ESG and Listed Real Estate Performance: Evidence from European REITs

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Abstract

The challenge of our time is financing further global sustainable development, above all characterised by its urgency. The real estate sector has a significant role in tackling the environmental issues, as it is responsible for approximately forty per cent of all energy consumption. Distinct from existing literature, we target the relatively unexplored European REIT market, while focussing on the relative market value and the cost of equity. We find no significant correlation between ESG and the relative market value, but do find that REITs with superior ESG performance have a lower cost of equity. Conversely, when a mandatory level of environmental reporting for property investments is present, the correlation disappears. As such, the results underline the importance of considering the institutional context for the correlation between ESG and real estate investments. However, future research should verify these findings with a more extensive dataset to establish a causal relationship in the European context.

Keywords: ESG, Market valuation, Cost of equity, REIT, Panel data

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1 Introduction

The challenge of our time is financing further global sustainable development, above all characterised by its urgency (EPRA, 2021). In tackling the environmental issues we face, the real estate sector plays a crucial role as the activities withing buildings are responsible for approximately forty per cent of all energy consumption (Morri et al., 2020). In line with this, markets for real estate investments have engaged with concepts such as Responsible Property Investment (RPI), Corporate Social Responsibility (CSR) and, most recently, Environmental, Social and Governance (ESG). This suggests that the adoption and awareness of The Paris Agreement and the Sustainable Development Goals of the United Nations in 2015 has since further intensified. Importantly, to measure the non-financial and sustainability-related impact of investments, a diversity of ESG metrics have become available. Yet, for the majority of investors, the business case for sustainable investing remains unclear (Cohen et al., 2011; Feri, 2009; Riedl & Smeets, 2015). To better understand how the real estate investment market links sustainability and financial performance, in this paper we specifically focus on ESG and REITs' performance.[1]

Despite a large body of research on the relationship between aspects of ESG and financial performance in general, empirical studies on ESG in the real estate sector are scarce. Friede et al. (2015) demonstrate this in their literature review study, which reveals that only seven of the 2,200 studies target the real estate sector. However, the long-term nature of real estate investments potentially aligns better with the long-term character of ESG strategies (Cajias et al., 2014). As availability of ESG data has grown exponentially in recent years, research on the real estate sector increased largely. However, empirical evidence of the relationship between ESG and REIT performance is still fragmented. First, the majority of existing research has focused on the relationship between energy efficiency and REIT performance (Coën et al., 2018; Devine et al., 2016; Eichholtz et al., 2018; Hsieh et al., 2020; Mariani et al., 2018; Sah, Miller & Ghosh, 2013;), while energy efficiency alone may not reflect a firm's broader ESG initiatives. Second, most of the available literature analyses the relationship at the asset level, while portfolio-level performance studies are limited to a few papers in the finance literature (Eichholtz et al., 2012, Fuerst, 2015; Mariani et al., 2018). Arguably, ESG goes beyond energy efficiency of assets, thus stresses the importance of firm level insights for REITs. Third, previous studies mainly focus on the impact of sustainability on operating performance and property values, in terms of higher rents (Bond & Devine, 2016), lower vacancy rates (Fuerst & McAllister, 2011), longer economic lifetime (Eichholtz

[1] An attractive opportunity for investors to achieve exposure to the real estate market is through listed Real Estate Investment Trusts (REITs), as REITs offer the potential to build a diversified portfolio quickly and instantly reach full investment (Brounen et al., 2021).

et al., 2010), higher investor and developer profit (Pivo & Fisher, 2010), higher stock returns (Fuerst et al., 2017) and lower operating expenditure (Eichholtz et al., 2012).[2] However, these benefits mainly accrue to the real estate owner, while the perception of capital market participants is neglected – and this is what this paper will address.

We capture the perception of capital market participants through the cost of equity capital and REITs' relative market valuation. The Capital Asset Pricing Model (CAPM) provides the estimates of the cost of equity (Berk et al., 2019, p. 420), and explicitly reflects the risk of perception capital market participants. On the other hand, the Tobin's *q* represents the ratio between the market value and the replacement costs of a firm's assets (Perfect & Wiles, 1994). Herewith, the Tobin's *q* includes both the tangible and intangible value of assets. It is this intangible value we are after, as many benefits arising from ESG investments are in fact intangible, such as increased customer loyalty (Waddock & Graves, 1997).

Another important observation which this paper addresses is that nearly all existing studies target the US REIT market (Brounen & Marcato, 2018; Cajias et al., 2014; Coën et al., 2018; Devine et al., 2016; Eichholtz et al., 2012; Fuerst, 2015; Sah et al., 2013), whereas the requirements in terms of transparency and reporting on ESG differ internationally (Brounen et al., 2021). There are only a few studies that address financial performance in the framework of the European market, which is most likely the effect of data limitations.[3] This paper addresses these gaps in literature, as it examines whether ESG performance is correlated with EU REITs' higher market value and lower cost of equity.

We employ an unbalanced panel approach to mitigate survivorship bias (Devine et al., 2016), which spans the period from 2011 to 2020. The data include 521 REIT-year observations consisting of 95 REITs that are in the sample for varying time periods (average number of years is 5.48). We find no significant correlation between ESG and the relative market value, but do find that REITs with superior

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[2] An early paper by Bauer et al. (2010) examines the effect of corporate governance, as part of broader ESG, on the market value of a sample of US REITs. Cajias et al. (2014) investigate the relationship between comprehensive ESG and financial performance using the MSCI ESG database on a sample of publicly traded US real estate companies. Sah et al. (2013) proxy greenness by REITs affiliated with the Energy Star Partnership Program and explore the effects on firm value as measured by the Tobin's *q*. Although these studies address REITs' market value, the focus is on separate elements of ESG (corporate governance, energy efficiency) rather than comprehensive ESG and the study context is US REITs. Moreover, the most recent study period covered runs to 2010, while literature on ESG becomes dated quiet quickly, especially since attention towards ESG in recent years increased, which likely influences the relationship (Brounen et al., 2021).

[3] Morri et al. (2020) explored the link between GRESB scores and the operating performance for a sample of fifty European REITs and find a positive effect. Brounen et al. (2021) reviewed the new EPRA sBPR database and explored the financial effect of ESG performance on stock returns. For a sample of 64 European REITs in 2018, they find a positive effect for both ESG reporting completeness and performance. The authors see this finding as initial evidence that investors are willing to pay a sustainability premium, but state that data limitations do not allow for significant estimations.

ESG performance have lower cost of equity. However, future research should verify this finding with a more extensive dataset to establish a causal relationship in the European context.

The remainder of this paper is organised as follows. Section two discusses relevant theories and existing knowledge to inform our hypotheses. Section three elaborates on the data, including a discussion on the dependent variables and sample selection. In the fourth section, we elaborate on the methodology, including empirical models. Section five presents our regression results, which we discuss in the sixth section. The paper ends with a conclusion in section seven.

2 Theoretical framework

2.1 Market valuation

There is a long history of theories describing the relationship between ESG-related elements and financial performance, with varying perspectives. First, according to the traditional neoclassical approach, investments in elements of ESG entail additional costs for firms (Palmer et al., 1995). The costs of allocating resources to ESG activities are relatively straightforward. The direct costs relate to implementation, monitoring and reporting of an active ESG strategy, whereas the indirect costs relate to potentially rejecting profitable business opportunities that do not match the ESG strategy (Cajias et al., 2014; Cappucci, 2018). In a competitive market, such increasing costs reduce firms' profits and consequently the market value (Baumol, 1991). A reduction in profits contradicts the famous shareholder theory of Friedman (1970), which argues that the sole social responsibility of firms is to maximise shareholder value. In addition to the cost perspective, there are two other perspectives that suggest a more neutral or positive relationship between ESG and financial performance – which are discussed in the following paragraphs.

As second perspective, the 'no-effect' hypothesis suggests that there is a neutral relationship between ESG and financial performance. According to this hypothesis, firms determine the level of investment in ESG-related attributes based on a cost-benefit analysis. The assumption here is that firms do not invest beyond the profit-maximising equilibrium or regulatory requirements (Hassel & Semenova, 2013). McWilliams and Siegel (2001) support the 'no-effect' hypothesis with their supply-and-demand model of CSR and provide a simple, yet clarifying example of two firms. The two firms produce identical goods, except one adds a social characteristic to the good. The 'no-effect' hypothesis and the supply-and-demand model indicate that, in equilibrium, both firms are equally profitable. That is, because the firm producing the good with the social characteristic faces higher costs and higher revenues, whereas the other firm faces lower costs but also lower revenues. Any other outcome would prompt the other firm to switch product strategies. Accordingly, the 'no-effect' hypothesis and supply-and-demand model assume that, in equilibrium, there should be no relationship between ESG and the market value.

The third perspective is known as the 'doing-well-by-doing-good' hypothesis and implies a positive relationship between ESG-related elements and financial performance (Kramer & Porter, 2011). Accordingly, ESG is associated with a more efficient use of resources and business innovations that ultimately lead to higher profits and market values (Hassel & Semenova, 2013). Considering business innovations, the Porter hypothesis proposes that well-designed and strict environmental regulation can stimulate innovation, which in turn increases the competitiveness of firms through product and process improvements (Porter & Van der Linden, 1995). A similar view, in line with Friedman's (1970) shareholder theory, infers that ESG investments involve lower explicit costs (e.g. taxes and potential penalties) (Brammer & Millington, 2005). Additionally, the 'doing-well-by-doing-good' proponents argue that there are several other benefits of ESG investments.

One of the benefits that is often mentioned in the literature is the ability of ESG-related efforts to enhance corporate reputation. In particular, there are two theories from management literature we may adopt: the slack resources theory and the good management theory. Under the slack resource theory, a company must be in a good financial position to contribute to societal and sustainability initiatives such as ESG. The key notion is that firms with a strong financial performance have slack resources available which enable them to invest in social performance, such as environmental improvements and community relations (Waddock & Graves, 1997). In turn, these can lead to a long-term competitive advantage (Miles & Covin, 2000). The slack resource theory thus advocates that financial performance comes first.

According to the good management theory, however, social performance comes first. The good management theory suggests that good management can improve firms' reputation, which in turn improves the firm's financial performance through improved relationship with stakeholders (Donaldson & Preston, 1995; Freeman, 1994; Waddock & Graves, 1997). Moreover, ESG may reduce reputational risks, which could heavily influence the market value (Godfrey et al., 2009). Last, a good reputation improves employee satisfaction, which in turn positively affects the willingness to work for the company and to stay with a company longer (McWilliams & Siegel, 2006). This is an asset to firms, as it reduces costs for attracting new employees and increases employee productivity (Molina & Ortega, 2003). Typically, reducing costs lead to a higher market value, *ceteris paribus*.

Although the benefits arising from ESG investments have been explored in academic work, monetising them seems harder in practice. For instance, Edmans (2011) suggests that it is possible to generate positive alpha based on employee satisfaction, as investors are not able to correctly price intangible assets. The ability of investors to value the intangible assets is closely related to the theory of Weber (2008), which follows the principles of the discounted cash flow method. The basic notion of this theory is that 'doing good' is profitable if the financial benefits exceed costs, with the total value of 'doing good' being determined by its net present value. However, Horváthová's (2010) theory suggests more of an inverted U-shaped relationship between CSR, one of the precursors of ESG, and financial performance. The inverted U-shaped relationship is the result of the believe that investing in CSR only adds value if as a firm's market value has not already been maximised. The different theories show that understanding the relationship asks for a nuanced consideration of the conditions.

The learning hypothesis is a theory that adds to a nuanced consideration. It states that as market awareness around a concept, such as ESG in this study, increases, investors have a harder time generating alpha because the market begins to adjust the price level. Bebchuk et al. (2013) find evidence of a learning effect when studying the effect of governance provisions over the period of 1990 to 2008. In their research, the positive alpha obtained in a period of low governance attention (1990 – 1999) disappears in the following period with increasing market awareness of corporate governance (2000 – 2008). Arguably, investors were unaware of the negative effects of governance provisions in the nineties, while awareness levels increased dramatically after the millennium. Moreover, Borgers et al. (2013) show the existence of the learning hypothesis in periods with differing attention towards stakeholder relationships. The learning hypothesis thus stresses the relevance of considering study periods when analysing concepts such as ESG that gained increased attention in recent years.

Another insight provided in academic literature is the relevance of considering the institutional context. To illustrate, Devine et al. (2016) compare the effect of sustainable investments on the market valuation of listed real estate firms for the US and the UK. The authors note that US REITs with a higher proportion of sustainable real estate (LEED, Energy Star, BREEAM) in their portfolio experience a higher market valuation relative to their net asset value (NAV). In the UK, the enhanced market value effects for listed real estate companies, including REITs, are less pronounced. The explanation for this difference relates to the basic level of mandatory environmental disclosure for property investments in the UK. The compulsory disclosure of environmental performance leads to overall sustainability improvement in the property stock, potentially absorbing the effect of voluntary energy certifications. Moreover, voluntary disclosure has a stronger signalling role in capital markets, as inferior ESG performers cannot easily replicate the level of ESG disclosure of superior ESG performers (Clarkson et al., 2013).

So far, we mainly focused on the effect of ESG performance, while there might be moderating effects present. For instance, Fatemi et al. (2018) explore the moderating role of disclosure of ESG on the market value for a sample of US firms. It turns out that ESG disclosure itself does not significantly explain changes in market value. However, ESG disclosure does play a critical moderating role of ESG performance by tempering the negative effects of ESG weaknesses and amplifying the positive effects of ESG strengths. Such moderating effects are interesting to consider in understanding empirical outcomes, as we do not know to what extent these are present in real estate investments.

Although the cost perspective and 'no effect' hypothesis suggest a negative or neutral correlation, many theories point towards a positive correlation between ESG and the market value, for instance coming from productivity improvements and increasing stakeholder commitment. Therefore, we test the following hypothesis in our study:

H1: ESG performance is positively correlated with the market valuation of European REITs.

2.2 Cost of equity

In finance literature, the cost of equity is regarded as the return that a firm pays its shareholders to offset the risk of investing in the firm (Hsieh et al., 2020). The cost of equity is intrinsically related to the market value, as when the cost of (equity and debt) capital increases, the market value decreases. Therefore, REIT managers aim to maximise market value by minimising the cost of (equity and debt) capital (Riddiough & Steiner, 2014).

Several studies show that analysts and investors consider ESG elements in investment decisions (Goss & Roberts, 2011; Heinkel et al., 2001; Mackey et al., 2007). The first perspective follows from the good management theory, which has direct implications for the cost of equity. The good management theory emphasises the importance of a good reputation for financial performance. In the context of the current market conditions, any commitment to ESG activities can improve a firm's corporate reputation (Song et al., 2017). Several studies find that a firm's commitment to ESG-related elements influences the risk profile perceived by capital market participants, leading to a lower cost of equity (Endrikat, 2014; Holz & Schlange, 2006; Stark, 2009). In addition, a good reputation increases stakeholder commitment (Wang et al., 2008), which could lead to greater willingness to provide resources to a firm, and thus lower cost of equity (Cajias et al., 2012; Rindova & Fombrun, 1999).

To further understand how stakeholder commitment links to financial performance, we consider the instrumental stakeholder theory. This theory states that meeting stakeholder demand can result in various competitive advantages, such as long-term stakeholder relationships and customer loyalty (Donaldson & Preston, 1995). In the current market, firm's contribution to environmental and societal challenges has become a stakeholder requirement (Hsieh et al., 2020). For our research, ESG performance may be perceived by stakeholders as a confirmation of REITs' efforts to contribute to solving the societal challenges. Therefore, the instrumental stakeholder theory suggests that ESG performance provides long-term financial benefits to REITs actively engaged in ESG activities.

Although ESG performance is assumed to have several positive effects, it may take time to materialise (Cajias et al., 2014). This can be easily related to ESG in the context of real estate investments, as there may stem high costs from ESG implementation at the start, such as strategy implementing costs or retrofitting assets, but also future benefits such as lower operating costs of assets or productivity improvements.

In the real estate investment context specifically, there is hardly any knowledge on the cost of equity. Therefore, we broaden our scope to other fields of study. There is evidence that US firms with superior environmental risk management exhibit lower systematic risk and less volatile financial performance. The market rewards such attributes with a lower cost of equity (Sharfman & Fernando, 2008). In terms of a more comprehensive sustainability measure, El Ghoul et al. (2011) find a negative relationship between CSR performance and the cost of equity for a large sample of US firms (2,809 unique firms) between 1992 and 2007. This is mainly the result of a larger investor base (risk sharing) and a lower perceived risk profile, mostly affected by improving employee relationships, environmental policies, and product strategies (El Ghoul et al., 2011). Importantly, implementing an CSR strategy increases analyst coverage. As a result, this reduces information asymmetry issues (Dhaliwal et al., 2011), leading to more information about the expected cashflow distribution (Cajias et al., 2012).

As knowledge on the effect of ESG-related performance on financing in the real estate market is confined to only a few articles, the cost of debt might also provide useful insights for the cost of equity. In one of the earliest papers on this topic, Eichholtz et al. (2019) find a negative association between the sustainability of a real estate portfolio (share of certified buildings) and the credit spread on US REIT bonds and mortgages. In addition to these debt financing products, loans on certified buildings have slightly better terms than loans on non-certified buildings (An & Pivo, 2020). The main reason for such discounts in the cost of debt is that sustainable buildings carry less default risk.

Regarding the cost of equity in the real estate investment market, we only know what impact green building certifications may have. Although such green building certifications do not fully reflect the effect of more comprehensive ESG performance we are after, it does provide insight in the risk perception. The first study to attempt to explore this in the field of real estate is by Eichholtz et al. (2018). US REITs experience a reduction in cost of equity by an average of 38 basis points for a 100 per cent certified (LEED and Energystar) portfolio compared to a completely uncertified portfolio. A recent study by Hsieh et al. (2020) confirms that participation in a green building certification (LEED) scheme significantly reduces the cost of equity. The results of these studies show that REITs can reduce their cost of equity if they become 'greener', as capital market participants see less risk in such investments.

The theories generally point towards a negative correlation between ESG and the cost of equity through a lower risk perception, better stakeholder commitment and reduced information asymmetry due to improved reporting. For real estate specific, sustainable buildings – as part of broader ESG – are less risky and cause investors to award this with a lower required rate of return. Given these insights, we test the following hypothesis in our study:

H2: ESG performance is negatively correlated with cost of equity of European REITs.

3 Data

3.1 Market valuation and cost of equity

To test the first hypothesis, we are interested in a measure of the market value of REITs. Finance literature widely uses Tobin's q to measure financial performance as it includes both the value of the tangible and intangible assets (Lang & Stulz, 1994). It is the latter we aim to capture, since many benefits arising from ESG investments are in fact intangible. Nevertheless, there are many variations of the Tobin's q, often requiring years of data to estimate the replacement costs of assets. The Perfect and Wiles (1994) Tobin's q does not require such sequences and therefore maximises useable panel data, a common approach in empirical research (Han, 2006). Moreover, Perfect and Wiles (1994) find that their measure has a correlation of 0.93 with Lindenberg and Ross' (1981) estimation that requires many years of data. Considering these properties, we operationalise the Tobin's q following Perfect and Wiles (1994):

$$Tq = \frac{MVC + MVP + LTD + STD}{TA} \tag{1}$$

Where Tq denotes the Tobin's q, MVC denotes the market value of common stocks, MVP the market value of preferred securities, LTD the book value of long-term debt, STD the book value of short-term debt, and *TA* the book value of total assets. The required financial input data is directly retrieved from Thomson Reuters Eikon, and based on the annual reports of the REITs (Appendix II provides more detail on the definitions). Thomson Reuters Eikon combines over 2,000 data sources on economic, financial, and business information. The data is not specifically focused on REITs but covers 99 per cent of the total global market capitalisation (Refinitiv, 2019).

For the second hypothesis, we are interested in a measure for the cost of equity. There are broadly two ways to determine the cost of equity: the dividend growth model or the capital asset pricing model (CAPM). The dividend growth model assumes the cost of equity is equal to the dividend yield plus a constant growth rate of dividends (Berk et al., 2019, p. 237). However, the main methodology used by large corporations to estimate their cost of equity is the CAPM (Berk et al., 2019, p. 420). Ideally, we would compute both estimates of the cost of equity, but data limitations do not allow. Therefore, we proceed with the CAPM model, calculated as:

$$E(R_i) = Rf + \beta_i * (E(R_m) - Rf) \tag{2}$$

Where $E(R_i)$ represents the expected return for security i, Rf the risk-free rate, β_i the beta of security i, and $E(R_m)$ the expected return on the market portfolio. In words, the CAPM argues that the expected return on an investment comes from a risk-free rate plus a risk premium. The latter varies with the amount of systematic risk in the investment, reflected by its beta (Berk et al., 2019, p. 419). The ten-year government bond yield serves as risk-free rate, and we base the expected market portfolio return on the year-on-year total return performance of the FTSE EPRA Nareit Developed Europe REITS Index. The beta comes from Thomson Reuters Eikon, and is derived by performing a least squares regression between the adjusted stock prices and the corresponding country market index (Appendix II provides more detail on the definitions).

3.2 ESG

ESG performance data comes from a subset (ASSET4) of Thomson Reuters Eikon, which provides ESG ratings for over 10,000 listed firms from many of the primary global and regional indices. It is therefore a generic score for all sectors, not exclusively focused on real estate. Thomson Reuters Eikon ESG ratings are assessed annually based on publicly available information, such as annual reports, corporate social responsibility reports, news websites and stock exchange fillings, which are then verified.[4] The collected data form the basis for nine hundred evaluation points and provide input for over one hundred

[4] The data quality control process of Thomson Reuters ASSET4 runs via several levels of manual validations by data analysts and automated checks, that verify consistency and logical relationships between data points.

key performance indicators, which are then categorised into ten drivers behind the environmental, social and governance pillars. The environmental drivers are Resource Use, Emissions, and Environmental Innovation. Social drivers include scores for Workforce, Human Rights, Community, and Product Responsibility. Governance drivers relate to scores for Management, Shareholders and CSR Strategy. Thomson Reuters ASSET4 uses a relatively equally weighted calculation of the pillar ratings to ultimately arrive at the comprehensive ESG rating, which varies between the minimum score of 0 and the maximum score of 100.

3.3 Selection process

Our initial dataset concerns a self-constructed database comprising 213 European REITs, of the total 220 European REITs in the European Public Real Estate Association (EPRA) Global REIT Survey 2020 (EPRA, 2020). The data cover the period 2011 – 2020, leading to 2,130 REIT-year observations (213 REITs x 10 years) initially. However, there are several errors in the data as not all REITs exist for the complete study period and there are also REITs that enter the sample later than 2011. Therefore, we first exclude these 440 observations, resulting in 1,690 REIT-year observations remaining. Second, we exclude the 1,126 REIT-year observations without ESG performance data, leaving 564 REIT-year observations. Next, we need to be able to construct our dependent variables. We exclude 11 REIT-year observations with missing values in the building blocks of Tobin's q (see Equation (1)) and 15 REIT-year observations for the cost of equity (see Equation (2)). Missing values in the other model components lead to the final sample of 521 REIT-year observations, consisting of 95 unique REITs that are in the sample for varying time spans.

Figure 1 clearly illustrates the unbalanced panel approach, with a varying number of observations over time. However, another issue the data suggest is increasing attention towards ESG over time, as the number of REITs in the sample clearly increases over time. Thus, a potential learning effect might be present in the data. A third observation is the huge drop in REIT-year observations in 2020. This is due to the processing time of Thomson Reuters Eikon before the ratings are distributed.

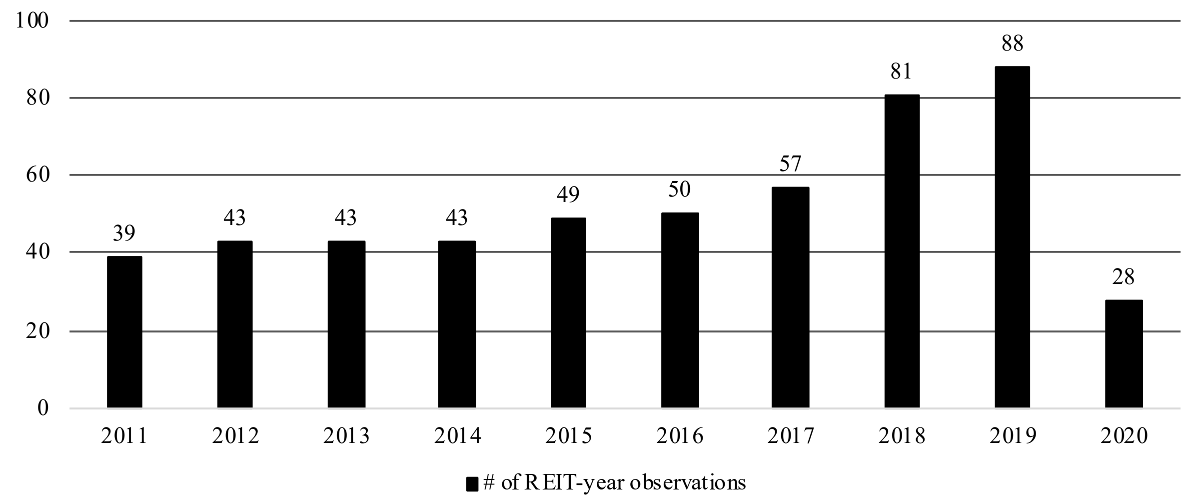

Figure 1 The varying number of REIT-year observations show the unbalanced panel approach

There are many missing values in the observations concerning ESG, as other studies targeting the European REIT market experienced. Although the data quality control process of Thomson Reuters Eikon is transparent, we cannot evaluate the accuracy of the data collection process. Arguably, larger funds or funds that exist longer are likely to be picked up sooner by Thomson Reuters Eikon than smaller funds or funds in starting phase. Therefore, the data might not be representative for all European REITs. As a result, we might overestimate the correlation between ESG and investment performance, as mainly larger funds with more resources and funds that exist longer with more experience end up in the sample. Given our relatively small sample size, there is no ideal solution to cope with this issue. Alternatively, following the approach of Bauer, Eichholtz and Kok (2010) who cope with the same issue, we mitigate potential upward bias by including relevant control variables in the analysis.

3.4 Descriptive statistics

Table 1 provides the descriptive statistics of the variables used in this study. Note that all monetary series are deflated (2015=100) to remove any part of the change in the variable that is attributable to general price movements.[5]

Table 1 Descriptive statistics

	Obs.	Mean	Std. Dev.	Min	Max

[5] Brooks and Tsolacos (2010, p. 30) state that 'deflation is a relevant process only for series that are measured in money terms, so it would make no sense to deflate a quantity-based series … or a series expressed as a proportion or percentage, such as vacancy or the rate of return on a stock'. However, for cost of equity and ROA, which are percentages, deflating (basically the Fisher equation) is in fact widely applied to calculate real series, based on an extensive review by the CFA institute (Wilcox, 2012), also in the context of the CAPM (King, 2009). Therefore, the cost of equity and ROA series are also deflated.

Tobin's *q*	521	.909	.154	.267	1.449
Cost of equity	521	.05	.024	.002	.161
ESG	521	51.34	20.86	2.69	93.13
ESG t_{-1}	429	50.73	20.939	2.69	93.13
Total Assets	521	9743.304	14382.113	64.844	104622.12
Market Cap	521	4813.39	7438.108	20.605	57351.391
Net Sales	521	623.044	885.025	0	5714.83
Leverage	521	.374	.129	0	.702
ROA	521	.058	.054	-.173	.281
Beta	521	.804	.44	-.026	3.08
Volatility	521	.254	.15	.086	1.045
ICR	521	7.271	8.701	-8.57	57.47
Market Index	521	.08	.192	-.24	.322

Notes: Tobin's *q* is the ratio of the market value to the replacement cost of assets. Cost of equity is the CAPM estimate in percentages. ESG is a score varying from 0 to 100. Total Assets, Market Cap and Net Sales are monetary series in million euros. Leverage is the ratio of total debt to total assets. ROA is the return on assets in percentages. Beta is a measure of systematic risk. Volatility is the measure of a stock's average annual price movement in percentages. ICR is the ratio of EBIT to interest expenses. Market Index is the y-o-y total return of the FTSE NAREIT Developed Europe REITS Index in percentages.

The average ESG performance of REITs in the sample is close to fifty, which is the Thomson Reuters Eikon average ESG score. Noteworthy, the variable ESG t_{-1} has less observations as it requires successive years of ESG data, which is not available for REITs that are not in the sample the entire study period. On average, REITs in the sample have a Tobin's *q* of approximately 0.91, implying that, on average, REITs in this panel have a lower market value relative to the replacement costs of assets. This is lower than what studies from the US typically report. Riddiough and Steiner (2014) confirm this contrast between EU and US REITs, and find that indeed REITs from Europe have a lower Tobin's *q*, below or close to one. This might be the result of the larger and more profitable REITs in the US compared to the EU. Lastly, we test for multicollinearity of the Tobin's *q* model and find no indication of the presence of multicollinearity in our data (Appendix III).

Furthermore, the descriptive statistics suggest that REITs in our sample have an average cost of equity of five per cent. This is slightly lower than what similar studies find, however, this can be attributed to the fact that we have less influential outliers in the cost of equity data compared to for instance the maximum 94.87 per cent cost of equity Eichholtz et al. (2018) report. The beta, however, is relatively low with 0.8, suggesting REITs in the sample are less volatile than the market average. We suggest this is due to the mainly larger funds in our sample, as the larger funds are more likely to report on ESG and end up in the sample. As the beta (as risk measure) is also a factor in the cost of equity, the correlation matrix (Appendix III) suggests high correlation. Therefore, we verify potential multicollinearity using the Variance Inflation Factors (VIF), and find no multicollinearity issues (Table 8 in Appendix III).

Table 2 Panel data summary statistics

Variable		Mean	Std. Dev.	Min	Max	Observations
Tobin's *q*	overall	0.909	0.154	0.267	1.449	N = 521
	between		0.150	0.403	1.399	n = 95
	within		0.091	0.581	1.203	T-bar = 5.484
Cost of equity	overall	0.050	0.023	0.002	0.161	N = 521
	between		0.020	0.004	0.098	n = 95
	within		0.016	-0.009	0.137	T-bar = 5.484
ESG	overall	51.340	20.860	2.69	93.13	N = 521
	between		19.064	6.868	90.384	n = 95
	within		8.482	19.629	84.315	T-bar = 5.484

Notes: Table reports panel data summary statistics for key variables (comprehensive overview of all variables in Table 7 in Appendix II).

Table 2 provides more detailed statistics for panel data specifically. Regarding ESG, most variation comes from the cross-section. However, we still observe variation within units over time, evidenced by a maximum variation in ESG score within units of 32.98 (84.315-51.340).[6] Similarly, although less pronounced, the Tobin's *q* and cost of equity show more cross-sectional variation than within REITs over time, albeit the difference is only marginal for the cost of equity. Likely, this is the result of a relatively steep decline in the cost of equity over time we observe in Figure 2, presumably the result of increased capital supply in the market.

[6] The Stata definitions of within minimum and maximum statistics refer to the deviation from each panel unit's average, and adds back the overall mean to make results comparable (Porter, n.d.). Therefore, we need to subtract the overall mean from the reported minimum and maximum statistics.

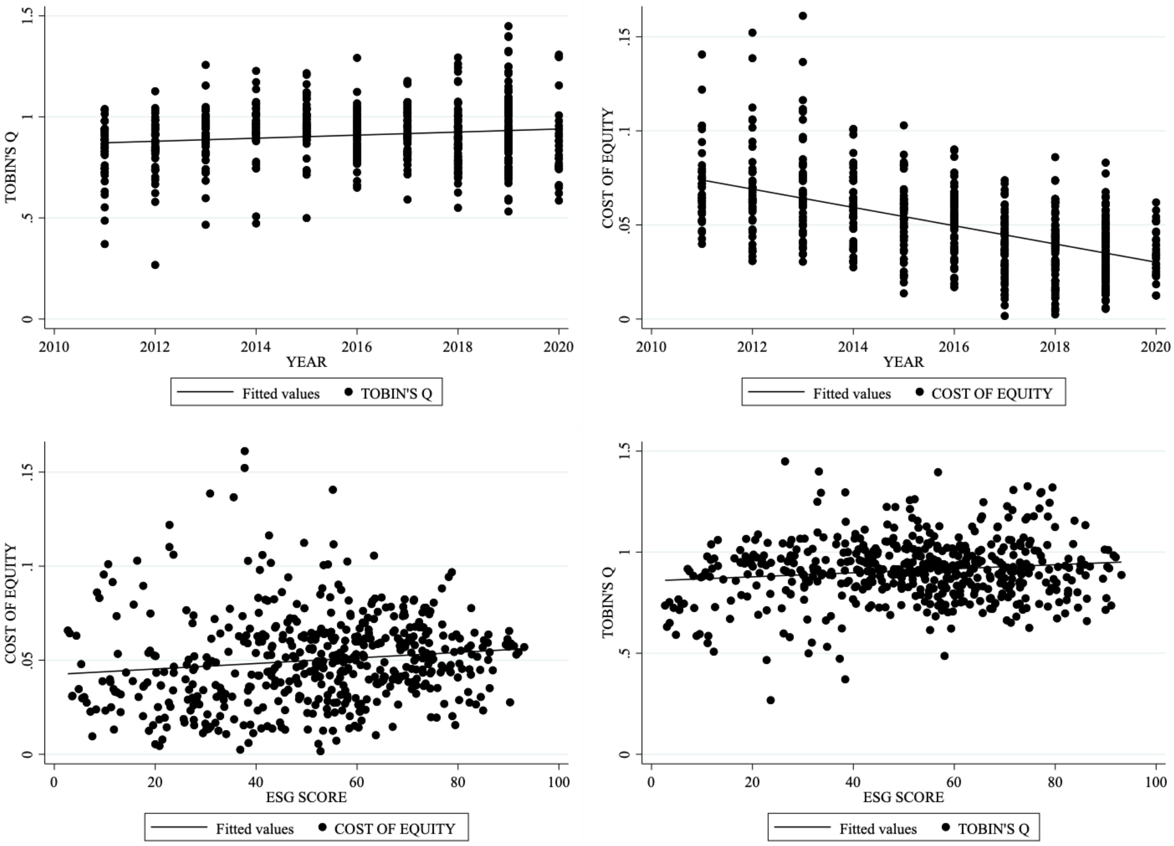

Figure 2 Scatterplots for the relative market value, cost of equity and ESG

The upper left plot in Figure 2 show that Tobin's q steadily increases over time, whereas the cost of equity in the upper right plot falls sharply. This opposite development is what we anticipated, as plotting the two variables in Figure 3 indeed indicates that lower equity financing costs are correlated to a higher relative market value. In the bottom left scatterplot, we observe that, in line with our hypothesis, REITs with higher relative market value have a better ESG performance on average, albeit slightly. In contrast, the raw cost of equity data suggest a positive relationship between ESG and the cost of equity, contrary to what we hypothesise. This requires further exploration and good model selection – which we discuss next.

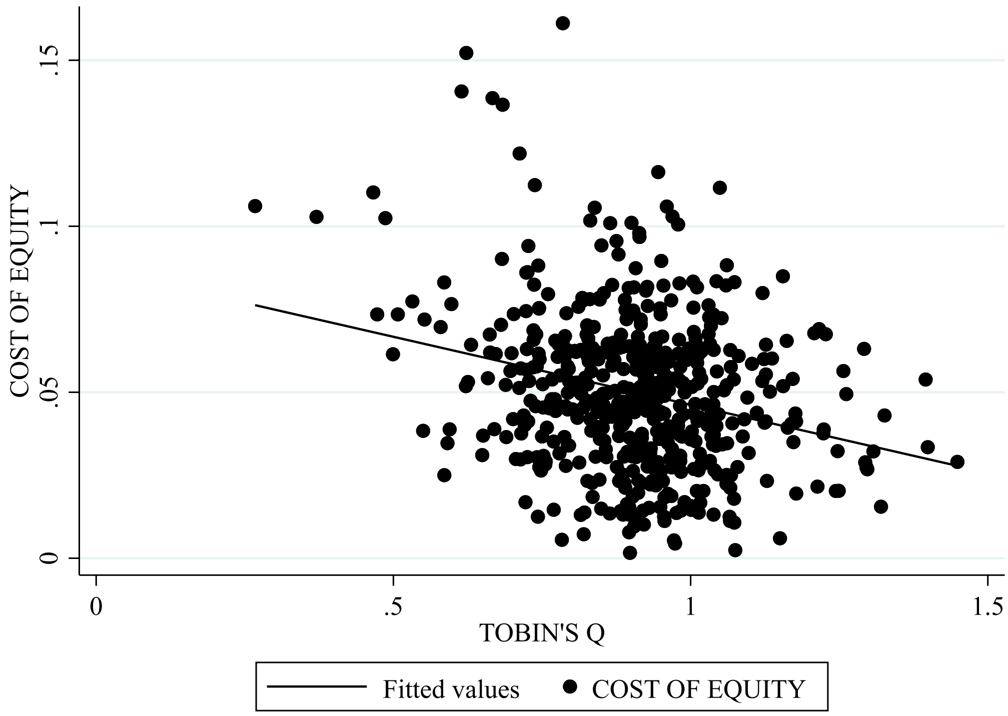

Figure 3 Scatterplot illustrating lower cost of equity for REITs with higher Tobin's q

4 Methodology

We employ a series of panel data models to explore the relationship between ESG and REITs' performance. Panel data models have some desirable properties as they allow for a combination of the cross-sectional and time-series universe. Broadly, there are two classes of panel estimators: *fixed effects (FE)* and *random effects (RE)* (Brooks, 2008, p. 490). The *FE* estimator allows individual-specific effects to be correlated to the explanatory variables, while the *RE* estimator assumes the individual-specific effects are uncorrelated to the explanatory variables. The formal test to decide which panel estimator yields the most efficient estimates is the Hausman test, which favours the *FE* estimator.[7] In practice, however, it is often hard to determine which estimator is the most efficient.[8] Therefore, we

[7] We reject the Hausman null hypothesis that the individual effects are uncorrelated with the other regressors (Park, 2011), favouring the *FE* models.

[8] Clark and Linzer (2015) argue that in addition to the Hausman test, one should consider the trade-off in bias and variance the models introduce. The *FE* model accounts for unobserved heterogeneity and delivers unbiased estimates, which however may be subject to high sample variance. The *RE* model reduces the variance of estimates, but may introduce bias in the estimates if the covariates are correlated with the individual-specific effects. Except in exceptional situations, however, there will always be some correlation between the covariates and the unit effects, and thus at least minimal bias (Angrist & Pischke, 2008, p. 223).

follow Sah, Miller and Ghosh (2013) and estimate all models with both *RE* and *FE* to demonstrate the robustness of our estimations.[9]

The relative market value and cost of equity we use to measure REIT performance, are explained by different factors. Therefore, we need separate model specifications. In this section, we only discuss the main model we take forward for each. In the results section, we gradually build up the models to demonstrate the robustness of our estimates (Neumayer & Plümper, 2017, p. 133).

In the first stage of the analysis, we explore the correlation between ESG and the relative market value. In constructing the model, we closely follow Cajias et al. (2014), and seek to improve their model by increasing its explanatory power and reducing endogeneity concerns. First, we include the natural logarithm of the book value of assets (Bauer et al., 2010; Shin & Stulz; 2000) and the natural logarithm of the cost of equity, as literature (Riddiough & Steiner, 2014) and the preliminary analysis in the previous section suggest a negative relationship. Second, we do not include contemporaneous and lagged ESG performance simultaneously, but in separate model specifications rather. In the main model, we include only the contemporaneous ESG performance, hence we specify the main model for the relative market value as follows:

$$ln(Tq)_{it} = \alpha + \beta_1 ESG_{it} + \gamma X_{it} + Z_t + \delta_i + \theta_t + \varepsilon_{it} \quad (3)$$

Where $ln(Tq)_{it}$ is the natural logarithm of Tobin's *q* for REIT *i* in year *t*; α is the constant; *X* is a vector of REIT-level financial attributes for REIT i in year *t*, including market capitalisation, volatility, net sales, leverage, total assets, and the cost of equity; Z_t is the FTSE NAREIT Developed Europe REITS Index in year *t* to control for real estate market conditions; δ_i are the REIT-specific dummies as this specification represents the FE estimator; θ_t are the dummies for years to control for a time trend[10]; and ε_{it} is the error term for REIT i in year *t*.

Next, we introduce the main model we use to analyse the correlation between ESG and the cost of equity. In deciding on which control variables to include, we closely follow Hsieh et al. (2020), who enhance the model of Eichholtz et al. (2018) with the most recent insights on the determinants of the

[9] As a final check before performing our regressions, we verify the presence of a panel effect in the *FE* model by conducting an F test and a Breusch-Pagan Lagrange multiplier (LM) test for the *RE* model, both comparing the panel estimator to a pooled ordinary least squares (OLS) regression (Clark & Linzer, 2015). We reject the null hypotheses of the F test and Breusch-Pagan LM test and assume panel estimators are the most efficient estimators.
[10] We run the model with and without time fixed effects and use the Stata command `testparm` to analyse whether time fixed effects should be included in the *FE* model. We reject the null-hypothesis that the coefficients for all years are jointly equal to zero, therefore we need to control for a potential time trend by including time fixed effects.

cost of equity. However, we replace the market-to-book ratio in the Hsiesh et al. (2020) model with the natural logarithm of Tobin's q, as a more accurate measure of REIT value, leading to the following specification:

$$ln(COE)_{it} = \alpha + \beta_1 ESG_{it} + \gamma X_{it} + \delta_i + \theta_t + \varepsilon_{it} \quad (4)$$

Where $ln(COE)_{it}$ is the natural logarithm of the CAPM estimate of the cost of equity for REIT i in year t; α is the constant; X is a vector of REIT-level financial attributes for REIT i in year t, including return on assets, total assets, leverage, Tobin's q, interest coverage ratio and volatility; δ_i are the REIT-specific dummies, again as this specification represents the *FE* estimator; θ_t are the year dummies to control for a time trend [11]; and ε_{it} is the error term for REIT i in year t.

Finally, an important consideration in financial and economic research is the presence of survivorship bias. Survivorship bias is a statistical bias caused by not including all indicators of all funds in performance studies, especially those that have failed (Zhou & Ziobrowski, 2009). We mitigate survivorship bias in our methodology by applying an unbalanced panel approach, following Cajias et al. (2014) and Devine et al. (2016). We carefully construct an unbalanced panel where REITs enter when they first meet the data requirements and exit when they default or merge.

5 Results

5.1 Market valuation

Table 3 shows the results of the first stage of the analysis, in which we take a step-by-step approach and test several variations of our main model to show the robustness of the results (Neumayer & Plümper, 2017, p. 133). We start with a baseline model and gradually add fixed effects to control for unobserved heterogeneity related to REIT-level attributes, real estate market conditions and a general time trend, and add lagged terms. The gradual development of the models enables us to observe the increase in explanatory power of the models in terms of r-squared.[12]. All models, except the baseline model which includes only the variable of interest, explain well over seventy per cent of the variance in the relative market value.

[11] We run the model with and without time fixed effects and use the Stata command `testparm` to analyse whether time fixed effects should be included in the *FE* model. We reject the null-hypothesis that the coefficients for all years are jointly equal to zero, therefore we need to control for a potential time trend by including time fixed effects.

[12] The r-squared for *FE* models is typically lower, since variables are demeaned to obtain the *FE* within-estimator, leading to less total variance to be explained.

Table 3 No significant correlation between ESG and the relative market value

	(1)	(2)	(3)	(4)	(5)
ESG	0.006	-0.019	-0.017	-0.010	
	(0.030)	(0.030)	(0.029)	(0.028)	
ESG t_{-1}					-0.000
					(0.018)
Cost of equity		0.000	0.001	-0.008	-0.004
		(0.013)	(0.013)	(0.014)	(0.014)
Leverage		0.153***	0.151***	0.149***	0.156***
		(0.031)	(0.031)	(0.033)	(0.041)
Total Assets		-0.419***	-0.410***	-0.397***	-0.404***
		(0.065)	(0.067)	(0.072)	(0.090)
Volatility		0.008	0.006	0.008	0.005
		(0.034)	(0.034)	(0.047)	(0.046)
Net Sales		-0.004	-0.004	-0.004	-0.001
		(0.010)	(0.010)	(0.009)	(0.013)
Market Cap		0.393***	0.386***	0.377***	0.380***
		(0.068)	(0.070)	(0.071)	(0.087)
Market Index			0.036*	0.057	-0.000
			(0.021)	(0.196)	(0.066)
Constant	-0.132	0.651***	0.617***	0.531**	0.518*
	(0.115)	(0.189)	(0.183)	(0.208)	(0.263)
Time fixed effects	NO	NO	NO	YES	YES
Observations	521	521	521	521	429
Number of REITs	95	95	95	95	87
Number of time periods	10	10	10	10	10
R-squared	0.000	0.716	0.720	0.730	0.719

Notes: Table reports the panel *FE* regression results. Dependent variable is the natural logarithm of Tobin's *q*. Cluster-robust Huber-White standard errors (clustered by REIT) in parentheses. Significance at *** p<0.01, ** p<0.05 and * p<0.1, respectively.

The results of all models indicate no significant correlation between ESG and the relative market valuation. In Model (5), we modify the main model by including one-year lagged ESG performance instead of contemporaneous ESG performance, as the effect can take several periods to materialise

(Cajias et al., 2014). The consideration to lag the performance by only one year lies in the concept of the ESG rating. The contemporaneous rating is in fact already partially lagged, as we observe in the number of REIT-year observations over time (Figure 1) that it takes Thomson Reuters time to construct and distribute the ESG ratings.

However, including lagged ESG performance reduces the number of observations compared to the other models, as it requires longer time series that are not available. As such, the estimates of Model (5) might be driven by the change in sample rather than the substitution of lagged for contemporaneous ESG performance. Therefore, we re-estimate all models with a constant sample, and find consistent results (see Table 18 in Appendix V). Additionally, we provide several robustness checks by conducting a first difference (*FD*) approach[13] following Cajias et al. (2014) and Eichholtz et al. (2018), re-estimating all models using the *RE* estimator following Sah et al. (2013), and different methodologies to estimate the dependent variable Tobin's q. The estimates of the robustness checks are consistent with the original estimates.

Still, some previous studies indicate a significant effect of ESG-related performance on the market value (Cajias et al., 2014; Devine et al., 2016), albeit slightly (Sah et al., 2013). A potential explanation relates to the period covered in these studies, as the learning hypothesis suggests the level of attention towards ESG might affect the correlation. Hence, we split up the original sample into two time periods covering 2011 – 2015 and 2016 – 2020, based on the increased attention towards ESG following the Paris Agreement in 2015. The results in Appendix V (Table 22) suggest the presence of a learning effect, as the initial insignificant estimate for ESG holds for 2011 – 2015, but becomes significant at the one per cent level for 2016 – 2020. Interestingly, the negative coefficient suggests that a one per cent increase in ESG is correlated with a 0.032 per cent lower Tobin's q, *ceteris paribus*.

Another issue that could clarify the insignificant correlation found in the original model is the proxy for sustainability Devine et al. (2016) use (green building certifications). Arguably, the benefits of green building certifications are clearest to investors as this comes closest to 'traditional' sustainability. In contrast, we use the broader ESG concept as sustainability proxy including intangible benefits. What we already know from literature, is that investors might not be able to correctly price such intangible assets (Edmans, 2011). It is therefore interesting to explore whether this impacts our estimates and

[13] As a first robustness check to account for unobserved heterogeneity in an alternative way compared to the *FE* estimators, we also estimate a *FD* model. Under the same assumptions as the *FE* model, both the *FE* and *FD* estimators are consistent. However, the *FD* model picks up only the instantaneous effect at time *t* of our variable of interest ESG on $Tobin's\ Q$. It is likely, however, that the effect of ESG needs several periods to materialise, for which the *FE* estimator picks up the average. We find that the insignificant relationship for contemporary ESG performance in the *FE* models is consistent with the *FD* model, which provides an insignificant coefficient of -0.007 (see Table 20 in Appendix V).

explains the insignificant results. We do so by decomposing comprehensive ESG performance into separate pillars (E, S and G) and present results in Appendix VI (Table 25).

The decomposing exercise does not provide evidence that the ability of investors to value the intangibles influenced our estimates of ESG for the relative market value, as the separate pillars (E, S and G) are all insignificant. However, we also explored the correlation of the separate pillars for the cost of equity (Table 26). Remarkably, the environmental and social pillar are significant at the one per cent level, whereas the governance metric is insignificant. A potential explanation for the absence of a governance correlation is that REITs in developed countries are typically subject to strict governance regulations to obtain – and maintain – their REIT status (EPRA, 2020). Consequently, there might be a baseline level of governance structure among all REITs, such that capital market participants place less value on superior governance performance. In conclusion, the absent governance correlation may explain the presence of a sustainability-related effects found in studies that exclusively focus on the environmental aspect (Devine et al., 2016).

5.2 Cost of equity

Table 4 presents the results of the second stage of the analysis, in which we explore the correlation between ESG and the cost of equity. We start with a baseline model and gradually add fixed effects to control for unobserved heterogeneity related to REIT-level attributes, real estate market conditions and a general time trend. The resulting main Model (3) explains 81.2 per cent of the variance in the cost of equity. In Model (4) we modify the main model by substituting contemporaneous ESG for one-year lagged ESG performance, leading to 86.8 per cent of the variance in the cost of equity explained.

Table 4 Negative correlation between ESG and the cost of equity

	(1)	(2)	(3)	(4)
ESG	-0.322***	-0.169***	-0.116**	
	(0.106)	(0.051)	(0.044)	
ESG t_{-1}				-0.059
				(0.042)
Tobin's q		-0.087	0.001	-0.142
		(0.112)	(0.100)	(0.089)
ROA		0.070	-0.081	0.182
		(0.220)	(0.233)	(0.218)
Total Assets		-0.125*	-0.009	-0.039

		(0.064)	(0.076)	(0.071)
Leverage		0.124***	0.046	0.114*
		(0.047)	(0.055)	(0.057)
Beta		1.207***	1.261***	1.269***
		(0.112)	(0.120)	(0.119)
ICR		0.000	0.001	0.002
		(0.002)	(0.002)	(0.002)
Volatility		-1.034***	-1.642***	-1.583***
		(0.305)	(0.436)	(0.433)
Constant	-1.908***	-2.033***	-2.952***	-2.912***
	(0.406)	(0.541)	(0.538)	(0.562)
Time fixed effects	NO	NO	YES	YES
Observations	521	521	521	429
Number of REITs	95	95	95	87
Number of time periods	10	10	10	10
R-squared	0.053	0.773	0.812	0.868

Notes: Table reports the panel *FE* regression results. Dependent variable is the natural logarithm of the cost of equity. Cluster-robust Huber-White standard errors (clustered by REIT) in parentheses. Significance at *** p<0.01, ** p<0.05 and * p<0.1, respectively.

Contrary to what the raw data suggests, the estimates across the first three models consistently show a negative and significant (either at one or five per cent) estimate of ESG and the cost of equity. Model (2), without time fixed effects, indicates that a one per cent increase in ESG performance relates to 0.169 per cent lower equity costs, at a one per cent significance level. With time fixed effects included, the estimate diminishes to a 0.131 per cent lower cost of equity for each per cent higher ESG, at a five per cent significance level. A time-related effect was anticipated, as our preliminary analysis in the descriptive statistics already identified a general decrease in the cost of equity over time. However, we find no indication of a lagged correlation, evidenced by the insignificant coefficient of lagged ESG performance in Model (4).

The longer historical time series required to construct the lagged ESG performance variable, again cause a reduced sample size for Model (4). As such, the estimates of Model (4) might be driven by the change in sample rather than the substitution of lagged for contemporaneous ESG performance. Therefore, we re-estimate all models with a constant sample, and find results are consistent (see Table 23 in Appendix V). Additionally, we run a *FD* model to account for unobserved heterogeneity in an alternative way.

The negative correlation found in the original model is consistent with the *FD* model, which provides a coefficient of -0.052, significant at five per cent (Table 21 in Appendix V). The lower coefficient of the *FD* model can be explained by the fact that the *FD* model picks up only the instantaneous effect of ESG performance at time *t*, while the *FE* estimator picks up an average over time through demeaning. Finally, we re-estimate all models using the *RE* estimator instead of the *FE* estimator, following Sah et al. (2013). The sign and significance are broadly similar, albeit the coefficient of Model (3) is insignificant. However, as the other robustness checks point towards a negative correlation, we consider the original estimates largely robust to the choice of estimator.

As with the relative market valuation, we split up the sample into two periods to test whether the increased attention towards ESG in recent years influences our estimates. Interestingly, the results in Appendix V (Table 22) show no significant correlation in the period 2011 – 2015, whereas the coefficient (-0.155) of ESG in 2016 – 2020 is significant at the five per cent level.

The empirical results imply that ESG performance is related to lower equity costs, contrary to what raw data suggests. A first line of reasoning emphasises the importance of a good model to control for characteristics and a time trend. At the same time, we put a lot of trust in our models. However, given the high goodness-of-fit measure, the expected negative correlation based on theory, and the fact that we closely followed existing empirical work in our model construction (Eichholtz et al., 2018; Hsieh et al., 2020), we believe the empirical results reflect the actual correlation better than the raw data.

5.3 Institutional context – EU vs. UK

The theoretical framework reveals that institutional differences might affect the correlation of ESG and financial performance. In specific, Devine et al. (2016) attribute the difference in effect of green building certifications between the UK and US to mandatory environmental reporting for property investments in the UK. Hitherto, no research made the comparison based on comprehensive ESG performance. Moreover, our original dataset – and therewith our estimates so far – includes REITs from, among others, the UK. Hence, it is interesting to explore whether mandatory environmental disclosure impacts our estimates. Therefore, we compare the UK to EU REITs in our sample and present results in Table 5.

Table 5 Institutional differences between the EU and UK

	Tobin's *q*		Cost of equity	
	(1)	(2)	(3)	(4)
	EU	UK	EU	UK

ESG	0.010	-0.033	-0.103***	-0.088
	(0.021)	(0.049)	(0.032)	(0.083)
Constant	0.824***	0.270	-3.420***	-2.133***
	(0.254)	(0.417)	(0.783)	(0.761)
REIT characteristics	YES	YES	YES	YES
Time fixed effects	YES	YES	YES	YES
Observations	308	213	308	213
Number of REITs	61	34	61	34
Number of time periods	10	10	10	10
R-squared	0.725	0.842	0.710	0.868

Notes: Table reports the panel *FE* regression results. Dependent variable for Model (1) and (2) is the natural logarithm of Tobin's *q*, and the natural logarithm of cost of equity for Model (3) and (4). Cluster-robust Huber-White standard errors (clustered by REIT) in parentheses. Significance at *** p<0.01, ** p<0.05 and * p<0.1, respectively.

First, the results show a clear distinction between UK- and EU REITs, particularly for the cost of equity. ESG is highly significant (at one per cent) correlated to the cost of equity for EU REITs, and insignificant for UK REITs. A second remarkable finding is the difference in explanatory power for the relative market valuation and cost of equity between UK- and EU REITs. Apparently, the models are better at explaining the market valuation and cost of equity for UK REITs as opposed to EU REITs.

6 Discussion

6.1 The economic value of 'doing good'

A growing body of literature clearly establishes a link between sustainability and real estate investment, in terms of higher rents (Bond & Devine, 2016), lower vacancy rates (Fuerst & McAllister, 2011), longer economic lifetime (Eichholtz et al., 2010), higher investor and developer profit (Pivo & Fisher, 2010) and lower operating expenditure (Eichholtz et al., 2012). The current study shifts to REITs' market valuation and cost of equity and goes beyond energy efficiency by engaging with the most recent concept of sustainability, ESG. We find that REITs' superior ESG performance correlates with lower cost of equity, however, we observe no significant correlation for the relative market value. There are several matters we can consider to better understand the seemingly mixed results.

First, the absence of significant correlation of ESG and relative market value might indicate a mixed presence of 'cost perspective'- and 'doing-well-by-doing-good' proponents among European REIT investors, as suggested by Eom and Nam (2017). Second, the 'no-effect' hypothesis may apply, where the costs and benefits arising from ESG cancel out (Hassel & Semenova, 2013; McWilliams & Siegel, 2001). Still, however, along these lines, one would expect to see similar result for the cost of equity. Moreover, in a competitive market, lower cost (of equity) should lead to a higher market value (Riddiough & Steiner, 2014). Therefore, as third consideration, we disentangle the measure of market value. The Tobin's q is considered the market value (numerator) over the asset replacement costs (denominator). Potentially, the replacement costs of assets (denominator) increase beyond the market value (numerator) with ESG performance, stabilising the relative market value and blurring potential correlation.

6.2 Institutional context and transparency – its implications

This study contributes to literature by providing insight in ESG and REITs' performance in Europe, whereas nearly all existing studies target the US REIT market (Brounen & Marcato, 2018; Cajias et al., 2014; Coën et al., 2018; Devine et al., 2016; Eichholtz et al., 2012; Fuerst, 2015; Sah et al., 2013). As ESG data availability in Europe strongly increased in recent years, we are able to explore how ESG is linked to the real estate investment market in Europe. In doing so, we present initial evidence that institutional context matters for ESG in Europe. We find a significant correlation for ESG and the cost of equity in the EU, which disappears in the UK where there is a mandatory level of environmental reporting. Arguably, the upside of mandatory reporting is that it increases overall environmental performance, as REITs with poor environmental performance cannot shy away. However, simultaneously, the baseline level of reporting might mitigate the presence of a correlation between voluntary ESG efforts and the cost of equity – or market value. An important remark with this finding, is that we group all EU REITs and compare those to the UK REITs, as data limitations do not allow us to dig deeper into the sample. However, this experiment could be enhanced in future research by explicitly taking country-specific regulations into account for all countries in the sample.

6.3 The future of ESG in real estate investments

In this study, we find that there is an insignificant correlation between ESG and the market value and cost of equity in the period 2011 – 2015, while there is a significant correlation in the more recent time frame 2016 – 2020. Based on the literature there are two possible explanations. First, reasoning from the learning hypothesis, the increased attention for ESG in recent years has increased investor awareness, which in turn caused market to adjust price levels (Bebchuk et al., 2013). The second perspective may stem from a 'reap what you sow' principle regarding ESG strategies. In the context of

ESG and REIT investment, there may be high upfront costs associated with ESG adoption, such as strategy implementing costs or retrofitting assets (Cappucci, 2018), but arguably also future benefits such as lower operating costs of assets or productivity improvements (Hassel & Semenova, 2013; Porter & Van der Linden, 1995). Possibly, REITs have taken on the majority of the upfront costs in the 2011 – 2015 period, decreasing their performance in that time frame, while enjoying some of the benefits in the more recent 2015 – 2020 time frame. Nevertheless, with this finding we agree with the accurate statement of Brounen et al. (2021) that research on ESG becomes dates quickly, and see this as an implication to frequently review the sign and significance of the correlation between ESG and REIT performance.

As for the future of REIT research, our results might be affected by the availability of historical data, reflected by relatively short time series. Moreover, the unbalanced sample approach we apply mitigates survivalship bias, but results in some funds being included, for instance, for only two years, preventing us from detecting potential inconsistencies. Therefore, it would be interesting to see whether the results are stable over longer time periods in future research. Additionally, regarding the cross-sectional element, we are unsure about the data collection process of Thomson Reuters Eikon as ESG data provider. Comparing data providers would give more insight in the representativeness of the data for European REITs and enhance reliability of the results – something future research could address.

7 Conclusion

In this study, we examined whether ESG performance is correlated with REITs' market value and cost of equity in the relatively unexplored European framework. We observe no correlation for REITs' relative market value, but we find that ESG performance is negatively correlated with the cost of equity. In contrast, when there is a mandatory level of environmental reporting for property investments present, the correlation disappears. As such, the results underline the importance of considering the institutional context for the correlation between ESG and real estate investments. However, future research should verify these findings with a more comprehensive dataset to establish a causal relationship in the European context.

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Appendices

Appendix I Stata code

```
* MSc Thesis "ESG and Listed Real Estate Performance: Evidence from European REITs"

clear all

* pathway to data
use "/Users/yngwieromijn/Documents/STUDIES/RIJKSUNIVERSITEIT GRONINGEN/MASTER REAL ESTATE STUDIES/THESIS/THESIS/DOCUMENTS/DATA/Dataset-v7.dta"

* exploring data
describe
summarize

* destring
destring hcip historicalbeta volatility roa interestcoverageratio markettobook shareprice bookvaluepershare ftseepranareitdevelopedindexreit capmequitycosts bvpsshares tobinsq1 tobinsq3 ESG_SCORE environmentalscore socialscore governancescore HCIP_INDEX, replace dpcomma

encode name, generate(REIT)

* rename
rename ftseepranareitdevelopedindexreit MarketIndex
rename totalassetsMillions TotalAssetsMillions
rename historicalvolatility VOL
rename historicalbeta BETA
rename interestcoverageratio ICR
rename year YEAR
rename esgscore ESG_SCORE
rename lagESG LAG_ESG_SCORE
rename MarketIndex_pct RE_INDEX
rename country_n COUNTRY
rename hcip_index HCIP_INDEX

* drop irrelevant variables and observations
drop icbindustryclassicification country portfoliolocation firmageyears eps monthforwardeps fundsfromoperation totalinvestmentreturn marketvalue deferredtaxes pricetobook bookvaluepershare commonshareholdersequity dividendspershare mthforwarddps payout retentionratio sustainabledividendgrowth preferredstock preferreddividend group20142019 group20152019 group2019 group20152019YEARonly name companyname ticker alphafehat capmgroup20152019yo _est_fixed _est_random groupesg lnFFO NumeratorTq1 lnNumerator lagROE markettobook

drop if capmgroup_unbalanced==0

* deflate monetary series (2015=100)
gen MCAP_def=MarketCapitalisationMillions/(HCIP_INDEX/100)
gen ASSETS_def=TotalAssetsMillions/(HCIP_INDEX/100)
```

```
gen DEBT_def=(totaldebt/1000)/(HCIP_INDEX/100)
gen SALES_def=(netsalesorrevenu/1000)/(HCIP_INDEX/100)
gen COE_def=COE_pct/(HCIP_INDEX/100)
gen ROA_def=roa_pct/(HCIP_INDEX/100)
gen BVE_def=(bvpsshares/1000)/(HCIP_INDEX/100)
gen PREF_def=(preferredstock/1000)/(HCIP_INDEX/100)
gen DEFTAX_def=(DEFTAX/1000)/(HCIP_INDEX/100)
sum MCAP_def ROA_def COE_def SALES_def DEBT_def ASSETS_def BVE_def PREF_def
DEFTAX_def

* gen new Tobin's q variables with deflated series
gen TQ_1_def=(MCAP_def+DEBT_def+PREF_def)/ASSETS_def
gen TQ_2_def=MCAP_def/(ASSETS_def-DEBT_def)
gen TQ_3_def=(MCAP_def+ASSETS_def-BVE_def-DEFTAX_def)/ASSETS_def
gen TQ_4_def=(MCAP_def+DEBT_def)/ASSETS_def
sum TQ_1_def TQ_2_def TQ_3_def TQ_4_def

gen LN_TQ_1=ln(TQ_1_def)
gen LN_TQ_2=ln(TQ_2_def)
gen LN_TQ_3=ln(TQ_3_def)
gen LN_TQ_4=ln(TQ_4_def)

* gen new leverage measure with deflated series
gen LEV_def=DEBT_def/ASSETS_def
sum LEV_def

gen PRE_LN_LEV=LEV_def+0.01
gen LN_LEV=ln(PRE_LN_LEV)

* transform non-normal distributed variables
gen LN_MCAP=ln(MCAP_def)
gen LN_COE=ln(COE_def)
gen LN_ASSETS=ln(ASSETS_def)
gen LN_VOL=ln(volatility)
gen PRE_LN_SALES=SALES_def+0.01
gen LN_SALES=ln(PRE_LN_SALES)
gen LN_ESG=ln(ESG_SCORE)
gen LAG_ESG=l.ESG_SCORE
gen LN_LAG_ESG=ln(LAG_ESG_SCORE)
gen PRE_LN_ENV = environmentalscore+0.01
gen LN_ENV= ln(PRE_LN_ENV)
gen PRE_LN_SOC = socialscore+0.01
gen LN_SOC= ln(PRE_LN_SOC)
gen PRE_LN_GOV = governancescore+0.01
gen LN_GOV= ln(PRE_LN_GOV)

* winsorize extreme outliers
```

```
winsor2 interestcoverageratio, replace cuts (1 99)

* descriptive statistics
summarize TQ_1_def COE_def ESG_SCORE LAG_ESG_SCORE ASSETS_def MCAP_def
SALES_def LEV_def ROA_def BETA VOL ICR RE_INDEX

correlate TQ_1_def ESG_SCORE COE_def LEV_def ASSETS_def VOL SALES_def MCAP_def
MarketIndex

correlate COE_def ESG_SCORE TQ_1_def ROA_def ASSETS_def LEV_def BETA ICR VOL

* variance inflation factors (VIF) to check high collinearity of beta and volatility
reg COE_def ESG_SCORE TQ_1_def ROA_def ASSETS_def LEV_def BETA ICR VOL
vif

* graphs
graph set window fontface "Times New Roman"

graph twoway (lfit COE_def YEAR) (scatter COE_def YEAR), play(BlackWhiteRecording)

graph twoway (lfit TQ_1_def YEAR) (scatter TQ_1_def YEAR), play(BlackWhiteRecording)

graph twoway (lfit COE_def ESG_SCORE) (scatter COE_def ESG_SCORE),
play(BlackWhiteRecording)

graph twoway (lfit TQ_1_def ESG_SCORE) (scatter TQ_1_def ESG_SCORE),
play(BlackWhiteRecording)

graph twoway (lfit COE_def TQ_1_def) (scatter COE_def TQ_1_def), play(BlackWhiteRecording)

* set data as panel data
xtset REIT YEAR
xtdescribe
xtsum REIT YEAR TQ_1_def COE_def ESG_SCORE ASSETS_def MCAP_def SALES_def
LEV_def ROA_def BETA VOL ICR RE_INDEX

* tq - Breusch-Pagan LM test for random effects versus OLS
quietly xtreg LN_TQ_1 LN_ESG LN_COE LN_LEV LN_ASSETS LN_VOL LN_SALES
LN_MCAP RE_INDEX i.YEAR, re
xttest0

* tq - Hausman test for fixed effects versus OLS
quietly xtreg LN_TQ_1 LN_ESG LN_COE LN_LEV LN_ASSETS LN_VOL LN_SALES
LN_MCAP RE_INDEX i.YEAR, fe
estimates store fixed1
quietly reg LN_TQ_1 LN_ESG LN_COE LN_LEV LN_ASSETS LN_VOL LN_SALES LN_MCAP
RE_INDEX i.YEAR
```

```
estimates store pols1
hausman fixed1 pols1

* tq - Hausman test for fixed versus random effects model
quietly xtreg LN_TQ_1 LN_ESG LN_COE LN_LEV LN_ASSETS LN_VOL LN_SALES
LN_MCAP RE_INDEX i.YEAR, re
estimates store random1
hausman fixed1 random1

* coe - Breusch-Pagan LM test for random effects versus OLS
quietly xtreg LN_COE LN_ESG LN_TQ_1 ROA_def LN_ASSETS LN_LEV BETA ICR VOL
i.YEAR, re
xttest0

* coe - Hausman test for fixed effects versus OLS
quietly xtreg LN_COE LN_ESG LN_TQ_1 ROA_def LN_ASSETS LN_LEV BETA ICR VOL
i.YEAR, fe
estimates store fixed2
quietly reg LN_COE LN_ESG LN_TQ_1 ROA_def LN_ASSETS LN_LEV BETA ICR VOL
i.YEAR
estimates store pols2
hausman fixed2 pols2

* coe - Hausman test for fixed versus random effects model
quietly xtreg LN_COE LN_ESG LN_TQ_1 ROA_def LN_ASSETS LN_LEV BETA ICR VOL
i.YEAR, re
estimates store random2
hausman fixed2 random2

* coe - XTOVERID as data failed to meet asymptotic assumptions of the Hausman test
qui tab YEAR, gen(D_YEAR)
xtreg LN_COE LN_ESG LN_TQ_1 ROA_def LN_ASSETS LN_LEV BETA ICR VOL D_YEAR1
D_YEAR2 D_YEAR3 D_YEAR4 D_YEAR5 D_YEAR6 D_YEAR7 D_YEAR8 D_YEAR9, re
xtoverid, cluster(REIT)

* test OLS assumptions (1: linearity, 2: homoscedasticity, 3: no autocorrelation, 4: independence, 5:
normal distribution)

* 1: linearity
quietly xtreg LN_TQ_1 LN_ESG LN_COE LN_LEV LN_ASSETS LN_VOL LN_SALES
LN_MCAP RE_INDEX i.YEAR, fe vce(cluster REIT)
predict alphafehat1, u
sum alphafehat1

quietly xtreg LN_COE LN_ESG LN_TQ_1 ROA_def LN_ASSETS LN_LEV BETA ICR VOL
i.YEAR, fe vce(cluster REIT)
predict alphafehat2, u
```

```
sum alphafehat2

* 2: homoscedasticity
xtreg LN_TQ_1 LN_ESG LN_COE LN_LEV LN_ASSETS LN_VOL LN_SALES LN_MCAP
RE_INDEX i.YEAR, fe vce(cluster REIT)
xttest3

xtreg LN_COE LN_ESG LN_TQ_1 ROA_def LN_ASSETS LN_LEV BETA ICR VOL i.YEAR, fe
vce(cluster REIT)
xttest3

* 3: autocorrelation
xtserial LN_TQ_1 LN_ESG LN_COE LN_LEV LN_ASSETS LN_VOL LN_SALES LN_MCAP
RE_INDEX

xtserial LN_COE LN_ESG LN_TQ_1 ROA_def LN_ASSETS LN_LEV BETA ICR VOL

* 4: independence
* Wooldridge test
xtreg LN_TQ_1 LN_ESG LN_COE LN_LEV LN_ASSETS LN_VOL LN_SALES LN_MCAP
RE_INDEX i.YEAR F.LN_ESG, fe vce(cluster REIT)
test F.LN_ESG

xtreg LN_COE LN_ESG LN_TQ_1 ROA_def LN_ASSETS LN_LEV BETA ICR VOL i.YEAR
F.LN_ESG, fe vce(cluster REIT)
test F.LN_ESG

* 5: normal distribution
xtreg LN_TQ_1 LN_ESG LN_COE LN_LEV LN_ASSETS LN_VOL LN_SALES LN_MCAP
RE_INDEX i.YEAR, fe vce(cluster REIT)
predict resid_mv
kdensity resid_mv, normal play(BlackWhiteRecording)

xtreg LN_COE LN_ESG LN_TQ_1 ROA_def LN_ASSETS LN_LEV BETA ICR VOL i.YEAR, fe
vce(cluster REIT)
predict resid_coe
kdensity resid_coe, normal play(BlackWhiteRecording)

* fixed effects models
* tq - baseline
xtreg LN_TQ_1 LN_ESG, fe vce(cluster REIT)

* tq - firm specific controls
xtreg LN_TQ_1 LN_ESG LN_COE LN_LEV LN_ASSETS LN_VOL LN_SALES LN_MCAP, fe
vce(cluster REIT)

* tq - real estate market conditions
```

```
xtreg LN_TQ_1 LN_ESG LN_COE LN_LEV LN_ASSETS LN_VOL LN_SALES LN_MCAP
RE_INDEX, fe vce(cluster REIT)

* tq - time fixed effects
xtreg LN_TQ_1 LN_ESG LN_COE LN_LEV LN_ASSETS LN_VOL LN_SALES LN_MCAP
RE_INDEX i.YEAR, fe vce(cluster REIT)

* test whether time fixed effects should be included
testparm i.YEAR

* tq - Lagged ESG
xtreg LN_TQ_1 LN_LAG_ESG LN_COE LN_LEV LN_ASSETS LN_VOL LN_SALES LN_MCAP
RE_INDEX i.YEAR, fe vce(cluster REIT)

* coe - baseline
xtreg LN_COE LN_ESG, fe vce(cluster REIT)

* coe - firm specific controls
xtreg LN_COE LN_ESG LN_TQ_1 ROA_def LN_ASSETS LN_LEV BETA ICR VOL, fe
vce(cluster REIT)

* coe - time fixed effects
xtreg LN_COE LN_ESG LN_TQ_1 ROA_def LN_ASSETS LN_LEV BETA ICR VOL i.YEAR, fe
vce(cluster REIT)

* test whether time fixed effects should be included
testparm i.YEAR

* coe - Lagged ESG
xtreg LN_COE LN_LAG_ESG LN_TQ_1 ROA_def LN_ASSETS LN_LEV BETA ICR VOL
i.YEAR, fe vce(cluster REIT)

* seperate ESG pillars (environmental, social, governance)
* tq
xtreg LN_TQ_1 LN_ENV LN_COE LN_LEV LN_ASSETS LN_VOL LN_SALES LN_MCAP
RE_INDEX i.YEAR, fe vce(cluster REIT)

xtreg LN_TQ_1 LN_SOC LN_COE LN_LEV LN_ASSETS LN_VOL LN_SALES LN_MCAP
RE_INDEX i.YEAR, fe vce(cluster REIT)

xtreg LN_TQ_1 LN_GOV LN_COE LN_LEV LN_ASSETS LN_VOL LN_SALES LN_MCAP
RE_INDEX i.YEAR, fe vce(cluster REIT)

* coe
xtreg LN_COE LN_ENV LN_TQ_1 ROA_def LN_ASSETS LN_LEV BETA ICR VOL i.YEAR, fe
vce(cluster REIT)
```

xtreg LN_COE LN_SOC LN_TQ_1 ROA_def LN_ASSETS LN_LEV BETA ICR VOL i.YEAR, fe vce(cluster REIT)

xtreg LN_COE LN_GOV LN_TQ_1 ROA_def LN_ASSETS LN_LEV BETA ICR VOL i.YEAR, fe vce(cluster REIT)

* learning effect
xtreg LN_TQ_1 LN_ESG LN_COE LN_LEV LN_ASSETS LN_VOL LN_SALES LN_MCAP RE_INDEX i.YEAR if inrange(YEAR,2011,2015), fe vce(cluster REIT)

xtreg LN_TQ_1 LN_ESG LN_COE LN_LEV LN_ASSETS LN_VOL LN_SALES LN_MCAP RE_INDEX i.YEAR if inrange(YEAR,2016,2020), fe vce(cluster REIT)

xtreg LN_COE LN_ESG LN_TQ_1 ROA_def LN_ASSETS LN_LEV BETA ICR VOL i.YEAR if inrange(YEAR,2011,2015), fe vce(cluster REIT)

xtreg LN_COE LN_ESG LN_TQ_1 ROA_def LN_ASSETS LN_LEV BETA ICR VOL i.YEAR if inrange(YEAR,2016,2020), fe vce(cluster REIT)

* institutional context
xtreg LN_TQ_1 LN_ESG LN_COE LN_LEV LN_ASSETS LN_VOL LN_SALES LN_MCAP RE_INDEX i.YEAR if inrange(COUNTRY,1,21), fe vce(cluster REIT)

xtreg LN_TQ_1 LN_ESG LN_COE LN_LEV LN_ASSETS LN_VOL LN_SALES LN_MCAP RE_INDEX i.YEAR if COUNTRY==22, fe vce(cluster REIT)

xtreg LN_COE LN_ESG LN_TQ_1 ROA_def LN_ASSETS LN_LEV BETA ICR VOL i.YEAR if inrange(COUNTRY,1,21), fe vce(cluster REIT)

xtreg LN_COE LN_ESG LN_TQ_1 ROA_def LN_ASSETS LN_LEV BETA ICR VOL i.YEAR if COUNTRY==22, fe vce(cluster REIT)

* Tobin's q variations for robustness
xtreg LN_TQ_1 LN_ESG LN_COE LN_LEV LN_ASSETS LN_VOL LN_SALES LN_MCAP RE_INDEX i.YEAR, fe vce(cluster REIT)

xtreg LN_TQ_2 LN_ESG LN_COE LN_LEV LN_ASSETS LN_VOL LN_SALES LN_MCAP RE_INDEX i.YEAR, fe vce(cluster REIT)

xtreg LN_TQ_3 LN_ESG LN_COE LN_LEV LN_ASSETS LN_VOL LN_SALES LN_MCAP RE_INDEX i.YEAR, fe vce(cluster REIT)

xtreg LN_TQ_4 LN_ESG LN_COE LN_LEV LN_ASSETS LN_VOL LN_SALES LN_MCAP RE_INDEX i.YEAR, fe vce(cluster REIT)

* first differences as alternative for elimating unobserved heterogeneity for robustness
* tq - First differences

reg D. LN_TQ_1 LN_ESG LN_COE LN_LEV LN_ASSETS LN_VOL LN_SALES LN_MCAP RE_INDEX i.YEAR, noconstant vce(cluster REIT)

* coe - First differences
reg D. LN_COE LN_ESG LN_TQ_1 ROA_def LN_ASSETS LN_LEV BETA ICR VOL i.YEAR, noconstant vce(cluster REIT)

* constant sample estimates for robustness
* tq - baseline
xtreg LN_TQ_1 LN_ESG if CONSTANT_SAMPLE==1, fe vce(cluster REIT)

* tq - firm specific controls
xtreg LN_TQ_1 LN_ESG LN_COE LN_LEV LN_ASSETS LN_VOL LN_SALES LN_MCAP if CONSTANT_SAMPLE==1, fe vce(cluster REIT)

* tq - real estate market conditions
xtreg LN_TQ_1 LN_ESG LN_COE LN_LEV LN_ASSETS LN_VOL LN_SALES LN_MCAP RE_INDEX if CONSTANT_SAMPLE==1, fe vce(cluster REIT)

* tq - time fixed effects
xtreg LN_TQ_1 LN_ESG LN_COE LN_LEV LN_ASSETS LN_VOL LN_SALES LN_MCAP RE_INDEX i.YEAR if CONSTANT_SAMPLE==1, fe vce(cluster REIT)

* tq - Lagged ESG
xtreg LN_TQ_1 LN_LAG_ESG LN_COE LN_LEV LN_ASSETS LN_VOL LN_SALES LN_MCAP RE_INDEX i.YEAR if CONSTANT_SAMPLE==1, fe vce(cluster REIT)

* coe - baseline
xtreg LN_COE LN_ESG if CONSTANT_SAMPLE==1, fe vce(cluster REIT)

* coe - firm specific controls
xtreg LN_COE LN_ESG LN_TQ_1 ROA_def LN_ASSETS LN_LEV BETA ICR VOL if CONSTANT_SAMPLE==1, fe vce(cluster REIT)

* coe - time fixed effects
xtreg LN_COE LN_ESG LN_TQ_1 ROA_def LN_ASSETS LN_LEV BETA ICR VOL i.YEAR if CONSTANT_SAMPLE==1, fe vce(cluster REIT)

* coe - Lagged ESG
xtreg LN_COE LN_LAG_ESG LN_TQ_1 ROA_def LN_ASSETS LN_LEV BETA ICR VOL i.YEAR if CONSTANT_SAMPLE==1, fe vce(cluster REIT)

* random effect models for robustness
* tq - baseline
xtreg LN_TQ_1 LN_ESG, re vce(cluster REIT)

* tq - firm specific controls

```
xtreg LN_TQ_1 LN_ESG LN_COE LN_LEV LN_ASSETS LN_VOL LN_SALES LN_MCAP, re
vce(cluster REIT)

* tq - real estate market conditions
xtreg LN_TQ_1 LN_ESG LN_COE LN_LEV LN_ASSETS LN_VOL LN_SALES LN_MCAP
RE_INDEX, re vce(cluster REIT)

* tq - time fixed effects
xtreg LN_TQ_1 LN_ESG LN_COE LN_LEV LN_ASSETS LN_VOL LN_SALES LN_MCAP
RE_INDEX i.YEAR, re vce(cluster REIT)

* tq - Lagged ESG
xtreg LN_TQ_1 LN_LAG_ESG LN_COE LN_LEV LN_ASSETS LN_VOL LN_SALES LN_MCAP
RE_INDEX i.YEAR, re vce(cluster REIT)

* coe - baseline
xtreg LN_COE LN_ESG, re vce(cluster REIT)

* coe - firm specific controls
xtreg LN_COE LN_ESG LN_TQ_1 ROA_def LN_ASSETS LN_LEV BETA ICR VOL, re
vce(cluster REIT)

* coe - time fixed effects
xtreg LN_COE LN_ESG LN_TQ_1 ROA_def LN_ASSETS LN_LEV BETA ICR VOL i.YEAR, re
vce(cluster REIT)

* coe - Lagged ESG
xtreg LN_COE LN_LAG_ESG LN_TQ_1 ROA_def LN_ASSETS LN_LEV BETA ICR VOL
i.YEAR, re vce(cluster REIT)
```

Appendix II Additional descriptive statistics

Table 6 Definitions of financial input variables

Variable	Definition
Market capitalisation	The market capitalisation is the market price – year end multiplied by the number of common shares outstanding. Market price – year end represents the closing price of the company's stock at their fiscal year end.
Preferred stock	Preferred stock of subsidiary and premium on preferred stock is included in preferred stock. It excludes minority interest in preferred stock. For Non-U.S. Corporations, the stated value of preferred stock is shown, and it includes all preferred stock related accounts. For Non-U.S. Corporations preference stock which participates with the common/ordinary shares in the profits of the company is included in common equity. It includes but is not restricted to: - Redeemable preferred stock - Non-redeemable preferred stock
Long term debt	Long term debt represents all interest-bearing financial obligations, excluding amounts due within one year. It is shown net of premium or discount. It includes but is not restricted to: - Mortgages - Bonds - Debentures - Convertible debt - Sinking fund debentures - Long term bank overdrafts - Long term notes - Long term bills - Medium term loans

	- Long term royalties - Long term contracts - Industrial revenue bonds - Notes payable, due within one year and to be refunded by long term debt when carried as non-current liability - Long term prepaid contracts - Advances and production payments - Talent and broadcasting rights - Capitalized lease obligations - Revolving credit - Long term advances from subsidiaries/associated companies - Compulsory convertible debt (South Africa) - Eurodollar borrowing - Long term liability in connection with ESOP - Federal Home Loan advances It excludes: - Current portion of long-term debt - Pensions - Deferred taxes - Minority interest
Short term debt	Short term debt represents that portion of debt payable within one year including current portion of long-term debt and sinking fund requirements of preferred stock or debentures. It includes but is not restricted to: - Current portion of long-term debt (field 18232) - Notes payable, arising from short-term borrowings - Current maturities of participation and entertainment obligations - Contracts payable for broadcast rights - Current portion of advances and production payments - Current portion of long-term debt that must be paid back during the next twelve months and included in long term debt - Bank Overdrafts

	- Advances from subsidiaries/associated companies, if the term of the loan is not known it is assumed to be long term debt - Current portion of preferred stock of a subsidiary - Treasury tax and loan demand notes - Short sales of U.S. government securities - Eurodollar borrowings, if not reported separately and the amount cannot be separated It excludes: - Securities loaned
Total assets	Total assets represent the sum of cash and equivalents, receivables, securities inventory, custody securities, total investments, net loans, net property, plant and equipment, investments in unconsolidated subsidiaries and other assets.
Risk free rate	The risk-free rate in this study serves as input for the CAPM to estimate the cost of equity. The risk-free rate for the euro is the ten-year German government bond yield, as we assume this asset offers the most risk-free investment for a European investor. For a UK based REIT, however, cashflows are in GBP and the risk-free rate should be accordingly (Damodaran, 2008). Therefore, the ten-year UK government bond yield serves as risk-free rate for UK REITs. Note that negative bond yields are equal to zero in CAPM, since a rational investor would seek non-negative return yielding investments (e.g. cash, gold or bank deposit) instead.
Beta	The beta factor is derived by performing a least squares regression between adjusted prices of the stock and the corresponding market index (e.g. FT All share in UK and AEX Index in The Netherlands). The historic beta so derived is then adjusted using Bayesian techniques to predict the probable behaviour of the stock price on the basis that any extreme behaviour in the past is likely to average out in the future. The beta thus represents the adjusted value, or "forecast" beta.
Expected return on market portfolio	The market portfolio is proxied by the FTSE EPRA Nareit Developed Europe REITS Index, which is a subset of the FTSE

	EPRA Nareit Developed Index. The expected return is the year-on-year performance of the total return (EUR).
Leverage	Leverage is the total debt, calculated as the sum of short term debt and long term debt, divided by the total assets.
Volatility	A measure of a stock's average annual price movement to a high and low from a mean price for each year. For example, a stock's price volatility of twenty per cent indicates that the stock's annual high and low price has shown a historical variation of plus twenty per cent to minus twenty per cent from its annual average price.
Net sales	Net sales (or revenues) represent gross sales and other operating revenue less discounts, returns and allowances. It includes but is not restricted to: - Franchise sales when corresponding costs are available and included in expenses. - Consulting fees - Service income - Royalty income when included in revenues by the company. - Contracts-in-progress income - Licensing and franchise fees - Income derived from equipment lease or rental when considered part of operating revenue - Commissions earned (not gross billings) for advertising companies - Income from leased departments It excludes: - Non-operating income - Interest income - Interest capitalized - Equity in earnings of unconsolidated subsidiaries - Rental income - Dividend income - Foreign exchange adjustment - Gain on debt retired - Sale of land or natural resources

	- Sale of plant and equipment - Sale of investment - Sales from discontinued operations - Security transactions - Income on reserve fund securities when shown separately - Operating differential subsidies for shipping companies - Net mutual aid assistance for airlines companies - General and Service Taxes - Value-Added taxes - Excise taxes - Windfall Profit Taxes
Interest coverage ratio	The interest coverage ratio is the ratio calculated as the EBIT divided by the interest expense. Interest expense represents the service charge for the use of capital before the reduction for interest capitalized. If interest expense is reported net of interest income, and interest income cannot be found the net figure is shown.

Notes: all definitions, except for the risk-free rate, expected return on the market portfolio and leverage are provided by Thomson Reuters. As the Thomson Reuters database covers a wide variety of geographies, and definitions differ for instance between US and non-US stocks, we only include the definitions relevant for our study area here. Please note that these are the definitions of the raw data, data transformations or deflating series applied later in the process are not included in the definitions.

Table 7 Panel data summary statistics

Variable		Mean	Std. Dev.	Min	Max	Observations
REIT	overall	104.758	58.461	2	210	N = 521
	between		59.009	2	210	n = 95
	within		0	104.758	104.758	T-bar = 5.484
Year	overall	2015.931	2.735	2011	2020	N = 521
	between		1.800	2012.5	2020	n = 95
	within		2.348	2011.431	2020.82	T-bar = 5.484
Tobin's *q*	overall	0.909	0.154	0.267	1.449	N = 521
	between		0.150	0.403	1.399	n = 95
	within		0.091	0.581	1.203	T-bar = 5.484
Cost of equity	overall	0.050	0.023	0.002	0.161	N = 521
	between		0.020	0.004	0.098	n = 95

	within		0.016	-0.009	0.137	T-bar = 5.484
ESG	overall	51.340	20.860	2.69	93.13	N = 521
	between		19.064	6.868	90.384	n = 95
	within		8.482	19.629	84.315	T-bar = 5.484
Assets	overall	9743.304	14382.11	64.844	104622.1	N = 521
	between		13137.8	214.274	64067.14	n = 95
	within		5094.406	-18602.53	50298.28	T-bar = 5.484
Market Cap	overall	4813.39	7438.108	20.605	57351.39	N = 521
	between		6867.379	44.809	37191.03	n = 95
	within		3185.085	-11874.86	30852.65	T-bar = 5.484
Net Sales	overall	623.044	885.025	0	5714.83	N = 521
	between		883.393	26.716	5298.664	n = 95
	within		230.489	-745.933	2211.564	T-bar = 5.484
Leverage	overall	0.374	0.129	0	0.702	N = 521
	between		0.120	0.022	0.625	n = 95
	within		0.055	0.014	0.588	T-bar = 5.484
ROA	overall	0.058	0.054	-0.173	0.281	N = 521
	between		0.028	-0.006	0.132	n = 95
	within		0.046	-0.181	0.248	T-bar = 5.484
Beta	overall	0.804	0.440	-0.026	3.08	N = 521
	between		0.354	0.037	1.765	n = 95
	within		0.292	-0.363	2.507	T-bar = 5.484
Volatility	overall	0.254	0.150	0.086	1.045	N = 521
	between		0.108	0.092	0.810	n = 95
	within		0.104	-0.099	0.771	T-bar = 5.484
ICR	overall	7.271	8.701	-8.57	57.47	N = 521
	between		5.980	-0.91	34.541	n = 95
	within		6.568	-23.932	51.469	T-bar = 5.484
Market Index	overall	0.080	0.192	-0.24	0.322	N = 521
	between		0.093	-0.24	0.322	n = 95
	within		0.186	-0.243	0.428	T-bar = 5.484

Notes: (note what the overall, between and within refer to).

Appendix III Correlation matrices

	Tobin's *q*	ESG	COE	Leverage	Total Assets	Volatility	Net Sales	Market Cap	RE Index
Tobin's *q*	1.0000								
ESG	0.1353	1.0000							
COE	-0.2626	0.1278	1.0000						
Leverage	0.2362	0.0743	0.1628	1.0000					
Total Assets	0.0181	0.3492	0.1666	0.2356	1.0000				
Volatility	-0.4035	-0.1038	0.7854	0.1037	-0.0404	1.0000			
Net Sales	0.0425	0.2792	0.1870	0.3220	0.9268	0.0045	1.0000		
Market Cap	0.1169	0.3432	0.1117	0.1322	0.9590	-0.1038	0.8643	1.0000	
RE Index	0.1499	-0.0204	0.0829	0.0281	0.0194	0.0339	0.0425	0.0551	1.0000

	COE	ESG	Tobin's *q*	ROA	Total Assets	Leverage	Beta	ICR	Volatility
COE	1.0000								
ESG	0.1278	1.0000							
Tobin's *q*	-0.2626	0.1353	1.0000						
ROA	0.0462	0.1066	0.3608	1.0000					
Total Assets	0.1666	0.3492	0.0181	0.0481	1.0000				
Leverage	0.1628	0.0743	0.2362	-0.1644	0.2356	1.0000			
Beta	0.9881	0.1296	-0.2684	0.0279	0.1554	0.1453	1.0000		
ICR	-0.1707	-0.0309	0.0778	0.4443	0.1562	-0.3441	-0.1742	1.0000	
Volatility	0.7854	-0.1038	-0.4035	-0.1048	-0.0404	0.1037	0.8071	-0,1862	1.0000

Table 8 VIF

Variable	VIF	1/VIF
Volatility	3.81	0.262610
Beta	3.67	0.272222
Tobin's *q*	1.64	0.608933
ROA	1.59	0.628347
ICR	1.57	0.637321
Leverage	1.47	0.680218
Total Assets	1.41	0.709690
ESG	1.28	0.781327
Mean VIF	2.06	

Appendix IV Assumptions concerning disturbance terms

Table 9 shows the set of assumptions underlying the classical linear regression model. If assumption (1) to (4) hold, the estimators obtained by Ordinary Least Squares (OLS) are known as the best linear unbiased estimators (BLUE). Essentially, this means that the estimators have the desirable properties that they are consistent, unbiased, and efficient (Brooks & Tsolacos, 2010, p. 87). The fifth assumption is typically required in classical linear regression models to make valid inferences about population parameters based on the sample parameters in finite samples (Brooks & Tsolacos, 2010, p. 86).

Table 9 Assumptions concerning disturbance terms (Brooks & Tsolacos, 2010, p. 86)

Technical notation	Interpretation
1. $E(\varepsilon_t) = 0$ Linearity	The errors have zero mean
2. $Var(\varepsilon_t) = \sigma^2 < \infty$ Homoscedasticity	The variance of the errors is constant and finite over all values of x_t
3. $Cov(\varepsilon_i, \varepsilon_j) = 0$ No autocorrelation	The errors are statistically independent of one another
4. $Cov(\varepsilon_t, x_t) = 0$ Independence	There is no relationship between the error and corresponding x variable
5. $\varepsilon_t \approx N(0, \sigma^2)$ Normality	The errors are approximately normally distributed

1. Linearity

The first assumption of linearity requires the average value of the errors to be zero. To test for this, we first recovered the regression residuals for the market value and cost of equity models, respectively, which both turn out to be close to zero (Table 10). Moreover, all our models contain a constant in the regression equation, which causes that the linearity assumption can never be violated (Brooks & Tsolacos, 2010, p. 137).

Table 10 Regression residuals for relative market value (alphafehat1) and cost of equity (alphafehat2)

Variable	Obs	Mean	Std. Dev.	Min	Max
alphafehat1	521	1.54e-10	.0756111	-.3444926	0.1969054
alphafehat2	521	-6.24e-10	.2477863	-1.580896	0.4806531

2. Homoscedasticity

The second assumption of homoscedasticity requires that the variance of the errors is constant (Brooks & Tsolacos, 2010, p. 138). As the *FE* estimator is the main estimator we interpret for this study, we can use the modified Wald statistic to test for groupwise heteroscedasticity in the residuals of a *FE* estimator, following Greene (2000, p. 598). The test is called the modified Wald statistic because one modification has been applied to allow for unbalanced panels, as the one we have at hand. The modified Wald statistic tests the hypothesis that sigma^2(i)==sigma for i=1,N_g, where N_g is the number of cross-sectional units. The results of the modified Wald statistic in Table 11 and Table 12 are significant for the market value and cost of equity models, respectively, rejecting the null hypothesis of homoscedasticity. Moreover, for small samples and panels with 'large N, small T', simulations have shown that its power is low, and the test should be used with caution. To control for potential heteroscedasticity, we apply the cluster robust Huber-White standard errors for all models we estimate. The use of cluster robust Huber-White standard errors also relates to the third assumption of no autocorrelation we discuss next.

Table 11 Modified Wald test for groupwise heteroscedasticity of the market value model

H0: sigma(i)^2 = sigma^2 for all i	
chi2 (95) =	27650.56
Prob>chi2 =	0.0000

Table 12 Modified Wald test for groupwise heteroscedasticity of the cost of equity model

H0: sigma(i)^2 = sigma^2 for all i	
chi2 (95) =	4.3e+34
Prob>chi2 =	0.0000

3. No autocorrelation

The third assumption of no autocorrelation requires the errors to be uncorrelated with one another (Brooks & Tsolacos, 2010, p. 144). *A priori,* it is likely that our data violates the no autocorrelation assumption as $T>2$. In fact, Schmidheiny (2020) argues that one can never be sure about the presence of serial correlation in such panels and advises to always use cluster robust Huber-White standard errors (see Woolridge, 2002 for a discussion). However, we test for the presence of autocorrelation formally using the Wooldridge test for autocorrelation in panel data, which Drukker (2003) presents simulation evidence for that this test has good size and power properties in reasonable sample sizes. The results of the Wooldridge tests in Table 13 and Table 14, respectively, are significant, rejecting the null hypotheses of no autocorrelation for the market value and cost of equity models. Therefore, we control for this by following the advice of Schidheiny (2020) and apply the cluster robust Huber-White standard errors in all models we estimate.

Table 13 Wooldridge test for the market value model

Wooldridge test for autocorrelation in panel data
H0: no first order autocorrelation

F(1, 61) = 60.241
Prob > F = 0.0000

Table 14 Wooldridge test for the cost of equity model

Wooldridge test for autocorrelation in panel data
H0: no first order autocorrelation
F(1, 61) = 139.794
Prob > F = 0.0000

4. Independence

The fourth assumption of independence requires that there is no relationship between the error and corresponding *x* variable (Brooks & Tsolacos, 2010, p. 167). In other words, the fourth assumption requires strict exogeneity. Nikolaev and Van Lent (2005) discuss two main sources of endogeneity: (1) simultaneity, and (2) omitted variables. Simultaneity arises when one of the explanatory variables is determined simultaneously with the dependent variable (Wooldridge, 2002). Earlier literature has already investigated simultaneity bias in the relationship between the financial performance and found that the simultaneity bias does not invalidate the results obtained via OLS (Cajias et al., 2012; Cajias et al., 2014). In specific, these studies apply a Granger causality test and find no empirical support for the hypothesis of circular causality. Moreover, as a modification to our main models, we include lagged ESG performance instead of contemporaneous ESG performance, so that the exogeneity assumption must hold.

The second source of endogeneity, omitted variables, occurs when the error term consists of omitted variables and the omitted variables are correlated with the explanatory variables (Wooldridge, 2002). In simple terms, the Hausman test is a test of endogeneity, as the null hypothesis states that the individual effects are uncorrelated with the other regressors (Park, 2011). We run the Hausman test for the market value model and reject the null hypothesis of the Hausman test (Table 15), favouring the *FE* estimator over the *RE* estimator. The data for the cost of equity model failed to meet the asymptotic assumptions of the Hausman test, so the `xtoverid` test is preferred over the Hausman test. The test statistic delivered by the `xtoverid` test is a Wald statistic, which under the conditional assumption of homoscedasticity is asymptotically equivalent to the usual Hausman fixed-vs-random effects test. As we already know the data suggests heteroscedasticity, we apply the cluster-robust standard errors. Based on the result reported in Table 16, we reject the null hypothesis and favour the *FE* estimator over the *RE* estimator for the cost of equity model as well.

As we move forward with the *FE* estimators for the market value and cost of equity models, respectively, in our main analysis, we remove the main source of endogeneity: unobserved heterogeneity (Wooldridge, 2002). Still, endogeneity might be present in *FE* models. However, Wooldridge (2010) designed a test for strict exogeneity in *FE* models, under the null hypothesis of strict exogeneity. We execute the Wooldridge test for strict exogeneity and do not reject the null hypothesis of strict exogeneity for the market value model and the cost of equity models, respectively.

Table 15 Hausman test for the market value model

Test: Ho: difference in coefficients not systematic
chi2(16) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 37.50
Prob>chi2 = 0.0018
(V_b-V_B is not positive definite)

Table 16 `xtoverid` test for the cost of equity model

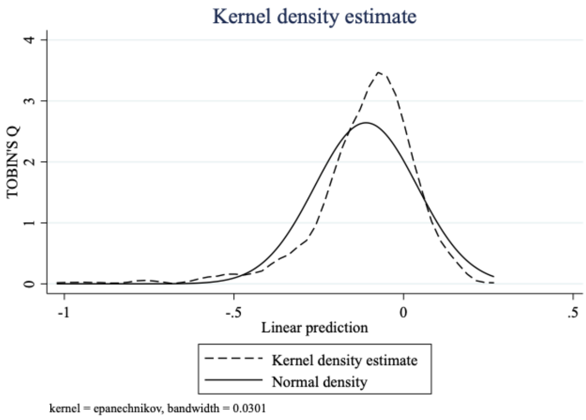
Test of overidentifying restrictions: fixed vs random effects
Cross-section time-series model: xtreg re robust cluster(REIT)
Sargan-Hansen statistic 303.640
Chi-sq(17)
P-value = 0.0000

5. Normality

We already know that if assumption (1) to (4) hold, the estimates are BLUE. To make statistical inferences, however, one should consider the normality of disturbances. However, in the panel data context, and specifically the *FE* context, it is not intuitive to expect a normal distribution, as each panel unit (REIT) has its own intercept (Battese & Coelli, 1995; Levin et al., 2002). Rather, the variables are transformated to make the variables more suitable for linear regression. Despite these notions, we formally test for normality, as it may provide useful insight in the data. Therefore, we obtain the regression residuals of the market value and cost of equity models, respectively, and plot the regression residuals in a Kernal density plot (Figure 4).

The data show signs of an approximate normal distribution, although particularly the regression residuals of the market value model show an aberrant pattern compared to the plotted normality line. However, often in real estate research, it is a few extreme outliers that cause a rejection of the normality assumption (Brooks & Tsolacos, 2010, p. 169). Removing such outliers will reduce the standard errors but is hard to reconcile with the notion that each datapoint offers valuable information (Brooks &

Tsolacos, 2010, p. 170). Instead, before dropping any observation, we double-check the extreme outliers in the data for any incorrect information by verifying with additional sources. We find that the outliers seem to represent the correct information, such as the absence of debt for some years for some REITs (e.g. Harworth Group in 2014) and a negative beta (e.g. Xior Student Housing in 2018).



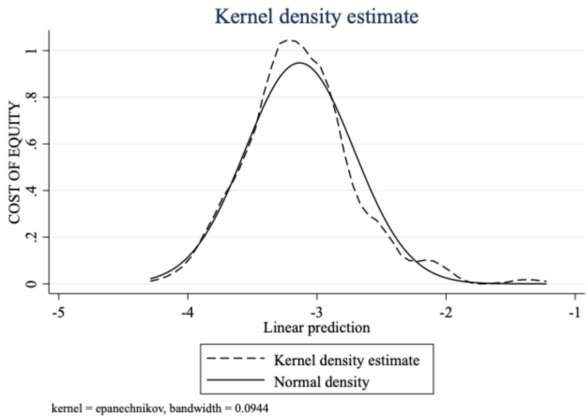


Figure 4 Kernal density plots for the market value (left) and cost of equity (right) models

Appendix V Robustness checks

Neumayer and Plümper (2017, p. 136) suggest testing the stability of the parameters by applying a model variation test, such as testing different operationalisations. The results in Table 17 show that the parameters are robust to different operationalisations of the market value. Below we present the variations, where the first variant is the original measure. Note that the numbers of the models correspond to the description of the variant.

Table 17 Different operationalisations of the relative market valuation

	(1)	(2)	(3)	(4)
ESG	-0.010	0.001	0.005	-0.011
	(0.028)	(0.026)	(0.031)	(0.028)
Cost of equity	-0.008	-0.007	0.009	-0.007
	(0.014)	(0.018)	(0.023)	(0.014)
Leverage	0.149***	0.213***	0.125***	0.149***
	(0.033)	(0.044)	(0.036)	(0.033)
Total Assets	-0.397***	-0.979***	-0.291***	-0.398***
	(0.072)	(0.045)	(0.075)	(0.072)
Volatility	0.008	0.075*	-0.025	0.008
	(0.047)	(0.039)	(0.041)	(0.047)
Net Sales	-0.004	-0.014	-0.012**	-0.004
	(0.009)	(0.009)	(0.005)	(0.009)
Market Cap	0.377***	0.916***	0.255***	0.377***
	(0.071)	(0.027)	(0.079)	(0.072)
Market Index	0.057	-0.338	0.470*	0.052
	(0.196)	(0.205)	(0.243)	(0.196)
Constant	0.531**	1.286***	0.706***	0.534**
	(0.208)	(0.278)	(0.256)	(0.208)
Time fixed effects	YES	YES	YES	YES
Observations	521	521	492	521
Number of REITs	95	95	93	95
Number of time periods	10	10	10	10
R-squared	0.730	0.930	0.557	0.730

Notes: Table reports the panel *FE* regression results. Dependent variables are the natural logarithms of several variations of Tobin's q, which model numbers correspond with the description directly after this table. Cluster-robust Huber-White standard errors (clustered by REIT) in parentheses. Significance at *** p<0.01, ** p<0.05 and * p<0.1, respectively.

(1) Tobin's *q*

The first variation of Tobin's *q* is the main measure discussed in the third chapter, and has been widely used in studies with a similar research aim (Cajias et al., 2014; Han, 2006; Konar & Cohen, 2001). We operationalise the Tobin's *q* following Perfect and Wiles (1994):

$$Tq = \frac{MVC + MVP + LTD + STD}{TA} \tag{5}$$

Where *Tq* denotes the Tobin's *q*; *MVC* denotes the market value of common stocks; *MVP* the market value of preferred securities; *LTD* the book value of long-term debt; *STD* the book value of short-term debt, and; *TA* the book value of total assets.

(2) Tobin's *q*

The second variation is defined by the Network for Business Sustainability (Turner, 2013), and transfers the debt from the nominator to the denominator. The rationale to do so lies in the fact that the replacement cost of assets should reflect the firm's net assets. Therefore, we specify the second Tobin's *q* variation as follows:

$$Tq = \frac{MVC + MVP}{TA + LTD + STD} \tag{6}$$

Where *Tq* denotes the Tobin's *q*; *MVC* denotes the market value of common stocks; *MVP* the market value of preferred securities; *LTD* the book value of long-term debt; *STD* the book value of short-term debt, and; *TA* the book value of total assets.

(3) Tobin's *q*

The third variation is used in several governance and ESG disclosure papers which use Tobin's *q* to proxy firm performance (Bauer et al. 2010; Fatemi et al., 2018; Servaes & Tamayo, 2013). The total value of the firm is determined by the market cap and total assets, from which the book value of equity and deferred taxes are subtracted, leading to:

$$Tq = \frac{MVC + TA - BVE - DEFTAX}{TA} \tag{7}$$

Where *Tq* denotes the Tobin's *q*; *MVC* denotes the market value of common stocks; *TA* the book value of total assets; *BVE* the book value of equity, and; *DEFTAX* the value of deferred taxes. Noteworthy, this variation has less observations due to extreme negative outliers, as some REITs have a relatively high book value of equity.

(4) Tobin's *q*

The final variation is a simplified version of the Tobin's *q*, however still closely related to the operationalisation of Perfect and Wiles (1994):

$$Tq = \frac{MVC + LTD + STD}{TA} \tag{8}$$

Where *Tq* denotes the Tobin's *q*; *MVC* denotes the market value of common stocks; *LTD* the book value of long-term debt; *STD* the book value of short-term debt, and; *TA* the book value of total assets.

Table 18 Constant sample estimates for the relative market valuation

	(1)	(2)	(3)	(4)	(5)
ESG	0.009	-0.022	-0.017	-0.011	
	(0.032)	(0.032)	(0.031)	(0.028)	
ESG t_{-1}					-0.000
					(0.018)
Cost of equity		0.003	0.005	-0.004	-0.004
		(0.013)	(0.013)	(0.014)	(0.014)
Leverage		0.165***	0.162***	0.157***	0.156***
		(0.036)	(0.037)	(0.041)	(0.041)
Total Assets		-0.437***	-0.423***	-0.407***	-0.404***
		(0.075)	(0.079)	(0.087)	(0.090)
Volatility		0.007	0.002	0.004	0.005
		(0.033)	(0.034)	(0.047)	(0.046)
Net Sales		-0.002	-0.001	-0.001	-0.001
		(0.013)	(0.013)	(0.013)	(0.013)
Market Cap		0.401***	0.393***	0.381***	0.380***
		(0.083)	(0.084)	(0.086)	(0.087)
Market Index			0.046*	-0.010	-0.000
			(0.023)	(0.063)	(0.066)

Constant	-0.146	0.759***	0.674***	0.576**	0.518*
	(0.123)	(0.198)	(0.183)	(0.247)	(0.263)
Time fixed effects	NO	NO	NO	YES	YES
Observations	429	429	429	429	429
Number of REITs	87	87	87	87	87
Number of time periods	10	10	10	10	10
R-squared	0.000	0.702	0.707	0.719	0.719

Notes: Table reports the panel *FE* regression results. Dependent variable is the natural logarithm of Tobin's *q*. Cluster-robust Huber-White standard errors (clustered by REIT) in parentheses. Significance at *** p<0.01, ** p<0.05 and * p<0.1, respectively.

Table 19 RE estimates for the relative market valuation

	(1)	(2)	(3)	(4)	(5)
ESG	0.022	-0.014	-0.013	-0.008	
	(0.020)	(0.017)	(0.017)	(0.016)	
ESG t_{-1}					-0.004
					(0.014)
Cost of equity		0.001	0.001	-0.006	-0.006
		(0.010)	(0.010)	(0.010)	(0.011)
Leverage		0.182***	0.181***	0.178***	0.178***
		(0.029)	(0.029)	(0.030)	(0.029)
Total Assets		-0.398***	-0.393***	-0.384***	-0.395***
		(0.059)	(0.059)	(0.062)	(0.070)
Volatility		0.017	0.014	0.010	0.011
		(0.021)	(0.022)	(0.034)	(0.036)
Net Sales		-0.006	-0.005	-0.005	0.001
		(0.007)	(0.007)	(0.007)	(0.012)
Market Cap		0.408***	0.401***	0.393***	0.398***
		(0.059)	(0.060)	(0.062)	(0.070)
Market Index			0.040**	0.123	0.026
			(0.020)	(0.161)	(0.055)
Constant	-0.176**	0.404***	0.391***	0.350***	0.322**
	(0.077)	(0.102)	(0.103)	(0.119)	(0.145)

Time fixed effects	NO	NO	NO	YES	YES
Observations	521	521	521	521	429
Number of REITs	95	95	95	95	87
Number of time periods	10	10	10	10	10

Notes: Table reports the panel *RE* regression results. Dependent variable is the natural logarithm of Tobin's *q*. Cluster-robust Huber-White standard errors (clustered by REIT) in parentheses. Significance at *** $p<0.01$, ** $p<0.05$ and * $p<0.1$, respectively.

Table 20 Relative market value FD

	(1)
ESG	-0.007
	(0.008)
Cost of equity	-0.013
	(0.013)
Leverage	0.022*
	(0.012)
Total Assets	-0.117***
	(0.028)
Volatility	0.087***
	(0.019)
Net Sales	0.003
	(0.008)
Market Cap	0.119***
	(0.027)
Market Index	0.632**
	(0.244)
Time fixed effects	YES
Observations	429
Number of REITs	87
Number of time periods	10
R-squared	0.319

Notes: Table reports *FD* regression results. Dependent variable is the natural logarithm of Tobin's *q*. Cluster-robust Huber-White standard errors (clustered by REIT) in parentheses. No constant included. Significance at *** p<0.01, ** p<0.05 and * p<0.1, respectively.

Table 21 Cost of equity FD

	(1)
ESG	-0.052**
	(0.025)
Tobin's *q*	0.091
	(0.088)
ROA	-0.412
	(0.258)
Total Assets	0.012
	(0.010)
Leverage	0.021
	(0.022)
Beta	0.233***
	(0.076)
ICR	0.006**
	(0.003)
Volatility	-0.436**
	(0.216)
Time fixed effects	YES
Observations	429
Number of REITs	87
Number of time periods	10
R-squared	0.275

Notes: Table reports *FD* regression results. Dependent variable is the natural logarithm of cost of equity. Cluster-robust Huber-White standard errors (clustered by REIT) in parentheses. No constant included. Significance at *** p<0.01, ** p<0.05 and * p<0.1, respectively.

Table 22 Learning effect for periods 2011-2015 and 2016-2020

	(1) 2011-2015 Tobin's *q*	(2) 2016-2020 Tobin's *q*	(3) 2011-2015 Cost of equity	(4) 2016-2020 Cost of equity
ESG	-0.069	-0.032***	-0.048	-0.155**
	(0.049)	(0.012)	(0.051)	(0.060)
Constant	-0.045	0.661***	-2.864***	-6.578***
	(0.378)	(0.166)	(0.273)	(1.436)
REIT characteristics	YES	YES	YES	YES
Time fixed effects	YES	YES	YES	YES
Observations	217	304	217	304
Number of REITs	50	94	50	94
Number of time periods	5	5	5	5
R-squared	0.696	0.913	0.850	0.800

Notes: Table reports the panel *FE* regression results. Dependent variable for model (1) and (2) is the natural logarithm of Tobin's *q*, and the natural logarithm of cost of equity for model (3) and (4). Cluster-robust Huber-White standard errors (clustered by REIT) in parentheses. Significance at *** p<0.01, ** p<0.05 and * p<0.1, respectively.

Table 23 Constant sample estimates for the cost of equity

	(1)	(2)	(3)	(4)
ESG	-0.389***	-0.153***	-0.096**	
	(0.136)	(0.044)	(0.045)	
ESG t_{-1}				-0.059
				(0.042)
Tobin's *q*		-0.158	-0.128	-0.142
		(0.105)	(0.093)	(0.089)
ROA		0.266	0.192	0.182
		(0.228)	(0.220)	(0.218)
Total Assets		-0.154***	-0.047	-0.039
		(0.055)	(0.068)	(0.071)
Leverage		0.176***	0.118**	0.114*

		(0.051)	(0.054)	(0.057)
Beta		1.235***	1.272***	1.269***
		(0.112)	(0.118)	(0.119)
ICR		0.001	0.002	0.002
		(0.002)	(0.002)	(0.002)
Volatility		-1.109***	-1.596***	-1.583***
		(0.305)	(0.428)	(0.433)
Constant	-1.610***	-1.788***	-2.705***	-2.912***
	(0.524)	(0.511)	(0.561)	(0.562)
Time fixed effects	NO	NO	YES	YES
Observations	429	429	429	429
Number of REITs	87	87	87	87
Number of time periods	10	10	10	10
R-squared	0.067	0.841	0.869	0.868

Notes: Table reports the panel *FE* regression results. Dependent variable is the natural logarithm of the cost of equity. Cluster-robust Huber-White standard errors (clustered by REIT) in parentheses. Significance at *** p<0.01, ** p<0.05 and * p<0.1, respectively.

Table 24 RE estimates for the cost of equity

	(1)	(2)	(3)	(4)
ESG	-0.144**	-0.101**	-0.040	
	(0.073)	(0.045)	(0.041)	
ESG t_{-1}				-0.019
				(0.029)
Tobin's *q*		-0.100	-0.068	-0.213***
		(0.097)	(0.078)	(0.073)
ROA		0.201	-0.121	0.145
		(0.263)	(0.249)	(0.245)
Total Assets		0.044	0.068**	0.045*
		(0.032)	(0.029)	(0.023)
Leverage		0.085*	0.025	0.069
		(0.051)	(0.054)	(0.052)
Beta		1.292***	1.313***	1.314***
		(0.124)	(0.124)	(0.118)

ICR		-0.001	0.000	0.002
		(0.002)	(0.002)	(0.002)
Volatility		-0.892**	-1.594***	-1.503***
		(0.377)	(0.439)	(0.433)
Constant	-2.755***	-3.912***	-3.978***	-3.897***
	(0.295)	(0.321)	(0.262)	(0.229)
Time fixed effects	NO	NO	YES	YES
Observations	521	521	521	429
Number of REITs	95	95	95	87
Number of time periods	10	10	10	10

Notes: Table reports the panel *RE* regression results. Dependent variable is the natural logarithm of the cost of equity. Cluster-robust Huber-White standard errors (clustered by REIT) in parentheses. Significance at *** p<0.01, ** p<0.05 and * p<0.1, respectively.

Appendix VI Decomposing underlying drivers

Table 25 Decomposing underlying ESG drivers for the relative market valuation

	(1)	(2)	(3)
Environmental	0.003		
	(0.003)		
Social		0.003	
		(0.017)	
Governance			-0.020
			(0.014)
Cost of equity	-0.009	-0.009	-0.010
	(0.014)	(0.014)	(0.014)
Leverage	0.148***	0.148***	0.149***
	(0.033)	(0.034)	(0.034)
Total Assets	-0.397***	-0.396***	-0.395***
	(0.074)	(0.072)	(0.073)
Volatility	0.010	0.009	0.009
	(0.046)	(0.047)	(0.046)
Net Sales	-0.004	-0.004	-0.004
	(0.009)	(0.010)	(0.009)
Market Cap	0.376***	0.376***	0.379***
	(0.073)	(0.073)	(0.072)
Market Index	0.123	0.103	0.055
	(0.198)	(0.197)	(0.191)
Constant	0.489**	0.480**	0.532**
	(0.220)	(0.216)	(0.210)
Time fixed effects	YES	YES	YES
Observations	521	521	521
Number of REITs	95	95	95
Number of time periods	10	10	10
R-squared	0.731	0.730	0.733

Notes: Table reports the panel *FE* regression results. Dependent variable is the natural logarithm of Tobin's q. Cluster-robust Huber-White standard errors (clustered by REIT) in parentheses. Significance at *** p<0.01, ** p<0.05 and * p<0.1, respectively.

Table 26 Decomposing underlying ESG drivers for the cost of equity

	(1)	(2)	(3)
Environmental	-0.018***		
	(0.006)		
Social		-0.077***	
		(0.029)	
Governance			-0.028
			(0.040)
Tobin's *q*	0.004	-0.010	-0.007
	(0.100)	(0.098)	(0.099)
ROA	-0.141	-0.048	-0.139
	(0.239)	(0.225)	(0.238)
Total Assets	-0.006	-0.022	-0.007
	(0.077)	(0.075)	(0.081)
Leverage	0.045	0.042	0.042
	(0.056)	(0.056)	(0.056)
Beta	1.253***	1.261***	1.230***
	(0.121)	(0.120)	(0.117)
ICR	0.001	0.001	0.002
	(0.002)	(0.002)	(0.002)
Volatility	-1.616***	-1.634***	-1.562***
	(0.426)	(0.427)	(0.417)
Constant	-3.352***	-3.003***	-3.292***
	(0.595)	(0.570)	(0.560)
Time fixed effects	YES	YES	YES
Observations	521	521	521
Number of REITs	95	95	95
Number of time periods	10	10	10
R-squared	0.810	0.811	0.808

Notes: Table reports the panel *FE* regression results. Dependent variable is the natural logarithm of Tobin's *q*. Cluster-robust Huber-White standard errors (clustered by REIT) in parentheses. Significance at *** p<0.01, ** p<0.05 and * p<0.1, respectively.