How ESG performance is associated with lower cost of debt of US Real Estate Investment Trusts

Master Thesis
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Abstract

The rising interest in the sustainability of real estate is entering a mature phase. This study gives an alternative financial incentive for real estate investments trusts (REITs) to invest in sustainability activities by testing whether Environmental, Social and Governance (ESG) performance is associated with a lower cost of debt. The literature argues that the ESG performance is negatively associated with the cost of debt. To examine the association a panel data analysis on 136 REITs over 2017 – 2020 is performed. Different ESG indicators are tested to analyze the association on the credit spread. The results provide significant evidence for a negative association between ESG performance and the credit spread. If a REIT enhances its ESG performance, then its cost of debt will decrease. This incentive will improve sustainability activities, which will be beneficial for REITs, their stakeholders, and all life on planet earth.

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1. Introduction

Sustainability is a central topic in today's economy. Two-thirds of Northern Europe and the United States (US) firms embrace sustainability as a key value in their long-term corporate strategy. In this context, Environmental, Social and Governance (ESG) factors are used as criteria for measuring companies' sustainability and social impact (Business Green, 2021). The adoption of ESG criteria for sustainability measurement is prominent in the field of real estate investments (Financial Times, 2021). With regard to the environmental factor, the real estate market has a 32% share in global energy use, 51% of the electricity usage and 25% of the CO2 emission during the period 2010 – 2013, that must be reduced (IPCC, 2014). Regarding the social factor, human rights are becoming increasingly crucial as a key condition for real estate investments. The governance factor is essential considering anti-bribery, money laundering, legal and regulatory fines (American Progress, 2021). Since the real estate market consists of 24% of Real Estate Investment Trusts (REITs) with a gross asset value of $3.5 trillion (NAREIT, 2020), ESG factors are considered essential in this market. Since real estate companies buy entire properties, they are often funded with a large quantity of debt. The debt-to-equity ratio for REITs is on average is approximately 366% that is remarkably higher than the average debt-to-equity of 150% of the S&P 500 companies (Investopedia, 2021). It is interesting to gain insights into how the performance of ESG factors relates to the debt perspective of REITs.

Unfortunately, the literature on the relationship between ESG performance and the debt side of REITs is relatively limited compared to knowledge on the effect of ESG activities on the financial income performance such as rent and value. For example, with regard to the effect of sustainable labelling, Eichholtz et al. (2010) provide initial credible evidence on the beneficial economic value of the label "green buildings". This is in line with the research of Brounen and Kok (2011), which explains that a reduction in energy consumption can lead to a sales value increase of 15%. There is also evidence that "compared to buildings in the same submarkets, eco-certified buildings have both a rental and sale price premium" (Fuerst & McAllister, 2011, p. 45). Reichardt et al. (2012) explain a relationship between the certification "Energy Star" and lower vacancy rates. Kok and Jennen (2012) report evidence that sustainability increases owners' rental income and stabilizes cash flows.

In addition to the economic benefits of ESG activities, empirical studies explain that ESG activities of REITs are associated with the returns on assets, enhancing operational performance and reducing risk. For example, Eichholtz et al. (2013) report that REITs' greenness is positively related to the short-term return on assets, return on equity, and the ratio of funds from operation to total revenue. Eichholtz et al. (2012) reports that properties with a higher fraction of greenness have a significantly lower market beta. Beta is a measure of a stock's volatility in relation to the overall market. Fuerst (2015) shows for the first time that investing comprehensively in sustainability as measured by the Global Real Estate Sustainability Benchmark (GRESB) rating pays off for REITs by enhancing operational performance and lowering risk exposure and volatility. Sah et al. (2013) suggest that Green REITs have a higher return on assets than less green REITs.

With regard to the scope of this thesis, we suggest that ESG performance is associated with higher rents, more stable occupancy rates, less operating expenses, increasing sales value, and the observation that it beneficially affects REITs' firm value and operating performance. We hypothesize that sustainability improvements are negatively associated with the cost of debt. An essential component of the cost of debt formula is the credit spread (default risk). A more stable occupancy rate and higher stable cashflows cause a decrease in systematic risk and lower default risks (An & Pivo, 2020; Eichholtz et al., 2019), which could lead to loans on more favourable terms due to improved reputation associated with engagement in ESG activities (Siano et al., 2010). The challenge of this thesis is to find evidence for the hypothesis that the extent of sustainability is negatively associated with the cost of debt. The missing evidence on this assumption could be considered as a gap in the literature. Only Eichholtz et al. (2019) explain the relationship between corporate environmental performance and firms' cost of capital. Eichholtz et al. (2019) finds that the cost of debt for REITs with a higher share of environmentally certified buildings is significantly lower. Ge & Liu (2015) and Oikonomou et al. (2014) investigated the association between ESG like activities and the cost of debt, but not focused on the real estate market. This thesis addresses the total ESG performance and not only the environmental pillar. The Environmental, Social and Governance perspective are all included in this research. This brings us to the main research question:

How is ESG performance associated with the cost of debt of US REITs?

To answer this research question, a panel data analysis[1] on US REITs is performed to provide an empirical answer to the research question. This method is suitable since it allows studying the effect of ESG performance on the cost of debt over the years for multiple REITs. In addition, this approach is in line with methods employed in previous studies (An & Pivo, 2020; Bauer et al., 2010; Eichholtz et al., 2019). The data used for this research is collected from the Thomson Reuters Eikon database. The sample used to analyse if the ESG score is negatively associated with the credit spread consists of four years *(t)* data of 136 REITs *(N)*.[2] The analysis focuses on US REITs because it is the largest and most mature market, and it prevents from cross-country inequalities issues (Devine et al., 2017).[3] Multiple regression analysis will be performed for different ESG score indicators, the overall ESG score, the ESG grade and the environmental, social and governance pillars individually.

The remainder of this thesis is organized as follows. In section 2, a theoretical background provides information about the key concepts that shape the hypotheses of this thesis. Section 3 explains the hypotheses that are evaluated in this study. Section 4 provides insights into the methodology. Section 5 provides an overview of the data collected for the research. Section 6 provides the outcomes of the data analyses. In section 7, the results are discussed, and section 8 provides a conclusion.

[1] This thesis is performing fixed effect models to prevent from Exogeneity, Homoscedasticity and Non-autocorrelation. This is explained in depth in the methodology section.

[2] The sample consists of 4 years because this is the optimal consecutive number of years once we include all variables.

[3] Cross-country inequalities such as institutional regulations and cultural differences.

2. Theoretical background

This chapter provides an overview of current theoretical knowledge with regard to the relationship between increased interest in the sustainability of real estate and the financial performance of key players in this field. To this end, section 2.1 will address how ESG activities relate to financial performance in general, followed by a discussion of this topic tailored to the field of real estate in section 2.2. The academic results regarding the relationship between ESG activities and the cost of debt of real estate organizations will be examined in section 2.3.[4] Finally, the discussed literature will function as the theoretical foundation for the hypothesis explained in section 2.4.

2.1. ESG activities and financial performance of organizations

The association between ESG activities and the financial performance of organizations has not gone unnoticed in the literature. The first official intersection of an investor and ESG can be dated to 2009, when the United States Private Equity Council adopted guidelines covering environmental, health, safety, labour, governance, and social issues (Zaccone & Pedrini, 2020). Recently, researchers have highlighted that ethical investing mainly involved excluding companies with a bad image within a particular industry or sector (Crifo & Forget, 2013). Due to concerns about reliance on negative screening, ethical and socially responsible investing evolved into ESG integration over time. Cappucci (2018) suggests that ESG integration into investment strategies challenges the lack of (sufficient) common support of ethically and morally responsible investments. Consequently, investment managers who adopt ESG compete with managers who are not and thus bear none of the costs of ESG integration.

Obviously, poor awareness of the beneficial financial effects of sustainability-proof investments by employing ESG criteria calls for the dissemination of scientific evidence. ESG performance is generally positively related to the financial return of equities, bonds, and real estate from the investor perspective. Friede et al. (2015) discuss the relevant literature regarding the relationship between ESG and performance based on approximately 2000 studies in a meta-study. They show a positive or neutral effect between one or all the ESG-factors and the financial return. Findings in the different studies are consistent across approaches, ESG pillars, asset categories[5] and regions. Although the results are generally positive (or at least non-negative), there are also notable differences. For example, whereas the effect of non-portfolio studies (effect on individual shares or bonds) is usually positive, portfolio studies (funds) usually show no or a

[4] The detailed information regarding the cost of debt and ESG pillars is provided in section A of the Appendix.

[5] Asset categories such as equities, bonds, and real estate.

mixed effect. Mixed results contain both positive and negative coefficients and might not be considered strong evidence for the financial benefits of sustainable-proof investments. Wetzels and Koedijk (2020) discuss the mixed effect and suggest that funds exclude investments because of non-financial (ethical) grounds without mitigating the consequences for the portfolio. They suggest that smaller-sized funds have relatively higher management fees cause lower financial benefits.

Although there is growing evidence for the financial benefits of taking into account ESG criteria for investments, awareness of the risk of a learning effect is indicated. The learning effect is an integrated theory that explains what the effect of ESG could be in the long term. The learning effect is defined as the so-called "learning hypothesis". Under this hypothesis, ESG data provides information about future risk-adjusted operating results. Since not many investors initially took this into account, ESG data was a source of additional and material information and thus a source of possible outperformance (Bebchuk et al., 2013; Borgers et al., 2013).[6] However, this potential will disappear if the capital market starts to pay more attention to ESG. This can negatively affect the ability to generate additional investment return in alpha using ESG factors. Once corporate governance becomes mainstream, there is evidence that the alpha is disappearing (Bebchuk et al., 2013). A similar result emerges from Borgers et al. (2013). In the period with more attention to ESG, the positive effect of ESG on the risk-weighted financial return will disappear. The learning effect implies that investors need a more active investment style concerning ESG choices if the goal is to generate alpha. Pereira et al. (2019) argue that there is also a learning effect within sustainable bond portfolios. They argue that earlier bond funds with a better sustainability rating outperform bond portfolios with a lower sustainability rating, while this outperformance disappears over time. In the literature, this subject receives scant attention regarding real estate and the cost of debt.

Another point that should be taken into account concerns the impact level difference of sustainability factors on a company's financial performance, described in the financial materiality theory. ESG factors that are financially relevant can significantly impact a company's business model and value drivers, such as revenue, risk, and capital requirements. This impact can be both positive and negative (Khan et al., 2016). An exciting aspect of this theory is that the impact of the ESG factors could differ per sector and subsector. The Sustainability Accounting Standards Board (SASB) has created a "Materiality Map" in which sustainable aspects are identified per sector that will likely influence companies' financial situation and performance. However, there is still

[6] Outperformance is also called the alpha effect

limited research on how this theory relates to the association between ESG performance and the cost of debt within real estate organizations.

2.2. ESG activities and financial performance in Real Estate

This section elaborates on the association between ESG and the financial performance in the field of real estate along the different ESG pillars.

Environmental pillar

Literature shows that the environmental pillar is commonly linked to certifications and positively related to the financial performance of real estate. The environmental pillar is relatively easy to measure because the real estate sector has different environmental certifications such as LEED, Energy Star or BREEAM. Those certifications indicate the environmental performance of properties regarding criteria such as energy efficiency, sustainable materials and resources, and sustainable sites (Berardi, 2012). Brounen and Kok (2011) explain that reducing energy consumption can lead to a sales value increase of 15%. Therefore, they take the energy performance certificates that the EU implements. They used a sample of both labelled and non-labelled homes. Eichholtz et al. (2010) provide initial evidence on green buildings 'economic value. Evidence suggests that the label's intangible effects (such as a healthier environment) may also play a role in determining green buildings' values in the marketplace. They use a sample of 10,000 firms and explain a 3 – 4% rental premium and a 16% sale price premium on certified buildings. Fuerst and McAllister (2011) provide results of 4 -5 % rental price premium and 24 – 25% sales price premium for eco-certified buildings. Reichardt et al. (2012) explain a significant relationship between the certification "Energy Star" and lower vacancy rates. Kok and Jennen (2012) report evidence of an increase in the direct return and that sustainability increases the cash flows, such as rental income. The increased sales price premium could be explained by the rise in the rental price premium. Theory suggests that the costs of achieving sustainability do not outweigh the financial benefits (Brounen & Kok, 2011; Eichholtz et al., 2010; Fuerst & McAllister, 2011; Kok & Jennen, 2012; Reichardt et al., 2012).

The environmental pillar is also positively associated with the financial returns of real estate portfolios of institutional investors and REITs. Eichholtz et al. (2013) explain that the greenness of REITs is positively related to the return on assets, return on equity and the ratio of funds from operation to total revenue. They also document a non-significant relationship between the greenness of property portfolios and abnormal stock returns, suggesting that stock prices already reflect the higher cash flows deriving from investments in more efficient properties. The long-term weakening often refers to the alpha performance or learning effect (Pereira et al., 2019).

Another essential finding is that assets with a higher fragment of greenness have a significantly lower market beta (Eichholtz et al., 2012). Fuerst (2015) shows for the first time that investing comprehensively in sustainability as measured by the GRESB rating pays off for REITs by enhancing operational performance and lowering risk exposure and volatility.[7] This paper analyses REITs from North America, Asia and Europe for the 2011-2014 time period. It concludes that "for real estate assets to maintain their competitive positioning, it is critical that their owners invest in measures that improve their sustainability" (Fuerst, 2015, p.1). Sah et al. (2013) suggest that Green REITs have a higher return on assets than less green REITs. They use a proxy for green initiatives by REITs. They find evidence of positive impact on firm value as measured by Tobin's Q.[8] As an additional analysis, they provide evidence of superior stock performance by green REITs using a different measurement, the Jensen's alpha, as a measure.

Social pillar

There is a positive association between the social pillar and the financial performance of real estate, although empirical evidence is relatively scarce. Brounen et al. (2021) refer to corporate social responsibility (CSR). Based on the article of Bauer et al. (2010), they explain that for real estate investments, there is a positive relationship between CSR ratings (KLD[9]) and Tobin's Q. Although positive CSR scores did not affect REIT returns, they documented that Tobin's Q spread was mainly due to the negative effects for low-scoring REITs. Brounen et al. (2021) also provide documentation that CSR ratings are higher for companies with fewer agency problems, affecting the governance pillar.

Governance pillar

There is empirical evidence for a positive relationship between the governance pillar and the financial performance of real estate organizations. Israelsen (2004) analyzed the performance effects of two competing governance structures, the self-administered that is outperforming the advisor structure REITs. Brzeszczyński and McIntosh (2014) used the study of Israelsen (2014) and extended it by using the Corporate Governance Quotient Index (CGQ), which is a metric developed by Institutional Shareholder Services (ISS) that rates publicly traded companies in terms of the quality of their corporate governance. They found a significant and positive relationship of governance performance on the performance of an organization.

[7] GRESB rating is an ESG rating agency that is specialized in real estate and infrastructure organization.
[8] Tobin's q, is the ratio between a physical asset's market value and its replacement value (Berk & DeMarzo, 2017).
[9] KLD Research & Analytics, Inc. (KLD) MSCI ESG research data.

Although individuals' association of the social and governance pillar is relatively underrepresented in the literature, there is evidence for a positive relationship when combined. Brounen and Marcato (2018) report the effect of combined sustainability pillars on real estate performance. They test different ESG ratings on the relation between ESG and REIT returns. They find that the different ESG-ratings, called GRESB, KLD[5] and Thomson Reuters, have a different impact on financial performance. Because the ESG ratings are based on different sustainability factors, it is related to the financial materiality theory (Khan et al., 2016). Brounen and Marcato (2019) report that the KLD and Thomson Reuters scores are positively related to REIT returns, and the GRESB rating is negatively related. Their findings indicate that the S and G components are positively related to returns.

2.3. ESG effect on the cost of debt in Real Estate

Considering that ESG-based investments are associated with higher rents, more stable occupancy rates, less operating expenses, increasing sales value, and the observation that it beneficially affects REITs' firm value and operating performance, we can assume that sustainability improvements are negatively associated with the cost of debt. An essential component of the cost of debt formula is the credit spread. A more stable occupancy rate and higher stable cashflows cause a decrease in systematic risk and lower default risks (An & Pivo, 2020; Eichholtz et al., 2019), which could lead to loans on more favourable terms due to improved reputation associated with engagement in ESG activities (Siano et al., 2010).

An and Pivo (2020) analyze the greenness of a portfolio for its effect on default risk. They use a sample of 600 buildings, and they find evidence for a reduced default risk for 34% of the green building. An and Pivo (2020) point out that the default risk effect is realized due to enhanced cash flows and a lower loan-to-value. A lower loan-to-value is positive because the price premium has increased the value, and therefore a lower loan-to-value is realized. Therefore, the cost of debt for greener firms is lower due to a decrease in default risk. Eichholtz et al. (2019) analyze the relationship between the greenness of the portfolio and the mortgage spread of individual assets, and the bond spread of REITs. For the research, they use a sample of 200 REITs. Eichholtz et al. (2019) point out that the mortgage spread is 25 – 29% lower for buildings with a sustainable certification. They also execute an analysis on bond spreads of REITs. They conclude that when a REIT' portfolio includes green buildings, this negatively associates with the bond spread ceteris paribus. In conclusion, they argue that the greenness of the portfolio lowers the cost of debt.

2.4. Hypothesis

The literate provides ample evidence for the positive association between improved ESG factors and rental price premiums, sale prices premiums, stable occupancy rate, higher stable cashflows and enhanced firm reputation. Moreover, these increased ESG-based investments result in better performance of the financial value of a REIT and cause a decrease in systematic risk and lower default risks (An & Pivo, 2020). From this line of reasoning, the hypotheses could be made that the ESG factor is associated with a decreasing cost of debt.[10]

Main hypothesis 1: The ESG score is negatively associated with the cost of debt of US REITs.

Given the financial materiality theory, which focuses on the underlying sustainable factors and suggests that those factors could impact credit spread differently per sector, it is worth exploring if sustainability factors in real estate differ within the sector. The REIT sector consists of different focus areas related to different market characteristics. Therefore, we will evaluate the variability of the impact of ESG factors on credit spread across different subindustries.

Exploratory Hypothesis 2: The association between the ESG score and the cost of debt varies between different sub-industries of the REITs.

3. Methodology

3.1. Methodology design

This thesis's primary goal is to understand better the association between the ESG performance and the cost of debt of US REITs. In this research, the panel data analysis method examines the association between the credit spread as the dependent variable and various ESG indicators as the exploratory variables.[11][12] The dependent variable is the credit spread, a component of the cost of debt.[13] This component has a direct effect on the cost of debt. The credit spread is the only cost of debt component that could be affected by the performance of a REIT. The economy affects the risk-free rate component, and the tax rate component is affected by government policies. Therefore, we use the credit spread as the variable to investigate the association between the ESG performance and the cost of debt. In appendix A, the cost of debt is explained in detail.

[10] In Figure 2.1 of appendix C a simplified theoretical framework is presented to visualize the argumentation of the hypothesis.
[11] The credit spread is a component of the cost of debt, this component indicates the default risk of a company.
[12] The exploratory variables are the ESG scores such as the combined ESG score environmental social and governance scores and the ESG grade.
[13] $Cost\ of\ Debt\ =\ (Risk\ Free\ Rate\ +\ Credit\ Spread)\ *\ (1\ -\ Tax\ Rate)$

This panel data analysis is suitable since it allows studying the effect of ESG performance on the cost of debt over the years for multiple REITs. The exploratory variables ESG scores are assessed once a year since they are based on the public year reports of the REITs. The panel analysis allows lags of the explanatory variable to analyze the association on credit spread over time. In addition, this approach is in line with methods employed in previous studies (An & Pivo, 2020; Bauer et al., 2010; Eichholtz et al., 2019; Fama & French, 1996).

The scope of this research is on the US REITs because they function as a useful market proxy. Since the real estate market consists of 24% of REITs with a gross asset value of $3.5 trillion (NAREIT, 2020), they are publicly listed, corporate data is publicly accessible, and many countries consider REITs as a vehicle to invest in real estate (EPRA, 2019). The analysis focuses on US REITs because it is the largest mature market. 219 REITs are present in the US; 38 of those are mortgage REITs which are outside the scope of this research (Statista 2020). A single country market is preferred to prevent cross-country inequalities such as institutional regulations and cultural differences (Devine et al., 2017)

3.2. Empirical models

Main model

To test the main hypothesis 1: *"The ESG score is negatively associated with the cost of debt of US REITs",* various models are constructed with different ESG variables. The specification of the main model (1) for REIT *i (i=1,…,n)* at time *t (t= year)* is

$$LnCreditSpread_{i,t} = \beta_0 + \beta_1 ESG_{i,t-1} + \beta_2 X_{i,t-1} + \alpha_1 Year + \alpha_2 Subindustry + \varepsilon_{i,t} \qquad (1)$$

Where β_0 is the constant; $LnCreditSpread_{i,t}$ is the natural log of the credit spread; $\beta_1 ESG_{i,t-1}$ is the one year lagged combined ESG score (0 to 100) of REIT i; $\beta_2 X_{i,t-1}$ the control variables for REIT i[14]; $\alpha_1 Year$ is the fixed effect for years; $\alpha_2 Subindustry$ is the fixed effect for subindustries presented on the right side of Table 3.4 of appendix B; and $\varepsilon_{i,t}$ is the error term. Because the ESG independent variables affect the credit spread variable and address potential endogeneity in the relationships of interest, we lag all right-hand side variables with one year.[15] The one-year lag is

[14] The control variables are $\beta_2 SizeREIT_{i,t-1}$ is the one year lagged natural log of the total asset of REIT I; $\beta_3 \Delta DebtSize_{i,t-1}$ is the one year lagged change in debt size of REIT I; $\beta_4 Debt-to-Asset_{i,t-1}$ the one year lagged debt to asset ratio for REIT i; $\beta_5 Cashflow Sales_{i,t-1}$ is on year lagged cashflow to sales ratio for REIT I; $\beta_6 Market-to-book_{i,t-1}$ is the one year lagged market to book ratio for REIT I; $\beta_7 ReturnOnAsset_{i,t-1}$ is the one year lagged return on asset ratio for REIT I; $\beta_8 CashPosition_{i,t-1}$is the one year lagged cash to asset ratio for REIT i. In section 3.1 the control variables are explained in detail.

[15] Bellemare, Masaki, and Pepinsky (2015) note that lagged explanatory variables address endogeneity when there is (i) serial correlation in the potentially endogenous explanatory variable, and (ii) no serial correlation among the unobserved sources of endogeneity.

in line with the literature (Oikonomou et al., 2014). Fixed effects for year and subindustry are taken to prevent the regressions from bias. Firms engage in ESG reporting over time, and the credit spread could follow a cyclical pattern. The subindustry is also considered fixed because it does not change over time. The different subindustries could have different volatilities, debt constructions and different yields. Considering the panel data assumption, several tests are conducted presented in Table 3.1, 3.2 and 3.3 of Appendix B.[16] The data is declared to be a panel on fund (RIC) and year level.[17]

The fixed effect selection

Practical tests are performed for the main model (1) to choose between the random-effect, fixed effect or pooled OLS model. The results of the tests are also presented in Table 3.1, 3.2 and 3.3 of Appendix B. The Hausman test is performed to reject the random-effect model. To refuse the pooled OLS model, the Breusch and Pagan Lagrangian multiplier test for random effects is performed, the test rejects the pooled OLS.[18] Modified Wald test for groupwise heteroskedasticity in fixed effect regression is performed ("xttest3" command) for the selected model. To solve for heteroskedasticity, the robust option is used in the model.[19]

Alternative regression models

Alternatives to the main model (1) are models 2-4. In models 2 – 4, the ESG scores of each pillar are included individually. The specification of the model (2-4) for REIT *i (i=1,…,n)* at time *t (t= year)* is

$$LnCreditSpread_{i,t} = \beta_0 + \beta_1 A_{i,t-1} + \beta_2 X_{i,t-1} + \alpha_1 Year + \alpha_2 Subindustry + \varepsilon_{i,t} \quad (2-4)$$

Where $\beta_1 A_{i,t-1}$ is for model 3 the one year lagged environmental score (0 to 100) of REIT i, for model 4 the one year lagged social score (0 to 100) of REIT i, and for model 5, the one year lagged governance score (0 to 100) of REIT i.[20]

[16] I) the error term has a conditional mean of zero, II) Homoscedasticity (constant error variance), III) Uncorrelated errors (autocorrelation), IV) Regressors are not correlated with the error term (endogeneity), V) Normally distributed errors and VI) multicollinearity. Assumption i) is not violated because a constant term is considered. Assumption v) the normally distributed error assumption is tested with the Jarque Bera test, and the error term is normally distributed. Assumption vi) multicollinearity is tested by the VCE correlation, and the larger than 0.7 rule of thumb is applied; there is no multicollinearity between the variables.

[17] RIC level is equal to firm level, the RIC is the ticket of the certain REIT. (xtset RIC1 YEAR)

[18] Random effects (RE) are preferred under the null hypothesis due to higher efficiency, while under the alternative Fixed effects (FE) is at least as consistent and thus preferred.

[19] The robust option is also used for the alternative models and exploratory model (vce Robust).

[20] β_0 is the constant; $LnCreditSpread_{i,t}$ is the natural log of the credit spread; $\beta_2 X_{i,t-1}$ the control variables for REIT i; $\alpha_1 Year$ is the fixed effect for years; $\alpha_2 Subindustry$ is the fixed effect for subindustries; and $\varepsilon_{i,t}$ is the error term.

In model 5, the individual pillars are combined in one model specification. Model 5 is an alternative to the main model (1) specification but with multiple explanatory variables. The specification of the model (5) for REIT *i (i=1,…,n)* at time *t (t= year)* is

$$LnCreditSpread_{i,t} = \beta_0 + \beta_1 E_{i,t-1} + \beta_2 S_{i,t-1} + \beta_3 G_{i,t-1} + \beta_4 X_{i,t-1} + \alpha_1 Year + \alpha_2 Subindustry + \varepsilon_{i,t} \quad (5)$$

$\beta_1 E_{i,t-1}$ is the one year lagged environmental score (0 to 100) of REIT i; $\beta_2 S_{i,t-1}$ is the one year lagged social score (0 to 100) of REIT i; $\beta_3 G_{i,t-1}$ is the one year lagged environmental score (0 to 100) of REIT i.[21]

Model 6 is similar to the main model (1) only in this model (6) the ESG grade is the dependent variable. This model specification is conducted to test the association between the credit spread and the ESG grade.

$$LnCreditSpread_{i,t} = \beta_0 + \beta_1 ESG\_Grade_{i,t-1} + \beta_2 X_{i,t-1} + \alpha_1 Year + \alpha_2 Subindustry + \varepsilon_{i,t} \quad (6)$$

Where $\beta_1 E$SG_Grade$_{i,t-1}$ is the one year lagged ESG grade (0 to 12) of REIT i. The ESG grade variable is explained in detail in the next section (5.1).

Exploratory model

To test the exploratory hypothesis 2: "*The association between the ESG score and the cost of debt is not similar for different sub-industries of the REITs".* The main model is tested regarding the industrial, office retail, residential and specialty subindustries. Table 3.4 of Appendix B presents the distribution of the subindustries in detail. This exploratory model has some limitations. The number of observations for the Retail (116) and Specialty (256) subindustries are relatively higher than for the Industrial (32), Office (80) and Residential (60) subindustries; this will reflect in a low degree of freedom. Therefore, this model is an additional model only meant to explore the financial materiality theory within the REIT market.

[21] β_0 is the constant; $LnCreditSpread_{i,t}$ is the natural log of the credit spread; $\beta_2 X_{i,t-1}$ the control variables for REIT i; $\alpha_1 Year$ is the fixed effect for years; $\alpha_2 Subindustry$ is the fixed effect for subindustries; and $\varepsilon_{i,t}$ is the error term.

4. Data

4.1. Data collection

Data of the ESG performance and corporate financial information of US REITs are collected from the Refinitiv Eikon database, also called the Thomason Reuter database. This database is collecting all public financial data. The database offers financial and ESG data to construct the required independent variable and control variables; Table 4.2 in Appendix C shows the input parameters. The risk-free rate used in this thesis is the 10-year-treasure bond collected from the macrotrends database.

The starting dataset consists of 169 US REITs for the period 2009-2020, in total, 2,028 observations. The US REIT market consist of 181 REITs in total, exclude Mortgage REITS (Statista, 2020). During collecting the data, 12 REITs were not providing data or unusable data. From this starting point, all the missing values of the required input are dropped except the ESG indicator. This results in a drop of 533 observations to a dataset of 1.495 observations. Most of the missing values were detected between 2009 and 2014.[22] An explanation for the missing values before 2014 is that the number of US REITs was lower just after the financial crisis of 2008. Figure 4.2 in de Appendix C presents the trend of active REITs in the US over the last decade. Another explanation for the sensitivity of the consistencies of the number of REITs is the number of mergers and acquisitions in the US REIT market.[23] The optimal sample of REITs that report ESG data consists of 136 REITs with a total of 544 observations for a period of 4 years (2017-2020).[24] The optimal sample is relevant because, from 2016, the ESG reporting entered a mature phase due to the global engagement to SDG.[25]

The ESG variables

The ESG data that is accessible through Thomason Reuter is the Refinitiv ESG data.[26] The ESG score is the leading independent variable in this thesis. The ESG score is assessed once a year and, therefore, an annual score. The ESG score is based on the three pillars environmental, social and governance. Each pillar individually gives a score from 0 to 100. The environmental pillar is computed from scores of three categories, resource use, emission and innovation scores. The

[22] Missing values in the per year; 110 missing values in 2009; 108 missing values in 2010; 100 missing values in 2011; 95 missing values in 2012; 43 missing values in 2013; 30 missing values in 2014; 18 missing values in 2015; 15 missing values in 2016; 9 missing values in 2017; 3 missing values in 2018; 0 missing values in 2019 and 2 missing values in 2020.

[23] In 2012 to 2017 a proximity of 51 M&A are performed in the REIT market (Goodwin Law, 2019).

[24] The robustness is from 2013 till 2020. This sample consists of 496 observations and 68 REITs that report data for this period. In this sample the ESG non-reporting REIT are not dropped. The decrease in observations is traceable to the number of active REITs and the high number of M&A.

[25] "On 1 January 2016, the 17 Sustainable Development Goals (SDGs) of the 2030 Agenda for Sustainable Development — adopted by world leaders in September 2015 at an historic UN Summit — officially came into force." (SDG, 2016)

[26] The Refinitive ESG data is differently assessed as the MSCI (KLD) or GRESB data.

social pillar is based on the categories such as workforce, human rights, community and product responsibility. The governance pillar is based on the categories such as management score, shareholder score and CSR strategy score. To determine the scores of the categories, more than 70 key performance indicators that are based on more than 400 data points are assessed. The database of Thomson Reuters uses weights to determine the total ESG score for each REIT. The scores weights are explained in table 4.3 of Appendix B. Regarding the ESG score, Thomas Reuters also provides an ESG grade distribution. There are 12 different grades where the option no score is also included. In Table 4.4 of Appendix B, the distribution of the grades is explained. The ESG grade is crucial because the difference in numbers could be slight, and the grade describes a broader range. The ESG grade also considers a no grade option. The ESG variables must be lagged with one year because they are annually assessed. Therefore, the ESG score could only affect the corporate performance after the announcement.

Credit spread

The credit spread is the only component that could be affected directly by the performance of the REIT. To calculate the credit spread, firstly, the cost of debt is calculated by total interest expense on debt divided by the total debt times 100. Then the cost of debt before tax is calculated. To calculate the credit spread, the risk-free is subtracted from the cost of debt. The risk-free rate that is subtracted is linked to the 10-year-treasure bond. In the regression, the natural logarithm of the credit spread is taken to correct for the positive skewness (Figure 4.3 and 4.4 in Appendix C).[27]

$$Cost\ of\ debt\ = \frac{Total\ interest\ expense\ on\ debt\ divided}{Total\ Debt} * 100\%$$

$$Credit\ Spread\ = Cost\ of\ debt\ -\ Risk\ Free\ Rate$$ [28]

Control variables

The size is the first control variable. The variable is the logarithm of the total asset. The size of an organization has a negative association with the yield/credit spread (Ge & Liu, 2015; Sun & Cui, 2014). Also, there is evidence that larger firms have lower default risk. Because they are considered more reliable when concerning paying back debt (Fama & French, 1996). There is also dissent regarding this reasoning, such as the nuance that there is an effect of size on default risk but only for the outer part of the default risk (Vassalou & Xing, 2004).

[27] The credit spread is winsorized with 5% to both sides to prevent from extreme outliers.

[28] This is the credit spread before tax rate is considered. The tax rate is not included in this research because the scope is on US REITs only and there for this is not necessary to take the corporate tax rate into account.

The second control variable is the change in the debt amount of a firm. The variable is based on the logarithm of the lagged total debt minus the total debt. The difference in debt size is positively related to the credit spread of a firm. When there is a large increase in debt size, the default risk of a firm increases (Drudi & Giordano, 2000). However, this could be nuanced because, in current financial systems, only financially good firms could attract a large sum of debt (Van Binsbergen, Graham, & Yang, 2010). Comparable studies also use the variable (Oikonomou et al., 2014; Van Binsbergen et al., 2010).

The third control variable is the Debt to Asset ratio. The Debt to Asset ratio is considered the leverage ratio based on the total debt divided by the total asset. Leverage explains the debt-to-equity position of the firm. When the leverage is positively related to the credit spread, an increase in the leverage will result in higher default risks (Cai et al., 2016; Oikonomou et al., 2014; Sun & Cui, 2014).

The fourth control variable is the cash flow ratio. The cash flow ratio is based on the cash flow divide by the sales. The cash flow ratio is essential for this research because the higher stable cashflows cause a decrease in systematic risk and lower default risks (An & Pivo, 2020; Eichholtz et al., 2019). In the research of (Van Binsbergen et al., 2010), the cash flow is also considered a variable associated with the cost of debt and, therefore, the credit spread.

The fifth control variable is the market to book ratio. First, the Market to Book ratio is calculated by the market capitalization divided by the book value. Then, the book value is calculated by the total asset subtracted by the total liabilities. In previous research, the Market to Book ratio is used as a control variable for similar analyses (Eichholtz et al., 2019; Oikonomou et al., 2014; Sun & Cui, 2014). High ratios are considered less risky and seen as growth opportunities with lower credit spreads.

The sixth control variable is considered as the return on asset ratio that expresses financial performance. The return on asset ratio is calculated by the EBIT divided by the total asset. In theory, when a firm is performing financially sound, the risk that they cannot repay their debt is lower. Therefore, the default risk is considered to be lower. So, the return on asset ratio should be negatively related to the credit spread (Oikonomou et al., 2014).

The seventh and last control variable is the cash position. The cash position is the cash of the firm divide by the total asset. The cash position is related to the default risk. If the cash position is relatively high, the firm can pay back short-term debts. On the other hand, if the firms can pay

back short-term debts, this stables the cash flow, and a stable cash flow relates to the credit spread (An & Pivo, 2020).

4.2. Descriptive statistics

The summary statistics for the optimal sample is presented in table 4.1[29] The observations are for all the variables 544. The credit spread is presented as a natural logarithm.[30] The lowest ESG score is 9,43, and the highest is 89,57, with a mean of 43,33. Thus, the mean of the ESG score is lower than the mean of the Social and Governance score individually, while the Environmental score is lower than the general ESG score. It is also remarkable that the minimal Environmental score is zero while the minimal ESG, Social and Governance score is higher than zero.

Figure 4.1 presents the distribution of the different scores for each year. The ESG scores and the individual pillar scores change over time—the mean of the ESG score increase from 38 in 2017 to 49,5 in 2020. The mean of environmental, social and governance pillars also increased over the years.[31] The environmental pillar mean increased the most with 20 over the years compared to an increase of 7 and an increase of 6.5 for the social and governance pillars. The relatively significant increase of the environmental mean suggests that most REITs have increased their environmental categories.

In Figure 4.1, it is remarkable that the environmental pillar generally scores much lower than the social and governance pillar. The distribution of the environmental score is centralized on the far left. The social scores are more centralized in the middle, and the governance to slightly to the right side. The general ESG score is centralized somewhat to the left side of the middle. The extreme low environmental pillar score is negatively affecting the ESG score. Most REITs could improve their environmental categories to improve ESG scores.

Also, the minimal ESG score is higher than the minimum score of the pillar score. From this, we could conclude that the individual pillars are not at the minimum simultaneously. This is also true about the maximum of those scores.

[29] For the robustness sample option and the starting dataset, the tables are shown in Table 4.6 and 4.7 in Appendix B.
[30] The credit spread is winsorized with 6 94 to both sides to prevent from extreme outliers.
[31] ESG score mean; 2017: 38.02; 2018: 41.13; 2019: 44.68; 2020 49.50. Environmental mean; 2017: 19.73; 2018: 23.65; 2019: 30.12; 2020 39.08. Social mean; 2017: 46.89; 2018: 48.31; 2019: 50.85: 2020: 53.86. Governance mean; 2017: 50.98; 2019: 54.75.31; 2019: 55.90; 2020: 57.54.

To prevent outliers, the debt to asset ratio, cash flow sales, return on asset, and cash variables are winsorized. This is in line with Oikonomou et al. (2014)[32]. The size and Δ debt size variables are also presented in a natural logarithm form. The debt size variable has a negative minimum which is possible because it could be that a REIT decreased their debt size. Finally, the market to book maximum value is winsorized with .95 but still relatively high this is remarkable but not strange[33].

Table 4.5 of Appendix B presents the correlations between the variables for sample option one. There is no remarkable high correlation except between the independent ESG variables, which makes sense because those variables are related to each other. The highest correlation is the one between size and the ESG variables. However, the other correlations are relatively low. From this, the conclusion could be made that there is no multicollinearity issue.

Table 4.1 – Descriptive statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
Dependent variable					
Credit spread (log)	544	16.684	1.139	13.816	19.353
ESG score variables					
ESG score	544	43.334	18.726	9.43	89.57
Environmental Pillar	544	28.145	29.355	0	95.35
Social Pillar	544	49.979	17.419	9.05	93.4
Governance Pillar	544	54.795	19.298	3	95.42
ESG grade	544	5.691	2.259	2	11
ESG reporting dummy	544	1	0	1	1
Variables					
Size (log)	544	15.268	.98	12.435	17.569
Δ Debt Size (log)	544	.067	.199	-.714	1.298
Debt to Asset Ratio	544	.484	.136	.074	1.019
Cashflow to Sales Ratio	544	.426	.148	-.176	.789
Market to Book Ratio	544	2.046	1.145	.259	5.173
Return on Asset	544	.086	.032	0	.188
Cash to Asset Ratio	544	.026	.037	0	.258

Note: This table provides the summary statistic for the optimal sample variables used for the main analysis. The number of observations, the mean, standard deviation, minimum value, and the maximum value is presented. The Credit Spread (log) is winsorized with 6 94; the Debt to Asset Ratio is winsorized with 1 99; the Cashflow to Sales Ratio is winsorized with 1 99; the Market to Book Ratio is winsorized with 1 95; the Return on Asset is winsorized with 3 97; the Cash to Asset Ratio is winsorized with 1 99.

[32] Winsorizing or winsorization is the transformation of statistics by limiting extreme values in the statistical data to reduce the effect of possibly spurious outliers. It is named after the engineer-turned-biostatistician Charles P. Winsor (1895–1951).

[33] If the book value is higher than the market value, analysts consider the company to be undervalued

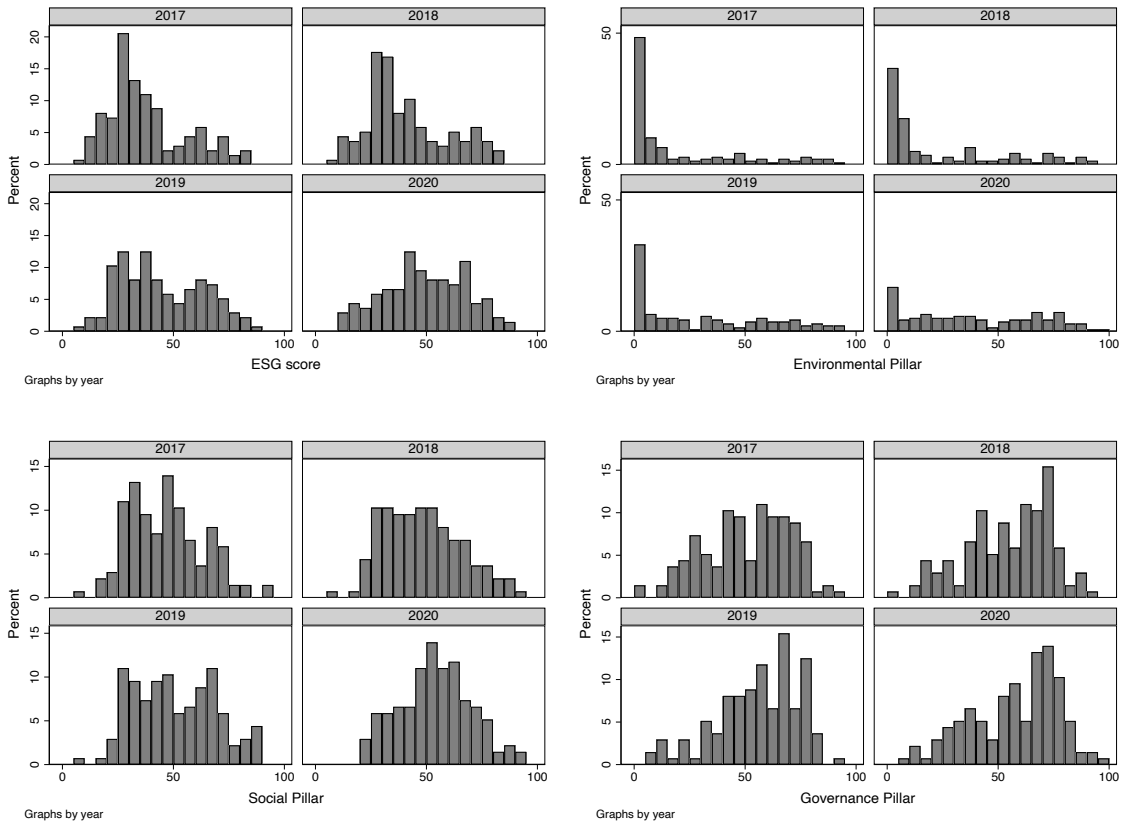

Figure 4.1 – Overview of the ESG data over 2017 – 2020

5. Results

This section will present the results on the association between de credit spread and the ESG score. Firstly, the results of the basic analysis will be given. Secondly, the main model and the alternative models will be discussed. Thirdly, the main model will be tested on robustness. Lastly, the result of the additional exploration model will be presented

5.1. Descriptive analysis

Scatterplots are presented in the graphs to raise a general understanding of the association between the different ESG variables and the credit spread. The horizontal axis shows the ESG variable. The vertical axis shows the natural logarithm of credit spread. In Figure 5.1a, the association of the ESG score with the credit spread is visualized. The line gives a first indication of the association between the credit spread and the ESG score.[34] This graph shows a linear downward sloping line and provides the first result for a negative association between the credit spread and ESG score. This implies that when the ESG score increases, the credit spread (log)

[34] The regression line is Credit Spread (log) = -.0080249 [.00259] * ESG score + 17.03149 [.1222473] with R2 = 0.0174 and N = 544

decreases, which is in line with the expectations. Graph 5.1b plots ESG pillars against the credit spread. Each line represents the linear association of each ESG pilar with the credit spread (log).[35] In the graph, three downward sloping lines represent that each pillar is negatively associated with the credit spread. This implies that the three ESG pillars have a similar association in relation to each other. Finally, in graph 5.1c, the association between the ESG grade and the credit spread (log) is shown. The line downward sloping in the graph shows a negative association between the ESG grade and the credit spread.[36] Although the findings are very predictable as the ESG grade is based on the ESG score, it is still essential to analysis because the more extensive range of steps between the grades are visualized. Although the results are rough, they are relevant initial evidence of the association between the credit spread and ESG performance.

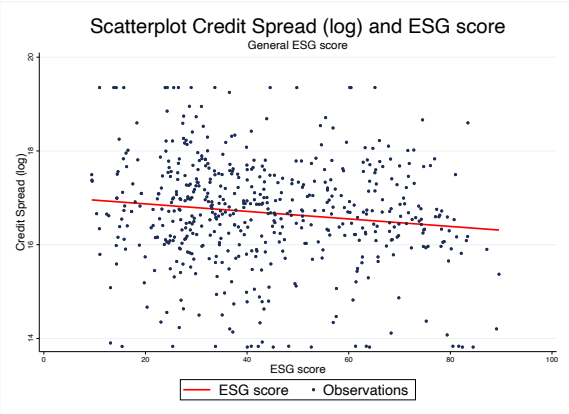

Figure 5.1a

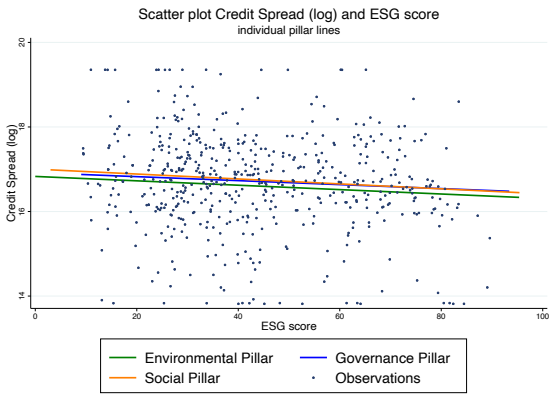

Figure 5.1b

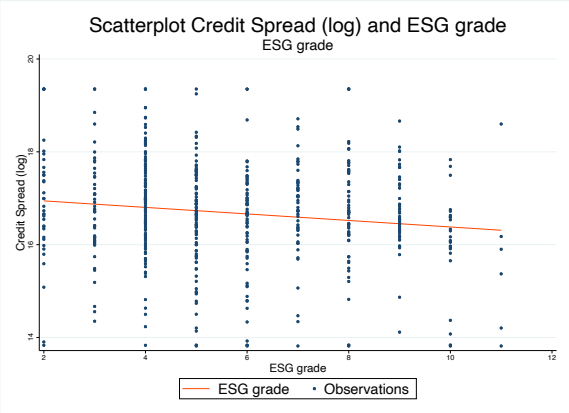

Figure 5.1c

Figure 5.1 (A-C) – Scatterplot credit spread and ESG variables

[35] The regression line is Credit Spread (log) = -.0051969 [.0016517] * Environmental + 16.83001 [.0671401] with R2 = 0.0179 and N = 544; The regression line is Credit Spread (log) = -.0047147 [.0028015] * Social score + 16.91938 [.1482622] with R2 = 0.0052 and N = 544; The regression line is Credit Spread (log) = -.0058321 [.002523] * Governance score + 17.00332 [.1465548] with R2 = 0.0098 and N = 544

[36] The regression line is Credit Spread (log) = -.070311 [.0214428] * ESG grade + 17.0839[.1312843] with R2 = 0.0195 and N = 544

5.2. Main analysis results

The credit spread is the dependent variable in the model specification, and the ESG performance is the explanatory variable. The models are considered as log-linear functions.[37] The model is based on 544 observations. In Table 5.1, the results of models 1-6 are shown with the natural logarithm of credit spread as the dependent variable, different ESG performance variables as explanatory and various control variables.

The models explain 18.2 to 19.5% of the association with the credit spread. This is relatively low compared to 30 to 62.2% of existing literature (Eichholtz et al., 2019; Ge & Liu, 2015; Oikonomou et al., 2014). A solution to increase the R-squared is adding control variables. For example, variables such as Tobin-q and the z-score return on investment; credit rank could be added to the model. Unfortunately, the dataset does not provide enough data to add these variables to the model specification. Comparative literature has a broader sample that not only focusing on the REIT market and uses a more extensive database (Eichholtz et al., 2019; Ge & Liu, 2015; Oikonomou et al., 2014).

Coefficients for the control variables are in line with expectations and are consistent across the specifications of models 1-6[38], except the coefficient of the size variable. The size variable presents a positive association with the credit spread that is significantly different from zero and consistent for all the models.[39] The size is shown as a logarithm there for the coefficient is presenting an elastic relationship.[40] This is not in line with the expectations but with the nuance that there is an effect of size on default risk but only for the outer part of the default risk (Vassalou & Xing, 2004). The Debt to Asset Ratio coefficient is significantly different from zero (1%), and the positive sign implies a positive association with the credit spread.[41] The coefficient of the variable is relatively stable for all the models. The Market to Book Ratio coefficient has a negative sign for all the models and is significantly different from zero (1%). This implies that the association with the credit spread is negative. An increase in the Market to Book ratio causes a decrease in the credit spread. Despite that, the coefficients of the control variables generally correspond to the literature expectations. The variables Δ Debt Size, Cashflow to Sales Ratio,

[37] Log-linear: ln(y) = b0 + b1x + . . . + e; b1 : growth rate +1 x increases y with exp(b1) times or +1 x increases y with ((exp(b1) − 1) ∗ 100) %; The "For small values of β^, approximately e β^ ≈ 1+β^. We can use this for the following approximation for a quick interpretation of the coefficients: 100 · β^ is the expected percentage change in Y for a unit increase in X. For instance, for β^ = .06, e .06 ≈ 1.06, so a 1-unit change in X corresponds to (approximately) an expected increase in Y of 6%." (Benoit, 2011).

[38] The baseline models are presented in table 5.4 of the Appendix B.

[39] The significant level the models 1,2 and 6 is 1% for the models 3-5 the significant level is 5%.

[40] The association between size and the credit spread is an elastic relationship because it is a log-log function. Elasticity +1% in x, increases y with (b_1)%

[41] The interpretation of the Debt to Asset Ratio, Cashflow to Sales ratio, Market to Book Ratio, return to asset and the Cash to Asset ratio. A log-linear form only interpreted with an increase of 0.01 instead of 1.

Return on Asset Ratio and the Cash to Asset Ratio are not significantly different from zero in the models.

The main ESG model (1) presents a coefficient of -0.013 for the association between the ESG score and the Credit Spread (log). The association is considered negative because of the negative sign and is significantly different from zero (1%). According to this model, an ESG score increase of one will decrease the credit spread by 1.29%.[42] The negative association is in line with the expectation and in line with comparative literature (Eichholtz et al., 2019; Ge & Liu, 2015; Oikonomou et al., 2014). The impact on the credit spread is smaller compared to the findings of Oikonomou et al. (2014) and Ge & Lui. (2015). Oikonomou et al. (2014) report that the aggregate strengths similar to the sound ESG performance have a coefficient of -0.0608 (-5.9%). Ge & Lui. (2015) report a coefficient of -0.03 (-2.96%) of CSR strengths also similar to ESG performance on the cost of corporate bonds. The research sample of Oikonomou et al. (2014) and Ge & Lui. (2015) consists of observations from different markets and is not specified to the REIT market.

The association between the individual pillar and the credit spread in the individual models (2-4) are significantly different from zero (1%). The Environmental model (2) presents a coefficient of -0.007 for the association between the Environmental pillar score and the credit spread. The negative sign implies a negative association. An increase in the environmental pillar of one will cause a decrease of 0.7% for the credit spread.[43] Compared to Eichholtz et al. (2019), they report a spread increase of 0.9 to 3.7 precent when a REIT has non-environmental certified assets, such as LEED or Energy Star. The -0.7% of this research is relatively lower. This could be because the environmental pillar that we use is more extensive than just the environmental certifications. Although the impact differs, the negative association is in line with the literature (Eichholtz et al., 2019).

The Social model (3) presents a negative association between the credit spread and the social score pillar that is significantly different from zero (1%). In particular, the coefficient of the social pillar is -0.011; the negative sign implies a negative association. So, when the social pillar increases with one, then the credit spread decreases by 1.09%.[44] The governance model (4) presents a negative association between the credit spread and the governance pillar that is significantly different from zero (5%). The coefficient of the governance pillar is -0.008, meaning that when the governance score of a REIT increases with one, then the credit spread decreases by

[42] $-1.2916\% = ((exp^{-.013} - 1) * 100)\%$
[43] $-0.6976\% = ((exp^{-.007} - 1) * 100)\%$
[44] $-1.094\% = ((exp^{-.011} - 1) * 100)\%$

0.8%.[45] The Social and Governance pillars are in literature often discussed as the CSR performance. Ce & Lui (2015) report a -3.67[46] coefficient on the association between CSR performance and the yield spread. This implies that the negative association is in line with the findings of this research. Ce and Lui (2014) report an impact larger than the social and governance pillars impact of this research, although it is difficult to compare because the sample scope differs.

The social pillar model (3) shows with -0.011 the most extensive negative impact on the credit spread compared to the environmental and governance pillar. So, increasing the social score would have the highest impact on the credit spread. In literature, there is evidence that the Social pillar has a larger impact on a REIT's performance than the Environmental and Governance pillars (Brounen & Marcato, 2018). Although, Jang et al. (2020) report that the Environmental pillar has the most significant impact on the performance, this evidence is not focused on the REIT market only.

The association between the credit spread and three ESG pillars in the ESG pillar model (5) is negative. However, all the ESG pillars are not significantly different from zero. This is because this model has multiple dependent variables. The individual pillars correlate with each other, or the residuals of the association between the individual pillars and the credit spread correlate. Therefore, the dependent ESG pillars are not significantly different from zero.

The ESG grade model (6) is presenting a more robust model. This model shows the association between the ESG Grade and the credit spread. The grades are derived from the ESG score but now describe in a range. The coefficient -0.102 of the association of ESG grade and the credit spread has a negative sign, implying a negative association. The coefficient is significantly different from zero (1%). If the REIT improves its ESG grade by one step, the credit spread decreases by 9.7%[47]. However, improving with one grade is more complex than a 1-point rise in the ESG score. To enhance the ESG Grade, a REIT has to increase its ESG score by approximately 8.33 points. The ESG Grade model (6) gives additional insight than the Main ESG Model (1) because it controls the step to different grades, which could be more complicated than just enhancing the score.

[45] $-0.7968\% = ((exp^{-.008} - 1) * 100)\%$
[46] Model specification is lin-lin
[47] $-9.697\% = ((exp^{-0.102} - 1) * 100)\%$

Table 5.1 – Panel data regression results main analysis: dependent variable log credit spread

	(0)	(1)	(3)	(4)	(5)	(2)	(6)
	Native ESG Model48	Main ESG Model	Environmental Model	Social Model	Governance Model	ESG Pillars Model	ESG Grade Model
ESG score	-.009** (.004)	-.013*** (.004)					
Environmental Pillar			-.007*** (.002)			-.003 (.003)	
Social Pillar				-.011*** (.004)		-.006 (.005)	
Governance Pillar					-.008** (.003)	-.006 (.004)	
ESG grade							-.102*** (.031)
Size (log)		.958*** (.355)	.909** (.35)	.843** (.341)	.8** (.352)	.947*** (.357)	.932*** (.354)
Δ Debt Size (log)		-.195 (.209)	-.194 (.21)	-.144 (.212)	-.164 (.205)	-.186 (.21)	-.191 (.21)
Debt to Asset Ratio		6.047*** (1.035)	6.107*** (1.016)	6.002*** (1.016)	5.962*** (1.04)	6.014*** (1.041)	6.088*** (1.021)
Cashflow to Sales Ratio		-1.065 (.743)	-1.188 (.777)	-1.039 (.747)	-.986 (.751)	-1.012 (.742)	-1.07 (.751)
Market to Book Ratio		-.353*** (.119)	-.352*** (.121)	-.344*** (.119)	-.372*** (.117)	-.354*** (.119)	-.353*** (.118)
Return on Asset		-1.195 (2.216)	-1.28 (2.25)	-1.238 (2.249)	-1.669 (2.216)	-1.207 (2.201)	-1.277 (2.231)
Cash to Asset Ratio		-1.642 (1.877)	-1.681 (1.86)	-1.571 (1.797)	-1.554 (1.915)	-1.608 (1.877)	-1.647 (1.853)
Constant	17.06*** (.172)	1.065 (5.228)	1.441 (5.197)	2.776 (5.038)	3.403 (5.2)	1.349 (5.267)	1.446 (5.233)
Observations	544	544	544	544	544	544	544
R-squared	.012	.195	.186	.185	.182	.195	.192
Fixed Effect Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effect Subindustry	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Dependent variable is the credit spread (log). The ESG score, Environmental Pillar, Social Pillar, Governance Pillar and the ESG grade are the explanatory variables. Control variables are Size (log), Δ Debt Size (log), Debt to Asset Ratio, Cashflow to Sales Ratio, Market to Book Ratio, Return on Asset and Cash to Asset Ratio. The R-squared is the R-squared within. Robust standard errors are in parentheses. *** p<.01, ** p<.05, * p<.1

5.3. Robustness of the models

The main results are tested on their robustness by focusing on a different sample size with the possibility of a non-reporting ESG REIT. Therefore, the ESG grade model is used, and a new dummy model is introduced because these models allow REITs that are not reporting ESG scores. The robustness sample consists of 496 observations over 7 years (2014-2020).[49] The ESG dummy model (7) is comparable to the main and alternative models only now included an ESG dummy as the exploratory variable.[50] The ESG dummy model is performed to test if only reporting of ESG is already affecting the credit spread.

Table 5.2 presents the results of the robustness models. The control variables seem to be relatively stable for the new models compared to the initial ESG grade model, implying that the ESG grade model is robust. The estimates of the control variables that are significantly different from zero decreases in magnitude. This is not remarkable considering the extensive score of seven years. Compared to the initial ESG grade model (6), the coefficient of the Size variable is slightly lower for the new ESG grade model (7) and relatively lower for the ESG dummy model

[48] This is the native model, this model only reports the association between the ESG score and the credit spread (log), the coefficient of the ESG score is -.009 and implies a negative association that is significantly different from zero (1%). Although this model has a very low R-squared.

[49] The low number of observations can be traced back to the previously discussed events surrounding the financial crisis and the high number of M&A.

[50] $LnCreditSpread_{i,t} = \beta_0 + \beta_1 ESG\ Grade_{i,t-1} + \beta_2 X_{i,t-1} + \alpha_1 Year + \alpha_2 Subindustry + \varepsilon_{i,t}$

(8) both are still significantly different from zero (model 7: 1%; model 8: 5%). The Δ Debt Size is remarkable because this variable is significantly different from zero (1%) for the new models (7-8), where it was not significantly different from zero in the initial ESG grade model (6). The estimates of the Δ Debt Size variable show a negative sign implying a negative elasticity association.[51] The Market to Book variable is not significantly different from zero for the robustness models, which means this variable is not robust. The Return on Asset Ratio because significantly different from zero for 10%, and the coefficient sign implies a negative association with the credit spread.

The coefficient -0.079 of the ESG grade is significantly different from zero (1%), and the negative sign implies that the credit spread is negatively associated with the ESG grade. The coefficient magnitude is less than the magnitude of the initial ESG grade model (6). The magnitude is slightly lower because the "no grade" option is considered a zero score. The zero scores will flatten the association with the credit spread. The R-squared of the new ESG grade model (7) is 0.154, which is slightly less than the initial model 7. The results present that the initial ESG grade model (6) is relatively robust compared to the new ESG grade model (7). This is a relevant finding because the ESG grade is based on the ESG scores that are based on the environmental, social and governance pillar.

In model 8, a dummy variable is tested. This model tests if only reporting ESG score is already associated with the credit spread. The association between the ESG reporting dummy and the credit spread is not significantly different from zero. This implies that only reporting ESG is not associated with the credit spread. This result shows that the models (1-6) in this thesis are presenting adequate information.

[51] Log-log function implies Elasticity +1% in x, increases y with (b_1)%

Table 5.2 – Panel data regression results from the robustness: dependent log credit spread

	(6) ESG Grade Model 2017 - 2020[52]	(7) ESG Grade Model 2014 - 2020	(8) ESG Dummy Model 2014 - 2020
ESG grade	-.102*** (.031)	-.079*** (.024)	
ESG reporting dummy			-.125 (.143)
Size (log)	.932*** (.354)	.782*** (.234)	.587** (.264)
Δ Debt Size (log)	-.191 (.21)	-.444*** (.094)	-.418*** (.09)
Debt to Asset Ratio	6.088*** (1.021)	4.128*** (1.168)	4.203*** (1.18)
Cashflow to Sales Ratio	-1.07 (.751)	-1.798 (1.31)	-1.685 (1.33)
Market to Book Ratio	-.353*** (.118)	-.088 (.162)	-.086 (.171)
Return on Asset	-1.277 (2.231)	-6.497* (3.717)	-7.467* (3.804)
Cash to Asset Ratio	-1.647 (1.853)	.99 (2.03)	.601 (2.006)
Constant	1.446 (5.233)	4.701 (3.383)	7.411* (3.845)
Observations	544	496	496
R-squared	.192	.154	.131
Fixed Effect Year	Yes	Yes	Yes
Fixed Effect Subindustry	Yes	Yes	Yes

Notes: Dependent variable is the credit spread (log). The ESG grade is the explanatory variables. Control variables are Size (log), Δ Debt Size (log), Debt to Asset Ratio, Cashflow to Sales Ratio, Market to Book Ratio, Return on Asset and Cash to Asset Ratio. The R-squared is the R-squared within. Robust standard errors are in parentheses. *** p<.01, ** p<.05, * p<.1

5.4. Additional exploratory analysis

It is worthwhile to explore if the impact of sustainability factors in real estate differs within the sector. The REIT sector consists of different focus areas related to different market characteristics, which impacts the REITs characteristic. Therefore, we will explore the variability of the impact of ESG factors on credit spread across various subindustries. This is tested by performing the main ESG score model (1) for the five different sectors.

Table 5.3 present the results of the subindustry models (9 – 13). It is immediately remarkable that only the associations between the ESG score and the credit spread are significantly different from zero for the retail and specialty models.[53] On the other hand, the Office, Industrial and Residential models (9, 10 and 12) are not significantly different from zero; this relates to the low number of observations.

The ESG score of the Retail industry is associated stronger with the credit spread compared to the overall REIT market. The ESG score of the specialty model (13) has a similar impact on the

[52] The results of model 6 are included to provide overview.

[53] The control variables are not showing stability compared to the ESG score model (1). For the Retail Model (9) only the Size variable is significant (5%) and the magnitude is comparable. The other variables are not significant. The Specialty model Shows that the Debt to Asset ratio is significant (1%) and a weak significancy level (10%) for the market to book ratio variable. This indicates the instability of the subindustry models.

credit spread compared to the overall REIT market. The retail model (11) presents an ESG score coefficient of -0.026 on the credit spread that is significantly different from zero (5%). The negative sign implies a negative association between the ESG score and the credit spread. If a Retail REIT increases its ESG score with one, the credit spread will decrease by 2.6%.[54] The ESG score coefficient of the specialty model (13) is -0.012 and is significantly different from zero (10%). The negative sign implies a negative association between the ESG score of the specialty REITs and the credit spread. If a specialty REIT increases its ESG score, the credit spread will decrease by 1.19%.[55] The R-squared is 0.226 for the Retail model (11) and 0.22 for the specialty model (13). This is slightly higher compared to the main ESG score model (1).

This analysis is not very strong because of the low number of observations of the Office, Industrial and Residential subindustries, and the fact that the specialty industry is composed of a diversified sample of REITs. Although, the analysis provides initial findings regarding the impact difference of ESG score on the credit spread per subindustry. It is useful to understand that effect of ESG performance on the credit spread is not generic.

Table 5.3 – Panel data regression results exploratory analysis: dependent log credit spread

	(1) Main ESG Model	(9) Industrial Model	(10) Office Model	(11) Retail Model	(12) Residential Model	(13) Specialty Model
ESG score	-.013***	.024 (.022)	-.008 (.006)	-.026** (.011)	.004 (.007)	-.012* (.006)
Size (log)	.958*** (.355)	.908 (.875)	1.85** (.72)	.965** (.437)	.427 (.654)	.795 (.542)
Δ Debt Size (log)	-.195 (.209)	-3.095*** (.811)	-1.746*** (.603)	-.28 (.419)	-2.094*** (.539)	.251 (.224)
Debt to Asset Ratio	6.047*** (1.035)	16.647** (5.922)	11.723*** (3.417)	4.024 (2.694)	19.082*** (2.742)	5.479*** (1.171)
Cashflow to Sales Ratio	-1.065 (.743)	.771 (1.891)	-2.007 (3.844)	-.991 (1.031)	3.647*** (.797)	-1.273 (1.036)
Market to Book Ratio	-.353*** (.119)	-.478 (.47)	-1.039* (.53)	-.159 (.165)	-1.079*** (.251)	-.321* (.17)
Return on Asset	-1.195 (2.216)	-17.188 (14.825)	3.198 (6.701)	2.908 (4.806)	-1.691 (1.904)	-2.963 (3.332)
Cash to Asset Ratio	-1.642 (1.877)	6.182 (3.646)	-3.947 (4.947)	.31 (3.436)	13.045*** (3.437)	-3.134 (2.662)
Constant	1.065 (5.228)	-3.121 (14.464)	-14.675 (11.826)	1.903 (6.304)	1.587 (9.949)	4.03 (7.951)
Observations	544	32	80	116	60	256
R-squared	.195	.585	.415	.226	.695	.22
Fixed Effect Year	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effect Subindustry	Yes	No	No	No	No	No

Notes: Dependent variable is the credit spread (log). The ESG score is the explanatory variables. Control variables are Size (log), Δ Debt Size (log), Debt to Asset Ratio, Cashflow to Sales Ratio, Market to Book Ratio, Return on Asset and Cash to Asset Ratio. The R-squared is the R-squared within. Robust standard errors are in parentheses. *** p<.01, ** p<.05, * p<.1

**** p<.01, ** p<.05, * p<.1*

[54] $-2.566\% = ((exp^{-0.026} - 1) * 100)\%$
[55] $-1.193\% = ((exp^{-0.012} - 1) * 100)\%$

6. Discussion

Contribution to literature

Sustainability activities in Real Estate have become a dynamic and productive field of science in the past decades. While the effect of ESG activities on the financial performance of REITs has been investigated widely, this research is among the first to extensively study the association of ESG performance on the cost of debt for US REITs. In addition, this research provides a first impetus for the possible different associations within the sub-industries of the REIT market. The literature suggests that the ESG performance is negatively associated with the cost of debt. The results of this thesis confirm this line of reasoning, which is in line with the existing literature (Eichholtz, Holtermans, Kok, & Yönder, 2019; Ge & Liu, 2015; Oikonomou, Brooks, & Pavelin, 2014). They commonly report that enhancing ESG related activities could cause a lower cost of debt. Ge and Liu. (2015) and Oikonomou. (2014) report a negative association between the cost of debt and ESG activities (CSR performance), although their findings are not focused on the REIT market. Eichholtz et al. (2019) report that REITs with a higher fraction of environmentally certified buildings have lower bond spreads; this is an only environmental perspective. This thesis provides initial evidence for a negative association between both the environmental, social and governance performance and the cost of debt. REITs with a higher ESG score have lower credit spreads.

Internal quality

Various ESG indicators have examined the association between ESG performance and credit spread in this thesis. This research provides insights regarding the distribution of the ESG score in the US REIT market. The US REIT market scores low on the Environmental pillar compared to the Social and Governance Pillar. The result shows that the Social pillar has a larger impact on the cost of debt compared to the Environmental and Governance pillar. However, these can be considered slightly questionable because they are based on the Refinitive Reuters ESG score. This rating is constructed for all kinds of markets and not focused on the real estate market. It could be interesting to use the GRESB rating that Fuerst (2015) uses in this article to report the financial rewards of REITs. The GRESB rating would be an interest ESG indicator because this ESG assessor is particular for Real Estate and Infrastructure organizations.

Another limitation of this thesis is the number of years analyzed. Therefore, it was impossible to investigate the “learning effect” theory and check the trend over a longer investment horizon. The main results are based on only four years of annual data. The margin range arose because the models were tested on contiguous data, and this gave limited options. This data availability issue on REIT is explained by the fact that after the financial of 2008, there were fewer REITs, and due

to the many mergers and acquisitions during the period 2008 to 2017, the consistency of the data is lost. Although other studies use the bond spread as an indicator of the cost of debt (Eichholtz et al., 2019; Ge & Liu, 2015; Oikonomou et al., 2014), this thesis uses the credit spread as the cost of debt indicator and takes all the debt financing into account.

Starting point and as an incentive

This study could be used as a vehicle for academic research and as an incentive for real estate investors to invest in ESG activities. Although this research gives an initial insight into the varying effects of ESG indicators on the cost of debt between the subindustries, the association is not considered generic for the overall REIT market. This insight could function as a starting point for future research. For real estate investors (REITs), the finding that is improving the ESG activities lead to a decrease in the cost of debt may be seen as an incentive to invest in sustainability activities. Those investments in sustainability could lead to global environmental and social improvements such as reducing energy consumption, lower CO2 emission, better human rights and increased social responsibility. Improving those topics is not only crucial for the REITs or investors but for all life on planet earth.

7. Conclusion

This study has investigated the association between the ESG performance and the cost of debt of US REITs by assessing how ESG scores are associated with the credit spread of REITs. The credit spread is selected as the designated component to explain the association because it's the only component fully affected by the performance of the REIT. The association is analyzed with a panel data analysis answering the research question: "*How is ESG performance associated with the cost of debt of US REITs?*" The findings indicate a negative association between ESG performance and the cost of debt. This confirms the main hypothesis "*The ESG score is negatively associated with the cost of debt of US REITs*". For example, if a REIT increases the ESG score by 1 point, the credit spread will decrease by 1.29%. In addition, the research finds that the association of the ESG performance and cost of debt is not generic and differs between the subindustries in the US REIT market. This thesis provides an academic substantiated financial incentive to invest in sustainability activities that increase the ESG scores of real estate organizations. This is not only crucial for the real estate sector but improving sustainability activities is something we owe to future generations.

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Appendices

Appendix A – Additional literature

The literature insights of the Cost of debt

The cost of debt is considered part of the company capital structure and the cost of equity. The capital structure is used to determine how a firm is financing its operations and growth. Measurement of the cost of debt is essential to understand the rate a firm is paying for its debt. The measure gives an investor a perspective of the firm's risk level compared to others; riskier firms have a higher cost of debt (Berk & DeMarzo, 2017).

The cost of debt is defined as the rate a company pays on its debt, such as bonds and loans (Van Binsbergen, Graham, & Yang, 2010). "Cost of debt is the cost the company is paying to carry all the debt it has acquired" (A. H. Chen, 1978). The cost of debt is based on three essential elements, the risk-free rate, the default risk and the time to maturity or liquidity (L. Chen, Lesmond, & Wei, 2007).

The risk that default can occur is called default or credit risk. Default risk is the probability that a firm fails to make the required interest or principal payments on its debt or violates the debt covenant. The credit risk is the risk of default by the issuer of any debt that is not default-free; it indicates that the bond's cash flows are not known with certainty (Berk & DeMarzo, 2017). The difference between the risk—free interest rate and the interest rates on all other loans is called the credit spread. The magnitude of the credit spread will depend on investors' assessment of the likelihood that a particular firm will default. Also referred to as the credit spread, credit rating is calculated, a rating assigned by a rating agency that assesses the likelihood that a borrower will default (Karna, 1972). The risk-free rate is the interest rate at which money can be borrowed or lent without risk over a given period (Berk & DeMarzo, 2017). In practice, the interest rate on government bonds is taken as the risk-free rate.
The time to maturity and the liquidity are considered in the literature as factors that influence the cost of debt. A longer time to maturity increases the possibility of interest rate changes over time, impacting the bond price and its returns. Also, the liquidity of a bond could affect the ease of trading of bonds and, therefore, affect the bond's spread (Chen, Lesmond, & Wei, 2007).

There is an essential difference between the cost of debt before and after-tax rate. Since the interest paid on debts is often treated favourably by tax codes, the deductions made to taxes due to outstanding debts can lower the effective cost of debt paid by a borrower (Berk & DeMarzo, 2017).

The literature insights of the Environmental, Social, and Governance (ESG)

In literature, ESG is interpreted in different ways. Some articles consider that ESG is integrated into a firm's strategy and could be compared to Corporate Social Responsibility (CSR) (Pereira et al., 2019). "This CSR is defined as the responsibility of enterprises for their impact on society. There are four distinct CSR strategies i. the produce long-term profits, ii. responsible use of business power, iii. integrating social demands, and iv. contributing to a good society by doing what is ethically correct"(Garriga & Melé, 2012). However, without CSR, there would be no ESG, but the two are far from interchangeable. While CSR aims to make a business accountable, ESG criteria make its efforts measurable. ESG could be considered a method to measure the sustainability of a particular organization (Cornell, 2021; Lydenberg, 2013; Zaccone & Pedrini, 2020).

ESG stands for Environmental (E), Social (S), and Governance (G). "The environmental perspective concerns company' commitments to the defense of the natural environment and resources" (Goodland, 1995). The following initiatives are most common for the environmental pillar: limiting harm to biodiversity and ecology, ensuring a responsible environmental footprint, minimizing the impact of products and packaging, minimizing carbon emissions, reducing waste, and preventing the mistreatment of animals. The social perspective concerns company' commitments to social issues (Davidson, 2009). Most common initiatives for the social pillar are protecting human rights, fighting child labour, engaging stakeholders, protecting diversity, protecting and promoting equal opportunity, protecting privacy and data, providing support in humanitarian crises, supporting community development, supporting employee safety, education and health, and fostering work-life balance. "The governance pillar concerns governance committed to guaranteeing the rights and responsibilities of stakeholders. It includes board composition, committee structure, bribery and corruption prevention, whistleblowing, codes of conduct, and fair compensation" (Elkington, 2006).

ESG factors represent a component of a full spectrum of sector attributes and management skills for investors to consider in evaluating investment opportunities. Those components are measured, and assessment agencies give ESG scores/rating. In literature, ESG-scores are commonly used as input for quantitative research (Eichholtz et al., 2019; Friede et al., 2015; Jang et al., 2020; Lydenberg, 2013; Type, 2020). In practices, there are different ESG ratings. The most dominating are MSCI, Sustainalytics, RepRisk, and new entrant ISS, for Real Estate focused ESG, GRESB[56]. Those assessment agencies provide investors with ESG information.

[56] Global Real Estate Sustainability Benchmark

Appendix B – Tables

Table 3.1 – overview of tested assumptions

Assumption	Test	Command	Explanation	Statistic	P-value
General assumption tests					
Nonlinearity	Nonlinearity test	"nlcheck"	Chi2 (9)	13.68	0.1342
Autocorrelation	Wooldridge test[57]	"Xtserial"	F(1,135)	67.433	0.0000
Normally distributed error	Jarque-Bera CE	"jb Residual_CE"	Chi(2)	15.33	0.00047
Normally distributed error	Jarque-Bera FE	"jb Residual_FE"	Chi(2)	74.2	7.7e-17
Main model tests					
RE or FE	Hausman	"Hausman"	Chi-square test value	31.92	0.0001
Heteroskedasticity[58]	Breusch and Pagan Lagrangian multiplier	"xttest0"	chibar2(01)	268,77	0.0000
Groupwise heteroskedasticity	Modified Wald test	"xttest3"	chi2 (136)	28687.46	0.0000

Table 3.2 - Recovering individual-specific effects testing assumption (error mean = 0)

Variable	Obs	Mean	Std. Dev.	Min	Max
alphafehat	544	0	1.36	-4.027	5.44

Table 3.3 - Multicollinearity test - Correlation matrix of coefficients of xtreg model

e(V)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) ESG score	1.0000								
(2) Size (log)	-0.3491	1.0000							
(3) Δ Debt Size (log)	0.0837	-0.1681	1.0000						
(4) Debt to Asset	-0.0101	0.1524	-0.2268	1.0000					
(5) Cashflow to Sales	-0.0291	-0.0326	0.0159	0.0971	1.0000				
(6) Market to Book	-0.0301	0.1082	0.1202	-0.2572	-0.0581	1.0000			
(7) Return on Asset	-0.0733	0.1361	0.2776	0.0598	0.2249	-0.0236	1.0000		
(8) Cash to Asset	0.0112	-0.0184	-0.0816	0.0035	-0.0401	-0.0612	-0.0867	1.0000	
(9) Size (log)	0.2957	-0.9850	0.1624	-0.2703	-0.0636	-0.1206	-0.2057	0.0152	1.0000

The variables (1-9) are all lagged.

[57] A "Wooldridge" test is performed to test for autocorrelation. This test is used to check for serial-correlation, in STATA we use the "xtserial" command. The Under the null hypothesis, there is no serial correlation in the regression model, while under the alternative hypothesis the opposite is true.

[58] A "Breusch-Pagan" test is performed to test for heteroskedasticity. If the test statistic has a p-value below an appropriate threshold (e.g. $p < 0.05$) then the null hypothesis of homoskedasticity is rejected and heteroskedasticity assumed.

Table 3.4 – Overview distribution REIT subindustries

Subindustry	REITs	Observations	Distribution	REITs	Observations
Industrial	8	32	Industrial	8	32
Office	20	80	Office	20	80
Retail	29	116	Retail	29	116
Residential	15	60	Residentail	15	60
Specialty	64	256	Diversified	10	40
			Health Care	15	60
			Hotel & Lodging	12	48
			Infrastructure	5	20
			RE developments	1	4
			Storage	4	16
			Timber	4	16
			Others	13	52
Total	**136**	**544**	**0**	**136**	**544**

Table 4.2 – Overview of input variables (variables collected)

Variable	Input indicators
RIC	RIC
Year	YEAR
Subindustry	Sub Industry
Credit spread	Interest Expense on Debt; Total Debt; Risk-free rate; optional; corporate tax rates
ESG scor	ESG score
Enviromental	Environmental Pillar Score
Social	Social Pillar Score
Governance	Governance Pillar Score
ESG Grade	ESG score
ESG Dummy	ESG score
Size	Total Asset
Detal Debt Size	Total Debt
Debt to asset ratio	Total debt; Total Asset
Cashflow to Sales	CashflowSales
Market to book ratio	Market Capitalization; Net Book Value
Return On Asset	EBIT; Total Asset
Cash to Asset	Cash; Total Asset

Table 4.3 – Overview structure ESG scores

Pillar	Category	Indicators in Scoring	Weights
Environmental	Resource Use	20	11%
	Emissions	22	12%
	Innovation	19	11%
Social	Workforce	29	16%
	Human Rights	8	4.5%
	Community	14	8%
	Product Responsibility	12	7%
Governance	Management	34	19%
	Shareholders	12	7%
	CSR strategy	8	4.5%
Total		178	100%

Table 4.4 – Overview distribution ESG grade (x 100)

Score Range	Grade
Score <= 0.0	No grade
0.000001 <= score <= 0.083333	D -
0.083333 <= score <= 0.166666	D
0.166666 <= score <= 0.250000	D +
0.250000 <= score <= 0.333333	C -
0.333333 <= score <= 0.416666	C
0.416666 <= score <= 0.500000	C +
0.500000 <= score <= 0.583333	B -
0.583333 <= score <= 0.666666	B
0.666666 <= score <= 0.750000	B +
0.750000 <= score <= 0.833333	A -
0.833333 <= score <= 0.916666	A
0.916666 <= score <= 1	A +

Table 4.5 – Correlation table

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) Credit spread (log)	1.000												
(2) ESG score	-0.080	1.000											
(3) Environmental	-0.072	0.924	1.000										
(4) Social	-0.047	0.866	0.778	1.000									
(5) Governance	-0.074	0.643	0.350	0.382	1.000								
(6) ESG grade	-0.093	0.992	0.909	0.859	0.649	1.000							
(7) Size (log)	-0.083	0.603	0.592	0.533	0.313	0.599	1.000						
(8) Δ Debt Size (log)	-0.470	-0.105	-0.124	-0.082	-0.027	-0.100	-0.032	1.000					
(9) Debt to Asset	0.116	-0.115	-0.050	-0.090	-0.183	-0.112	0.020	-0.034	1.000				
(10) Cashflow to Sales	-0.202	-0.146	-0.151	-0.184	-0.013	-0.148	0.020	0.085	-0.134	1.000			
(11) Market to Book	-0.113	0.103	0.143	0.107	-0.036	0.104	0.134	0.034	0.063	0.142	1.000		
(12) Return on Asset	0.187	0.035	0.067	0.069	-0.071	0.027	0.103	-0.153	0.187	0.050	0.276	1.000	
(13) Cash to Asset	0.068	-0.073	-0.008	-0.086	-0.136	-0.066	-0.084	0.000	0.026	-0.198	0.046	0.108	1.000

Table 4.6 - Descriptive Statistics robustness model

Variable	Observations	Mean	Std. Dev.	Min	Max
Dependent variable					
Credit spread (log)	496	16.785	1.258	13.804	19.353
ESG score variables					
ESG score	369	45.128	19.578	9.43	89.08
Environmental Pillar	369	34.255	30.404	0	95.35
Social Pillar	369	50.863	17.473	9.05	90.79
Governance Pillar	369	52.383	20.621	3	94.4
ESG grade	496	4.399	3.288	0	11
ESG reporting dummy	496	.744	.437	0	1
Variables					
Size (log)	496	15.212	1.035	11.621	17.569
Δ Debt Size (log)	496	.105	.37	-2.781	6.16
Debt to Asset Ratio	496	.485	.128	.074	.93
Cashflow to Sales Ratio	496	.4	.142	-.11	.741
Market to Book Ratio	496	2.037	1.264	.203	5.558
Return on Asset	496	.084	.027	.021	.16
Cash to Asset Ratio	496	.03	.046	0	.258

Note: This table provides the summary statistic for the variables of the robustness sample that is used for the main analysis. The number of observations, the mean, standard deviation, minimum value, and maximum value are presented. The Credit Spread (log) is winsorized with 6 94; the Debt to Asset Ratio is winsorized with 1 99; the Cashflow to Sales Ratio is winsorized with 1 99; the Market to Book Ratio is winsorized with 1 95; the Return on Asset is winsorized with 3 97; the Cash to Asset Ratio is winsorized with 1 99.

Table 4.7 - Descriptive Statistics Starting dataset

Variable	Observations	Mean	Std. Dev.	Min	Max
Dependent variable					
Credit spread (log)	1488	17.005	1.433	13.781	19.353
ESG score variables					
ESG score	937	40.387	18.458	1.59	89.65
Environmental Pillar	937	25.881	27.84	0	95.35
Social Pillar	937	47.912	17.464	4.92	95.81
Governance Pillar	937	50.226	20.609	.25	95.42
ESG grade	1310	3.824	3.061	0	11
ESG reporting dummy	1310	.715	.451	0	1
Variables					
Size (log)	1310	15.031	1.084	11.435	17.569
Δ Debt Size (log)	1132	.111	.36	-2.781	6.16
Debt to Asset Ratio	1310	.485	.139	.074	.93
Cashflow to Sales Ratio	1310	.392	.159	-.11	.741
Market to Book Ratio	1310	1.973	1.247	.203	5.558
Return on Asset	1310	.081	.031	.021	.16
Cash to Asset Ratio	1310	.029	.043	0	.258

Note: This table provides the summary statistic for the variables of the starting dataset sample that is used for the main analysis. The number of observations, the mean, standard deviation, minimum value, and maximum value are presented. The Credit Spread (log) is winsorized with 6 94; the Debt to Asset Ratio is winsorized with 1 99; the Cashflow to Sales Ratio is winsorized with 1 99; the Market to Book Ratio is winsorized with 1 95; the Return on Asset is winsorized with 3 97; the Cash to Asset Ratio is winsorized with 1 99.

Table 5.4 – Result of the baseline regression: dependent variable credit spread log

	(1) OLS Baseline Model	(2) FE Baseline Model
Size (log)	-.039 (.048)	.714*** (.189)
Δ Debt Size (log)	-.305 (.239)	-.141 (.188)
Debt to Asset Ratio	1.618*** (.371)	6.018*** (.832)
Cashflow to Sales Ratio	-.872*** (.333)	-1.122** (.565)
Market to Book Ratio	-.259*** (.044)	-.362*** (.085)
Return on Asset	5.66*** (1.757)	-1.7 (1.979)
Cash to Asset Ratio	.692 (1.268)	-1.58 (1.599)
Constant	16.927*** (.774)	4.308 (3.019)
Observations	544	544
R-squared	.127	.17
Fixed Effect Year	No	Yes
Fixed Effect Subindustry	No	Yes

Notes: This model presents the baseline model, where the control variables are presented towards the dependent credit spread (log)Control variables are Size (log), Δ Debt Size (log), Debt to Asset Ratio, Cashflow to Sales Ratio, Market to Book Ratio, Return on Asset and Cash to Asset Ratio. The R-squared is the R-squared within. Robust standard errors are in parentheses. *** p<.01, ** p<.05, * p<.1

**** p<.01, ** p<.05, * p<.1*

Appendix C – Figures

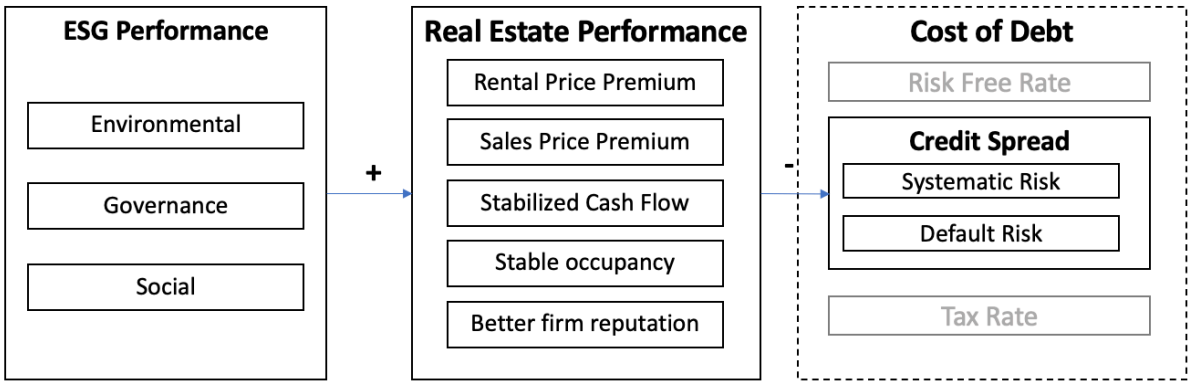

Figure 2.1 – Theoretical framework visualising the hypotheses

ESG activities are positively related with the performance indicator of a real estate organisation and those are negatively related to the credit spread. The credit spread with the tax rate and the risk-free rate form the cost of debt.

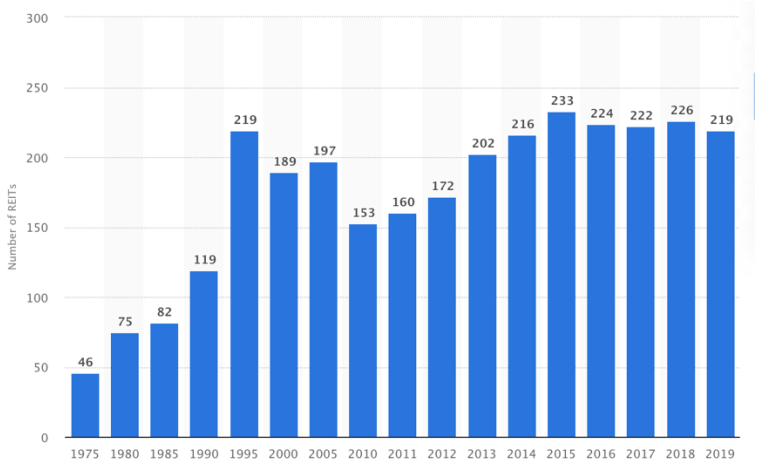

Figure 4.2 – Overview of US REIT market (mortgage REITs include)

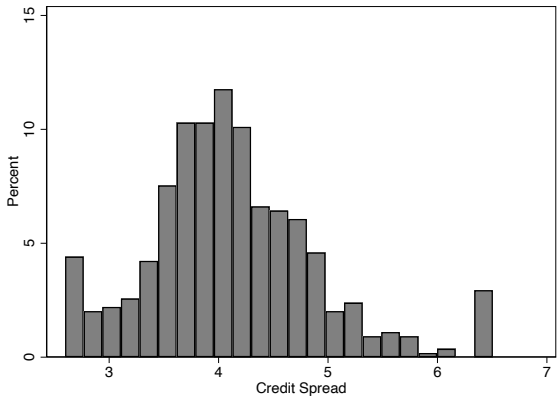

Figure 4.3 – Graph credit spread

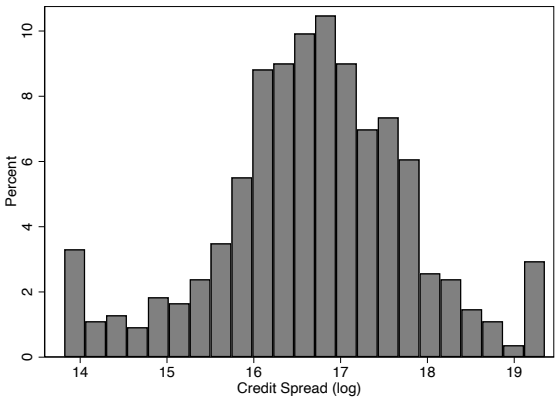

Figure 4.4 – Graph log credit spread