The effect of ESG performance on the financial performance of US REITs

Abstract

This study investigates the relationship of Environmental, Social and Governance (ESG) performance on the financial performance of US Real Estate Investment Trusts for the 2012-2020 period. Despite a large body of research in the finance literature, empirical studies on ESG and financial performance in the real estate sector are still scarce. In general, the results suggest that there is no significant relationship between ESG and operating performance, and between ESG and stock performance. However, we find a significant negative relationship between lagged ESG performance and the relative market value measured by the natural logarithm of Tobin's Q. Furthermore, we find a significant positive relationship between the year-over-year change in ESG score and market value. Further in-depth analysis shows us that the year-over-year changes in governance and social scores are the main drivers.

Master Thesis Real Estate Studies

Sander Kaj Geres

S2937670

31 December 2022

Supervisor: Dr. F.P.W. Schilder

Words: 9.735

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1 Introduction

During the 2015 United Nations Climate Change Conference in Paris, 174 states and the European Union signed a climate treaty with the objective to limit global warming to a maximum of 2 degrees Celsius compared to pre-industrial levels. Investors and firms are experiencing increasing pressure from governments and other stakeholders to accomplish this goal. Since the real estate and construction sector is responsible for 40% of global carbon emissions (Deloitte, 2020), the sector's performance is crucial to achieve the 2015 Paris Climate Agreement. The real estate sector has seen various concepts of sustainability in the past decades such as Responsible Property Investment (RPI), Corporate Social Responsibility (CSR), and more recently, a framework consisting of Environmental, Social, and Governance (ESG). Syntrus Achmea Real Estate & Finance state in their ESG 2020 – 2030 strategy that the 'E' from ESG is of the highest relevance (Synstrus Achmea, 2020), but also social and governance initiatives by real estate firms are becoming more important. For example, the societal demand for social impact investing like tenant shared spaces, investing in social housing, and the transformation of underutilized buildings. Governance is essential with respect to money laundry, anti-bribery and legal fines. ESG is a diverse framework to measure this broad range of initiatives.

Investors are increasingly incorporating sustainability practices of real estate firms into their investment decisions. Whereas 'being sustainable' was initially often considered as a silver lining, the debate has recently shifted more towards a prerequisite. According to a report by McKinsey & Company, 93% of investors include Environmental, Social and Governmental (ESG) criteria in their investment decisions which shows great awareness (McKinsey & Company, 2021). Additionally, in recent years, a wide range of stakeholders have encouraged and demanded real estate firms to increase sustainability. Currently, the majority of international firms publish sustainability reports to meet these demands. To get a better understanding of how the real estate sector links a broader concept of sustainability to financial performance, we specifically focus on ESG and Real Estate Investment Trusts (REITs) performance in this paper. Listed REITs are a convenient opportunity for investors to get access to the real estate market since REITs offer the potential to build a diversified portfolio.

Despite a large body of empirical research on the relationship between ESG and financial performance within the finance literature, studies on ESG and real estate financial performance are still rather scarce. In their meta-analysis, Friede et al. (2015) analyse over 2,000 empirical studies on the ESG – financial performance relationship, of which only seven focus on the real estate sector. The effect of ESG or comparable concepts on real estate financial performance has been mainly researched by focusing on energy efficiency labels such as LEED or Energy Star. The majority of previous research focuses on the asset level by investigating the relationship of those energy effectivity labels on rents, vacancy, and property prices (Eichholtz et al., 2010; Fuerst & McAllister, 2011; Miller, Spivey & Florance, 2011; Reichardt et al., 2012; Cajias & Piazolo, 2013). The latter studies mainly focus on offices as assets. The

literature on the portfolio level is growing (Eichholtz et al., 2012; Fuerst, 2015; Brounen & Marcato, 2018; Mariani et al., 2018;), but is still relatively limited. Thus far, relatively little is known regarding the empirical effects of ESG on REIT financial performance. Therefore, this study focuses on the portfolio level by investigating the effect of ESG performance on financial performance, firm value, and stock performance. Furthermore, we break down the ESG framework into the three individual components to analyse the individual effects on financial performance. This brings us to the main research question:

How is ESG performance associated with the financial performance of US REITs?

Additionally, this study aims to address whether a positive change in EP could affect financial performance. Sometimes a relative score does say more than an absolute score. Syntrus Achmea Real Estate & Finance for example state in a LinkedIn press release[1] that due to modernization and enhancing sustainability, their German residential portfolio scored over 14% higher on the GRESB sustainability benchmark compared to the previous year. REITs with low absolute EP scores, but relatively high relative EP scores could be attractive to investors in the long-term. For REITs with already high ESG performance, it is more difficult to obtain an even higher ESG score. For REITs with low ESG performance, there is a great potential to increase ESG performance.

To answer the main research question, we employ an unbalanced panel data approach that covers the period from 2012 to 2020, containing annual data, of the US market to obtain empirical findings. The data consists of 849 REIT-year observations for 149 unique REITs. The data used for this research is collected from the Thomson Reuters Eikon database. This research focuses on the US market because this is the largest and also the most mature REIT market. Furthermore, by focusing on one market, we do not have the potential issue of cross-country differences.

We do not find a significant relationship between ESG and operating performance for a wide range of ESG variables. For the relative market valuation, measured by the natural logarithm (ln) of Tobin's Q, we do find a negative significant relationship between the lagged ESG score and ln Tobin's Q. On the other hand, we find a positive significant relationship between the year-over-year (y-o-y) change in ESG performance and ln Tobin's Q. Further analysis shows that the social pillar and the governance pillar are the main drivers behind this positive relationship.

[1] Syntrus Achmea Real Estate & Finance, March 6th, 2021, https://www.linkedin.com/company/syntrus-achmea-real-estate-&-finance/?originalSubdomain=nl

The remainder of this paper is organized as follows: Section two sets out a literature review to provide a theoretical background on previous research. Section three discusses the data selection and variables. The fourth section elaborates the methodology. Section five presents the regression results. Section six presents a discussion of the obtained results and section seven concludes.

2 Literature review

Chapter 2 provides an overview of the general ESG – financial performance relationship in section 2.1. This relationship is extensively researched within the finance literature. Section 2.2 describes the latter relationship specifically for the real estate sector, and we will narrow this relationship down to the REIT market. Finally, in section 2.3 we will use the information of the first sections to formulate the hypotheses.

2.1 General ESG – financial performance relationship

The literature provides several perspectives on the general ESG – financial performance relationship. According to the traditionalist neoclassical view, CSR initiatives impose additional costs on firms. (Palmer, Oates, & Portney, 1995). Cajias et al. (2014) state that the direct costs of implementing an active ESG strategy contain of implementation and monitoring, while indirect costs are associated with rejecting profitable investment opportunities that do not match the ESG objectives and standards. The shareholder theory, which Friedman (1970) underlines, states that ESG concerns interfere with managers' core responsibility to maximize profits and shareholder value. Friedman further argues that managers use CSR to promote their own political, social, or career agendas. Furthermore, Wagner & Schaltegger (2003) argue that the purpose of ESG-related regulations is solely to reduce negative externalities that contribute to lower social welfare.

On the other hand, there is a revisionist view arguing that ESG policies can lead to win-win situations by enhancing both financial performance and social welfare (Porter, 1991). This hypothesis is also known as "doing-well-by-doing-good". Furthermore, Porter and van der Linde (1995a,b) argue that pollution is often a result of waste of resources like materials, water, and energy, and that strict environmental regulations could stimulate innovations and improve the competitiveness of firms ("Porter hypothesis"). Beside direct enhanced financial performance, there are several other benefits by following the "doing-well-by-doing-good argument". One of the most important factors is improved corporate reputation. According to the good management theory, CSR investments can improve a firm's corporate reputation. As a result of improved reputation, financial performance will also improve due to better stakeholder relationships (Waddock & Graves, 1997).

Lastly, a third view proposes a 'no-effect' hypothesis by arguing that there is a neutral relationship between ESG and financial performance. Wagner (2001), proposes an inverse U-shaped relationship in which there is a positive relationship between ESG investment and financial performance up to a level where financial performance is optimized. Beyond this point, the latter relationship becomes negative, and any further investment in CSR contributes to lower financial performance. McWilliams & Siegel (2001) illustrate the no-effect theory by the example of two firms that produce identical goods in their supply-demand model. Firm A produces the product in an ordinary way, but firm B adds social characteristics (CSR practices) towards to product. Firm B faces higher costs but is also able to generate more revenue because consumers value these social characteristics and are willing to pay more for the product. On the other hand, firm A faces lower costs than firm B, but also generates less revenue.

2.2 ESG – financial performance for direct real estate

Researchers have found multiple reasons why sustainability could lead to improved financial performance of direct real estate, the bricks and mortar. The earliest literature consists of mainly case studies at the (individual) asset level focusing on the costs and benefits of green property investment. Kats (2003) found that the present value of the reduced operating costs exceeds the costs of implementing sustainable investments. Kats furthermore states that green offices use 30% less energy compared to non-green offices, which is attractive to tenants. Furthermore, sustainable commercial buildings are likely to have increased economic life, lower market risk, and a lower probability of obsolescence, which is of importance to investors (Eichholtz, Kok, & Quigley, 2010). However, case studies are seldom representable as the mean of going green. Other earlier literature has mainly focused at the asset level (e.g. offices) by analysing the relationship of energy certificates on rents, occupancy rates, and sales prices (e.g. Eichholtz et al., 2010; Reichart et al., 2012; Miller, Spivey, & Florance, 2008; Fuerst & McAllister, 2011). The majority found that green real estate assets outperform their non-green peers. Eicholtz et al. (2010) state that 'green rated' buildings command effective rental premiums of above 6% compared to 'non-green rated' buildings after controlling for building characteristics and the location. For selling prices, Eichholtz et al. (2010) found that green buildings have a 16% premium compared no non-green buildings. Fuerst & McAllister (2011) find transaction premiums of 10% and 31% for Energy Star and LEED-certified buildings respectively. However, they could not verify whether the observed premiums are due to lower operating costs or other factors such as a better corporate image or higher productivity. Furthermore, premiums could reflect short-run imbalances between supply and demand.

2.3 ESG – financial performance for indirect real estate

On the portfolio level (or indirect real estate), the literature is growing but is still relatively limited. Eichholtz et al. (2012) are the first to address the relationship between the sustainability of commercial buildings and the financial performance of the owners of these commercial buildings such as REITs. As

a proxy of portfolio greenness, they match LEED and Energy Star certificates to US REITs for the period 2000 – 2011. Their results show that portfolio greenness is positively related to operating performance measured by the return on assets, return on equity, and funds from operations. On the other hand, no significant relationship is observed between portfolio greenness and abnormal stock returns. They suggest that stock prices already reflect the higher cashflows obtained by investing in more sustainable properties. However, they do find that green portfolios are negatively correlated to the estimated market beta. This could indicate that green commercial buildings may be exposed less to volatile energy prices and vacancy risk. Sah et al. (2013) found a positive impact of portfolio greenness on firm value by using Tobin's Q as a benchmark. Furthermore, they find that green REITs have superior stock performance compared to non-green REITs of 5.68% using the Carhart model. On the other hand, Mariani et al. (2018) found for a sample of European REITs that a higher percentage of green-certified buildings within a portfolio has a negative impact on the ROA, ROE, and the alpha of stocks. They argue that the negative impact is due to the incremental capital expenditures in order to obtain the LEED or Energy Star certification. In another more recent study, Coën, Lecomte, & Abdelmoula (2018) focus on the comparison between green and non-green US REITS on financial performance for the period 2010 – 2016. Their results indicate that non-green REITs tend to outperform their green peers (Jensen's alpha). The results for the Sharpe ratio show no significant results for the difference between green and non-green REITs.

Within the real estate literature, empirical studies on the relationship between the social pillar, or socially responsible investing (SRI) are rather limited (Cajias et al., 2014). The majority of the research is qualitative work focusing on the importance of the concepts of SRI for real estate firms (see for example Roberts et al., 2009; Newell, 2009; Chiang et al., 2019).

There is a body of research focusing on the relationship between governance and the financial performance of REITS. The results are mixed. Hartzell et al. (2008) analysed the effect of corporate governance structure on initial public offering (IPO) valuations and found that REITs with superior governance mechanisms have higher IPO valuations compared to less superior peers. Furthermore, REITs with stronger governance mechanisms have better long-term operating performance. Feng et al. (2005) focused on the boards of REITs and document that more efficient boards (e.g. smaller board size, more outside directors, and a non-chair CEO) have better financial performance. However, this effect is strictly between superior and poor boards. On the other hand, Bauer et al. 2010 find for U.S. REITs that governance performance, as measured by the Corporate Governance Quotient index, is not related to firm value (Tobin's Q) and operating performance (ROE, ROA, and FFO growth). Anglin et al. (2013) investigated the relationship between effective corporate governance and the earnings management of REITs. Their results indicate, even in the presence of unique legal and reporting structure, REITs engage in some form of earnings manipulation. However, the ability to do so is reduced when corporate

governance is more effective. Setting high corporate standards, above the already strongly regulated REIT regime, can create value for investors.

The studies of Eichholtz et al. (2012), Sah et al. (2013), and Mariani et al. (2018) have in common that they purely focus on the greenness of buildings as a proxy for CSR. Cajias et al. (2014) are one of the first that use the ESG performance framework to measure the effects on the financial performance of real estate firms. By using a dataset on US publicly traded real estate firms from 2003 – 2010 they find a positive relationship between ESG score and Tobin's Q. However, ESG concerns (e.g. reputational benefits) are the main driver behind this relationship instead of the ESG competitive profile. For stock returns, they find that ESG ratings are positively related to lower returns. Negative ESG scores are associated with lower returns, but they are not significant. On the other hand, Fuerst (2015) analysed 442 REITs for North-America, Europa and Asia for the period 2011-2014 by using a similar comprehensive sustainability proxy (GRESB rating) and found that the ROA and ROE of greener REITs outperform less green REITS. In a more recent study, Brounen & Marcato (2018) analysed the relationship between three types of CSR metrics, namely GRESB, Thomson Reuters ESG and MSCI (KLD) on the financial performance of U.S. REITs. All three metrics consist of an environmental, social, and governance score. Surprisingly, they find that there is a strong difference between the three metrics. For the GRESB metric, the environmental pillar is responsible for 57% of the total ESG score, while for the MSCI(KLD) this is only 17% for GRESB. Furthermore, Brounen & Marcato find in general that high GRESB scores are associated with lower REIT returns. For both ESG metrics, they do find a positive relationship for REIT excess returns. Additional research on the individual pillars shows that there is a discount on return for the environmental score, while the social and governance score both have a positive effect on return. The authors state that this could be due to the fact that making a real estate portfolio greener tends to be relatively costly.

Contradictory to studies focusing on the individual asset level and operating performance, the results of studies for indirect real estate (in this case REITS) and on financial performance have been less conclusive. Furthermore, prior research often has used exclusively building eco-labels such as LEED and Energy Star as greenness proxy and could potentially miss a whole range of sustainability measures at the firm level (Fuerst, 2015). This research contributes to the current literature by incorporating the ESG framework, a more multi-dimension proxy for greenness performance that could better represent a firm's overall commitment towards environmental awareness and commitment compared to the asset level measure. Furthermore, the majority of the studies that do focus more on sustainability performance at the portfolio level do not account for the differences between the three pillars of ESG (Caijas et al., 2014; Fuerst, 2015), Therefore, this study will analyse in addition to the general ESG score, the three pillars separately to analyse the most relevant components of the ESG Score.

Additionally, the majority of prior research on sustainability and real estate performance have in common that they focus on sustainability performance as an absolute score. To date, only a few general finance studies have looked into the relationship of relative sustainability – financial performance, and to my best knowledge no study specifically for the real estate sector. A relative score could reveal more information about a REIT's commitment to ESG than absolute scores: It gives a signal to the market and investors that the REIT is actively committing to (future) CSR initiative. If investors would purely focus on REITs with high ESG scores, they could mis potential positive investment opportunities of REITs that currently have a low ESG score, but signal to the market that their score is improving and will improve in the future. Sahut & Pasquini-Descomps (2015) are among the first that have investigated the change in ESG scores and stock returns by analysing excess returns for the US, the UK, and Switzerland and included a risk factor that captures the change in ESG score. Surprisingly, they found a slightly negative relationship between the change in ESG score and abnormal stock performance for UK firms. No significant results were found for the U.S. and Switzerland. Some other studies have used a slightly different methodology. Dimson, Karakas & Li (2015) find positive (cumulative) abnormal stock returns after a successful CSR implementation for U.S. firms. However, Fernando et al., (2017) find that a firm's increase in greenness does not create shareholder value. The relative sustainability score, in this research the percentage change in ESG performance from t-1 to t1, might be of high relevance to investors since it does better reflect the progress the REIT is making concerning environmental performance and could signal anticipated future sustainability investments and progress.

2.4 Hypothesis

Although the literature of the relationship of ESG performance on REIT financial performance is fragmented, previous literature provides evidence and arguments for a positive relationship between CSR initiatives in general and asset performance such as rental price premiums, sale price premiums, improved occupancy rates and financial performance such as ROA and FFO. Therefore, a conceptual framework in figure 1 and the following hypotheses are formulated indicating a positive relationship between the ESG score and US REIT financial performance:

Hypothesis 1*: "The ESG score is positively associated with US REIT financial performance".*
Hypothesis 2: *"The y-o-y change in ESG score is positively associated with US REIT financial performance".*

This study does not take into account the ESG feedback loop, where companies disclose action on ESG and win investors' and shareholders' support. Resultingly, this improves firms' reputational and competitive advantage which stimulates further action in ESG commitment, creating a vicious circle (J.P. Morgan, 2022).

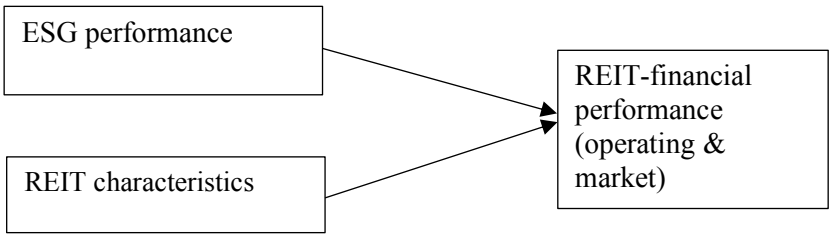

Figure 1 Conceptual model

3 Data

3.1 Data selection

Data on ESG performance and corporate financial accounting data is collected from the Refinitiv Eikon Database, also known as Thomson Reuters Datastream. The US REIT market consists of 219 REITS consisting of Equity and mortgage REITs. For this research, we are interested in equity REITs which leads to a selection of 179 REITs for the period 2011 - 2020. For three REITs Eikon was unable to provide data on ESG measures. Several REITs have ESG data for not all 10 years. Additionally, observations with missing ESG data were deleted, which led to a sample of 1.091 observations. Thereafter, observations with missing financial accounting data were deleted resulting in a decrease to 849 observations for the period 2012 – 2020 for 149 unique REITs. Most of the missing values are detected from 2011 till 2014 which can be clearly observed in figure 2. The data suggest increasing attention towards ESG over time, since the number of REITs in the data sample increases evidently over time. The drop in REIT-year observations can be explained by the processing time of Thomson Reuters Eikon to allocate ESG ratings, but also other data.

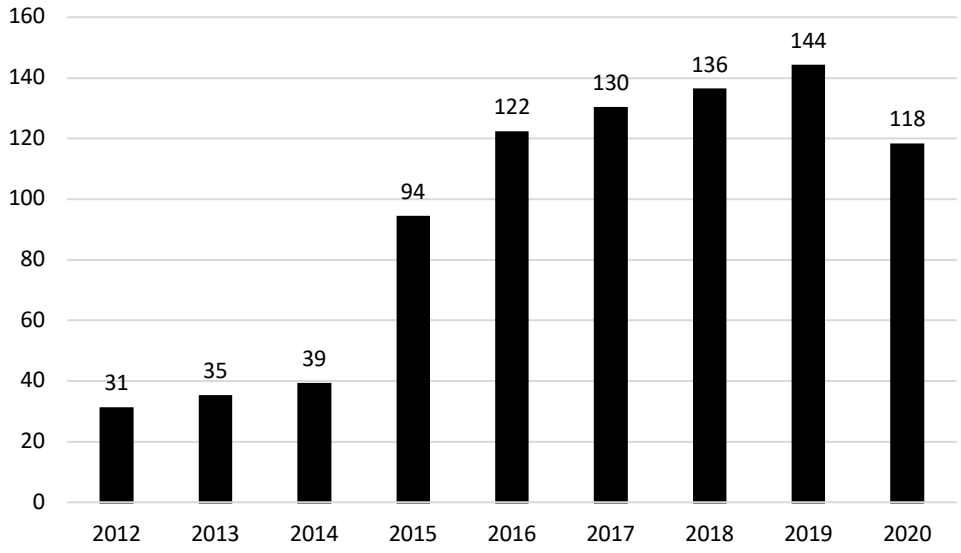

Figure 2 Distribution of the number of REIT -year observations

3.2 Financial performance variables

To measure the financial performance of REITs several parameters will be used. In line with previous research, Funds from Operations (FFO) divided by Revenue and total annual return are used as accounting-based performance indicators. FFO is a widely used method to define cashflows from their operations. In general, REIT managers believe that net income does not precisely reflect the REIT performance due to the mandatory inclusion of non-cash items like depreciation, amortization, and non-recurring expenses (Ben-Shahar et al., 2011). Therefore, FFO can provide as a better measure for operating performance. To calculate the FFO, one must add non-cash expenses or losses that actually have not taken place from operations to net income. To control for size, FFO is subsequently divided by Revenue to control for size following Eichholtz et al. (2012).

$$FFO = Net\ Income + (Depreciation + Amortization + Losses\ on\ Sale\ of\ Assets) - (Gains\ on\ Sale\ of\ Assets + Interest\ Income) \quad (1)$$

Furthermore, I will use FFO divided by total assets as a robustness check of operating performance. In contrast to other studies (Eichholzt et al., 2012; Sah et al., 2013; Fuerst, 2015; Mariani et al.,2018), I use this variable instead of the return on assets (ROA), since the ROA is calculated by using net income rather than FFO.

As a market-based performance indicator, Tobin's Q will be used. Tobin's Q is widely used in the finance literature to capture both the tangible as the intangible assets. We are interested to capture the intangible value. Currently, there are many variations to measure Tobin. By following previous research (Cajias et al., 2014), Tobin's Q is calculated as the market capitalization plus preferred stock plus total debt (long-and-short term) divided by the total assets as defined by Han (2006).

$$Tobin's\ Q = \frac{MVC + MVP + LTD + STD}{TA} \quad (2)$$

Where MVC denotes the market value of common stock, MVP the market value of preferred stocks, LTD the book value of long0term debt, STD the book value of short-term debt and, TA the book value of total assets.

3.3 ESG variables

The main independent variable within this research is the ESG score. The ESG score is determined annually and consists of three pillars: environmental, social, and governance. Each pillar gives a score from 0 to 100 and the combined ESG score gives a weighted average of the three pillars. Each pillar is divided into several categories. Appendix II gives a detailed overview of how the ESG score is

conducted by giving weight to each component. The environmental pillar measures resource use, emissions, and innovation. The social pillar assesses workforce, human rights, community, and product responsibility. The governance score is based upon management score, stakeholders score, and CSR strategy.

3.4 Control variables

To control for REIT-specific characteristics, I will include several control variables which are widely used in previous research. These measures are (1) *size* calculated as the natural logarithm of the market capitalization following Cajias et al. (2014), (2) the natural logarithm of revenue to control for size differences in earnings, (3) the natural logarithm of market capitalization, (4) leverage as the debt-to-assets ratio and (4) *NAREIT return,* which is the total annual return of the FTSE NAREIT U.S. Real Estate Index, a market proxy for the performance of US REITs.

Table 1 Dependent, independent and control variables

Variable	Definition
Independent	
Total Annual Return (%)	Annual stock return, dividends are reinvested
FFO/Assets (%)	Funds from operations divided by total assets
FFO/Revenue (%)	Funds from operations divided by total revenue
Tobin's Q	Tobin's Q ratio measured by market capitalization over total assets
Dependent	
ESG Score (t)	Environmental, Social and Governance score
ESG Score (t-1)	Lagged Environmental, Social, and Governance score
ESG Grade	Categorial variable of ESG score
ESG Change (%)	Year over Year change in ESG score
Environmental Score	Environmental pillar score
Social Score	Social pillar score
Governance Score	Governance score
Control	
Total Assets	Total Assets ($ 1.000)
Total Revenue	Gross sales and other operating revenue less discounts, returns, and allowances ($ 1.000)
Market Capitalization	Year-end share price * common shares outstanding ($ 1.000)
Leverage (%)	Total debt (short term and long term) divided by total assets
NAREIT Return	Total annual return of the NAREIT index

3.5 Descriptive statistics and correlation

Table 2 presents the descriptive statistics of all the variables used in this study. The average ESG score is 42,91, the minimum score 2.46, and the maximum core 87.81. The environmental score is on average lower than the combined ESG score, while the social and governance score on average have a higher score than the combined ESG score. Notably is that the environmental score has a minimum score of zero. Tobin's Q has on average a score above one which indicates that the REITs in this sample have on average a higher market value compared to the replacement value. Comparable studies also document a Tobin's Q above one (Sah et al., 2013; Cajias et al., 2014). For the variable FFO/Total Revenue we document a mean of 43,2%, which is slightly lower than Eichholtz et al. (2012) who find a mean of 46.32%. The data does not show extreme outliers. Therefore, the variables are not winsorized.

Table 3 presents the correlation matrix. The correlation between the three components of the ESG Score and the overall ESG Score is very high. This is not remarkable since high (or low) scores on one sub score often go hand in hand with high (or low) scores on the other two pillars. As regard the correlation between the dependent (5-10) and independent variables (1-4), we observe relatively low absolute correlation levels, and therefore weak linear relationships. These levels indicate a neutral linear relationship between de dependent and independent variables.

Table 2 Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
FFO/Total Assets	849	.055	.027	-.067	.302
FFO/Total Revenue	849	.432	.198	-1.305	1.05
Total Return	849	.08	.236	-.827	1.553
Tobin's Q	849	1.389	.487	.581	4.413
ESG Score (t)	849	42.91	18.203	2.462	87.807
ESG Score (t-1)	849	41.67	17.974	2.462	87.807
ESG Δ (y-o-y change)	708	.159	.901	-.733	22.166
ESG Score Grade	849	2.232	.763	1	4
Environmental Score	849	28.747	28.076	0	95.577
Social Score	849	48.742	17.552	5.623	93.881
Governance Score	849	53.958	19.936	.772	95.448
Total Assets ($ 1.000)	849	7,243,853.2	7,519,908.6	251,529	56,065,005
Total Revenue ($ 1.000)	849	1,007,993.2	1,210,222.5	11,338.07	8,041,500
Market Capitalization ($ 1.000)	849	7,579,280.4	11,169,583	93,512.919	1,018e+08
Leverage	849	.476	.129	0	.894
NAREIT Index	849	.084	.121	-.059	.281

Table 3 Correlation matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(1) FFO/Total Assets	1.000														
(2) FFO/Total Revenue	0.539	1.000													
(3) Total Return	0.166	0.219	1.000												
(4) Tobin's Q	0.668	0.327	0.350	1.000											
(5) ESG Score (t)	0.111	0.048	-0.104	0.066	1.000										
(6) ESG Δ	0.043	-0.030	0.043	0.085	0.075	1.000									
(7) ESG Grade	0.090	0.044	-0.092	0.044	0.924	0.044	1.000								
(8) ENV Score	0.083	0.011	-0.097	0.086	0.909	0.059	0.824	1.000							
(9) SOC Score	0.106	0.025	-0.063	0.090	0.845	0.064	0.782	0.731	1.000						
(10) GOV Score	0.090	0.100	-0.084	-0.031	0.626	0.064	0.605	0.303	0.349	1.000					
(11) Total Assets	0.134	0.165	0.058	0.265	0.504	-0.007	0.474	0.529	0.464	0.162	1.000				
(12) Total Revenue	0.313	-0.057	0.051	0.367	0.482	0.063	0.444	0.491	0.436	0.186	0.829	1.000			
(13) Market Capitalization	0.334	0.200	0.151	0.552	0.386	0.018	0.354	0.411	0.365	0.106	0.883	0.838	1.000		
(14) Leverage	-0.121	-0.214	-0.150	-0.023	-0.085	0.014	-0.108	-0.033	-0.042	-0.154	-0.005	0.050	-0.029	1.000	
(15) NAREIT Index	0.070	0.033	0.612	0.097	0.009	0.009	0.003	0.026	0.004	-0.021	0.017	0.035	0.045	-0.027	1.000

4 Methodology

4.1 Main regression model

To explore the relationship between ESG and the financial performance of US REITs, I will perform a series of panel data models following Cajias et al. (2014). I have not chosen for time series tests since not many REITs have annual ESG data for a longer time-period, which is indicated in figure 2. In general, there are two types of panel estimators: fixed effects (FE) and random effects (RA). The fixed-effect model assumes that individual-specific effects are correlated with the independent variable while the random effect model assumes that individual-specific effects are uncorrelated with the independent variable. To choose between a random effect regression model or a fixed effect regression model, The Hausman test is performed which rejects the random effect model (Appendix I). The financial performance indicators of interest are FFO/Total Assets, FFO/Total Revenue, Total Annual Return, and the natural logarithm of Tobin's Q. Furthermore, for each financial indicator, we make a distinction between the contemporaneous ESG performance, the lagged ESG performance, the y-o-y change in ESG performance and the three individual pillars of the ESG Score. To test the first hypothesis: *"The ESG Score is positively associated with the financial performance of US REITs"*, the main model is specified as follows:

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

Where FP_{it} is the financial indicator of interest for REIT *I* in year *t*; α is the constant; X represents a vector is REIT specific variables (market capitalization, leverage, and revenue.)[2]; Z_t is the FTSE NAREIT ALL REITs Index in year *t* to control for yearly real estate market performance; δ_i are REIT specific dummies representing the FE estimator ε_{it} is the error term. θ_t are year dummies for time-fixed effects.

4.2 Alternative regression models

Alternatives for the main model are specified in equation 4 – 10. In equation 4, the dependent variable is the y-o-y percentage change in ESG performance represented by $\beta_1 \Delta ESG_{it}$, to test the second hypothesis: *"The y-o-y change in ESG score is positively associated with US REIT financial performance"*.

$$FP_{it} = \alpha + \beta_1 \Delta ESG_{it} + \gamma X_{it} + Z_t + \delta_i + \theta_t + \varepsilon_{it} \quad (4)$$

[2] Total Assets is left out the regression since the Variance Inflation Factors (VIF) in STATA resulted in a VIF of above five, which could potentially have been a multicollinearity issue with Market Capitalization

Equation 5 presents a model where the contemporaneous ESG score is replace by the one year lagged ESG score.

$$FP_{it} = \alpha + \beta_1 ESG_{it-1} + \gamma X_{it} + Z_t + \delta_i + \theta_t + \varepsilon_{it} \quad (5)$$

In equations 6 – 8, a distinction is made between the three individual pillars of the ESG score in line with Brounen & Mercato (2018) to analyse the individual score on REIT financial performance. In equation 6 – 8, environmental performance, social performance and governance performance are the dependent variable respectively.

$$FP_{it} = \alpha + \beta_1 ENV_{it} + \gamma X_{it} + Z_t + \delta_i + \theta_t + \varepsilon_{it} \quad (6)$$

$$FP_{it} = \alpha + \beta_1 SOC_{it} + \gamma X_{it} + Z_t + \delta_i + \theta_t + \varepsilon_{it} \quad (7)$$

$$FP_{it} = \alpha + \beta_1 GOV_{it} + \gamma X_{it} + Z_t + \delta_i + \theta_t + \varepsilon_{it} \quad (8)$$

Equation 9 presents a combined model of all three individual pillars of the ESG score.

$$FP_{it} = \alpha + \beta_1 ENV_{it} + \beta_2 SOC_{it} + \beta_3 GOV_{it} + \gamma X_{it} + Z_t + \delta_i + \theta_t + \varepsilon_{it} \quad (9)$$

For the final model, the dependent variable is represented by the ESG score grade. This is a categorial variable with a range from A to D, where D represents a score of 0 – 24.99, and is the poorest category, C a score of 25 – 49.99, B represents a score of 50 – 74.99, and A represents a score of 75 – 100, and is the best performing category. Thomson Reuters has a 12-grade scoring system of 12 grade where each grade is divided into three categories. For example, grade A is divided into A-, A, A+. Because some grades have few observations, we decide to modify the 12-grade scoring system into a four-grade scoring system.

$$FP_{it} = \alpha + \beta_1 ESGGrade_{it} + \gamma X_{it} + Z_t + \delta_i + \theta_t + \varepsilon_{it} \quad (10)$$

A final note on the methodology is the concept of survivorship bias. We mitigate survivorship bias by including REITs that have at least 1-year observation for the 2012-2020 period, resulting in unbalanced panel data instead of choosing a balanced sample following Cajias et al. (2014). REITs enter the data sample when they meet the data requirements and leave when they default or merge.

5. Results

5.1 Main analysis and alternative regression results

Table 4 – 7 show the regression results the correlation between ESG performance and the two variables for operating performance (FFO/Total revenue and FFO/Total Assets), the correlation between ESG performance and relative market value measured by Tobin's Q, and the relationship between ESG performance and stock performance measured by Total Returns. For each model, we start by including the contemporaneous ESG score (t) in model one. For models two and three, we use the lagged ESG performance, and the y-o-y change in ESG performance respectively. Model four, five, and six use the three individual pillars of the ESG score and model seven includes the three pillars simultaneously. Model eight includes the ESG grade as the dependent variable, where grade D, indicating the lowest ESG performance, is the base category.

Table 3 shows that the models explain 17.7% to 26.6% of the association with FFO divided by Total Revenue. For all models, we could not find a significant relationship between ESG performance and FFO divided by revenue. In other words, a higher ESG score does not lead to significantly lower or higher financial performance. The results show that there is a slightly positive relationship between ESG (t) and ESG (t-1) and the FFO/Total Revenue. Surprisingly, the coefficient becomes negative for the y-o-y change in ESG score. For model 8, we can observe that compared to the reference category D, poor ESG performance, the ESG grade is positively associated with financial performance when REITs belong to categories C and B. However, the effect becomes negative when REITs belong to the best category, A. Except for leverage, all control variables have a positive effect on FFO divided by revenue. Eichholtz et al. (2012) also use FFO/Total Revenue for operating performance but do find a positive significant relationship for green properties. However, we have to bear in mind that the study of Eichholtz uses a different proxy for greenness, the number of energy efficiency certified properties and energy efficiency certificates, compared to the ESG score that we use. This difference in the proxy of greenness could lead to different results.

Table 5 shows the regression results for FFO divided by Total Assets, which also serves as a robustness check for the previous variable FFO/Total Revenue. The base model for the contemporaneous ESG score also show a minimal positive effect on the dependent variable. However, for the lagged ESG score, we document a minimal negative effect on FFO/Total Assets, while for FFO/Total Revenue we observe a positive effect. For the y-o-y change in ESG score in model 3, Governance performance in model 6 the coefficient signs are the opposite. For model eight we can observe that the compared to score grade D, ESG score grade C has a positive effect on FF/Total Assets, and this become negative for B and A. similarly to the operating performance indicator FFO/Total Revenue we do not find any significant relationship. Prior studies for the real estate sector do not use FFO/Total Assets but use the return on

assets as a similar proxy to measure the efficiency of profitability to total assets. Sah et al. (2013) find that green REITs that hold a relatively large sustainable portfolio have significant higher return on assets. Eichholtz et al. (2012) finds similar results for the return on assets and Fuerst (2015) also document a positive significant relationship by using the GRESB score as proxy for sustainability. Furthermore, the regression results show that the natural logarithm of Market Capitalization is negatively associated with FFO/Total Assets, while for FFO/Total Revenue this association is positive.

Table 4 Panel fixed effect regression results. Dependent variable: FFO/Total Revenue

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ESG (t)	.0004							
	(.001)							
ESG (t-1)		.001						
		(.001)						
ESG Δ			-.001					
			(.001)					
ENV				.0001			-0.0001	
				(.0005)			(.001)	
SOC					.001		.001	
					(.001)		(.001)	
GOV						-0.000	-0.0001	
						(.0004)	(.0005)	
ESG_Grade (C)								.019
								(.025)
ESG_Grade (B)								.002
								(.031)
ESG_Grade (A)								-.005
								(.041)
Leverage	-.532***	-.761***	-.761***	-.531***	-.535***	-.529***	-.533***	-.526***
	(.17)	(.202)	(.201)	(.171)	(.169)	(.168)	(.172)	(.166)
Market Cap (ln)	.045*	.028	.026	.045*	.043	.045*	.042	.042
	(.027)	(.027)	(.027)	(.027)	(.026)	(.027)	(.026)	(.027)
Revenue (ln)	.077	.148*	.15*	.078	.077	.079	.078	.084
	(.077)	(.08)	(.081)	(.076)	(.077)	(.077)	(.077)	(.077)
NAREIT index	.272	.229*	.201*	.255	.289*	.234	.273	.191
	(.186)	(.129)	(.108)	(.197)	(.175)	(.164)	(.194)	(.17)
Constant	-1.081	-1.673*	-1.638*	-1.083	-1.065	-1.088	-1.065	-1.112
	(.8)	(.921)	(.916)	(.797)	(.801)	(.798)	(.799)	(.802)
Observations	849	709	708	849	849	849	849	849
Time fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
R-squared	.176	.266	.265	.176	.178	.176	.178	.179

Notes: T-statistics with robust Huber-White standard errors (clustered by REIT) in parentheses. Significance at *** p<.01, ** p<.05, * p<.1

Table 5 Panel fixed effect regression results. Dependent variable: FFO/Total Assets

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ESG (t)	0.0000							
	(.0001)							
ESG (t-1)		-.0000						
		(.0001)						
ESG Δ			.0001					
			(.0003)					
ENV				0.000			-.00004	
				(.0001)			(.0006)	
SOC					.0001		.0001	
					(.0001)		(.0001)	
GOV						-.00004	-.0005	
						(.0001)	(.0001)	
ESG_Grade (C)								.002
								(.003)
ESG_Grade (B)								-.001
								(.005)
ESG_Grade (A)								-.003
								(.006)
Leverage	-.055**	-.076***	-.077***	-.055**	-.055**	-.055**	-.055**	-.054**
	(.022)	(.024)	(.024)	(.022)	(.022)	(.022)	(.022)	(.022)
Market Cap (ln)	-.008*	-.011**	-.011**	-.008*	-.009**	-.008*	-.009**	-.009**
	(.004)	(.005)	(.005)	(.004)	(.004)	(.004)	(.004)	(.004)
Revenue (ln)	.031***	.04***	.04***	.031***	.031***	.032***	.031***	.032***
	(.007)	(.007)	(.007)	(.007)	(.007)	(.007)	(.007)	(.007)
NAREIT index	.044***	.003	.003	.043**	.051***	.038**	.046***	.032*
	(.017)	(.048)	(.049)	(.017)	(.016)	(.016)	(.017)	(.017)
Constant	-.22***	-.281***	-.277***	-.22***	-.217***	-.22***	-.216***	-.224***
	(.052)	(.058)	(.058)	(.052)	(.052)	(.052)	(.052)	(.053)
Observations	849	709	708	849	849	849	849	849
Time fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
R-squared	.254	.407	.408	.254	.258	.254	.259	.258

Notes: T-statistics with robust Huber-White standard errors (clustered by REIT) in parentheses. Significance at *** p<.01, ** p<.05, * p<.1

Table 6 represents the regression results for the relative market valuation, Tobin's Q. The models explain 63.7% to 65.5% of the association between ESG score and the natural logarithm of Tobin's Q. Contradictory to the results in table 3, the results show a negative relationship between ESG (t) performance and Tobin's Q. Model 2, the lagged ESG score, documents a negative significant relationship at the 5% level. Contradictory, for model 3, the y-o-y change, we document a positive significant relationship at the 1% level on Tobin's Q. this result indicates that REITs that increase their commitment to ESG (and therefore increase their ESG score) have higher ratio of intangible assets. Many benefits from investing in ESG are intangible such as improved employee productivity, better corporate standards and regulations, and superior management practices (Sah et al., 2013). It is difficult to precisely determine the cause of this observation. One potential reason could be that REITs with poor

ESG performance improve their ESG score but still have subpar ESG performance. Therefore, the y-o-y change is relatively large because for these REITs there is a great opportunity for improvement, whereas, for REIT's that already perform relatively well, this is much more difficult, and probably also more expensive. Although insignificant, some evidence is shown in model 8 where obtaining an ESG score grade of B or C results in a higher Tobin's Q compared to the lowest score grade D, but leads to a negative effect on Tobin's Q for the highest score grade A. In general, the results are contradictory to the results of Cajias et al. (2014). Cajias document a positive significant relationship between ESG (t), ESG (t-1), and the logarithm of Tobin's Q. However, Cajias also states that this positive effect is driven by ESG concerns. Sah et al. (2013) also use Tobin's Q as a measurement for firm value, and also document a positive relationship.

Table 6 Panel fixed effect regression results. Dependent variable: Natural Logarithm of Tobin's Q

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ESG (t)	-.0004							
	(.0004)							
ESG (t-1)		-.001**						
		(.0004)						
ESG Δ			.006***					
			(.002)					
ENV				-.0003			-.0002	
				(.0003)			(.0004)	
SOC					-.0005		-.0004	
					(.001)		(.001)	
GOV						.0001	.0002	
						(.0003)	(.0004)	
ESG_Grade (C)								.002
								(.014)
ESG_Grade (B)								.001
								(.019)
ESG_Grade (A)								-.051
								(.033)
Leverage	.387***	.387***	.366***	.388***	.387***	.382***	.389***	.385***
	(.107)	(.121)	(.121)	(.107)	(.107)	(.107)	(.106)	(.106)
Market Cap (ln)	.363***	.355***	.354***	.363***	.365***	.364***	.365***	.359***
	(.023)	(.023)	(.023)	(.022)	(.023)	(.023)	(.023)	(.023)
Revenue (ln)	-.194***	-.171***	-.173***	-.194***	-.194***	-.196***	-.194***	-.192***
	(.027)	(.031)	(.031)	(.027)	(.027)	(.027)	(.027)	(.026)
NAREIT index	.175*	.219	.274	.166*	.173**	.222***	.162*	.172*
	(.094)	(.258)	(.225)	(.094)	(.083)	(.085)	(.094)	(.091)
Constant	-2.847***	-3.011***	-3.001***	-2.85***	-2.856***	-2.84***	-2.863***	-2.824***
	(.282)	(.349)	(.346)	(.281)	(.281)	(.282)	(.28)	(.281)
Observations	849	709	708	849	849	849	849	849
Time fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
R-squared	.637	.655	.652	.637	.637	.637	.638	.641

Notes: T-statistics with robust Huber-White standard errors (clustered by REIT) in parentheses. Significance at *** p<.01, ** p<.05, * p<.1

However, Sah et al. use LEED and Energy Star certificates as a proxy for greenness instead of ESG score. The financial benefits of green or energy-efficient building accreditations could potentially be clearer to investors since this comes close to the conventional concept of sustainability. Furthermore, investors might find it difficult to fully value these intangible assets driven or affected by ESG factors (Edmans, 2011).

To analyse the significant positive relationship between the change in ESG score and the natural logarithm of Tobin's Q more in-depth, we break down the change in ESG score into the change in the score of each individual pillar. Table 7 shows us that the change in the social pillar and the change in the governance pillar are mainly responsible for the positive relationship between the change in ESG and ln Tobin's Q. Model 2 tells us that the change in social performance is positively significant at the 5% level and for the change in governance performance, we document a positive significant relationship on ln Tobin's Q at the 1% level. One potential reason could be the argument that Brounen & Marcato (2018) present: Implementing stronger governance mechanisms and establishing social responsibility is considered to need less devotion of resources and capital compared to making a real estate portfolio more sustainable.

Table 7 Panel fixed regression results. Individual pillars y-o-y ESG change for ln Tobin's Q

	(1)	(2)	(3)	(4)
ENV Δ	.0004			.0003
	(.003)			(.0003)
SOC Δ		.008**		.016
		(.003)		(.01)
GOV Δ			.006***	.008**
			(.001)	(.003)
Leverage	.307**	.365***	.373***	.304**
	(.151)	(.121)	(.122)	(.15)
Market Cap (ln)	.347***	.354***	.355***	.345***
	(.027)	(.023)	(.023)	(.027)
Revenue (ln)	-.165***	-.173***	-.173***	-.165***
	(.035)	(.031)	(.031)	(.035)
NAREIT index	.322	.276	.27	.328
	(.225)	(.224)	(.225)	(.233)
Constant	-2.999***	-2.996***	-3.017***	-2.98***
	(.429)	(.347)	(.347)	(.433)
Observations	522	708	708	522
Time fixed effects	YES	YES	YES	YES
R-squared	.668	.652	.653	.671

Notes: T-statistics with robust Huber-White standard errors (clustered by REIT) in parentheses. Significance at *** p<.01, ** p<.05, * p<.1. Model 1, environmental change has less observations (522) because some REITs have an environmental score of 0 (for multiple years).

The estimation results of the impact of ESG score on the Total Annual Stock Returns are presented in table 8. Similar to the other three dependent variables for financial performance, we have eight model variations. The regressions do not estimate a significant relationship across all eight models of ESG performance on total returns. For the contemporaneous ESG score at t we document a negative effect on total returns, while model two documents a positive effect of the lagged ESG performance on total returns. Similarly, to FFO divided by revenue and Tobin's Q we observe in model eight that compared to the base group, ESG Grade D, a higher ESG score belonging to grade C has a positive effect on total returns. However, the sign already becomes negative at score grade B. Cajias et al. (2014) find a significant negative relationship between ESG at t and a positive significant relationship between the lagged ESG performance and Total Returns.

Table 8 Panel fixed effect regression results. Dependent variable: Total Returns

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ESG (t)	-.0004							
	(.001)							
ESG (t-1)		.0002						
		(.001)						
ESG Δ			.003					
			(.005)					
ENV				-.0002			.0001	
				(.0004)			(.001)	
SOC					-.001		-.001	
					(.001)		(.001)	
GOV						0.0000	.0001	
						(.001)	(.001)	
ESG_Grade (C)								.001
								(.03)
ESG_Grade (B)								-.008
								(.037)
ESG_Grade (A)								-.03
								(.059)
Leverage	-.022	-.064	-.059	-.023	-.02	-.026	-.021	-.024
	(.158)	(.159)	(.16)	(.156)	(.157)	(.156)	(.157)	(.156)
Market Cap (ln)	.251***	.293***	.293***	.251***	.252***	.251***	.253***	.248***
	(.026)	(.029)	(.029)	(.026)	(.026)	(.026)	(.027)	(.027)
Revenue (ln)	-.089	-.148***	-.147***	-.09	-.089	-.091	-.09	-.088
	(.058)	(.047)	(.047)	(.058)	(.058)	(.059)	(.058)	(.058)
NAREIT index	1.576***	1.554***	1.543***	1.59***	1.565***	1.614***	1.573***	1.575***
	(.151)	(.186)	(.192)	(.154)	(.141)	(.131)	(.154)	(.148)
Constant	-2.633***	-2.522***	-2.516***	-2.631***	-2.646***	-2.625***	-2.647***	-2.63***
	(.696)	(.596)	(.595)	(.693)	(.697)	(.693)	(.694)	(.698)
Observations	849	709	708	849	849	849	849	849
Time fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
R-squared	.559	.646	.646	.559	.559	.559	.559	.559

Notes: T-statistics with robust Huber-White standard errors (clustered by REIT) in parentheses. Significance at *** p<.01, ** p<.05, * p<.1

We find similar results except that ours are not significant. The negative relationship in model one underlines the 'sin stock' expectation mentioned by Cajias et al. (2014): lower market prices are associated with higher returns. Comparable to our results, Newell & Lee (2012) also do not find any significant results on Total returns by using a CSR system consisting of environmental, social, and governance dimensions, similarly to ESG.

5.2 Best-and-worst in class portfolios

To analyse whether there is a difference between REITs that score high on ESG performance and REITs that score poor on ESG performance, we conduct best-and-worst in class portfolios. Table 9 shows the results for the best scoring 10% and the poorest 10% for the contemporaneous ESG performance[3]. The 10% poorest group is considered as the reference group. The results show that the best class portfolio has significant lower financial performance for FFO/Total Assets at 1% level, for FFO/Total revenue at the 10% level, and for the natural logarithm of Tobin's Q at the 1% level. The results are not entirely consistent because for Total Returns we observe a significant positive effect for the best-in-class portfolio compared to the poorest 10%. The results indicate that the possible financial performance premium does not outweigh the extra capital expenditures to reach such superior ESG scores.

Table 9 Best-and-worst in class portfolios (10%) for ESG (t) score

	(1) FFO/Total Assets	(2) FFO/ Total Revenue	(3) Ln Tobin's Q	(4) Total Returns
ESG (t) 10% best	-.016***	-.138*	-.184***	.291***
	(.005)	(.076)	(.042)	(.078)
Leverage	-.093*	-.807	.21	.877
	(.056)	(.612)	(.294)	(.825)
Market Cap (ln)	-.022***	-.075	.34***	.347***
	(.008)	(.085)	(.045)	(.102)
Revenue (ln)	.052***	.363	-.142***	.065
	(.014)	(.251)	(.052)	(.203)
NAREIT index	.038	.737	.086	1.946***
	(.032)	(.639)	(.24)	(.68)
Constant	-.254	-2.874	-3.033***	-6.734**
	(.17)	(3.223)	(.562)	(3.325)
Observations	169	169	169	169
Time fixed effects	YES	YES	YES	YES
R-squared	.613	.382	.714	.457

Notes: T-statistics with robust Huber-White standard errors (clustered by REIT) in parentheses.
Significance at *** p<.01, ** p<.05, * p<.1

[3] We have also conducted portfolios at the 15, 20, and 25% level. However, for these levels we do not find significant results between the poorest and best ESG performing REITs.

6. Discussion

The main purpose of this paper is to gain insight into the relationship between ESG and the financial performance of REITs. We assess this relationship we analyse whether there is a positive relationship between both the absolute ESG score on REIT financial performance, and the relative, y-o-y ESG score on REIT financial performance. For financial performance, we have used 4 variables. Operating performance is measured by FFO/Total Revenue and FFO/Total Assets as a robustness check. Stock performance is tested by total returns, and firm value is measured by Tobin's Q.

The results suggest that there is a neutral relationship between ESG and both operating performance and stock performance. We do not find a positive or negative significant relationship for any of the models. Therefore, a higher ESG score does not lead to significantly improved operating or stock performance. For market value, the natural logarithm of Tobin's Q we do find a negative significant relationship for lagged ESG performance. On the other hand, we observe a positive relationship for the y-o-y change in ESG score. A higher positive percentage change in ESG performance from year t-1 to year t is associated with a higher ratio between market value and the replacement costs of a REIT's assets. When we analyse the y-o-y change of ESG performance more extensively, we do find that this effect is mainly due to the y-o-y change in the social score and the governance score.

The results for operating performance are not in line with previous research. Eichholtz et al. (2012) find for operating performance measured by ROA, ROE and FFO/Total Revenue a positive significant relationship. Similarly to Eichholtz et al., Sah et al. (2013) also observe a positive significant relationship between the share of green properties within a portfolio and the return on assets for US REITs. However, it should be noted that direct comparison between the studies is difficult. Both Eichholtz et al. and Sah et al. have used energy certificates as a proxy of sustainability commitment. The study of Fuerst (2015) uses the GRESB score as a proxy for sustainability and comes closer to our research. Fuerst also observes a positive significant relationship between the GRESB score and operating performance for both ROA and ROE. Potential reasons why we did not find a positive significant relationship could be the fact that the GRESB score is composed differently than the ESG score as explained in chapter 2.3. Furthermore, Fuerst used a log-log model for the GRESB coefficient. and operating performance indicator. We did not use such a model in our research. A potential reason for the largely insignificant results for operating performance may be the "no effect" relationship where the benefits and costs due to ESG initiatives cancel each other out (McWilliams & Siegel, 2001). Mariani et al. (2018) is makes a similar statement by arguing that obtaining a LEED or Energy Star certificate leads to significant incremental capital expenditures.

For stock performance, the results are mainly in line with previous research. Eichholtz et al. (2012) find similarly to our research no significant relationship between sustainability and stock performance. However, we have to bear in mind that they use as already explained above not the ESG score but LEED and Energy Star certificates as a proxy for greenness. Furthermore, instead of total returns, Eichholtz et al. use abnormal stock returns by using a standard 4-factor model following Fama & French (1993) and Carhart (1997) as a measurement for stock performance. Newell & Lee (2012) use Australian data and also do not observe significant results on Total returns by using a CSR system consisting of environmental, social, and governance dimensions, similarly to ESG. Cajias et al. (2014) used similar to our research the ESG score as a sustainability proxy and total returns to measure stock performance. Cajias et al. finds a significant negative relationship between the contemporaneous ESG score and Total Returns. Our results for the contemporaneous ESG score on Total Returns are also negative, but not significant. The negative relationship in model one underlines the 'sin stock' expectation mentioned by Cajias et al. (2014): lower market prices are associated with higher returns.

For the relationship between ESG and Tobin's Q the results are somewhat fragmented compared to previous research. Cajias et al. 2014 find a positive relationship between ESG rating and Tobin's Q. Sah et al. (2013) also document a positive significant relationship. It is notable that apart from the neutral relationship for the contemporaneous ESG score, we observe a negative relationship for the lagged ESG score. It is difficult to determine the cause of this difference (e.g. unobserved factors). For the change in ESG performance, we do find in line to the latter studies a positive significant relationship. However, Sah et al. and Cajias do not use the relative performance of ESG. Our further analysis shows that when we analyse the individual pillars for the change in ESG, the social and governance pillars are both positively significant. A potential reason for this could be that investments in the environmental pillar to make real estate portfolios more sustainable need more effort than investments in social responsibility or governance (Brounen & Marcato, 2018). A potential reason why we do observe significant relationships between ESG and the natural logarithm of Tobin's Q is the fact that capital markets can price any changes in ESG instantaneously while the real effects on operating performance take longer and are likely to be lagged (Cajias et al., 2014).

7. Conclusion

This study aimed to investigate the relationship between ESG performance on the financial performance of listed US real estate. The literature on sustainability initiatives in the real estate sector has been growing significantly over the last few decades. An extensive body of literature clearly establishes a link between sustainability initiatives on the asset level in terms of higher rents and asset values (Reichardt et al., 2008; Eichholtz et al., 2010; Fuerst & McAllister, 2011) lower vacancy rates (Miller et al., 2008), and longer economic lifetime (Eichholtz et al., 2010). The majority of these studies focus on energy efficiency labels. For this study, we have used one of the most recent and most popular concepts of sustainability, namely ESG.

We have used both the absolute ESG score and the year-over-year, or relative ESG performance using an unbalanced panel dataset for 849 REIT observations for the period of 2012 – 2020 to answer the main research question of this study: *How is ESG performance associated with the financial performance of US REITs?* The results indicate that there is no significant relationship between ESG and REIT financial performance in terms of operating performance measured by FFO/Total Revenue and FFO/Total Assets, and stock performance measured by total returns. For operating performance, the results are not in line with previous theory since other studies do find a positive relationship. For stock performance, we do find similar results. However, we observe a significant positive relationship between the y-o-y change in ESG score and market value measured by Tobin's Q. Further in-depth analysis shows us that the y-o-y change in governance and social score are the main drivers.

Whereas the early literature on sustainability and real estate financial performance often used energy efficiency labels as a proxy, this study uses the ESG framework which goes beyond energy efficiency labels such as the widely used LEED and Energy Star. Our findings provide new insights into this relationship by including the relative ESG performance, whereas previous research in the field of real estate has used absolute scores. So far, only a few studies have analysed the relative performance in the finance literature (Dimson et al., 2015; Sahut & Pasquini-Descomps, 2015; Fernando et al., 2017), but to my best knowledge, no study specifically for the real estate sector.

The results from this study could provide useful insights into the decision-making of REITs to achieve higher ESG scores and become more sustainable. The neutral relation suggests that the allocation of resources and capital does not lead to a decline in operating performance and stock performance. Additionally, the significant positive relationship between the relative ESG score and Tobin's Q provide some evidence that REITs with low absolute ESG scores have the potential to dedicate resources and capital to obtain a higher relative ESG score and improve the market value.

This study has several limitations. Similarly to many previous studies, the data only focuses on the US REIT market. Therefore, cross-country analysis with for example European countries is not possible. It would be interesting to investigate whether the results hold for different markets. Furthermore, we observe for the change in ESG performance on the natural logarithm of Tobin's Q that the social pillar and the governance pillar have a larger impact than the environmental pillar. The score on the environmental pillar is considerably lower than the social and governance score (see table 2). It seems that the data on environmental performance is less reported by REITs because a substantial part of the observations report a zero score. This is especially the case in the years prior to 2015. It could be that the Paris Climate Agreements of 2015 have stimulated REITs to disclose more information on environmental performance. Thirdly, to analyse stock performance we have used total returns as a variable. Lastly, this study focuses mainly on financial implications of ESG practices for US REITs and did not analyse the implications on the behaviour and management of like, for example, the study of Przychodzen et al. (2016) where they research the motives, behaviour, and characteristics that affects mutual fund managers' willingness to incorporate ESG into investment decision making.

For future research of sustainability on REIT financial performance, it would be interesting to compare the results for ESG with comparable sustainability proxies. The GRESB rating, used by Fuerst (2015), is particularly interesting because this indicator is widely used in the real estate sector. Furthermore, because we use an unbalanced sample approach to mitigate survival ship bias, some REITs are included for only one or two years in the dataset, while other REITs are included for nine years. Our results might be affected because the unbalanced sample prevents us from detecting potential inconsistencies. Therefore, it would be interesting to analyse whether the results are stable over a longer time period for each REIT – something future research could address.

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Appendix I – Diagnostics

Several tests have been performed to analyse the data on issues.

Fixed effects or random effects

To test whether the panel data should use fixed effects or random effects, we perform the Hausman test. Table 10 shows that the probability for ln Tobin's Q is below 5% and for the other equations below 1%. Therefore, we reject the null hypothesis that random effects are likely to produce inconsistent coefficient estimates. Therefore, we use fixed effects in our panel data models.

Table 10. Hausman specification test

	FFO/Total Assets	FFO/Total revenue	Ln Tobin's Q	Total Returns
Chi-square test value	28.95	138.38	24.92	32.10
P-value	0.0040	0.0000	0.0152	0.0013

Linearity

Table 11 shows that the mean of the errors is close to zero. Furthermore, all models contain a constant in the equation and therefore, the linearity assumption cannot be violated (Brooks & Tsolacos, 2010).

Table 11. Regression residuals for FFO/Total Assets (alphahat1), FFO/Total Revenue (alphahat2), Ln Tobin's Q (alphahat3), and Total Returns (alphahat4).

Variable	Observations	Mean	Std. deviation	Min	Max
Alphahat1	849	6.45e-11	.027	-.062	.082
Alphahat2	849	2.80e-11	.198	-.559	.587
Alphahat3	849	1.36e-10	.212	-.462	.714
Alphahat4	849	1.29e-10	.236	-.546	1.025

Homoscedasticity

To test whether the variance of the errors is constant, one can use the modified Wald statistic test to test for groupwise heteroscedasticity in the residuals of the panel data models. The Wald test show significant results for all equations (table 12 – 15), so we reject the null hypothesis of homoskedasticity. Therefore, we use robust standard errors (Huber-White) in the regressions to control for potential heteroscedasticity.

Table 12. Modified Wald test for groupwise heteroscedasticity for FFO/Total Assets

H0: sigma(i)^2 = sigma^2 for all i
chi2 (149) = 3.4e+32
Prob>chi2 = 0.0000

Table 13. Modified Wald test for groupwise heteroscedasticity for FFO/Total Revenue

H0: sigma(i)^2 = sigma^2 for all i
chi2 (149) = 1.2e+32
Prob>chi2 = 0.0000

Table 14. Modified Wald test for groupwise heteroscedasticity for ln Tobin's Q

H0: sigma(i)^2 = sigma^2 for all i
chi2 (149) = 1.7e+32
Prob>chi2 = 0.0000

Table 15. Modified Wald test for groupwise heteroscedasticity for Total Returns

H0: sigma(i)^2 = sigma^2 for all i
chi2 (149) = 2.6e+31
Prob>chi2 = 0.0000

No autocorrelation

Autocorrelation could be a potential problem since the data contains several years. To test for autocorrelation, we apply the Woolridge test for autocorrelation in panel data. The results in table 16 - 19 are all significant and therefore reject the null hypothesis of no autocorrelation. Similarly, to assumption 2, we use robust standard errors (Huber-White) in the regression to control for potential heteroscedasticity.

Table 16. Woolridge test for FFO/Total Assets

Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
(1, 134) = 38.697
Prob > F = 0.0000

Table 17. Woolridge test for FFO/Total Revenue

Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
(1, 134) = 14.334
Prob > F = 0.0002

Table 18. Woolridge test for ln Tobin's Q

Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
(1, 134) = 11.973
Prob > F = 0.0007

Table 19. Woolridge test for Total returns

Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
(1, 134) = 14.367
Prob > F = 0.0002

Appendix II – Overview ESG composition

Table 20. Overview ESG Composition

Pillar	Category	Indicators	Weights
Environmental	Resource Use	20	11%
	Emissions	22	12%
	Innovations	19	11%
Social	Workforce	29	16%
	Human Rights	8	4,50%
	Community	14	8%
	Product Responsibility	12	7%
Governance	Management	34	19%
	Shareholders	12	7%
	CSR Strategy	8	4,50%
Total		**178**	**100%**

Appendix III – Stata Syntax

```
* Transform String
encode ESG_Grade, gen(ESG_Grade1)
label define ESG_order 1 D 2 C 3 B 4 A
drop ESG_Grade1
encode ESG_Grade, gen(ESG_Grade1) label(ESG_order)
drop ESG_Grade
rename ESG_Grade1 ESG_Grade
tab ESG_Grade

rename ESG_GRADE_LAG ESG_Grade_LAG

encode ESG_Grade_LAG, gen(ESG_Grade_LAG1)
label define ESG_order2 1 D 2 C 3 B 4 A
drop ESG_Grade_LAG1
encode ESG_Grade_LAG, gen(ESG_Grade_LAG1) label(ESG_order2)
drop ESG_Grade_LAG
rename ESG_Grade_LAG1 ESG_Grade_LAG
tab ESG_Grade_LAG


* Generate natural logarithm variables
gen LNRevenue=ln(Revenue)
gen LNMarketCap=ln(MarketCap)


* Descriptive Statistics
summarize FFOAssets FFORevenue TotalReturn TobinQ ESG_Score ESG_LAG ESG_CHANGE
ESG_grade ENV_Score SOC_Score GOV_Score TotalAssets Revenue MarketCap Leverage
NAREIT


* Correlation
correlate FFOAssets FFORevenue TotalReturn TobinQ ESG_Score ESG_LAG ESG_CHANGE
ESG_grade ENV_Score SOC_Score GOV_Score TotalAssets Revenue MarketCap Leverage
NAREIT


* Variance inflation factors (VIF) to check high collinearity
reg LNTobinQ ESG_Score TotalAssets Revenue MarketCap Leverage NAREIT
vif


* Set data as panel data
egen isin = group(ISIN)
drop ISIN

isid isin Year
bysort isin Year: assert _N == 1
duplicates report isin Year

xtset isin Year


* Hausmann test (Random effects or Fixed effects)
xtreg FFOAssets ESG_Score Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
estimates store fixed1
xtreg FFOAssets ESG_Score Leverage LNMarketCap LNRevenue NAREIT i.Year, re
estimates store random1
hausman fixed1 random1
```

```
xtreg FFORevenue ESG_Score Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
estimates store fixed2
xtreg FFORevenue ESG_Score Leverage LNMarketCap LNRevenue NAREIT i.Year, re
estimates store random2
hausman fixed2 random2

xtreg LNTobinQ ESG_Score Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
estimates store fixed3
xtreg LNTobinQ ESG_Score Leverage LNMarketCap LNRevenue NAREIT i.Year, re
estimates store random3
hausman fixed3 random3

xtreg TotalReturn ESG_Score Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
estimates store fixed4
xtreg TotalReturn ESG_Score Leverage LNMarketCap LNRevenue NAREIT i.Year, re
estimates store random4
hausman fixed4 random4


* Test for Linearity
xtreg FFOAssets ESG_Score Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
vce(cluster isin)
predict alphafehat1, u
sum alphafehat1

xtreg FFORevenue ESG_Score Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
vce(cluster isin)
predict alphafehat2, u
sum alphafehat2

xtreg LNTobinQ ESG_Score Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
vce(cluster isin)
predict alphafehat3, u
sum alphafehat3

xtreg TotalReturn ESG_Score Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
vce(cluster isin)
predict alphafehat4, u
sum alphafehat4


* Homoskedasticity (Modified Wald Test)
xtreg FFOAssets ESG_Score Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
vce(cluster isin)
xttest3

xtreg FFORevenue ESG_Score Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
vce(cluster isin)
xttest3

xtreg LNTobinQ ESG_Score Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
vce(cluster isin)
xttest3

xtreg TotalReturn ESG_Score Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
vce(cluster isin)
xttest3
```

```
* Autocorrelation/uncorrelated errors (Wooldridge Test)
xtserial FFOAssets ESG_Score Leverage LNMarketCap LNRevenue NAREIT

xtserial FFORevenue ESG_Score Leverage LNAssets LNMarketCap LNRevenue NAREIT

xtserial LNTobinQ ESG_Score Leverage LNAssets LNMarketCap LNRevenue NAREIT

xtserial TotalReturn ESG_Score Leverage LNAssets LNMarketCap LNRevenue NAREIT

* Regressions
* 1: FFOAssets
xtreg FFOAssets ESG_Score Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
vce(cluster isin)
xtreg FFOAssets ESG_LAG Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
vce(cluster isin)
xtreg FFOAssets ESG_CHANGE Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
vce(cluster isin)
xtreg FFOAssets ENV_Score Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
vce(cluster isin)
xtreg FFOAssets SOC_Score Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
vce(cluster isin)
xtreg FFOAssets GOV_Score Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
vce(cluster isin)
xtreg FFOAssets ENV_Score SOC_Score GOV_Score Leverage LNMarketCap LNRevenue NAREIT
i.Year, fe vce(cluster isin)
xtreg FFOAssets i.ESG_Grade Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
vce(cluster isin)

* 2: FFORevenue
xtreg FFORevenue ESG_Score Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
vce(cluster isin)
xtreg FFORevenue ESG_LAG Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
vce(cluster isin)
xtreg FFORevenue ESG_CHANGE Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
vce(cluster isin)
xtreg FFORevenue ENV_Score Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
vce(cluster isin)
xtreg FFORevenue SOC_Score Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
vce(cluster isin)
xtreg FFORevenue GOV_Score Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
vce(cluster isin)
xtreg FFORevenue ENV_Score SOC_Score GOV_Score Leverage LNMarketCap LNRevenue
NAREIT i.Year, fe vce(cluster isin)
xtreg FFORevenue i.ESG_Grade Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
vce(cluster isin)

* 3: LNTobinQ
xtreg LNTobinQ ESG_Score Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
vce(cluster isin)
xtreg LNTobinQ ESG_LAG Leverage LNMarketCap LNRevenue NAREIT i.Year, fe vce(cluster
isin)
xtreg LNTobinQ ESG_CHANGE Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
vce(cluster isin)
xtreg LNTobinQ ENV_Score Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
vce(cluster isin)
xtreg LNTobinQ SOC_Score Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
vce(cluster isin)
xtreg LNTobinQ GOV_Score Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
```

```
vce(cluster isin)
xtreg LNTobinQ ENV_Score SOC_Score GOV_Score Leverage LNMarketCap LNRevenue NAREIT
i.Year, fe vce(cluster isin)
xtreg LNTobinQ i.ESG_Grade Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
vce(cluster isin)

* 4:TotalReturn
xtreg TotalReturn ESG_Score Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
vce(cluster isin)
xtreg TotalReturn ESG_LAG Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
vce(cluster isin)
xtreg TotalReturn ESG_CHANGE Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
vce(cluster isin)
xtreg TotalReturn ENV_Score Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
vce(cluster isin)
xtreg TotalReturn SOC_Score Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
vce(cluster isin)
xtreg TotalReturn GOV_Score Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
vce(cluster isin)
xtreg TotalReturn ENV_Score SOC_Score GOV_Score Leverage LNMarketCap LNRevenue
NAREIT i.Year, fe vce(cluster isin)
xtreg TotalReturn i.ESG_Grade Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
vce(cluster isin)


* TobinQ, change in ESG breakdown
asdoc xtreg LNTobinQ ENV_CHANGE Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
vce(cluster isin), replace nest
asdoc xtreg LNTobinQ SOC_CHANGE Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
vce(cluster isin), nest append
asdoc xtreg LNTobinQ GOV_CHANGE Leverage LNMarketCap LNRevenue NAREIT i.Year, fe
vce(cluster isin), nest append
asdoc xtreg LNTobinQ ENV_CHANGE SOC_CHANGE GOV_CHANGE  Leverage LNMarketCap
LNRevenue NAREIT i.Year, fe vce(cluster isin), nest append


* Best vs Worst in class 10%
egen rank1 = group(ESG_Score)
gen rank_dummy1 = 0
replace rank_dummy1 = 10 if rank1 < 850
replace rank_dummy1 = 9 if rank1 < 0.9*849
replace rank_dummy1 = 8 if rank1 < 0.8*849
replace rank_dummy1 = 7 if rank1 < 0.7*849
replace rank_dummy1 = 6 if rank1 < 0.6*849
replace rank_dummy1 = 5 if rank1 < 0.5*849
replace rank_dummy1 = 4 if rank1 < 0.4*849
replace rank_dummy1 = 3 if rank1 < 0.3*849
replace rank_dummy1 = 2 if rank1 < 0.2*849
replace rank_dummy1 = 1 if rank1 < 0.1*849

xtreg FFOAssets i.rank_dummy1 Leverage LNMarketCap LNRevenue NAREIT i.Year if
rank_dummy1==1 | rank_dummy1==10, fe vce(cluster isin)
xtreg FFORevenue i.rank_dummy1 Leverage LNMarketCap LNRevenue NAREIT i.Year if
rank_dummy1==1 | rank_dummy1==10, fe vce(cluster isin)
xtreg LNTobinQ i.rank_dummy1 Leverage LNMarketCap LNRevenue NAREIT i.Year if
rank_dummy1==1 | rank_dummy1==10, fe vce(cluster isin)
xtreg TotalReturn i.rank_dummy1 Leverage LNMarketCap LNRevenue NAREIT i.Year if
rank_dummy1==1 | rank_dummy1==10, fe vce(cluster isin)
```