only the effects of ambition level are recorded for the greenium. Figure 1 in Appendix depicts that while some of the control variables exhibit a certain level of correlation, they do not warrant exclusion from the model.

[2] Decarbonization experts KPMG consultants suggest creating this distinction between the ambition levels as “ambition” or commitments to decarbonize is means differently to companies operating within their sectors due to certain limitations and opportunities for their respective fields.

Table 8: Summary statistics of ICMA certified green bonds after industry adjustment with bond control variables and the industry and control dummies

R-squared	0.423
Adjusted R-squared	0.287
F-statistic	3.116
Prob (F-statistic)	1.20e-08
Log-Likelihood	377.58
AIC	-657.2
BIC	-484.0

The summary statistics in Table 8 reveal a significant improvement in the R-squared and adjusted R-squared values, indicating the best fit model. Consequently, any results or insights derived from this model are likely to be more reliable. Table 9 shows that for the other decarbonization metrics, starting with the emissions score, none of the models produce significant values, indicating that this variable likely does not contribute substantially to the ambition score. Similarly, the GHG emissions reduction targets for Scope 1 and 2 in tones and their intensity are also not significant, suggesting they do not significantly impact the ambition score. In contrast, the GHG emissions reduction target for Scope 1, 2, and 3 in tones (except for the model including only bond control variables) and the GHG emissions reduction target intensity for Scope 1, 2, and 3 in tones are significant across all models, indicating these are the primary drivers of a firm's ambition level. Lastly, the variable measuring the years left to achieve the target is only significant in the model with every control variable included. Overall, the model incorporating all control variables yields the most significant results, making the ambition score for this particular model the most relevant.

The p-values of the ambition score for all models, except for the baseline model and the one including industry dummies, are less than 0.05, indicating a statistically significant relationship between the normalized greenium and ambition score. This leads to the rejection of the null hypothesis, suggesting that a firm's ambition to decarbonize impacts its yield to maturity. Specifically, higher ambition levels can result in a discount on yield to maturity compared to similar conventional bonds. However, the emission score, used to measure the realism of these goals, did not yield significant results for any of the models. While only the bonds that adhere to the GBP standards developed by ICMA were chosen for the analysis which adds a layer of confidence in the realism of set targets[3], without an additional variable measuring the realism of the target concretely or significant results to the emissions score, a confident assertion that both ambition and realistic goals lead to a higher green discount cannot be made.

[3] Issuer of the bonds are also required to get their practiced "assured" by auditing firms like KPMG to confirm the targets and claims made by the issuer, adding yet another layer of reliability.

Table 9: Greenium from ICMA certified green bonds regressed each of the individual decarbonization parameters.

Variable	Statistic	Baseline	With bond control variables	With bond control variables and industry dummies	With bond control variables and country dummies	With bond control variables and both country and industry dummies
Ambition Score	*coefficient*	0.0120897	-0.0837526	-0.0929224	-0.0941398	-0.0984139
	t-value	0.506114	-2.02765	-1.94752	-2.32669	-2.11909
	p-value	0.613221	0.0437649	0.0527507	0.020926	0.0352926
Emissions Score	*coefficient*	0.00706294	-0.00335479	0.00289931	0.00859275	0.0215699
	t-value	0.515807	-0.212478	0.171176	0.552749	1.26183
	p-value	0.606443	0.831925	0.864243	0.581018	0.208449
GHG Emissions Reduction Target for Scope 1,2,3 in Tonnes	*coefficient*	1.15691	-0.0567692	-0.079741	-0.0494099	-0.0690052
	t-value	9.74986	-2.81366	-3.21329	-2.4398	-2.73815
	p-value	2.90494e-19	0.00532767	0.00151007	0.015517	0.00672488
GHG Emissions Reduction Target for Scope 1,2 in Tones	*coefficient*	1.20342	-0.00805442	-6.6877e-05	-0.00903935	0.0010953
	t-value	9.58278	-0.346726	-0.00226805	-0.377972	0.0355413
	p-value	9.55229e-19	0.729119	0.998192	0.70583	0.971683
GHG Emissions Reduction Target Intensity for Scope 1,2,3 in Tones	*coefficient*	1.6376	-0.0512307	-0.0547266	-0.0483221	-0.0505364
	t-value	10.0836	-2.62766	-2.50424	-2.53622	-2.38345
	p-value	2.62444e-20	0.00918364	0.0130006	0.0119258	0.0180688
GHG Emissions Reduction Target Intensity for Scope 1,2 in Tones	*coefficient*	1.26467	-0.012698	-0.012252	-0.00922399	-0.00586554
	t-value	10.6683	-0.636105	-0.466924	-0.473554	-0.236919
	p-value	3.60073e-22	0.525349	0.641018	0.636305	0.812958
(Inverted) Year Left to Achieve Target	*coefficient*	1.0106	0.00804296	0.000836454	-0.0185479	-0.0430611
	t-value	34.6888	0.545984	0.0461972	-1.2589	-2.28286
	p-value	6.1053e-98	0.585613	0.963195	0.20945	0.0234693

Additionally, the linearity and nature of this relationship cannot be determined from the current research since all the variables used are normalized. The model incorporating bond characteristics as controls and country dummies yields the most significant results, albeit with a slightly lower coefficient for the normalized greenium compared to the model including both country and industry dummies. Nonetheless, the model including all variables is the more reliable model with the most significant individual variables.

7. DISCUSSION

This study demonstrates a direct positive correlation between a corporation's decarbonization ambition and the green premium (greenium) awarded to them. Companies that set ambitious and perhaps even realistic decarbonization targets benefit from a discount on the yield to maturity of their green bonds which translate to financial savings in the long term as explained in section 3.4. Therefore, it is in the best interest of corporations to set transparent, realistic, and ambitious decarbonization goals, as this leads to a higher greenium and ultimately greater long-term savings. With the latest research at their disposal, companies can optimize their processes before seeking funding. The greater discounts not only help accelerate the low-carbon transition and combat climate change, but also allow for reinvestment into the disclosed project or perhaps even new sustainability-linked initiatives. This can help address current environmental, social, and governance challenges.

Although the study confirms a direct and positive (since the coefficient for ambition score was negative, which suggests that a company gets a discount on their yield to maturity) correlation between a firm's decarbonization ambition and the greenium of their green bonds, it acknowledges several limitations that need to be addressed in future research to enhance the reliability of the results. One primary limitation is the need for significant improvement in propensity score matching. After matching ICMA-certified green bonds to conventional bonds, the average propensity score is 0.486, which is lower than the expected 0.86 (Huang et al., 2023). One of the reasons that this lower score can be attributed to the inability to eliminate non-investment grade bonds and bonds with no issuer rating from an already smaller sample size, as the research is confined to the European market. Another contributing factor is the significant lack of essential financial data, including but not limited to the yield to maturity of the bonds. Of the 12,129 bonds, 5,507 had no issuer rating data. Further testing is necessary to improve this score, which would lead to better matching and a more accurate calculation of the greenium. This, in turn, would provide a clearer picture of the effects of decarbonization ambition on greenium and help eliminate statistical biases such as selection bias. Another limitation of the dataset is the ambiguity regarding whether companies have set absolute or relative reduction targets. Relative targets are more meaningful and give a clearer indication of the commitment to put the effort to decarbonise and therefore a better indicator of ambition.

Upon making the aforementioned improvements, further research is necessary to quantify the impact of ambition level on the greenium awarded to green bonds. While this research establishes that ambition is a significant driving force, additional studies are required to determine the extent of its influence on the greenium. For instance, future research could investigate how a movement of 1 standard deviation movement in ambition affects the greenium in basis points. Building on this research, perhaps other financial markets around the world will incorporate and support the inception and development of green bonds and other green financial products.

Lastly, the lack of uniform reporting and disclosure standards for sustainability has resulted in a significant shortage and even reliability of data regarding decarbonization efforts. It can be seen in this study itself that of the 772 ICMA certified bonds 519 bonds had no decarbonization data at all. Not all companies are currently disclosing their sustainability targets comprehensively and uniformly, leading to incomplete or no data at all. The absence of stringent reporting standards in the European Union therefore complicates the collection and comparison of companies' decarbonization ambitions.

This issue is poised for reform with the introduction of the European Single Electronic Format (ESEF) (KPMG N.V., 2024). ESEF mandates the digital tagging of financial and sustainability information in annual reports, enhancing accessibility and comparability. This requirement applies to EU-listed companies and obligates non-listed companies to tag sustainability disclosures in management reports (KPMG N.V., 2024). While the chosen decarbonization parameters are comprehensive, the implementation of digital tagging will provide greater access to decarbonization metrics and perhaps inclusion of other decarbonisation metrics, thereby refining the definition of each company's decarbonization goals and improving the comparability of ambitions. For instance, incorporating data from Carbon Disclosure Project (CDP) disclosures which checks the realism and achievability of the target (Molfetas, 2024) or data from Science Based Targets Initiatives (SBTi) detailing how these targets should be formulated could significantly enhance the measurement of the realism and achievability of targets (*Science Based Targets - CDP*, n.d.), thereby improving the ambition score. Additionally, information on the year a target was established is crucial for determining a baseline year to calculate the timeframe for achieving the goal. Bonds with a target year of 2023 were excluded from the analysis, as the absence of a base year makes it challenging to assess their ambition. Further assessments could examine the transparency of sustainability reporting and its impact on greenium. The regulations for tagging are still under development to align with ESRS, with implementation expected by 2025, although the exact timeline is yet to be finalized.

8. CONCLUSION

Green bonds have emerged as a significant financial instrument over the past decade, identified as an essential tool for financing the transition to a low-carbon future. Their rapid growth in the financial market has prompted inquiries into how the greenium is influenced by certain sustainability characteristics of the issuing firms. This paper specifically examines the variable of a firm's decarbonization ambition.

Green bonds issued between 2013 and 2024 from the EU region are analysed due to several factors, primarily the more developed financial markets and the higher likelihood of data availability compared to other regions of the world, both financial and sustainability-related. Propensity score matching is employed to pair green bonds with their conventional counterparts. Subsequently, chosen decarbonization metrics are normalized, and their weighted average is used to calculate a composite ambition score. This score is then regressed against the normalized greenium, with bond characteristics, industry classification, and country of issuance as control variables to isolate the effect of the ambition level.

Regressing normalized greenium against a calculated green ambition score reveals that more ambitious decarbonization goals can lead to a discount on the yield to maturity of green bonds. This finding suggests that financial gains and sustainability practices need not be as mutually exclusive as previously assumed. Corporations, particularly those in developed countries with advanced financial institutions, should lead by example and take advantage of these provisions. By setting and transparently reporting these ambitious targets, they not only create a lasting positive environmental impact but also reap financial benefits. Ideally, these financial gains would be reinvested into ESG initiatives, further improving the planet.

However, achieving a substantial impact requires more than merely setting overarching targets. Continuous monitoring and verification are crucial to ensure these provisions are not taken advantage of and the targets are actively pursued and achieved within the specified timelines. This research emphasizes the need for further studies to quantify the correlation between decarbonization ambition and financial performance, thereby providing tangible results to motivate corporations to decarbonize rapidly and combat climate change. Only through rigorous adherence to these practices can corporations effectively contribute to environmental sustainability while also reaping financial rewards.

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10.APPENDIX

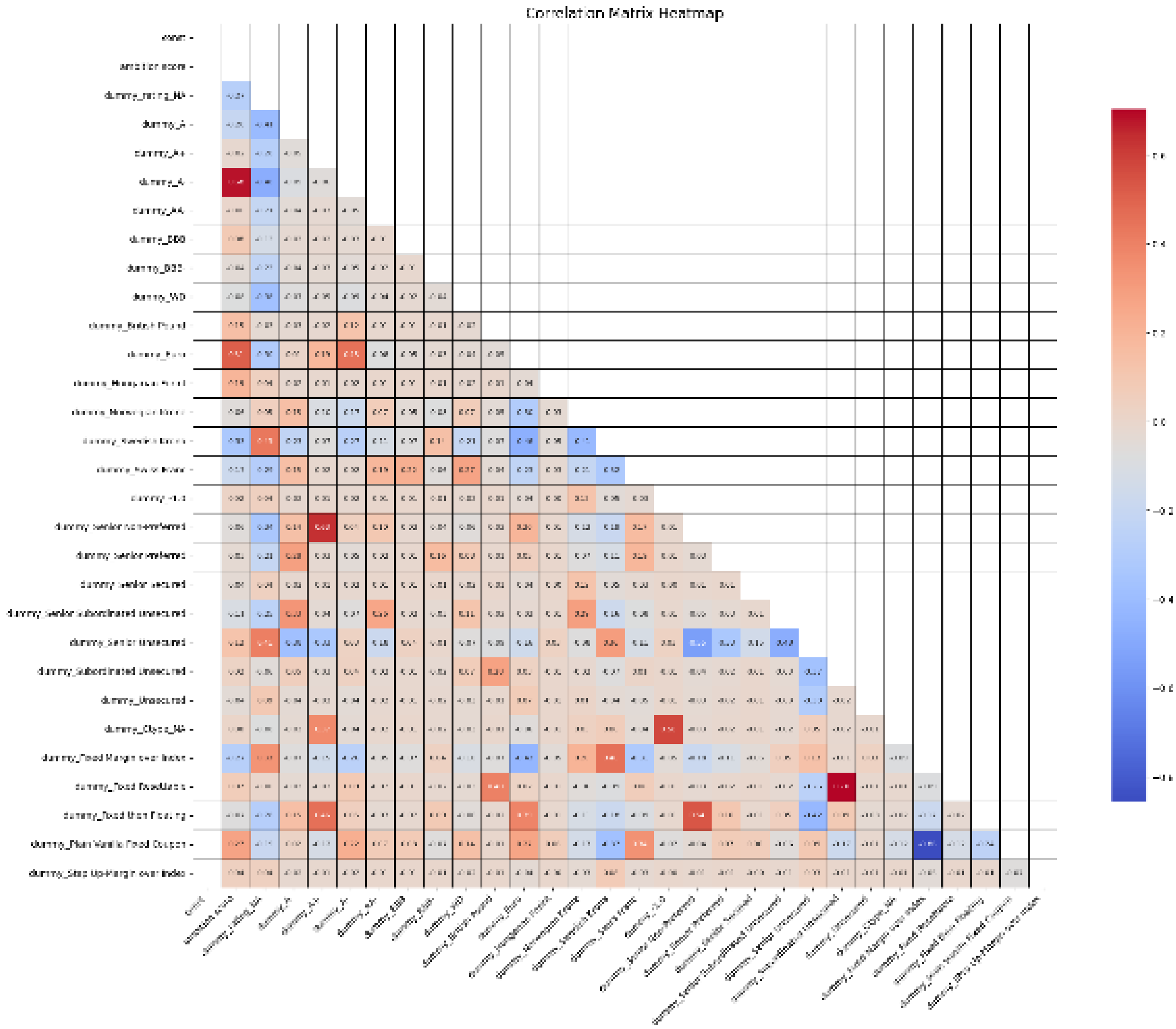

Figure 1 Correlation Matrix

Table 10: Broader Industry reclassification

Broader sector classification	TRBC sector
Manufacturing & Industrial	Advanced Polymers, Auto Truck & Motorcycle Parts (NEC) Commodity Chemicals (NEC) Construction & Engineering (NEC) Electrical Components & Equipment (NEC) Industrial Machinery Paper Products (NEC) Specialty Chemicals (NEC)
Financial Services	Banks (NEC), Consumer Lending (NEC) Corporate Financial Services (NEC) Investment Holding Companies (NEC) Life & Health Insurance (NEC) Multiline Insurance & Brokers (NEC) Personal & Car Loans Wealth Management
Real Estate & Construction	Diversified REITs Office Real Estate Rental & Development Real Estate Rental Development & Operations (NEC), Residential Builders - Multifamily Homes Residential Real Estate Rental & Development Retail Real Estate Rental & Development
Energy & Utilities	Electric Utilities (NEC), Multiline Utilities Oil & Gas Refining and Marketing (NEC) Oil Exploration & Production – Offshore Renewable Energy Services Renewable IPPs Wind Electric Utilities
Consumer Goods & Retail	Appliances, Tools & Housewares (NEC) Food Retail & Distribution (NEC) Frozen Food Manufacturing Supermarkets & Convenience Stores
Healthcare	Healthcare Facilities & Services (NEC)
Telecommunications & Technology	Integrated Telecommunications Services (NEC)
Aquaculture & Food Production	Aquaculture Seafood Product Preparation & Packaging
Market Operators & Service Providers	Financial & Commodity Market Operators & Service Providers (NEC)